California State Wildlife Action Plan

2015 UPDATE

A Conservation Legacy for Californians

Volume I: Plan Update

September 2015






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CALIFORNIA STATE WILDLIFE ACTION PLAN 2015 UPDATE

A Conservation Legacy for Californians

Volume I: Plan Update

California State Wildlife Action Plan

Prepared by
California Department of Fish and Wildlife

Edited by
Armand G. Gonzales and Junko Hoshi, PhD

With Assistance from

Ascent Environmental, Inc.

Improving the Practice of Conservation

Foundations of Success

Blue Earth Consultants, LLC

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Acronyms and Abbreviations

ACE	Areas of Conservation Emphasis
ACEC	Areas of Critical Environmental Concern
AF	Acre Feet
AFB	Air Force Base
AFRP	Anadromous Fish Restoration Program
AFWA	Association of Fish and Wildlife Agencies
AML	Appropriate Management Levels
AUM	Animal Unit Months
BCP	Budget Change Proposal
BDCP	Bay Delta Conservation Plan
BIOS	Biogeographic Information and Observation System
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
BRBP	Blue Ridge Berryessa Partnership
BSSC	Bird Species of Special Concern
CAL FIRE	California Department of Forestry and Fire Protection
CalEMA	California Emergency Management Agency
CalEPA	California Environmental Protection Agency
CalNASP	California National Archery in the Schools Program
CalSTA	California State Transportation Agency
CalTIP	Californians Turn in Poachers and Polluters
Caltrans	California Department of Transportation
CAMP	Campaign Against Marijuana Planting
CAPP	Conceptual Area Protection Plan
CBC	California Biodiversity Council
CCAS	California Climate Adaptation Strategy
CCWCN	Coastal Cactus Wren Conservation Network

CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDNPA	California Desert Native Plants Act
CDOF	California Department of Finance
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CERES	California Environmental Resources Evaluation System
CESA	California Endangered Species Act
CFA	Code of Federal Regulations
CHAT	Crucial Habitat Assessment Tool
CIB	California Interregional Blueprint
CISAC	California Invasive Species Advisory Committee
CISR	Center for Invasive Species Research
CLNWS	China Lake Naval Weapons Station
CNDDB	California Natural Diversity Database
CNRA	California Natural Resources Agency
Commission	Fish and Game Commission
CTP	California Transportation Plan
CVFPP	Central Valley Flood Protection Plan
CVP	California Central Valley Project
CVPIA	Central Valley Improvement Protection Act
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationships
DBW	Division of Boating and Waterways
Delta Reform Act	Sacramento-San Joaquin Delta Reform Act of 2009
Delta	Sacramento-San Joaquin Delta
DMG	Deserts Managers Group
DOD	U.S. Department of Defense
DOI	U.S. Department of Interior

DOW	Defenders of Wildlife
DRECP	Desert Renewable Energy Conservation Plan
DSC	Delta Stewardship Council
DSP	Distinct Population Segment
DWR	California Department of Water Resources
EBM	Ecosystem Biodiversity Monitoring
EGPR	Environmental Goals and Policy Report
ELI	Environmental Law Institute
ELRT	Eagle Lake rainbow trout
ELRTCS	Eagle Lake Rainbow Trout Conservation Strategy
ENSO	El Niño-Southern Oscillation
EPA	U.S. Environmental Protection Agency
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FGC	Fish and Game Code
FPR	Forest Practice Regulation
FRAP	Fire and Resource Assessment Program
FRGP	Fisheries Restoration Grants Program
FRPA	Fish Restoration Program Agreement
GGRF	Greenhouse Gas Reduction Fund
GHG	Greenhouse Gas
GIS	Geographic Information Systems
HCP	Habitat Conservation Plan
HCPB	Habitat Conservation Planning Branch
HUC	Hydrologic Unit Code
IEP	Interagency Ecological Program
IID	Imperial Irrigation District
INRMP	Integrated Natural Resource Management Plan
IPCC	Intergovernmental Panel on Climate Change

ISCC	Invasive Species Council of California
KEA	Key Ecological Attribute
LAE	Land Acquisition Evaluation
LCC	Landscape Conservation Cooperative
LED	Law Enforcement Division
LMP	Land Management Plan
Lower Colorado River Program	2005 Lower Colorado River Multi-Species Conservation Program
LSA	Lake and Streambed Alteration
MAST	Management, Analysis and Synthesis Team
MBTA	Migratory Bird Treaty Act
MCU	Marine Conservation Unit
MCS	Marijuana Cultivation Site
MLPA	Marine Life Protection Act
MMA	Marine Managed Area
MMBF	Million Board Feet
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSCP	Multiple Species Conservation Program
MSHCP	Multiple Species Habitat Conservation Plan
MSSC	Mammal Species of Special Concern
NASP	National Archery in the Schools Program
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NERRS	National Estuarine Research Reserve System
NGO	Non-Governmental Organization
NISC	National Invasive Species Council
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System

NPPA	Native Plant Protection Act
NPS	National Park Service
NRCS	National Resource Conservation Service
NZMS	New Zealand mud snails
OHV	Off-Highway Vehicle
OPC	California Ocean Protection Council
OPR	Governor's Office of Planning and Research
OSPR	Office of Spill Prevention and Response
OTD	Office of Training and Development
PAD	Passage Assessment Database
PDO	Pacific decadal oscillation
PLM	Private Lands Management
PORTS	Parks On-line Resources for Teachers and Students
PUC	Public Utilities Commission
QSA	Quantification Settlement Agreement
RAMP	Regional Advance Mitigation Planning
RCD	Resource Conservation District
RDM	Residual Dry Matter
REAT	Renewable Energy Action Team
ROW	Right-Of-Way
SCP	Scientific Collector's Permit
SGCN	Species of Greatest Conservation Need
SHA	Safe Harbor Agreement
SHARE	Shared Habitat Alliance for Recreational Enhancement
SI	CDFW's Science Institute
Sierra Framework	Sierra Nevada Framework for Conservation and Collaboration
SJRRP	San Joaquin River Restoration Program
SMART	Specific, Measurable, Attainable, Relevant, and Time-Bound
SMCA	State Marine Conservation Area
SMR	State Marine Reserve

SMRMA	State Marine Recreational Management Area
SNEP	Sierra Nevada Ecosystem Project
SNFPA	Sierra Nevada Forest Plan Amendment
SRWP	Sacramento River Watershed Program
SSC	Species of Special Concern
SVRA	State Vehicular Recreation Area
SWAP	State Wildlife Action Plan
SWG	State and Tribal Wildlife Grants
SWP	State Water Project
SWRCB	State Water Resources Control Board
TA	Technical Assistance
TAC	Technical Advisory Committee
TCP	Timberland Conservation Program
TMDL	Total maximum daily load
TNC	The Nature Conservancy
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNVC	U.S. National Vegetation Classification
UTS	Unarmored Threespine Stickleback
VegCAMP	Vegetation Classification and Mapping Program
WCB	Wildlife Conservation Board
WCGA	West Coast Governors Alliance
WET	Watershed Enforcement Team
WFL	Wildlife Forensic Laboratory
WIL	Wildlife Investigations Lab

Foreword

California is an amazing place. From the Sierra Nevada to the Pacific coast, from the redwood forests to the Mojave Desert, California is the most biologically diverse state in the country. Biodiversity measures richness of life and California Department of Fish and Wildlife's mission is to manage that richness of life for future generations.

The state is facing a warming climate and a fourth year of historic drought threatening many species, particularly native trout, salmon, and other inland fish. At the same time, California is the eighth largest economy in the world, and home to Silicon Valley, the birth of the aerospace industry, and Hollywood, just to name a few common references. We must have a solid plan in place to navigate the challenges ahead.

California Department of Fish and Wildlife is proud to present the first major revision to the State Wildlife Action Plan (SWAP 2015). SWAP 2015 includes conservation actions that respond to current and future challenges with objectives and goals that are specific, measurable, and time bound. The conservation strategies consider the anthropogenic pressures imposed by the legitimate need for food, housing, transportation, and recreation, taken together with the recognition of limited funding and time. The strategies focus on restoring ecological function and processes capable of withstanding the stresses imposed by a changing environment. Collaboration and partnerships will be imperative to implementing these strategies.

SWAP 2015 is a product of many individuals and organizations. More than 300 people and 40 organizations worked across 200 meetings to pull together this update. Every one of them deserves a big thank you. The document has received incredible public participation and scrutiny. We are grateful to all who helped in its development, and look forward to the continued collaboration needed to succeed in conserving California's tremendous biodiversity.

Wallace Stegner, a great native son, once remarked, "One cannot be pessimistic about the West. This is the native home of hope." California has always been a land of hope, dreams, and optimism, all of which we will need to safeguard the state's fish and wildlife for the future. Stegner also reminds us it is possible as Californians, "to create a society to match its scenery." At California Department of Fish and Wildlife, we have a duty to ensure the state's fish and wildlife and the habitats upon which they depend will be here and healthy for our children, their children, and so on. The 2015 update to the State Wildlife Action Plan will help us meet that challenge.

Charlton H. Bonham
Director

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SWAP 2015 Document Structure

SWAP 2015 provides an ecosystem approach for conserving California's fish and wildlife resources by identifying strategies intended to improve conditions of Species of Greatest Conservation Need (SGCN) and the habitats upon which they depend (see Figure 1 of the Executive Summary). CDFW designed SWAP 2015 to guide resource managers, conservation partners, and the public in how they can directly or indirectly participate in conserving California's precious natural heritage. This section provides an overview of the structure of SWAP 2015 to help readers navigate through the document and find information. Key terms are defined in the text box on page 8.

SWAP 2015 is organized as follows:

- **Executive Summary** provides a summary of: the vision for wildlife conservation in California; statewide goals; the process used to develop conservation strategies based on an ecosystem approach; conservation targets and strategies for seven provinces and anadromous fish; statewide summary; plans for integration and implementation; and process for adaptive management and monitoring.
- **Chapter 1** provides an introduction to SWAP 2015. The challenge of sustaining biodiversity, a summary of CDFW responsibility, and the vision for California wildlife conservation are described. Chapter 1 also explains the requirements for updating SWAP, summarizes major changes since the original 2005 SWAP, and describes the analytical approach used in the 2015 update.
- **Chapter 2** describes California's natural diversity, identifies SGCN and the criteria used to evaluate species and habitat conditions, and addresses major pressures and stresses currently affecting the SGCN and their habitats.
- **Chapter 3** describes the existing conservation approaches in the state, including the major regulations protecting natural resources, CDFW planning tools, and major conservation programs.
- **Chapter 4** presents the statewide goals of SWAP 2015 and broad, state-level conservation strategies that will be implemented to achieve the desired conservation outcomes.
- **Chapter 5** is divided into seven sections that describe for each geographic province the conservation targets, SGCN and other focal species, KEAs, stresses, pressures, and conservation strategies, including goals and objectives for the provinces.
- **Chapter 6** focuses on conservation strategies developed for anadromous fish in California.
- **Chapter 7** describes how SWAP 2015 will be integrated with other programs and coordinated with partners for the implementation, including through companion plans.
- **Chapter 8** describes the monitoring plan for the conservation strategies, including the mandate for CDFW to use monitoring and adaptive management. It also presents a summary of the effectiveness evaluation of how SWAP 2005 was implemented. The chapter describes how the recommendations from the SWAP 2005 evaluation have been integrated into SWAP 2015. Rationales for selecting conservation strategies presented in SWAP 2015 and a framework for monitoring the effectiveness of the strategies are also described.

- **Chapter 9** provides the list of preparers of SWAP 2015.
- **Chapter 10** provides bibliographic references used in each chapter.
- **Chapter 11** provides a glossary of major terms used in SWAP 2015.
- **Several appendices** accompany SWAP 2015 to provide more detailed information and extensive tables that support the document.
- **Database files** created during the development of SWAP 2015 to compile and evaluate ecological information and to create strategies can be accessed at: http://www.dfg.ca.gov/SWAP/.

Figure A provides a "roadmap" to the document illustrating how SWAP 2015 is organized.

If questions arise regarding the use of SWAP 2015, please email SWAP@wildlife.ca.gov.

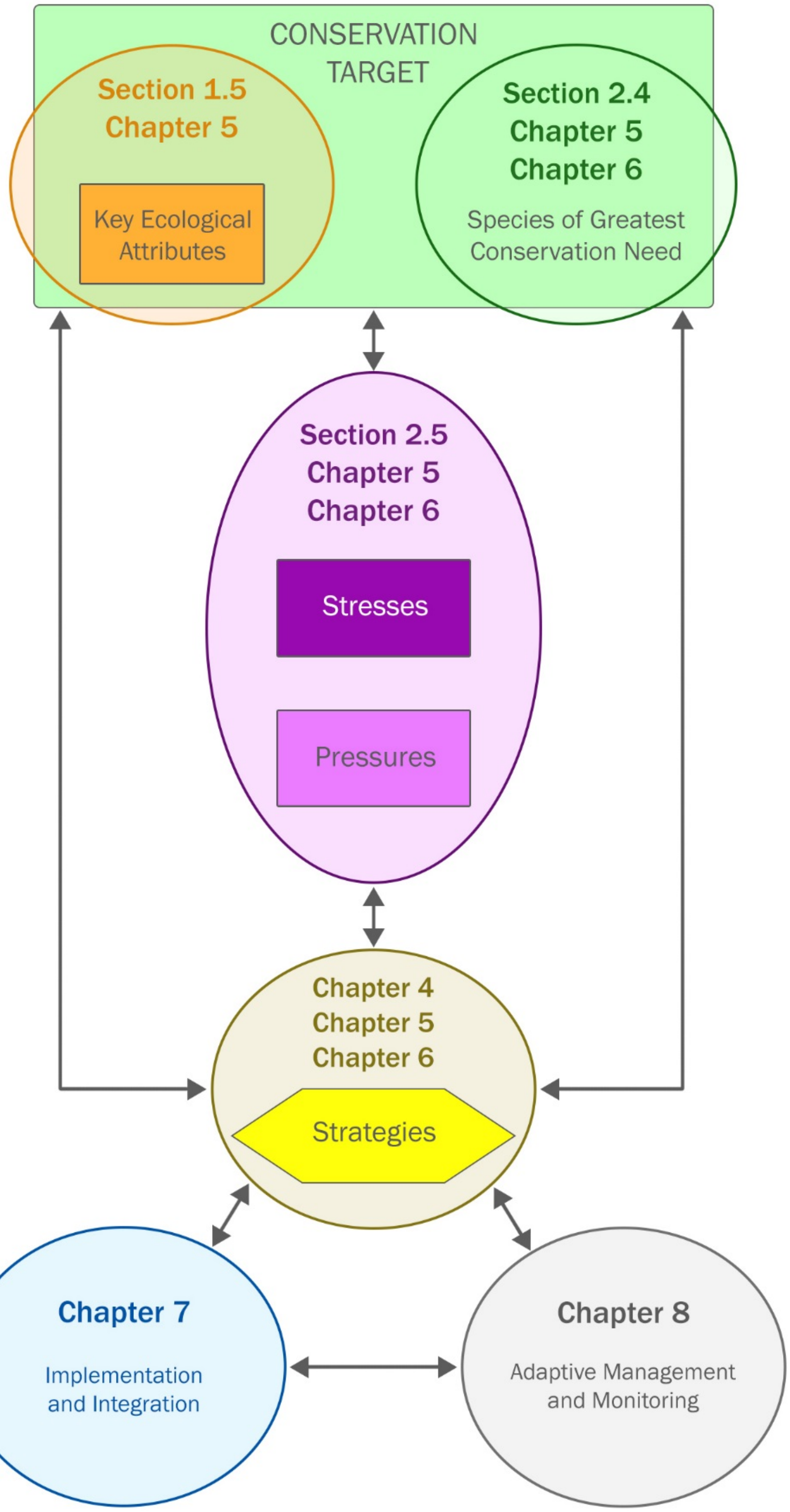


Figure A **SWAP 2015 Organizational Roadmap**

Executive Summary

Congress created the State and Tribal Wildlife Grants (SWG) program in 2000, recognizing the need to fund programs for the conservation of wildlife diversity. Congress mandated each state and territory to develop by 2005 a State Wildlife Action Plan (SWAP) that provided a comprehensive wildlife conservation strategy to continue receiving federal funds through the SWG program. California's first SWAP was completed by California Department of Fish and Game (now the California Department of Fish and Wildlife [CDFW]) and approved by the U.S. Fish and Wildlife Service (USFWS) in 2005. California's SWAP 2005 identified and targeted Species of Greatest Conservation Need (SGCN) and the vital habitats on which they depend. CDFW has received approximately $37 million in federal support for the state's wildlife conservation activities through the SWG program from 2005 through 2014. The SWG program requires SWAP updates at least every 10 years. CDFW has now prepared SWAP 2015, which is the first comprehensive update of SWAP 2005.

Vision for Wildlife Conservation

In SWAP 2015, CDFW is focusing on conservation of the wildlife resources of the nation's most biologically diverse state using an approach that is in harmony with a growing human population and the need for resilience in the face of a changing climate. SWAP 2015 is a flexible, but scientifically grounded plan. Employing an ecosystem approach to conserve and manage diverse habitats and species, SWAP 2015 provides a blueprint for actions necessary to address the highest priorities for conserving California's aquatic, marine, and terrestrial resources. Its implementation relies on making important and helpful conservation information more accessible to resource managers and the public, and on developing lasting partnerships with a broad array of governments, agencies, organizations, businesses, and citizens.

For SWAP 2015 to be successful, it will need to be supported and adopted internally at the highest levels and by staff of CDFW, as well as externally by partners. Internally, priorities will be articulated and direction given to integrate and implement SWAP goals, strategies, and actions into programs and ongoing activities. Externally, CDFW will advocate for adoption and integration of SWAP goals, strategies, and actions into other planning efforts and coordinate and collaborate with its conservation partners to leverage human and financial capacity to achieve success.

CDFW's vision for conserving the state's wildlife is to sustain the floral and faunal biodiversity of California over the next decade, and to establish a solid conservation framework for the decades that follow. Through SWAP 2015 and together with diverse partners, CDFW seeks to:

- maintain and enhance the integrity of ecosystems by conserving key natural processes and functions, habitat qualities, and sustainable native species population levels, so that

California’s ecosystems are resilient to shifting environmental conditions resulting from climate change and other causes;

- promote partnerships with federal, state, and local agencies; tribal governments; and non-governmental organizations with aligned conservation goals to leverage efficient use of funding and other public resources;
- inspire greater understanding and recognition of critical needs for conserving wildlife and their habitats by lawmakers, land use planners, private landowners, and others who have influence in developing and implementing conservation actions;
- allocate sufficient water and manage water resources to maintain healthy ecosystems and fish and wildlife populations when considering state and regional water supply needs;
- provide resources and coordinate efforts with partners to eradicate or control invasive species and prevent new introductions;
- promote hunting and fishing as a conservation tool to use when working to eradicate or control invasive or non-native game species;
- sustain the quality of California’s natural resources and biodiversity in harmony with predicted economic growth and human population increases;
- continue to prioritize protection of key habitat linkages, sensitive habitats, and specialized habitats for SGCN;
- integrate wildlife conservation with working landscapes and environments, recognizing both the economic and ecological values of agriculture, rangeland, forestry, and fisheries;
- support conservation programs that benefit native species, habitats, and ecosystems through broad-based public funding from federal, state, special district, and local government sources;
- educate the public about wildlife conservation issues, including hunting and fishing as conservation tool, and inspire a conservation ethic in present and future generations through public outreach; and
- enhance conservation capacity by clearly articulating conservation purposes, applying adaptive management principles, and effectively using staff and financial resources.

Statewide Goals

Three statewide goals to enhance California ecosystems have been identified for SWAP 2015. These overarching goals, with their associated sub-goals, represent the desired ecological outcomes of SWAP 2015 implementation.

Goal 1 – Abundance and Richness: Maintain and increase ecosystem and native species distributions in California, while sustaining and enhancing species abundance and richness.

- *Goal 1.1 (Ecosystem Distribution):* Maintain and increase ecosystem distributions.

- *Goal 1.2 (Native Species Range and Distribution):* Maintain and increase native species ranges and distributions.
- *Goal 1.3 (Native Species Abundance and Richness):* Sustain and enhance native species abundance and diversity, including genetic diversity.
- *Goal 1.4 (Ecosystem Richness):* Sustain and enhance ecosystem diversity.

Goal 2 - Enhance Ecosystem Conditions: Maintain and improve ecological conditions vital for sustaining ecosystems in California.

- *Goal 2.1 (Connectivity):* Maintain and improve connectivity vital for sustaining ecosystems (including those relevant to vegetation, wildlife corridors, genetic permeability, water flow, floodplains [longitudinal and lateral], and groundwater.)
- *Goal 2.2 (Community Structure and Composition):* Maintain and improve community structure and composition vital for sustaining ecosystems (including age structure, structural heterogeneity, habitat richness, and native and key species population levels).
- *Goal 2.3 (Water Quality, Quantity, and Availability):* Maintain and improve water quality (including temperature, chemistry, and pollutant/nutrient concentrations and dynamics) and water quantity and availability vital for sustaining ecosystems and their attributes (including ocean, lakes, rivers, streams, groundwater, and snowpack).
- *Goal 2.4 (Soil and Sediment Quality):* Maintain and improve soil and sediment quality vital for sustaining ecosystems (including soil moisture, chemistry, and pollutant/nutrient concentrations and dynamics).

Goal 3 - Enhance Ecosystem Functions and Processes: Maintain and improve ecosystem functions and processes vital for sustaining ecosystems in California.

- *Goal 3.1 (Successional Dynamics):* Maintain or improve successional dynamics vital for sustaining ecosystems.
- *Goal 3.2 (Disturbance Regime):* Maintain or improve disturbance regimes vital for sustaining ecosystems (including fire, flooding and grazing regimes).
- *Goal 3.3 (Hydrological Regime):* Maintain or improve hydrological regimes vital for sustaining ecosystems (including riverine, lacustrine, and estuarine hydrodynamics).
- *Goal 3.4 (Sediment Deposition Regime):* Maintain or improve sediment deposition regimes vital for sustaining ecosystems (including hydro-geomorphic processes, wind-driven processes, and soil stability).

Ecosystem Approach

A multi-species, ecosystem approach has been used as the guiding framework for developing SWAP 2015. An ecosystem approach to conservation involves maintaining and enhancing the ecosystem processes, structure, and conditions, recognizing that all components are interrelated in a dynamically changing system. Large-scale landscape approaches are generally the most reliable and preferred method to conserve ecological integrity, including biological diversity. The approach benefits both game and non-game (or harvested and non-harvested) wildlife species, and creates many co-benefits related to both ecological values (such as enhanced water quality, soil conservation, or resilience to the effects of climate change) and societal values (such as open space, scenic quality, or outdoor recreation opportunities).

Species of Greatest Conservation Need

A key element of updating the SWAP is identifying and compiling information on the species of wildlife that are indicative of the state's biological diversity and have the greatest need for conservation. These species are referred to as Species of Greatest Conservation Need (SGCN). For SWAP 2015, regional teams developed criteria and evaluated species, resulting in a list of over 1,000 species of invertebrates, amphibians, reptiles, fish, birds, mammals, and plants that are considered SGCN. Because of the large number of species, applying a species-based conservation approach to develop SWAP 2015 was not feasible; however, it is recognized that dividing California into habitat categories may present limitations that must be balanced with species-specific efforts when needed to effectively address conservation of species.

SWAP 2015 used three criteria to determine the list of SGCN:

- species listed at threatened, endangered, or candidate species in California under the federal Endangered Species Act or the California Endangered Species Act;
- species for which there is a conservation concern (generally equivalent to California Species of Special Concern); or
- species identified by CDFW as being highly vulnerable to climate change.

Consideration of Climate Change

Significant climate-related changes to California's environment have been documented in the last decade, including sea level rise, natural community shifts, increased prevalence of invasive species, increased number and intensity of wildfires, and prolonged drought (CNRA 2009; CNRA 2014). Climate-induced effects on wildlife, in combination with other pressures, have the potential to greatly diminish vulnerable wildlife populations and habitats and must be considered when developing management strategies. Climate change considerations have been given great weight during development of SWAP 2015 in the following ways:

- adopting climate vulnerability as a criterion for selecting SGCN;
- incorporating climate forecasts when assessing the ecological conditions of conservation targets;

- conducting climate change vulnerability analyses for native species and vegetation in California; and
- identifying how the SWAP conservation strategies align with California's Climate Change Adaptation Strategy (CNRA 2009; CNRA 2014) and the National Fish, Wildlife, and Plants Climate Adaptation Strategy (National Fish, Wildlife, and Plants Climate Adaptation Partnership 2012), thus achieving important climate adaptation co-benefits through SWAP implementation.

Prioritizing Conservation Targets

The process to provide the SWAP elements required by USFWS and develop multi-species conservation strategies began by broadly categorizing natural resources in California. The categories used in SWAP 2015 are terrestrial, freshwater aquatic, and marine habitats. SWAP 2015 recognizes that within each of these resource categories, there are strategies that apply to specific geographic regions and others that are more broadly relevant across many regions or possibly statewide. To assess conservation needs at a manageable scale, the state was subdivided for each resource category using established and accepted geographic units. These geographic units are ecoregions (adopting "sections" identified under the U.S. Forest Service Ecoregion Classification) for terrestrial resources, hydrologic units (adopting the four digit hydrologic unit codes identified by the U.S. Geologic Survey) for freshwater aquatic resources, and marine conservation units (adopting marine study regions identified under the Marine Life Protection Act [Fish and Game Code Sections 2850-2863]), collectively called conservation units. The conservation units were then grouped together into seven major geographic provinces. This approach facilitated the discussion of ecosystems, natural communities, and species at a scale appropriate for regional conservation planning. The seven provinces are:

- North Coast and Klamath
- Cascades and Modoc Plateau
- Central Valley and Sierra Nevada
- Bay Delta and Central Coast
- South Coast
- Deserts
- Marine

An exception to developing conservation strategies within these geographic scales is the analysis for anadromous fish. Anadromous fish begin life in the fresh water of rivers and streams, migrate to the ocean to grow into adults, and then return to fresh water to spawn. Most anadromous fish spend the majority of their life in marine environments and travel great distances to reach their spawning rivers or streams. Because the geographic ranges of anadromous fish span many of the provinces developed for SWAP 2015, the organization of conservation strategies by hydrologic unit or even province does not adequately address their conservation needs. As such, the geographic organization of conservation strategies for anadromous fish has been developed separately to capture all the habitats within their ranges.

For each conservation unit in California, SWAP 2015 developed at least one conservation project, consisting of a set of conservation strategies to improve conditions of a conservation target. The focus of SWAP 2015 is on species deemed to be most rare, imperiled, and in need of conservation. Habitat types with high levels of species richness, high counts of rare and endemic species, and high counts of vulnerable species (including declining and at-risk species and SGCN), are prioritized for selection as potential terrestrial conservation targets. Expert opinion and knowledge were employed to identify the highest priority freshwater aquatic targets for each hydrologic unit. Marine ecosystem targets were based on priorities identified through work recently completed as part of the Marine Life Protection Act (MLPA). Anadromous fish conservation targets are key species, species guilds, habitat types, or ecological processes essential to the future conservation of anadromous species. They have been prioritized by CDFW to adequately encapsulate their evolutionary and ecological significance.

Development of Conservation Strategies

SWAP 2015 provides an ecosystem approach for conserving California's fish and wildlife resources by identifying strategies intended to improve conditions of SGCN and the ecosystems upon which they depend (Figure 1).

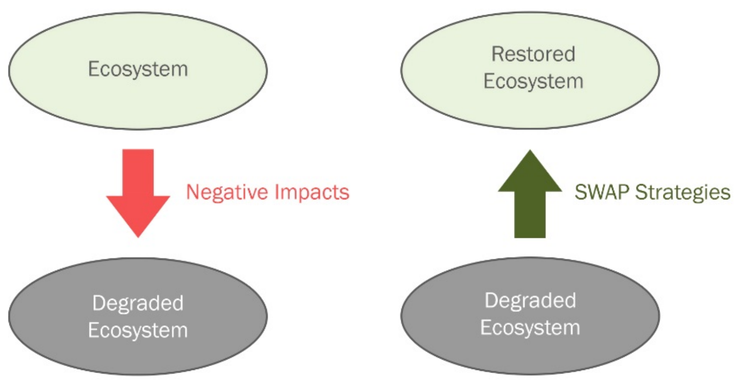


Figure 1 Ecosystem Condition Before and After SWAP 2015 Implementation

Regional conservation strategies have been developed in SWAP 2015 for terrestrial, freshwater aquatic, and marine resources in the following strategy categories:

- Data Collection and Analysis
- Partner Engagement
- Management Planning
- Direct Management
- Economic Incentives
- Environmental Review
- Land Acquisition, Easement, and Lease
- Land Use Planning
- Law and Policy
- Outreach and Education
- Training and Technical Assistance

Specific conservation strategies were developed as part of a conservation project for each conservation target using a systematic approach (Figure 2). First, for each conservation target, key ecological attributes (KEAs) were identified. These attributes are the ecological qualities on which the viability of the conservation target most depends. Stresses, the degraded conditions of the ecological attributes, were then identified followed by the identification of the sources of the degradation called pressures, which consist of anthropogenic (human-induced) or natural drivers that have strong influences on the ecological conditions of the target. If applicable, underlying socio-economic causes for the pressures were also recognized. After illustrating the interrelationship of KEAs, stresses and pressures, conservation strategies were developed that would either directly or indirectly alleviate negative impacts of pressures or stresses, or to improve or maintain the ecological viability of conservation targets by conserving KEAs. Strategies reduce pressures directly and stresses indirectly, or act directly on stresses or the target. Desired outcomes of each conservation project are articulated as the project's goals and objectives. The goals describe the desired outcomes for the condition of the KEAs and the objectives address the desired outcomes of the strategies. The conservation targets, stresses, pressures, and conservation strategies for each province are summarized in Tables 1-7.

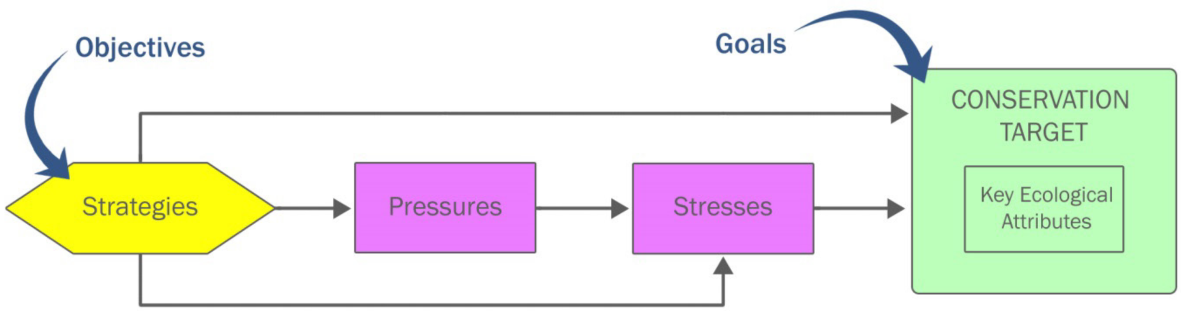


Figure 2 Conceptual Model - How Strategy Implementation Improves Conservation Target Condition

Conservation strategies for anadromous fish are summarized in Table 8 and consist of the following general strategies:

- Research, Assessment, and Monitoring;
- Securing Adequate Funding;
- Habitat Enhancement, Restoration, and Protection; and
- Developing Water Management Plans.

Definitions Important to SWAP 2015

Conservation Target: An element of biodiversity at a project site, which can be a species, habitat/ecological system, or ecological process on which a project has chosen to focus.

Goal: A formal statement detailing a desired outcome of a conservation project, such as a desired future status of a target. The scope of a goal is to improve or maintain key ecological attributes (defined below).

Key Ecological Attribute (KEA): Aspects of a target's biology or ecology that, if present, define a healthy target and, if missing or altered, would lead to the outright loss or extreme degradation of the target over time.

Objective: A formal statement detailing a desired outcome of a conservation project, such as reducing the negative impacts of a critical pressure (defined below). The scope of an objective is broader than that of a goal because it may address positive impacts not related to ecological entities (such as getting better ecological data or developing conservation plans) that would be important for the project. The set of objectives developed for a conservation project are intended, as a whole, to lead to the achievement of a goal or goals, that is, improvements of key ecological attributes.

Pressure: An anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of the target. Pressures can be positive or negative depending on intensity, timing, and duration. Negative or positive, the influence of a pressure to the target is likely to be significant.

Species of Greatest Conservation Need (SGCN): All state and federally listed and candidate species, species for which there is a conservation concern, or species identified as being vulnerable to climate change.

Strategy: A group of actions with a common focus that work together to reduce pressures, capitalize on opportunities, or restore natural systems. A set of strategies identified under a project is intended, as a whole, to achieve goals, objectives, and other key results addressed under the project.

Stress: A degraded ecological condition of a target that resulted directly or indirectly from negative impacts of pressures (e.g., habitat fragmentation).

Table 1 Conservation Targets and Strategies for the North Coast and Klamath Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
North Coastal and Montane Riparian Forest and Woodland	Northern California Coast Ranges: • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. Northern California Coast: • By 2025, acres of habitat (riparian) are increased at least 5% from 2015 acres. • By 2025, acres with desired endemic plant diversity (ground cover, shrubs, understory) are increased at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (natural floodplain) are increased by at least 5% from 2015 acres/miles. • By 2025, miles connected (to natural floodplain) are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime (through management of water operations in the Eel, Klamath, Trinity, Mad, and Russian Rivers) are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Connectivity among communities and ecosystems • Hydrological regime • Successional dynamics	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Dams and water management/use • Household sewage and urban wastewater • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Connectivity among communities and ecosystems • Community structure and composition • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban wastewater • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Pacific Northwest Conifer Forests	• By 2025, acres of redwood habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity (multi-story canopy) are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic (udic) regime are increased by at least 5% from 2015 acres/miles. • By 2025, acres with suitable soil characteristics (in wet meadows) are increased by at least 5% from 2015 acres. • By 2025, acres with desired (late) stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Hydrological regime • Soil quality and sediment deposition regime • Successional dynamics	• Agricultural and forestry effluents • Climate change • Fire and fire suppression • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Parasites/pathogens/diseases • Roads and railroads • Wood and pulp plantations	• Data Collection and Analysis • Direct Management • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance

Table 1 Conservation Targets and Strategies for the North Coast and Klamath Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Pacific Northwest Subalpine Forest	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Parasites/pathogens/diseases • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Environmental Review • Land Use Planning • Management Planning • Partner Engagement • Training and Technical Assistance
California Foothill and Valley Forests and Woodlands	• By 2025, acres with desired endemic plant diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity (oak recruitment) are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired inches of groundwater are increased by at least 5% from 2015 acres/miles.	• Community structure and composition • Fire regime • Soil quality and sediment deposition regime • Successional dynamics	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and, ranching • Recreational activities	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Outreach and Education • Partner Engagement
Alpine Vegetation	• By 2025, acres connected are maintained within the ecoregion from 2015 acres. • By 2025, acres of macrogroup (target) are maintained within the ecoregion from 2015 acres. • By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained within the ecoregion from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems	• Climate change • Commercial and industrial areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Wet Mountain Meadow Fen (Wet Meadow) Mountain Riparian Scrub and Wet Meadow Subalpine Aspen Forests and Pine Woodlands (Meadows) Western Upland Grasslands	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime • Hydrological regime • Successional dynamics	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting	• Data Collection and Analysis • Direct Management • Environmental Review • Law and Policy • Outreach and Education • Partner Engagement
Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Soil quality and sediment deposition regime • Successional dynamics	• Climate change • Fire and fire suppression • Logging and wood harvesting • Parasites/pathogens/diseases	• Data Collection and Analysis • Direct Management • Environmental Review • Law and Policy • Outreach and Education • Partner Engagement

North Coast and Klamath Province

Table 1 Conservation Targets and Strategies for the North Coast and Klamath Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Montane Upland Deciduous Scrub	• By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, connected montane shrubland and grassland acres are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Connectivity among communities and ecosystems • Community structure and composition • Fire regime • Hydrological regime	• Climate change • Fire and fire suppression • Housing and urban areas • Logging and wood harvesting	• Data Collection and Analysis • Direct Management • Environmental Review • Law and Policy • Outreach and Education • Partner Engagement
Coastal Dune and Bluff Scrub	• By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Soil quality and sediment deposition regime	• Airborne pollutants • Climate change • Commercial and industrial areas • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Environmental Review • Land Acquisition/Easement/ Lease • Land Use Planning • Law and Policy • Management Planning • Partner Engagement
Native Aquatic Species Assemblages/Communities	• By 2025, miles of streams with target amphibian population are increased by at least 5% from 2015 miles. • By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. • By 2025, miles of streams with key species population are increased by at least 5% from 2015 population. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles. • By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage (flow) are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired temperature are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Pollutant concentrations and dynamics Soil quality and sediment deposition regime • Surface water flow regime • Water temperatures and chemistry	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Garbage and solid waste • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Marine and freshwater aquaculture • Mining and quarrying • Parasites/pathogens/diseases • Renewable energy • Roads and railroads	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Outreach and Education

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Table 2 Conservation Targets and Strategies for the Cascades and Modoc Plateau Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
North Coastal Mixed Evergreen and Montane Forests	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of water yield are increased by at least 5 % from 2015 miles.	• Community structure and composition • Hydrological regime • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Livestock, farming, and ranching • Logging and wood harvesting • Renewable energy • Utility and service lines	• Data Collection and Analysis • Land Acquisition/Easement/Lease • Law and Policy • Management Planning • Outreach and Education
Western Upland Grasslands	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity (remove in-growth trees from within grassland habitats) are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime • Successional dynamics	• Annual and perennial non-timber crops • Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting	• Data Collection and Analysis • Direct Management • Economic Incentives • Land Acquisition/Easement/Lease • Land Use Planning • Law and Policy
Big Sagebrush Scrub Great Basin Dwarf Sagebrush Scrub Great Basin Upland Scrub	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime • Soil quality and sediment deposition regime • Successional dynamics	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Housing and urban areas • Invasive plants/animals (non-native species) • Invasive plants/animals (native species) • Livestock, farming, and ranching • Recreational activities • Renewable energy • Utility and service lines	• Data Collection and Analysis • Direct Management • Economic Incentives • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Great Basin Pinyon-Juniper Woodland	• By 2025, acres where desired native species are dominant and desired structural diversity are increased by at least 5% within the presettlement range of pinyon-juniper and juniper habitats in the ecoregion. • By 2025, acres of desired successional stage are increased by at least 5% from presettlement habitat acreage. • By 2025, acres with desired fire return interval are increased by at least 5% from 2015 levels.	• Community structure and composition • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Invasive plants/animals • Other ecosystem modifications	• Data Collection and Analysis • Direct Management • Partner Engagement
Eagle Lake Native Fish Assemblage	• By 2025, miles of streams with target fish population (Eagle Lake Rainbow Trout - ELRT) are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population of key species (ELRT) is increased by at least 5% from the 2015 population size. • By 2025, acres with desired genetic connectivity between lower Pine Creek and lake populations during spawning and migration period are increased by at least 5% from 2015 acres. • By 2025, miles connected are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Surface water flow regime • Water level fluctuations	• Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Roads and railroads	• Data Collection and Analysis • Direct Management • Economic Incentives • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Goose Lake Native Fish Assemblage	• By 2025, acres connected are increased by at least 5% from 2015 acres by improving access to habitat in all lake tributaries and enhancing fish passage. • By 2025, populations of key species are increased by at least 5% from 2015 population size. • By 2025, miles of river in Pine and Davis Creeks where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles connected between stream and lake populations during spawning and migration period are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Nutrient concentration and dynamics • Soil quality and sediment deposition regime • Surface water flow regime • Water temperatures and chemistry • Water level fluctuations	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Roads and railroads	• Data Collection and Analysis • Direct Management • Law and Policy • Outreach and Education

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Table 3 Conservation Targets and Strategies for the Bay Delta and Central Coast Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
American Southwest Riparian Forest and Woodland	• By 2025, acres of habitat are increased by at least 5% from 2015 acres of riparian habitat in the Central Coast Ecoregion. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, miles connected are increased by at least 5% from 2015 miles of riparian habitat. • By 2025, miles with desired level of discharge are increased by at least 5% from 2015 miles. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres of riparian habitat.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Water level fluctuations	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads • Utility and service lines	• Direct Management • Land Acquisition/Easement/ Lease • Outreach and Education
California Grassland, Vernal Pools, and Flowerfields	• By 2025, acres of grassland habitat restored are increased by at least 5% from 2015 acres. • By 2025, acres of vernal pool habitat restored are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres by treatment with managed grazing. • By 2025, population of key species (spadefoot toad) is increased by at least 5% from 2015 population levels. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres by reducing encroachment of coyote bush/coastal scrub into grassland. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles through length of hydroperiod. • By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles by meeting standards of Basin Plan.	• Area and extent of community • Community structure and composition • Successional dynamics • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Renewable energy • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/ Easement/ Lease • Land Use Planning • Partner Engagement
Coastal Sage Scrub Northwest Coast Cliff and Outcrop Coastal Dune and Bluff Scrub North Coast Deciduous Scrub and Terrace Prairie	• By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Soil quality and sediment deposition regime	• Airborne pollutants • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads • Tourism and recreation areas	• Data Collection and Analysis • Direct Management • Environmental Review • Land Acquisition/Easement/ Lease • Land Use Planning • Law and Policy • Management Planning • Partner Engagement

Table 3 Conservation Targets and Strategies for the Bay Delta and Central Coast Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Coastal Lagoons	• By 2025, area (miles/acres) with desired nutrient load (TMDL) are increased by at least 5% from 2015 area (miles/acres). • By 2025, acres of lagoon habitat are increased by at least 5% from 2015 acres. • By 2025, acres of connected lagoon habitat are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of discharge (water level) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Nutrient concentrations and dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Garbage and solid waste • Housing sewage and urban waste water • Housing and urban areas • Livestock, farming, and ranching • Other ecosystem modifications • Recreational activities • Roads and railroads • Tourism and recreation areas • Wood and pulp plantations	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Training and Technical Assistance
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat acre increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver, tricolored blackbird, giant garter snake, and western pond turtle) are increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Salt Marsh	• By 2025, miles with desired level of water quality are increased by at least 5% from 2015 miles. • By 2025, acres of habitat (salt-marsh habitat) are increased by at least 5% from 2015 acres. • By 2025, acres with desired genetic connectivity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres of habitat (salt-marsh habitat by providing high-tide refugia for native species) are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of water yield (consistent with the Bay-Delta Water Quality Control Plan requirements) are increased by at least 5% from 2015 miles. • By 2025, improve water quality in the San Francisco Bay Delta by meeting Total Maximum Daily Load (TMDL) requirements for organic and inorganic pollutants. • By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Pollutant concentrations and dynamics • Soil quality and sediment deposition regime • Successional dynamics • Water level fluctuations	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Other ecosystem modifications • Roads and railroads • Shipping lanes	• Data Collection and Analysis • Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education • Partner Engagement

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Central Valley and Sierra Nevada Province

Table 4 Conservation Targets and Strategies for Central Valley and Sierra Nevada Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
American Southwest Riparian Forest and Woodland	• By 2025, acres of functional riparian habitat are increased by at least 5% from 2015 acres. • By 2025, acres connected riparian habitat are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from 2015 acres/miles. • By 2025, acres/miles with total dissolved solids (meeting TMDL) are decreased by at least 5% from 2015 acres.	• Area and extent of community • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Roads and railroads • Utility and service lines	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Chaparral Desert Transition Chaparral Montane Chaparral California Foothill and Coastal Rock Outcrop Vegetation	• By 2025, acres of macrogroup habitat (target) are maintained or increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired connectivity are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Housing and urban areas • Livestock, farming, and ranching • Renewable energy	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Partner Engagement
California Foothill and Valley Forests and Woodlands	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, populations of key species (oaks) are increased by at least 5% from 2015 population. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of water yield are increased by at least 5% from 2015 miles.	• Community structure and composition • Fire regime • Soil quality and sediment deposition regime • Successional dynamics	• Climate change • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities • Roads and railroads	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Outreach and Education • Partner Engagement

Table 4 Conservation Targets and Strategies for Central Valley and Sierra Nevada Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
North Coastal Mixed Evergreen and Montane Conifer Forests	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity (increase rotation age) are increased by at least 5% from 2015 acres. • By 2025, acres of habitat (with increased recruitment of oaks, aspen, and shrubs) are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired water yield are increased by at least 5% from 2015 acres/miles.	• Community structure and composition • Hydrological regime • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Livestock, farming, and ranching • Logging and wood harvesting • Renewable energy • Utility and service lines	• Data Collection and Analysis • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Alpine Vegetation	• By 2025, acres connected are maintained within the ecoregion from 2015 acres. • By 2025, acres of macrogroup (target) are maintained within the ecoregion from 2015 acres. • By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained within the ecoregion from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems	• Climate change • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities	• Data Collection and Analysis • Direct Management • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Pacific Northwest Subalpine Forest	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Parasites/pathogens/diseases • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Environmental Review • Land Use Planning • Management Planning • Partner Engagement • Training and Technical Assistance
Wet Mountain Meadow Western Upland Grasslands	• By 2025, acres of habitat (meadows) are increased by at least 5% from 2015 acres. • By 2025, populations of key species (hydrophilic vegetation for SGCNs) are increased by at least 5% from 2015 population. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres/miles with a natural hydrologic regime are increased by at least 5% from acres/miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics (reduced sediment input) are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of discharge are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Soil quality and sediment deposition regime • Water level fluctuations	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Housing and urban areas • Invasive plants/animals (non-native) • Invasive plants/animals (native species) • Livestock, farming, and ranching • Logging and wood harvesting • Parasites/pathogens/diseases • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Outreach and Education
Clear Lake Native Fish Assemblage	• By 2025, acres of habitat (wetland) are increased by at least 5% from 2015 acres. • By 2025, acres of habitat (riparian) are increased by at least 5% from 2015 acres. • By 2025, populations of key species (tule perch, prickly sculpin, and Clear Lake hitch) are increased by at least 5% from 2015 population. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, water flow of Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake County is increased by at least 5% during spring and early summer season so that native fish species could better migrate in these creeks. • By 2025, miles with desired stream stage (in Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake Co. during spring and early summer season) are increased by at least 5% from 2015 miles. • By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Nutrient concentrations and dynamics • Pollutant concentration and dynamics • Soil quality and sediment deposition regime • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Invasive plants/animals • Mining and quarrying • Recreational activities	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Outreach and Education • Partner Engagement

Table 4 Conservation Targets and Strategies for Central Valley and Sierra Nevada Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Carson River Native Fish Assemblage	• By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles in the Carson River basin. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles (consistent with TMDL). • By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Fire regime • Pollutant concentration and dynamics • Soil quality and sediment deposition regime • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Household sewage and urban waste water • Housing and urban areas • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education • Training and Technical Assistance
Walker River Native Fish Assemblage	• By 2025, miles of streams with target fish population (SGCNs) are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles connected (i.e., past barriers) are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5% from 2015 miles. • By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5% from 2015 miles. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Surface water flow regime • Water quality	• Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Data Collection and Analysis • Direct Management • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
San Joaquin Native Fish Assemblage	• By 2025, miles connected native fish habitat are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles with desired level of water yield (flow) are increased by at least 5% from 2015 miles. • By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. • By 2025, acres/miles of native fish habitat with desired temperature are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Surface water flow regime • Water level fluctuations • Water quality • Water temperature and chemistry	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Household sewage and urban waste water • Invasive plants/animals • Marine and freshwater aquaculture • Recreational activities	• Data Collection and Analysis • Direct Management • Law and Policy • Management Planning • Outreach and Education
Upper Kern River Native Fish Assemblage	• By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles (consistent with TMDL). • By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Fire regime • Soil quality and sediment deposition regime • Surface water flow regime	• Climate change • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Outreach and Education • Training and Technical Assistance

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Table 5 Conservation Targets and Strategies for the South Coast Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
California Grassland and Flowerfields	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired endemic plant/animal diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, populations of key species are increased by at least 5% from 2015 population levels. • By 2025, acres/miles with desired plant/animal diversity are increased by at least 5% from 2015 acres/miles. • By 2025, acres with desired genetic connectivity are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Nutrient concentrations and dynamics • Successional dynamics • Soil quality and sediment deposition regime	• Annual and perennial non-timber crops • Climate change • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Partner Engagement
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
American Southwest Riparian Forest and Woodland	• By 2025, acres of habitat are maintained or increased by at least 5% in every watershed throughout the ecoregion. • By 2025, acres/miles of continuous riparian habitat are increased by at least 5% from 2015 levels. • By 2025, the range of more than one riparian SGCN is maintained or increased by at least 5%. • By 2025, miles of stream that display the full range of age classes and vegetation layers (herb, shrub, subtree, trees) are increased by at least 5% from 2015 levels. • By 2025, miles of surface water flows, both ephemeral and permanent, are restored to mimic historic patterns (hydrographs) of flooding and low flow patterns by at least 5% from 2015 miles. • By 2025, acres where native species are dominant are increased by at least 5% of riparian habitat. • By 2025, miles connected are increased by at least 5% from 2015 miles of riparian habitat connected.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Surface water flow regime • Water level fluctuations	• Catastrophic geological events • Climate change • Dams and water management/use • Fire and fire suppression • Garbage and solid waste • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Recreational activities • Roads and railroads • Tourism and recreation areas	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Native Fish Assemblage	• By 2025, miles of streams containing their historic native fish composition are increased by at least 5%. • By 2025, at least two more streams than in 2015 have improved connectivity. • By 2025, the ratio of native fish to non-native fish in Big Tujunga Creek, Haines Creek, and the Santa Clara River mainstem is increased by at least 5%. • By 2025, all species and their life stages are present and commonly encountered during summer fish surveys within their currently known range. • By 2025, suitable flows are released to maintain target populations below Big Tujunga and Cogswell dams. • By 2025, the natural hydrologic regime in coastal lagoons that support target species is maintained or increased by at least 5%.	• Community structure and composition • Connectivity among communities and ecosystems • Surface water flow regime • Water level fluctuations	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Mining and quarrying	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Outreach and Education
South Coast Native Aquatic Herp Assemblage	• By 2025, area occupied by assemblage is increased by at least 5% from 2015 levels. • By 2025, all populations contain both juvenile (egg and tadpole) and adult life stages in adequate abundance to ensure population sustainability. • By 2025, non-native invasive aquatic species are reduced by at least 5% within sensitive amphibian habitat, and their source populations are identified to aid recovery of native amphibians. • By 2025, flow regimes to provide access to suitable habitat for native species are restored by at least 5% from 2015.	• Area and extent of community • Community structure and composition • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Housing and urban areas • Invasive plants/animals • Mining and quarrying • Parasites/pathogens/diseases • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Outreach and Education

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Table 6 Conservation Targets and Strategies for the Deserts Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Big Sagebrush Scrub	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime	• Climate change • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Parasites/pathogens/diseases • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Partner Engagement
Great Basin Pinyon-Juniper Woodland	• By 2025, acres where desired native species are dominant and desired structural diversity are increased by at least 5% within the presettlement range of pinyon-juniper and juniper habitats in the ecoregion. • By 2025, acres of desired successional stage are increased by at least 5% from presettlement habitat area. • By 2025, acres with desired fire return level are increased by at least 5% from 2015 levels.	• Community structure and composition • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Other ecosystem modifications	• Data Collection and Analysis • Direct Management • Partner Engagement
Shadscale-Saltbush Scrub	• By 2025, acres of disturbed areas showing signs of successional dynamics are increased by at least 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired endemic plant/animal diversity are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with habitat connectivity are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from acres/miles. • By 2025, acres with suitable soil characteristics are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Successional dynamics	• Airborne pollutants • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Military activities • Mining and quarrying • Recreational activities • Renewable energy • Roads and railroads • Utility and service lines	• Data Collection and Analysis • Land Acquisition/Easement/ Lease • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Desert Wash Woodland and Scrub	• By 2025, acres of (desert wash) habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired endemic plant/animal diversity are increased at least 5% from 2015 acres. • By 2025, population of key species (Couch's spadefoot) is increased by at least 5% from 2015 population levels. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, miles with habitat connectivity (desert wash habitat) are increased by at least 5% from 2015 miles. • By 2025, miles with stable bank (desert wash) are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (water volume and flow) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Soil quality and sediment deposition regime • Surface water flow regime	• Climate change • Commercial and industrial areas • Dams and water management/use • Housing and urban areas • Military activities • Mining and quarrying • Recreational activities • Renewable energy • Roads and railroads • Tourism and recreation areas • Utility and service lines	• Data Collection and Analysis • Land Use Planning • Outreach and Education • Partner Engagement
Sparsely Vegetated Desert Dune	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres of habitat are maintained or increased by at least 5% from 2015 acres. • By 2025, acres of habitat with suitable soil characteristics regimes are increased by at least 5% from 2015 acres. • By 2025, acres of habitat with desired ground water levels are increased by at least 5% from 2015 acres. • By 2025, acres of habitat with desired connectivity are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime	• Climate change • Commercial and industrial areas • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities • Renewable energy • Tourism and recreation activities	• Data Collection and Analysis • Direct Management • Land Use Planning • Management Planning • Partner Engagement
American Southwest Riparian Forest and Woodland	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres of target habitat are increased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Housing and urban areas • Invasive plants/animals • Parasites/pathogens/diseases • Recreational activities • Renewable energy	• Data Collection and Analysis • Direct Management • Land Use Planning

Table 6 Conservation Targets and Strategies for the Deserts Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
High Desert Wash and "Rangeland" Scrub Great Basin Upland Scrub	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Successional dynamics	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Renewable energy	• Data Collection and Analysis • Direct Management • Management Planning • Partner Engagement
Mojave and Sonoran Desert Scrub	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with habitat connectivity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, populations of key species are increased by at least 5% from 2015 population. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Weather regime	• Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Housing and urban areas • Invasive plants/animals • Renewable energy • Roads and railroads • Utility and service lines	• Land Acquisition/Easement/ Lease • Land Use Planning • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Walker River Native Fish Assemblage	• By 2025, miles of streams with target fish population (SGCNs) are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles with habitat connectivity (i.e., past barriers) are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5% from 2015 miles. • By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5% from 2015 miles. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Surface water flow regime • Water quality	• Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Data Collection and Analysis • Direct Management • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Cienegas	• By 2025, acres of cienegas habitat are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime (frequent low-intensity fire) are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired inches of groundwater (stable depth) are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Fire regime • Hydrological regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Housing and urban areas • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Parasites/pathogens/diseases • Renewable energy	• Data Collection and Analysis • Direct Management • Land Acquisition/ Easement/ Lease • Outreach and Education • Partner Engagement
Springs and Spring Brooks	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles with habitat connectivity are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired inches of groundwater are increased by at least 5% from 2015 acres/miles. • By 2025, acres/miles with desired water yield are increased by at least 5% from 2015 acres/miles. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Successional dynamics • Surface water flow regime • Water quality	• Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Marine and freshwater aquaculture • Recreational activities • Renewable energy	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Outreach and Education • Partner Engagement
Anthropogenically Created Aquatic Features	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired genetic connectivity are increased (between Salton Sea drains) by at least 5% from 2015 acres. • By 2025, miles with stable bank are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (mimic natural flow hydrograph) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Soil quality and sediment deposition regime • Surface water flow regime • Water quality	• Agricultural and forestry effluents • Climate change • Dams and water management/use • Invasive plants/animals • Marine and freshwater aquaculture • Recreational activities • Renewable energy • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Use Planning • Law and Policy • Outreach and Education • Partner Engagement

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Marine Province

Table 7 Conservation Targets and Strategies for the Marine Province

Target*	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Embayments Estuaries Lagoons	• By 2025, in coordination with partners, area of target is increased by at least 5% (with half of this new area available as buffer for sea level rise). • By 2025, increase reproductive success of native shorebirds by at least 5%, increase native oyster populations by at least 5%, and reduce key invasive species populations (those that pose the greatest ecological risk) by at least 5%, as indicators of improved community structure in the embayments, estuaries, lagoons ecosystems. • By 2025, protect at least 5% more shorebird habitats to secure high quality embayments, estuaries, lagoons ecosystems. • By 2025, native seagrass (eelgrass) bed acreage is increased by at least 5%. (Will result in an increase in floating vegetation) • By 2025, in coordination with partners, surface water flow (both ephemeral and permanent) is increased by at least 5% into embayments, estuaries, lagoons. • By 2025, in coordination with State Water Boards and other partners, improve the water quality of tributaries that flow into embayments, estuaries, lagoons by meeting at least 5% of the TMDLs. • By 2025, in coordination with partners, at least 5% of the embayment, estuary, and lagoon water bodies improve circulation and hydro-connectivity so that key ecological processes are restored, for example, nutrient and other chemical mixings in the water body are functioning better and improved tidal marsh evolutions are experienced throughout the target. • By 2025, in coordination with State Water Boards and other partners, the water quality standards are met for at least 5% of those embayment, estuary, and lagoon water bodies not currently meeting those standards. • By 2025, in coordination with State Water Boards and other partners, the sediment quality objectives are met for at least 5% of those embayment, estuary, and lagoon water bodies not currently meeting those objectives.	• Area and extent of community • Biogenic habitat • Circulation and connectivity within target • Community structure and composition (e.g., key species population levels, age class structure, biodiversity, endemic diversity, native versus non-native diversity) • Hydrologic characteristics (e.g., flow coming into and out of target) • Quantity of sediment delivered into target (sediment deposition) • Sediment quality • Water quality	• Agricultural and forestry effluents • Airborne pollutants • Climate change • Dams and water management/use • Fishing, harvesting, and collecting aquatic resources • Garbage and solid waste • Household sewage and urban wastewater (urban runoff) • Housing and urban areas, commercial and industrial areas (shoreline development) • Industrial and military effluents (hazardous spills) • Industrial and military effluents, household sewage and urban wastewater (point discharges) • Invasive plants/animals • Logging and wood harvesting • Marine and freshwater aquaculture • Other ecosystem modifications (modifications of mouth/channels, ocean/estuary water diversion/control, artificial structures) • Parasites/pathogens/diseases • Recreational activities • Shipping lanes (ballast water) • Stormwater (urban runoff)	• Data Collection and Analysis • Direct Management • Economic Incentives • Environmental Review • Land Acquisition/Easement/Lease • Land Use Planning • Law and Policy • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance

* Conservation strategies were only developed for the embayments, estuaries, lagoon target. Strategies for other marine conservation targets will be developed in the future. See Appendix H for discussion of Offshore Islands.

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.

[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Table 8 Conservation Targets and Strategies for Anadromous Fish

Geography	Conservation Target	Conservation Strategy (Implementation by 2025)	
Statewide	In-river spawning and rearing habitat	• Document range and distribution of spawning and rearing habitat. • Enhance and protect key spawning and rearing habitat for each specific anadromous species.	• Promote restoration actions that focus on ecological processes and climate change resilience (e.g., removing barriers to migration, expanding riparian corridors).
	River flow	• Identify annual flow regimes and habitat connectivity necessary for migration, rearing, and spawning of each anadromous species. • Develop water management and conservation plans necessary to conserve anadromous fishes.	• Implement water management and conservation plans.
	Wetland habitat	• Identify current condition of riparian and marsh habitat associated with anadromous species. • Restore marsh and riparian habitat to improve carrying capacity of anadromous fishes.	• Protect key areas necessary to maintain viable populations.
North Coast and North Central Coast	California Anadromous Salmonid Stronghold Watersheds Conditions	• Establish collaborative working groups for each Stronghold (Smith, Mattole, and South Fork Eel rivers). • Assess ecological and human conditions that are allowing for healthy fish populations.	• Establish technical, agency, and financial support to maintain and expand ecological and human conditions supporting strong salmon and steelhead populations.
	Coastal estuaries	• Evaluate current condition and estuarine needs for coho salmon, eulachon, Pacific lamprey, and longfin smelt in key estuaries (i.e., Smith, Klamath, and Eel rivers and Humboldt Bay). • Restore and enhance estuary habitat, connectivity, and ecological processes essential for anadromous species.	• Establish estuary function and structure that will allow anadromous migration and be responsive to climate change.
	Russian River Watershed Conditions	• Restore and enhance estuary and river habitat necessary to support viable populations of all listed anadromous fishes (i.e., Chinook salmon, coho salmon, steelhead, green sturgeon). • Develop and implement water management plan to ensure Russian River fisheries and land use are compatible.	• Expand Warm Springs Hatchery complex to function as a potential regional conservation facility for coho salmon and other listed species in the North-Central Domain.
Klamath-Trinity Rivers Basin	Pacific lamprey	• Establish standing committee of local, tribal, State, and federal partners in the Klamath-Trinity Rivers Basin to implement interstate/intertribal 2012 Pacific lamprey conservation agreement. • Implement basin-wide habitat restoration and monitoring programs.	• Secure funding specific for conserving Pacific lamprey in the Klamath/Trinity Rivers Basin.
	Ecological processes	• Evaluate wood debris, gravel, and water cycling and transport mechanisms across the basins. • Establish agreements and practices to ensure adequate ecological processes, habitat quality, and connectivity are maintained to support sustainable anadromous populations across the basins.	• Establish monitoring and evaluation programs to track ecological processes and functioning.
	Listed and at-risk salmonids	• Establish standing inter-organizational team to implement federal and state recovery plans, and continue to support the Trinity River Restoration Plan, and Klamath River Settlement. • Integrate recovery actions with strategic hatchery management (e.g., Iron Gate and Trinity River facilities).	• Integrate sustainable river and tribal fisheries with establishing sustainable, natural populations of salmon and steelhead.
South-Central and Southern California Coasts	Steelhead trout populations	• Establish a robust monitoring program to evaluate steelhead populations, habitat, and ecological processes. • Secure additional funding necessary to pursue essential habitat recovery.	• Determine role of resident populations to recovery and sustainability of anadromous populations.
	Migration barriers	• Remediate most downstream barriers to steelhead entering rivers and streams. • Accelerate planning and remediation of rim dam barriers to key steelhead populations.	• Modify land use practices (e.g., water use, agriculture, recreation, urban and road development) to minimize effects on migration corridors.
	Water management	• In addition to the statewide strategy, identify key streams and locations essential for over-summering juvenile and adult steelhead. • Investigate ability and options to creating water banks for steelhead habitat.	• Update CDFW management and conservation plan to integrate modern water management, including drought and climate change parameters.
Central Valley	Pacific lamprey	• Establish standing committee to implement interstate/intertribal 2012 Pacific lamprey conservation agreement. • Implement habitat restoration and monitoring programs.	• Secure funding specific for conserving Pacific lamprey in the Central Valley.
	Sturgeon	• Establish fisheries management and conservation plans for white and green sturgeon. • Implement habitat restoration and monitoring programs.	• Secure funding specific for conserving sturgeon populations and fisheries in the Central Valley.
	Chinook salmon and steelhead	• Establish biological production goals for each species, coupled with SMART ecological objectives, prioritized restoration actions, focused biotic and abiotic monitoring, and adaptive management planning framework that are developed and overseen by an established standing inter-organizational team to integrate activities of NMFS and CDFW recovery programs, Central Valley Program Improvement Act program, Bay Delta Conservation Plan, San Joaquin River Restoration program, and CDFW fisheries programs to establish sustained salmon and steelhead populations and fisheries.	• Revise and integrate hatchery practices of the six facilities in the Central Valley to maximize scientific standards, minimize effects of programs on natural spawning populations and river habitat, and promote healthy fisheries populations. • Conduct rim dam re-introduction pilot projects on Yuba and Sacramento rivers and evaluate efficacy of expanding rearing and spawning habitats for recovery.

Statewide Summary of Most Common Key Ecological Attributes, Stresses, Pressures, and Strategies

Input provided by the regional teams was summarized using available data through June 2014 (Tables 9 through 12). This summary depicts a current statewide trend regarding the overall status of the state's ecosystem health, key conservation factors, and conservation actions needed to improve ecosystem conditions. Several strategies have been created or refined since June 2014 and these changes are not reflected in the summary below. In addition, the pressure of "climate change" has not been included in this summary. Climate change is discussed in more detail in the province sections (Chapter 5). Table 13 provides, at a state-wide level, the strategies that are most commonly applied to each pressure identified for the priority conservation targets.

Table 9 Most Commonly Identified Key Ecological Attributes

Key Ecological Attributes	Conservation Unit Type	
	Terrestrial	Aquatic
Area and extent of community	X	X
Community structure and composition	X	X
Connectivity among communities and ecosystems	X	X
Fire regime	X	
Successional dynamics	X	
Surface water flow regime		X

Table 10 Most Commonly Identified Stresses

Stress	Conservation Unit Type	
	Terrestrial	Aquatic
Change in annual average temperatures [climate related factor]	X	X
Change in annual average precipitation [climate related factor]	X	X
Change in natural fire regime	X	
Change in runoff and river flow		X
Change in water level and hydroperiod		X
Change in groundwater table		X
Change in spatial distribution of habitat types	X	
Change in community structure or composition	X	
Change in biotic interactions (altered community dynamics)	X	
Change in succession processes and ecosystem development	X	
Habitat fragmentation	X	

Table 11 Most Commonly Identified Pressures

Pressures	Conservation Unit Type	
	Terrestrial	Aquatic
Agriculture and forestry effluents		X
Annual and perennial non-timber crops	X	X
Dams and water management		X
Fire and fire suppression	X	X
Housing and urban development	X	
Introduced genetic materials		X
Invasive plants and animals	X	X
Livestock, farming, and ranching	X	X
Recreational activities	X	X
Roads and railroads	X	X
Utility and service lines	X	

Table 12 Most Commonly Identified Strategies

Strategies	Conservation Unit Type	
	Terrestrial	Aquatic
Data Collection and Analysis	X	X
Partner Engagement	X	X
Management Planning	X	X
Direct Management - Manage Invasive Species	X	X
Direct Management - Habitat Restoration	X	
Direct Management - Manage Dams and Other Barriers		X
Direct Management - Species Reintroductions		X
Land Acquisition, Easements, and Lease	X	X
Law and Policy	X	
Outreach and Education	X	X

Table 13 Number of Conservation Strategy Categories Addressing Each Pressure

Pressure	Strategy Category										
	Data collection and analysis	Partner engagement	Management planning	Direct management	Economic incentives	Environmental review	Land acquisition, easement, and lease	Land use planning	Law and policy	Outreach and education	Training and technical assistance
Agricultural and forestry effluents	○	○	○	○		○		○	○	○	○
Airborne pollutants	○	○	○			○		○	○		
Annual and perennial non-timber crops	●	○	○	●	○		●	○	○	○	○
Catastrophic geological events	○										
Climate change	●	●	○	○	○	○		○	○	○	○
Commercial and industrial areas[1]	○	○	○	○	○	○	●	○	○	○	
Dams and water management/use[2]	○	●	○	○	○	○	○	○	○	○	
Fire and fire suppression	▣	▣	○	▣				○	○	○	○
Garbage and solid waste	○	○	○			○			○	○	○
Household sewage and urban wastewater[3]	○		○					○	○	○	○
Housing and urban areas[1]	●	●	○	○	○	○	▣	○	○	○	
Industrial and military effluents[4]		○	○					○	○	○	
Fishing and harvesting aquatic resources		○	○			○			○	○	
Introduced genetic material	○	○	○	○						○	○
Invasive plants/animals	▣	▣	▣	■	○		○	○	○	◙	○
Livestock, farming, and ranching	○	●	●	▣	○		●		●	●	○
Logging and wood harvesting	○	○	○			○	○		○	○	
Marine and freshwater aquaculture	○	○	○	○				○	○	○	
Military activities		○									
Mining and quarrying			○	○							
Other ecosystem modifications[5]			○	○				○	○	○	
Parasites/pathogens/diseases	○	○	○	○	○			○	○	○	
Recreational activities	○	○	○	○				○	○	○	○
Renewable energy	○	●	○	○			○	○		○	
Roads and railroads	○	●	○	○	○	○	○	○	○	○	
Shipping lanes[6]	○	○	○					○	○	○	
Tourism and recreation areas	○	○					○	○	○		
Utility and service lines	○	○	○				○	○		○	
Wood and pulp plantations	○			○			○		○		○

Number of strategies: ○ = 1-9, ● = 10-19, ▣ = 20-29, ◙ = 30-39, ■ = 40-49

Pressures include the following, which are unique to the Marine Province:

[1] Shoreline development, artificial structures
[2] Urban runoff
[3] Point discharge
[4] Hazardous spills and point discharge
[5] Modification of mouth/channels and ocean/estuary water diversion/control
[6] Ballast water

Integration and Implementation

Integration and implementation are two of the most important aspects of SWAP 2015 development. Implementation of California's SWAP 2015 will involve integrating SWAP features into other resource management programs and plans led by CDFW or partners, developing more detailed SWAP implementation plans, systematically pursuing resources necessary for implementation of conservation strategies, effectively coordinating and collaborating with CDFW partners, and adaptively responding to emerging issues.

Because of California's tremendous biodiversity and the broad spectrum of actions needed to implement conservation strategies across a complex assemblage of resources, land uses, government activities, and resource-consumptive industries, CDFW determined that a more detailed coordination framework for SWAP 2015 implementation was needed beyond the presentation in SWAP 2015. Called "companion plans," these sector-specific action plans will be instrumental in the implementation of SWAP 2015. CDFW, in partnership with other state and federal agencies and organizations involved in the use, management, and conservation of California's natural resources and cultural heritage, are creating nine sector-specific plans.

Sector-Specific Companion Plans:

- Agriculture
- Consumptive and Recreational Uses
- Energy Development
- Forests and Rangelands
- Land Use Planning
- Transportation Planning
- Tribal Lands
- Water Management
- Marine Resources

Companion plans will support development of well-coordinated, collaborative, multi-stakeholder efforts that leverage human and financial resources, as well as increase efficiencies for implementation of strategies, to achieve goals and objectives of SWAP 2015. These plans will identify shared priorities of SWAP 2015 and CDFW partners, and mutually strengthen the conservation capabilities of CDFW and participating organizations.

Adaptive Management and Monitoring

Natural communities, ecosystems, species population dynamics, and the effects of pressures or conservation actions on the environment are inherently complex. Resource managers often need to take action to conserve species even though scientific information may be incomplete and outcomes of the actions may be uncertain. Adaptive management is essential to implementing effective conservation programs in light of these challenges. In the implementation of a conservation plan, adaptive management is a process of continually monitoring and assessing relevant environmental conditions, as well as the effects and effectiveness of conservation strategies, and adjusting the plan when improvement is needed to achieve the desired outcomes. SWAP 2015 has integrated the concept of adaptive management into its preparation and implementation.

For SWAP 2015, CDFW has adopted a framework of effectiveness measures that is consistent with the *Open Standards for the Practice of Conservation* (http://www.conservationmeasures.org) and that has been recommended by the Association of Fish and Wildlife Agencies (AFWA; 2011). This framework establishes a standardized and readily accessible monitoring and evaluation process to inform and guide SWAP design and implementation. Under the effectiveness measure framework, the information gathered through monitoring and evaluation can be used to identify successful strategies that should be continued and shared, and also to identify less effective ones that should be improved or abandoned. The effectiveness measure framework also provides a mechanism for CDFW to report on the status of SWAP implementation to USFWS, conservation partners, and the public.

SWAP 2015 employs three types of monitoring: (1) status monitoring, which tracks conditions of species, ecosystems, and other conservation factors over time; (2) effectiveness monitoring, which determines if conservation strategies are having their intended results and identifies ways to improve actions that are less effective (i.e., through adaptive management); and (3) effect monitoring, which addresses whether and how the target conditions are being influenced by the implementation of strategies. The effectiveness measure framework promoted by AFWA and adopted for SWAP 2015 brings these three types of monitoring together to (1) attribute changes in ecosystems and species status to the effectiveness of SWAP conservation strategies, and (2) roll up the results of many different strategies into statewide reports.

Conclusion

California's SWAP 2015 establishes a strategic vision of the integrated conservation efforts needed to sustain the tremendous diversity of fish and wildlife resources found in the state. Although SWAP 2015 is not a specific work plan for CDFW or any other organization, it is meant to visualize, support, complement, and unite the plans of the multiple conservation and management entities within California. More detailed, operation-level plans will be needed to complete many of the strategies identified in SWAP 2015. Such plans should be developed by the appropriate entities whose interest, authority, or responsibility encompass each action and in coordination with the SWAP and its companion plans. Support provided by the SWG program will enable coordination and implementation of many projects identified in the SWAP.

SWAP 2015 is an adaptive plan that will continually be updated, revised, and improved, based on the input and deliberations of all those involved in wildlife conservation. Working together, Californians can shape a future with abundant wildlife, outstanding biodiversity, and healthy ecosystems that define the state and provide for the inspiration, recreation, sustenance, and livelihood of its residents and visitors for current and coming generations.

1 Introduction and Vision

> "One thing is clear—to be effective, SWAPs need to serve as a catalyst for conservation, a mechanism for aggregating data that can be presented in a geospatial context, and that provides easily accessible and usable products by any and all for the purpose of conservation."
>
> SWAP Best Practices Report, AFWA 2012

California's State Wildlife Action Plan (SWAP) is a comprehensive, statewide plan for conserving the state's fish and wildlife and their vital natural habitats for future generations. It is part of a nationwide effort by all 50 states and five U.S. territories to develop conservation action plans and participate in the federally authorized State and Tribal Wildlife Grants (SWG) Program.

The purpose of the SWG Program is to support state actions that broadly benefit wildlife and habitats, but particularly the "Species of Greatest Conservation Need" (SGCN) identified by the individual states. Each state has prepared a SWAP that assesses the health of the state's wildlife and habitats, identifies the problems they face, and outlines the actions needed to conserve them over the long term. SWAPs describe the steps needed to conserve fish and wildlife and their habitats before species become too rare or habitats become too costly to restore. Taken as a whole, all the SWAPs together present a national action blueprint for conserving the country's wildlife heritage and preventing species from becoming threatened or endangered.

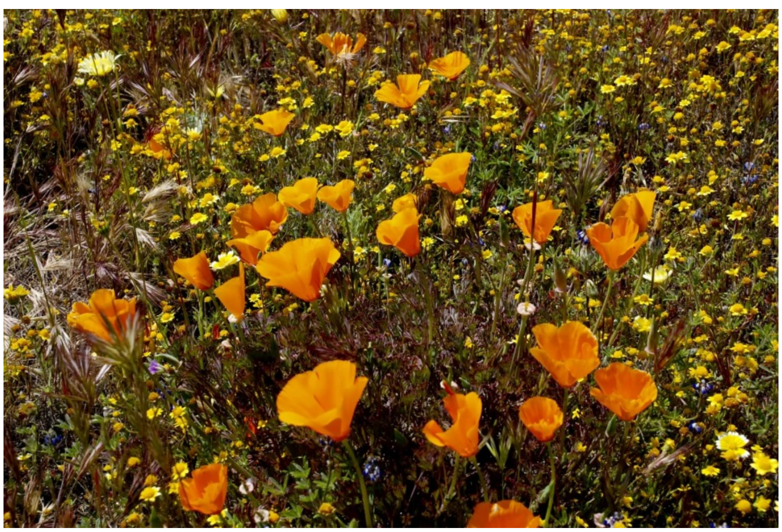
California developed its first SWAP in 2005 (called SWAP 2005 in this document). At that time, California Department of Fish and Game (CDFG) worked in collaboration with the University of California, Davis to prepare *California Wildlife: Conservation Challenges – California's Wildlife Action Plan* (CDFG 2005). To meet current requirements of the grant program, California Department of Fish and Wildlife (CDFW, formerly CDFG) has now prepared SWAP 2015, the first comprehensive update of SWAP 2005.

SWAP 2015 is an adaptive management plan that will continually be updated, revised, and improved, based on the input and deliberations of all those involved in wildlife conservation. Working together, Californians can shape a future with abundant wildlife, outstanding biodiversity, and healthy ecosystems that define the state and provide for the inspiration, recreation, sustenance, and livelihood of its residents and visitors for current and coming generations.

1.1 California's Challenge – Sustaining Biodiversity

California is a state with both tremendous biodiversity and a large and growing human population. The challenges of supporting sustainable socioeconomic activities while protecting natural heritage are, therefore, paramount. SWAP 2015 is a key component of the state's approach to meet these challenges.

California's landscapes support the greatest biodiversity of any state in the nation. With a Mediterranean climate and varied topography, geology, soils, and hydrology, the state's vegetation communities are recognized as one of the world's important biodiversity hotspots. The deserts, mountain ranges, vast valleys, wetlands, woodlands, rivers, estuaries, and marine environments of the state provide habitats for approximately 650 bird species, 220 mammals, 100 reptiles, 75 amphibians (CDFW 2014), approximately 70 freshwater fish (Moyle and Davis 2001), and approximately 6,500 taxa of native plants. California's lands span more than 158,000 square miles with over 4,900 lakes and reservoirs, 175 major rivers and streams, and 1,100 miles of coastline. An integrated ecosystem conservation approach is essential to maintaining healthy wildlife populations in such a diverse setting.



Debra Hamilton, CDFW

California is also the most populous state in the nation. As recognized in the Governor's latest *Environmental Goals and Policy Report* (EGPR), California's population is anticipated to grow from approximately 38 million in 2013 to 50 million by mid-century. This continued growth creates the challenge of how to support an increasing population in harmony with the state's environment and natural resources. Climate change and the state's efforts to confront it will touch nearly every aspect of land use planning, investments for the future, and decisions about natural resource conservation. Among its array of goals, the EGPR calls for the state to take steps to preserve natural systems, working landscapes, and natural resources, as well as striving to increase ecosystem services and biodiversity and ensure resilience of natural systems to recover from disruption (Governor's Office of Planning and Research [OPR] 2013).

1.2 CDFW Jurisdiction

CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, plants, and habitat necessary for biologically sustainable populations of those species. It includes the authority to manage threatened or endangered native animals and plants and to acquire and seek the designation of wildlife areas, ecological reserves, and other natural areas. SWAP 2015 helps CDFW fulfill these responsibilities.

As the state's trustee agency for fish and wildlife resources, CDFW is responsible for providing biological expertise to review and comment upon environmental documents and impacts arising from development, infrastructure, and other project activities as they are considered under the California Environmental Quality Act, or CEQA (Public Resources Code 21000 et seq.). (A "trustee agency" is a state agency having jurisdiction by law over natural resources that may be affected by a project and that are held in trust for the people of the state of California.)

Bob Sahara, CDFW

CDFW responsibilities also include, but are not limited to:

- conducting wildlife resource assessments, wildlife and habitat research and monitoring, conservation planning, and wildlife management;
- assisting with the development of, and issuing approvals for, Natural Community Conservation Plans;
- regulating alteration to the bed, bank, channel or flow of rivers, lakes, and streams;
- regulating the take of plant and animal species that have been designated as rare, threatened, or endangered by the California Fish and Game Commission;
- collecting scientific data, conducting analyses, evaluating resource status, and developing regulations to provide hunting and fishing opportunities to the public;
- activities that are required by statute, provide considerable public benefit, and contribute substantially to the state's economy;
- protecting, maintaining, enhancing, and restoring California's marine ecosystems for their ecological values and their use and enjoyment by the public through sound science and effective communication;
- serving as the principal state agency contact for wildlife issues in all counties and communities;
- educating the public about wildlife conservation and wildlife public safety issues;

- providing technical advisers for species and habitat conservation planning efforts and evaluating lands considered for acquisition for the benefit of wildlife resources;
- advising local governments, commissions, and working groups regarding biological, technical, and conservation issues;
- serving as the lead state agency charged with helping to resolve human-wildlife conflict, public safety, and depredation problems (an increasing challenge because of growth and development in rural communities and natural areas and expansion of agricultural activities); and
- participating in the development of strategies to monitor, assess, reduce, and manage wildlife disease, as well as responding to potential and actual outbreaks of disease.

1.3 Vision for State Wildlife

A vision for SWAP 2015 has guided its preparation and will facilitate its implementation. The intent of this vision is to provide the underlying foundation for defining conservation strategies in the plan and for addressing changing circumstances that may emerge during its implementation. The vision is presented below.

> Through SWAP 2015, CDFW seeks to conserve the wildlife resources of the nation's most biologically diverse state in harmony with the need to support a growing human population and in recognition of the challenges of a changing climate. SWAP 2015 is a flexible, but scientifically grounded plan. It uses an ecosystem approach to conserve and manage diverse habitats and species and create a blueprint for conservation actions to respond to the highest priorities of California's aquatic, marine, and terrestrial resources. Its implementation relies on making important and helpful conservation information more accessible to resource managers and the public and on developing lasting partnerships with a broad array of governments, agencies, organizations, businesses, and citizens. With guidance from SWAP 2015 and help from many partners, CDFW's vision for the state's wildlife is to sustain the floral and faunal biodiversity of California over the next decade through the strategies described in SWAP 2015 and establish the framework for ongoing conservation for future generations in the decades that follow.

1.3.1 Vision Components

SWAP 2015 describes the key conservation factors crucial to the sustainability of California ecosystems, and for each geographic province, provides specific conservation strategies that will either reduce or ameliorate negative impacts to ecological systems or enhance the qualities vital to the natural landscapes of California. While the SWAP strategies are tailored to specific conservation targets and geographic provinces, several components of the strategies have broader benefits that clearly apply across the state and describe fundamental, desired outcomes for wildlife conservation in California. The vision for wildlife conservation developed through SWAP 2015 includes the following components:

- Maintain and enhance the integrity of ecosystems by conserving key natural processes and functions, habitat qualities, and sustainable native species population levels, so that California's ecosystems are resilient to shifting environmental conditions resulting from climate change.
- Promote partnerships with federal, state, and local agencies; tribal governments; and non-governmental organizations with aligned conservation goals to leverage efficient use of funding and other public resources.
- Inspire greater understanding and recognition of critical needs for wildlife and their habitats by lawmakers, land use planners, private landowners, and others who can influence conservation actions.
- Allocate sufficient water and manage water resources to maintain healthy ecosystems and fish and wildlife populations when considering state and regional water supply needs.
- Provide resources and coordinate efforts with partners to eradicate or control invasive species and to prevent new introductions.
- Promote hunting and fishing as a conservation tool to use when working to eradicate or control invasive or non-native game species.
- Sustain the quality of California's natural resources and biodiversity in harmony with predicted economic growth and human population increases.
- Continue to prioritize protection of key habitat linkages, sensitive habitats, and specialized habitats for SGCN.
- Integrate conservation with the productivity of working landscapes and environments, recognizing the values of agriculture, rangeland, forestry, and fisheries.
- Support conservation programs that benefit all species, habitats, and ecosystems through broad-based public funding from federal, state, special district, and local government sources.
- Educate the public about wildlife conservation issues, including hunting and fishing as a conservation tool, and inspire a conservation ethic in present and future generations through public outreach.
- Enhance conservation capacity by clearly articulating conservation purposes, applying adaptive management techniques, and effectively using staff and financial resources.

1.3.2 Relationship to the CDFW Strategic Plan

The CDFW Strategic Plan was originally issued in May 1995 and was approved by the Governor's Office in October 1997. It was developed in collaboration with stakeholder organizations, employees, and other interested individuals. Updated in 2007, the Strategic Plan is a major tool for CDFW to effectively accomplish its mission and goals. It provides a guiding framework for 10 years or longer, attempts to anticipate the future of California's wildlife resources, and describes the actions to improve CDFW's organizational effectiveness.

SWAP 2015 and the CDFW Strategic Plan are well aligned in their perspective and emphasis on collaboration and partnership for conservation success. To make progress in the contemporary arena of wildlife conservation, CDFW has acknowledged in the Strategic Plan that it must conserve wildlife in a manner that serves the residents of this state. The will of the public, as expressed by laws, regulations, and land use decisions, ultimately determines the quality and quantity of wildlife habitat to be preserved for the state's natural heritage and future generations. These realities suggest a model of action for conserving wildlife that inspires collaboration and cooperation among a wide range of interested parties by placing greater emphasis on educating, motivating, and rewarding the public, landowners, organizations, businesses, and other agencies (CDFG 2007).

This collaborative approach maintains reliance upon the science-based method of making resource management decisions. Offering cooperative arrangements and incentives for conservation can result in a more enlightened and involved public. An informed public will demand that good science remain a vital part of the decision-making process. In keeping with these principles, four themes are reflected in the CDFW Strategic Plan that guide and are wholly consistent with the underpinnings of SWAP 2015:

1. Public service, outreach, and education;
2. Cooperative approaches to resource stewardship and use;
3. Managing wildlife from a broad habitat perspective; and
4. Organizational vitality.

1.4 State and Tribal Wildlife Grant Program

SWAPs prepared by each state represent a groundbreaking effort to bring together the best science available to conserve priority fish and wildlife and their habitats through innovative public-private partnerships. The SWG Program is a primary funding source available for state fish and wildlife agencies and their conservation partners to restore and actively manage the nation's declining wildlife. With no dedicated funding stream, the program has been funded at relatively modest levels averaging just over $1 million in apportioned funding annually for each state and territory. Without the SWG Program, funding for state fish and wildlife diversity programs to prevent endangered species listings would be greatly curtailed or eliminated.

Nationwide, SWAPs have identified 12,000 species that are at risk of becoming endangered and they offered a set of conservation actions to address key pressures, providing a voluntary and non-regulatory alternative to the federal listing process. The SWG Program has had strong bi-partisan backing and is supported by over 6,300 organizations and businesses that make up the Teaming with Wildlife Coalition (http://www.teaming.com). The coalition represents millions of bird watchers, hikers, hunters, anglers, and other nature enthusiasts and their businesses. The coalition was founded in the mid-1990s to specifically advocate for the creation of the SWG program and remains strong and committed today to ensure this successful program continues.

1.4.1 Required SWAP Elements

Each SWAP must be approved by the U.S. Fish and Wildlife Service (USFWS) Director and must consider the broad range of fish and wildlife and associated habitats, with priority on those species with the greatest conservation need. The states must review and, if necessary, revise their SWAPs at least every 10 years. California’s due date for updating SWAP 2005 is October 1, 2015. Revisions to each SWAP must follow the guidance issued in the July 12, 2007 letter from the USFWS Director and the President of the Association of Fish and Wildlife Agencies (AFWA). In satisfying this guidance, as with all state wildlife action plans, SWAP 2015 must address the following eight elements of a comprehensive wildlife conservation strategy required by Congress. These elements are incorporated into the plan and Appendix A identifies where the elements are addressed in SWAP 2015.

The required SWAP elements are:

Element 1: Species Distribution and Abundance. The distribution and abundance of species of wildlife, including low and declining populations, as each state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of wildlife of the state. (In subsequent discussions, these species are referred to as Species of Greatest Conservation Need or SGCN.)

Element 2: Key Habitats and Community Types. The location and relative condition of key habitats and community types essential to the conservation of each state’s SGCN.

Element 3: Problems and Research/Survey Priorities. The problems that may adversely affect SGCN or their habitats, and priority research and surveys needed to identify factors that may assist in restoration and improved conservation of SGCN and their habitats.

Element 4: Conservation Actions and Priorities. The actions necessary to conserve SGCN and their habitats and establish priorities for implementing such conservation actions.

Element 5: Monitoring and Adaptive Management. The provisions for periodic monitoring of SGCN and their habitats, for monitoring the effectiveness of conservation actions, and for adapting conservation actions, as appropriate, to respond to new information or changing conditions.

Element 6: SWAP Review and Update Procedures. Each state’s provisions to review its strategy at intervals not to exceed 10 years.

Element 7: Coordination with Conservation Partners. Each state’s provisions for coordination during the development, implementation, review, and revision of its strategy with federal, state, and local agencies and Indian Tribes that manage significant areas of land or water within the state, or administer programs that significantly affect the conservation of species or their habitats.

Element 8: Public Participation Strategies. Each state's provisions to provide the necessary public participation in the development, revision, and implementation of its strategy.

1.4.2 Summary of Key Changes from SWAP 2005

SWAP 2015 has been substantially updated and revised from SWAP 2005. The changes are based on (1) guidance from USFWS (2007) and AFWA (2011; 2012) about the revision process; (2) an independent evaluation of SWAP implementation from 2005-2014 (see Section 8.2); and (3) new data, directives, and initiatives from CDFW and others relevant to SWAP 2015 (see details below).

Since the approval of SWAP 2005, many new initiatives have been completed or are underway in California that affect or will affect strategies and priorities for managing the state's natural resources. These initiatives include, but are not limited to the following:

- California Natural Resources Agency's 2009 Climate Change Adaptation Strategy and 2014 update, Safeguarding California: Reducing Climate Risk (2009; 2014);
- National Fish, Wildlife and Plant Climate Adaptation Strategy (National Fish, Wildlife, and Plants Climate Adaptation Partnership 2012);
- California Essential Habitat Connectivity Project (Spencer et al. 2010), showing the habitat connectivity of the state;
- Phase II of the Areas of Conservation Emphasis Mapping Model (ACE II), showing biological richness and biodiversity;
- updates to the Species of Special Concern (SSC) documents for birds, mammals, reptiles, amphibians, and freshwater fish;
- implementation of a statewide network of Marine Protected Areas (MPAs), as required by the Marine Life Protection Act (MLPA);
- California Water Plan (California Department of Water Resources [DWR] 2013), and the Governor's Water Action Plan (2014) providing a collaborative framework for decisions about California's water resources;
- development of a large-scale conservation planning effort in the Sacramento-San Joaquin Delta called the Bay Delta Conservation Plan or BDCP (http://baydeltaconservationplan.com);
- development of a large-scale conservation planning effort in the southern California desert region, called the Desert Renewable Energy Conservation Plan or DRECP (CEC et al. 2014);
- Central Valley Flood System Conservation Strategy (DWR 2015);
- California Fish and Wildlife Strategic Vision Plan (CDFW and California Fish and Game Commission 2012);
- initiation of Regional Advanced Mitigation Planning (RAMP; described in more detail in Section 7.1.2);

- adoption of a resolution by the California Biodiversity Council (2013) to promote better alignment among California and federal resource agencies for natural resource conservation priorities;
- adoption of a resolution by the California Biodiversity Council and the Strategic Growth Council (2014) to collaboratively undertake "Integrated Regional Planning Initiatives";
- implementation of the Air Resources Board's Cap-and-Trade Program, which includes conservation actions related to carbon sequestration;
- California Department of Forestry and Fire Protection Fire and Resource Assessment Program's California Forest and Rangelands: 2010 Assessment (2010) and 2015 update in preparation;
- update of the OPR Environmental Goals and Policy Report, California @ 50 Million (2013);
- West Coast Governors' Agreement on Ocean Health Action Plan (2008);
- release of the Nursery Functions of U.S. West Coast Estuaries: The State of Knowledge for Juveniles of Focal Invertebrate and Fish Species (Hughes et al. 2014);
- implementation of the California Salmon Stronghold Initiative by CDFW, USFWS, National Marine Fisheries Service, Caltrout, TNC, Trout Unlimited, and the Wild Salmon Center (Wild Salmon Center 2012);
- release of the Congressional independent scientific report, California Hatchery Scientific Review Group's California Hatchery Review Report (2012), and implementation of interagency-tribal, strategic hatchery management;
- adoption of the CDFW's Policy for Quality in Science and Key Elements of Scientific Work (CDFG 2008a);
- Secretarial Order Number 3330 entitled "Improving Mitigation Policies and Practices of the Department of the Interior," issued by Secretary of the Interior Sally Jewell in October 2013, which calls for an ecosystem approach to conservation; and
- completion of the Wildlife Conservation Board Strategic Plan (2014).

The California Legislature has also provided broad guidance regarding CDFW's approach to resource management decisions since 2005. In 2012, Assembly Bill 2402 was enacted into law, adding provisions to the Fish and Game Code relevant to the ecosystem conservation, adaptive management, and stakeholder partnership approaches embodied in SWAP 2015. The bill also changed the name of the California Department of Fish and Game to the California Department of Fish and Wildlife, indicating CDFW's increasing role to safeguard the natural resources of the state. Among the revisions to the Fish and Game Code (FGC) were the following:

- FGC Section 703.3 was added to declare the state policy that CDFW and the Fish and Game Commission "use ecosystem-based management informed by credible science in all resource management decisions to the extent feasible," and "resource management decisions … should also incorporate adaptive management to the extent feasible."
- FGC Section 703.5 was added to establish that it is state policy to "seek to create, foster, and actively participate in effective partnerships and collaborations with other agencies and stakeholders to achieve shared goals and to better integrate fish and wildlife resource

conservation and management with the natural resource management responsibilities of other agencies."

The principles of ecosystem conservation, adaptive management, and use of effective partnerships to achieve the conservation goals for CDFW are central to the approach for preparing SWAP 2015.

Significant recent changes to California's environment have also been documented resulting from climate change, including sea level rise, natural community shifts, increased prevalence of invasive species, increased duration and intensity of wildfires, and prolonged drought (CNRA 2009, CNRA 2014). These climate-induced stresses on wildlife, in combination with other known stresses, have the potential to greatly affect wildlife species and habitats and must be considered when developing management strategies.

Climate change-related issues were considered during the development of SWAP 2015 by analyzing the impacts of climate change on ecosystems, using climate change vulnerability as a criterion for SGCN selection, and developing conservation strategies that address impacts of climate change. Specifically, SWAP 2015 considered climate change in the following ways:

- Under SWG, CDFW conducted climate change vulnerability analyses for species in four taxonomic groups (birds, mammals, amphibians/reptiles, and fish) as part of developing the revised SSC lists for California.
- Under SWG, CDFW is conducting statewide vegetation (macrogroup) climate change vulnerability analysis.
- Climate change vulnerability was considered as a criterion for the selection of SGCN. Within the four taxonomic groups, if the considered species were ranked "high" under the species vulnerability study described above, the species were identified as an SGCN.
- A climate forecast report was used to assess the conditions of selected targets, including the identification and evaluation of ecological conditions that are important to the targets and vulnerable to climate changes (PRBO 2011).
- Climate change experts provided information in assessing the effects of climate change on targets.
- Ecoregional conservation strategies were developed to consider ways to address the impacts of climate change.
- Every strategy identified under a regional analysis in SWAP 2015 was coded and cross-referenced with the National Fish, Wildlife, and Plants Climate Adaptation Strategy (USFWS 2012) and California's Climate Adaptation Strategy (Natural Resource Agency 2014), and the therefore, SWAP 2015 implementation will achieve important climate adaptation co-benefits.
- Climate adaptations were considered in defining statewide goals and objectives.
- One of the key evaluation factors for the SWAP/SWG implementation evaluation report (see Section 8.2) was to determine if climate change issues were considered under individual

SWG projects. The SWG grant projects that considered climate change were recognized and further investigated to determine which of the following five categories were addressed under the grant: (1) data analysis and modeling, (2) data collection, (3) adaptation strategy plan development, (4) adaptation strategy plan implementation, and/or (5) scenario development and analysis. The total grant amount addressing each of the categories was calculated.

The key changes in SWAP 2015, compared to the approach used in SWAP 2005, are described in detail in Appendix B. In summary, the key changes include:

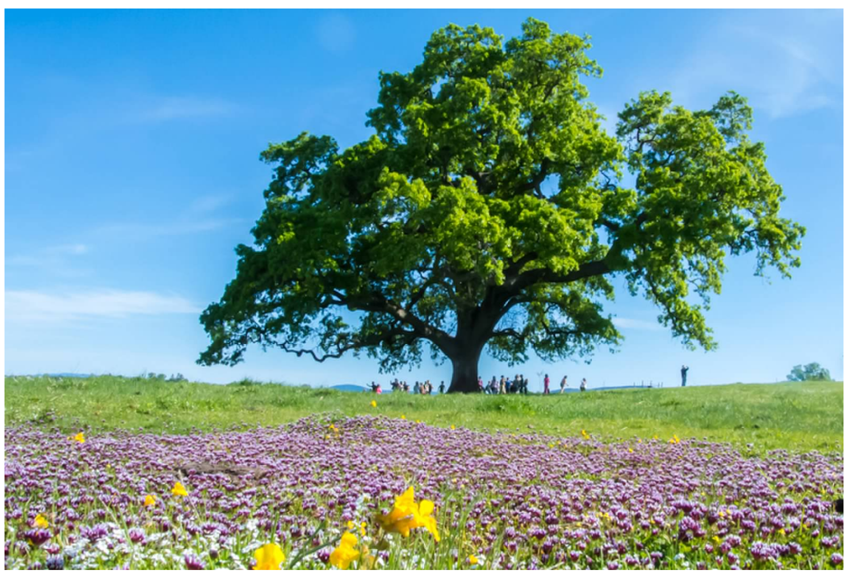
- new multi-scaled, ecologically focused geographic boundaries;
- revisions to the list of SGCN;
- multi-species, ecosystem approach;
- inclusion of plants on the list of SGCN;
- inclusion of marine conservation targets;
- transparent and systematic planning framework for ongoing management of the SWAP program (i.e., *Open Standards for the Practice of Conservation*);
- standard lexicon for key factors, including key ecological attributes (KEAs), stresses, pressures, and conservation strategies;
- systematic identification and ranking of pressures and stresses to conservation targets;
- integration of climate change related issues;
- emphasis on partnerships and collaboration;
- development of companion plans;
- development of effectiveness measures for conservation strategies and adaptive management; and
- a new format available as a dynamic, online resource.

As described in Chapter 7, CDFW remains substantially underfunded to complete essential conservation actions. Many important programs, such as the California Endangered Species Act program that reviews listing petitions, conducts periodic status reviews of listed species, and issues incidental take permits, receives no money from the state general fund. Other programs, declared to be very high priority by the legislature and the Governor's Office, such as Climate Science and Renewable Energy, lack a stable funding source. As described in Chapter 4, the most pervasive pressure on California ecosystems comes from invasive species. California is the only western state without a state weed program, since California Department of Food and Agriculture discontinued its efforts in 2010. Unfunded programs like these require shifting resources from other funded programs, to their detriment, to keep pace with the workload.

1.5 SWAP 2015 Approach

1.5.1 Ecosystem and Multi-Species Approach to Conservation

SWAP 2015 adopted an ecosystem and multi-species approach to conservation. An ecosystem approach to conservation is the broad management of natural resources using ecosystems as a unit to ensure that native plants and animals bound to the system are maintained at viable levels. It involves maintaining and enhancing ecological processes, structure, and conditions, recognizing that all components are interrelated in a dynamically changing system. Large-scale landscape approaches are generally the most reliable and preferred method to conserve ecological integrity, including biological diversity. The approach benefits both game and non-game (or harvested and non-harvested) wildlife species, and creates many co-benefits related to both ecological values (such as enhanced water quality, soil retention, or resilience to the effects of climate change) and societal values (such as open space, scenic quality, or outdoor recreation opportunities). Ecosystem-based management is defined and established as state policy in the California Fish and Game Code (FGC Sections 43 and 703.3).



Bob Sahara, CDFW

Directing conservation strategies for SGCN is one of the federal requirements for a SWAP. The SGCN list consists of species deemed to be most rare, imperiled, and/or in need of conservation identified by CDFW for California. The SWAP 2015 list of SGCN includes invertebrates, fish, wildlife, and plants to allow SWAP to be comprehensive in its scope, although the federal SWG funding is limited to just non-game fish and wildlife species. There are however benefits for all species sharing a target habitat with an SGCN. While it is true that most, if not all, native biota have a conservation need, for the list to be useful as a prioritization tool, only those species that were considered to have the greatest conservation needs are included. In 2005 the original California SWAP used the existing CDFG Sensitive Animals List as the SGCN list. This was a comprehensive and convenient decision, but resulted in a list without a specific effort to prioritize species.

For SWAP 2015, a new SGCN list has been developed by CDFW to facilitate prioritization of conservation targets (Appendix C). The SGCN list includes species that are state or federally listed as threatened or endangered, candidates for such listing under the state and/or federal Endangered Species Acts, considered by CDFW to be SSC, and considered to be highly vulnerable to climate change by CDFW. Development of the new SGCN list followed a rigorous scientific process to determine the lower end of "need" by using the detailed technical reviews being conducted for CDFW SSC reports (http://www.dfg.ca.gov/wildlife/nongame/ssc/), which identify imperiled species that are not already listed as threatened or endangered by the state or federal government. For more details about the criteria used for SGCN, see Section 2.4.

To comprehensively address California ecosystems in a spatially explicit manner, terrestrial, freshwater aquatic, and marine ecosystems have been used to represent habitat types. Because SWAP 2015 has identified over 1,000 SGCN, developing the SWAP based on a comprehensive assessment of individual species was not feasible or desirable; it is recognized that dividing California into habitat categories, however, may present limitations that must be balanced with conservation efforts that consider species-specific needs to be effective in improving the SGCN status. The conservation targets in SWAP 2015 were selected because they represent habitats for the most SGCN, as well as meet other criteria (see Appendix D).

1.5.2 Geographic Scales

To address conservation needs for the full SGCN list and to apply an ecosystem management approach, SWAP 2015 uses three geographic scales to differentiate and organize California's terrestrial, freshwater aquatic, and marine ecosystems. These geographic scales are used to analyze key conservation factors and their influences on SGCN and their habitats, as well as to identify conservation strategies. The geographic scales in the SWAP are: statewide, provinces, and regional conservation units.

An exception to developing conservation strategies within these geographic scales is the analysis for anadromous fish. Anadromous fish begin life in the fresh water of rivers and streams, migrate to the ocean to grow into adults, and then return to fresh water to spawn. Most anadromous fish spend the majority of their life in marine environments and travel great distances between their marine habitat and spawning rivers or streams. Because the geographic ranges of anadromous fishes span many of the provinces developed for SWAP 2015, the organization of conservation strategies by conservation unit or province does not adequately address their conservation needs. As such, conservation strategies for anadromous fishes have been developed separately to capture all the habitats within their ranges. See Chapter 6 for a full discussion of anadromous fishes in California.

California has been subdivided into seven provinces for analysis and conservation planning in SWAP 2015 (Figure 1.5-1). There are six terrestrial and freshwater aquatic landscape provinces

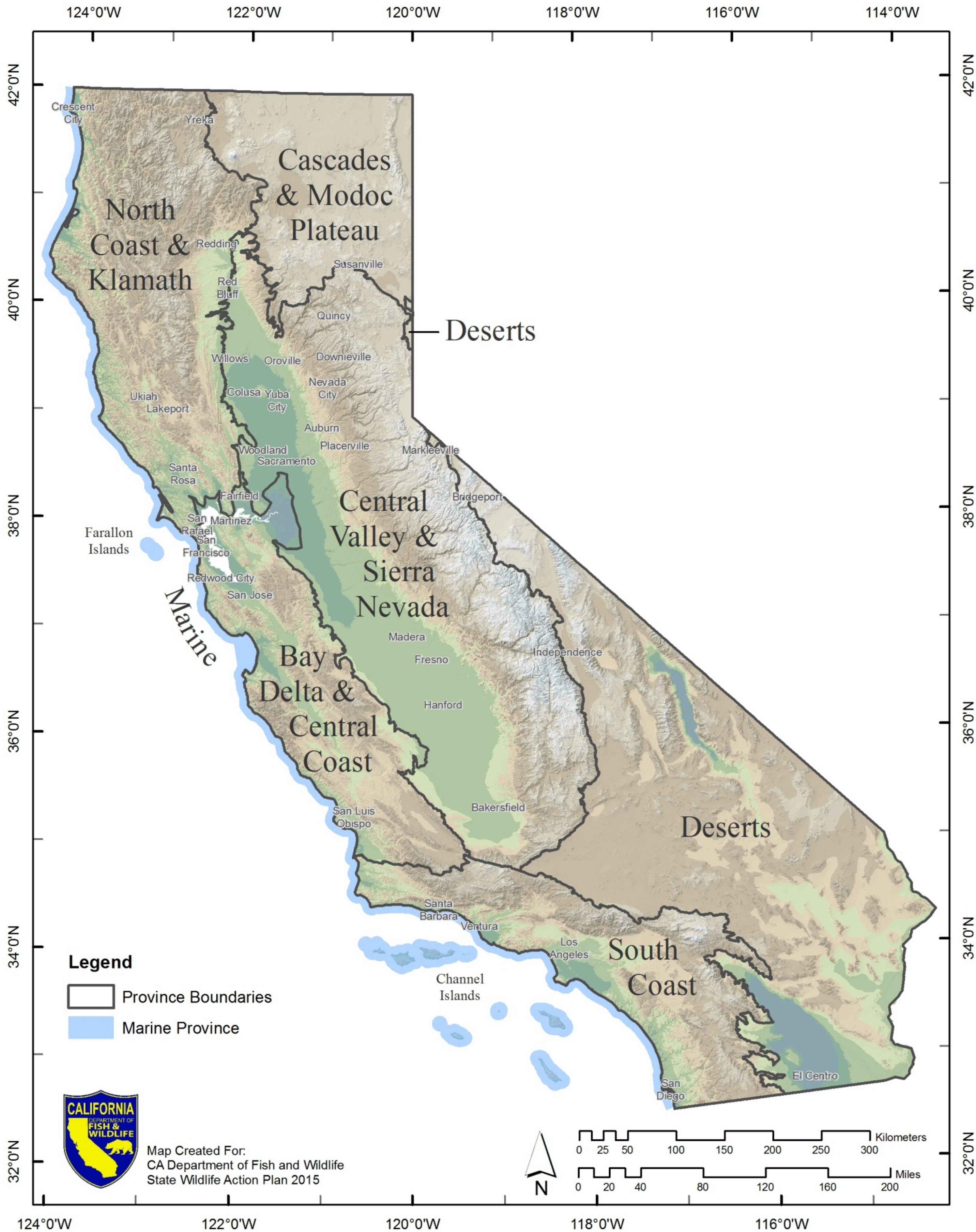


Figure 1.5-1 SWAP 2015 Provinces

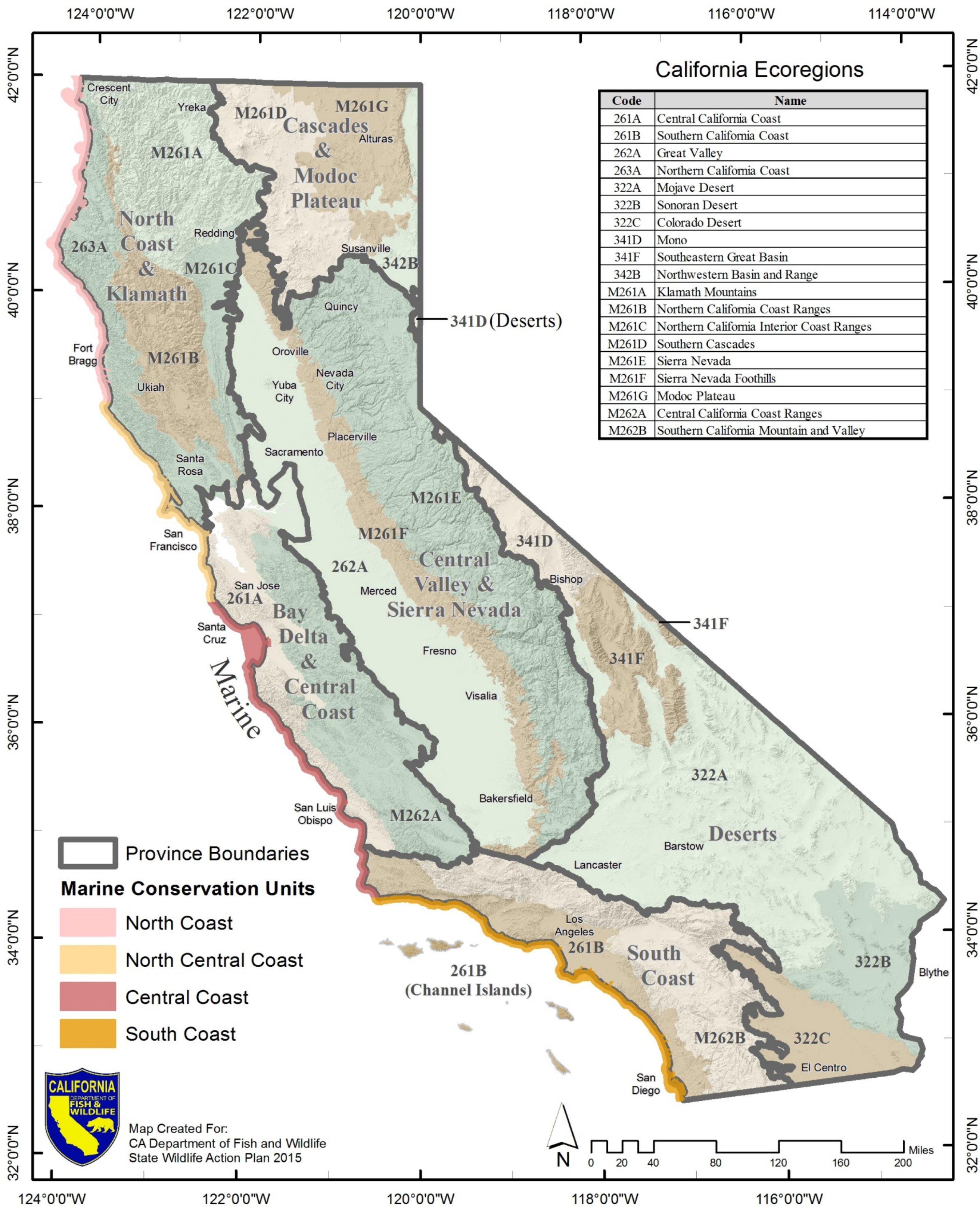
based generally on the definition of provinces by Bailey (1976) from U.S. Forest Service (USFS) that use vegetation and other natural land cover types, which are influenced by geophysical features, to define boundaries. The province definition of SWAP 2015 deviates from Bailey's definition to a degree in an effort to better integrate the terrestrial and freshwater aquatic characteristics of California ecosystems. Geophysical features of the state (such as a mountain range or major valley) and Bailey's province boundaries are oriented mostly north-south. Many aquatic features (such as rivers and numerous watersheds) flowing into those features have an east-west orientation. The SWAP terrestrial landscape/freshwater aquatic system provinces seek to take both into account. A seventh province--the Marine Province--consisting of state-controlled, intertidal and subtidal land between the coast and a three-mile limit, has been added to SWAP 2015 to increase consistency and effectiveness in protecting the state's marine life, marine ecosystems, and marine natural heritage.

The smallest geographic area defined for analysis in SWAP 2015 is the "conservation unit," which consists of "ecoregions," "hydrologic units," and "marine conservation units." Ecoregions, defined as "sections" in the Bailey (1976) nomenclature, are subdivisions of provinces based on major terrain features, such as a desert, plateau, valley, mountain range, or a combination thereof. SWAP 2015 uses 19 sections described in Bailey (1976) as the ecoregions for SWAP 2015 (Figure 1.5-2).

Dave Feliz, CDFW

The ecoregions, by definition, focus on terrestrial ecosystems, and are not well-suited for aquatic biodiversity planning, especially for fish, because rivers cross multiple ecoregions. CDFW used the Watershed Boundary Dataset classification and mapping system of U.S. Geologic Survey (USGS), which divides and sub-divides the United States into successively smaller watersheds, to define "hydrologic units" for the SWAP 2015 analysis of aquatic ecosystems. The USGS hydrologic classification system includes areas of different sizes that are nested within each other, from the largest geographic area (i.e., regions) to the smallest geographic area (i.e., cataloging units). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits (in California) based on the levels within the USGS hydrologic classification system. The "subregion" level in the USGS classification system (i.e., HUC 4) is the most analogous in size and geographic configuration to the terrestrial ecoregions; therefore, the subregions under the USGS classification were used as the hydrologic units for SWAP 2015.

Adoption of the USFS Bailey's terrestrial classification and USGS hydrologic classification system provides an organizational approach that is both nationally recognizable to resource managers and is sufficiently flexible to customize for meeting the particular needs of conserving California ecosystems (Figure 1.5-3).

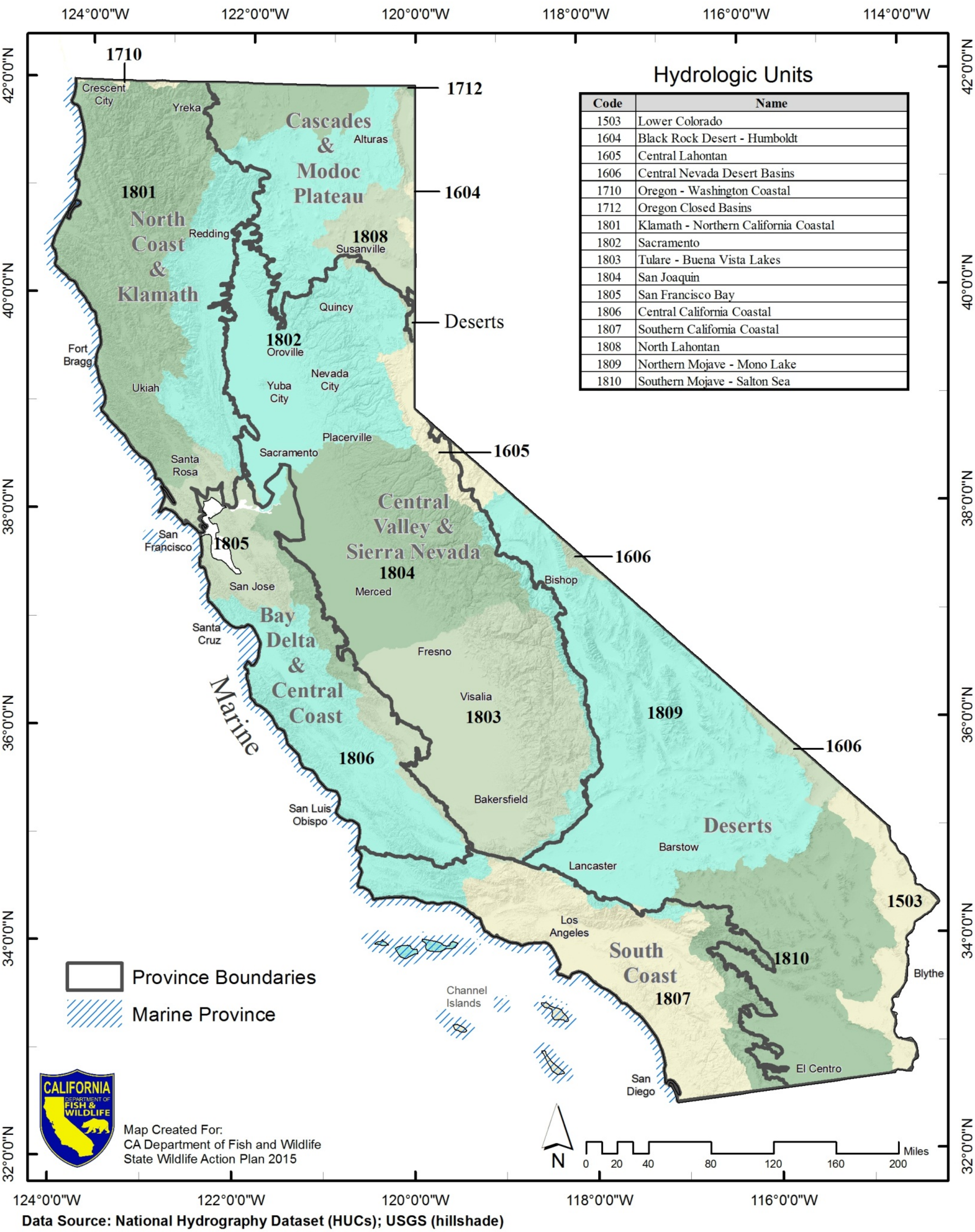


California Ecoregions

Code	Name
261A	Central California Coast
261B	Southern California Coast
262A	Great Valley
263A	Northern California Coast
322A	Mojave Desert
322B	Sonoran Desert
322C	Colorado Desert
341D	Mono
341F	Southeastern Great Basin
342B	Northwestern Basin and Range
M261A	Klamath Mountains
M261B	Northern California Coast Ranges
M261C	Northern California Interior Coast Ranges
M261D	Southern Cascades
M261E	Sierra Nevada
M261F	Sierra Nevada Foothills
M261G	Modoc Plateau
M262A	Central California Coast Ranges
M262B	Southern California Mountain and Valley

Data Source: USDA Forest Service (Ecoregion Sections); USGS (hillshade)

Figure 1.5-2   Relationship of Ecoregions to SWAP 2015 Provinces



Code	Name
1503	Lower Colorado
1604	Black Rock Desert - Humboldt
1605	Central Lahontan
1606	Central Nevada Desert Basins
1710	Oregon - Washington Coastal
1712	Oregon Closed Basins
1801	Klamath - Northern California Coastal
1802	Sacramento
1803	Tulare - Buena Vista Lakes
1804	San Joaquin
1805	San Francisco Bay
1806	Central California Coastal
1807	Southern California Coastal
1808	North Lahontan
1809	Northern Mojave - Mono Lake
1810	Southern Mojave - Salton Sea

Figure 1.5-3 Relationship of Hydrologic Units to SWAP 2015 Provinces

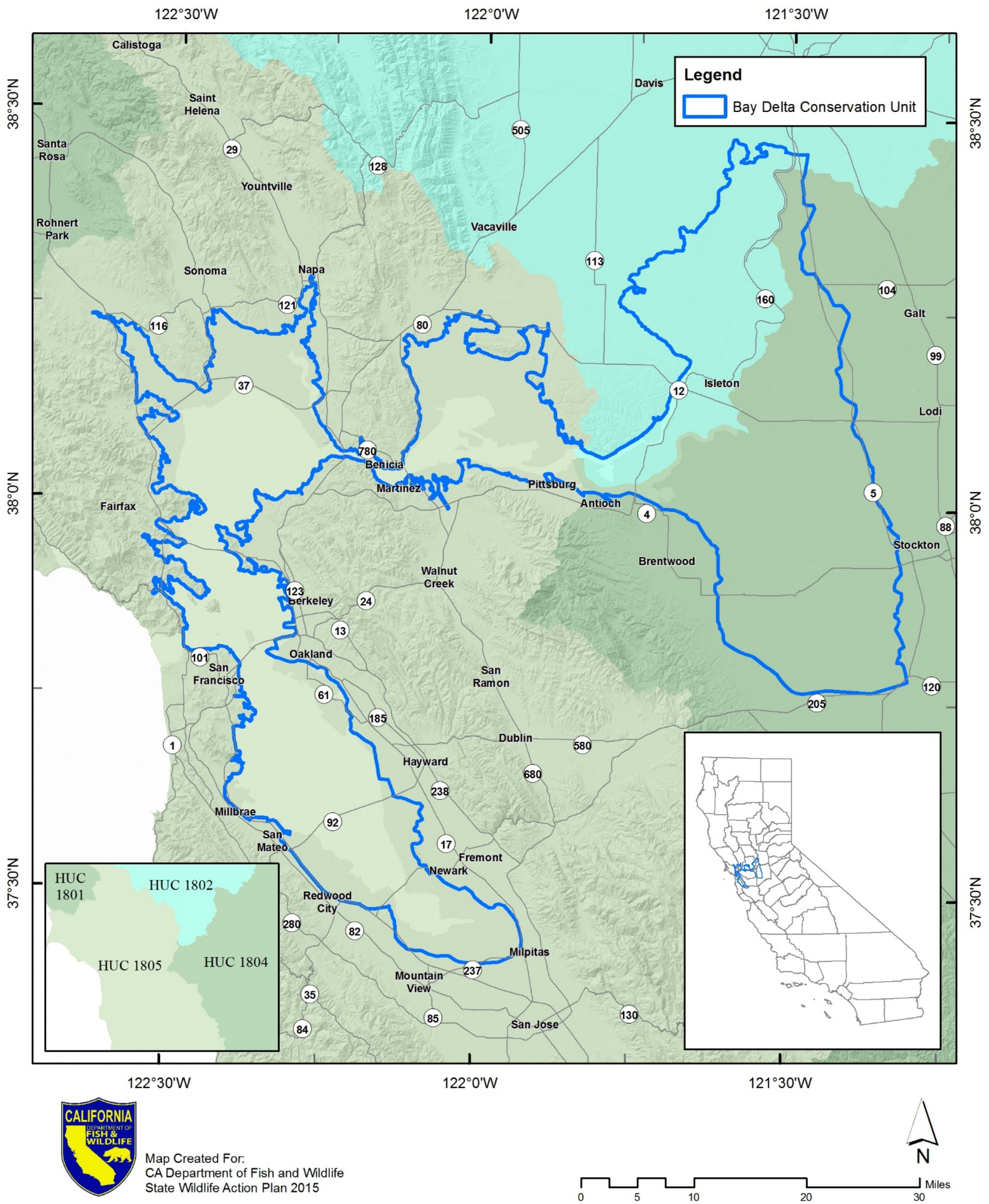
The marine conservation units have the same boundaries as the study areas identified within the 2008 MLPA Master Plan (CDFG 2008b).

During the SWAP 2015 update process, a boundary was defined for the San Francisco Bay-Delta (Figure 1.5-4) that consists of the entire San Francisco Bay and portions of the San Francisco Bay HUC (HUC 1805), Sacramento River HUC (HUC 1802), and San Joaquin River HUC (HUC 1804). The boundary includes areas of tidal influence, areas of salt marsh vegetation, and lowland elevations behind dikes/levees. In addition, the area was increased to roughly incorporate a 1-meter sea level rise to take climate change into account. This area does not correspond to the legal definition of the Delta or any CDFW organizational region; it is a unique area designed for SWAP 2015 and is called the Bay Delta conservation unit.

1.5.3 Process to Prioritize Conservation Targets

The approach to adhere to the SWAP elements required by USFWS and develop multi-species conservation strategies began by broadly categorizing natural resources in California. These categories include terrestrial, freshwater aquatic, and marine habitats. Within each of the resource categories there would be strategies applicable to specific geographic regions, and others that would be applied more broadly across many regions or possibly statewide. To assess conservation needs at a manageable scale, the state was subdivided for each resource category using established and accepted units for analysis, as described above, i.e., ecoregions, hydrologic units, and marine conservation units, collectively referred to as conservation units. Geographically associated conservation units were then grouped into provinces.

A conservation target is an ecological entity chosen to be the focus of conservation actions for a conservation project. While in concept a target can be a species, a habitat, or an ecological system, for SWAP 2015 the conservation targets are defined in terms of some natural community such as vegetation, habitat type, or species assemblage. To better understand the relative location, extent, and distribution of ecosystems in California, a habitat type was chosen as a surrogate to represent the interactions between the biotic and abiotic characteristics of the system, and associated species. This decision to focus on ecosystems rather than individual species was influenced by direction given by USFWS, as well as recently enacted legislation in California (AB 2402, Statutes of 2012). AB 2402 (FGC Section 43), or the "Huffman Bill," established the policy within state government to use ecosystem-based management, defined as "an environmental management approach relying on credible science that recognizes the full array of interactions within an ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation."



Map Created For:
CA Department of Fish and Wildlife
State Wildlife Action Plan 2015

Data Source: USDA Forest Service (ecoregions); US Geological Survey (hillshade), NHD (hydrologic units)

Figure 1.5-4 Bay Delta Conservation Unit Defined for SWAP 2015

Specifically, the conservation targets in SWAP 2015 consist of:

- *macrogroups*, which are terrestrial plant communities within ecoregions that support wildlife, and are defined by California's Vegetation Classification and Mapping Program, based on the National Vegetation Classification System (http://www.dfg.ca.gov/biogeodata/vegcamp/);
- *native fish and freshwater aquatic species assemblages* occupying the freshwater aquatic habitats within the hydrologic units; and
- *marine ecosystems*, which are six marine habitats in the Marine Province representing (a) embayments, estuaries, and lagoons; (b) intertidal zone; (c) nearshore subtidal zone (0-30 m depth); (d) mid-depth zone (30-100 m depth); (e) deep zone (>100 m depth); and (f) offshore rocks that support marine life.

Macrogroups are mid-level plant communities in the hierarchical classification based upon the Manual of California Vegetation classification system adopted by California, consistent with the U.S. National Vegetation Classification (USNVC) standard. These plant communities can be considered as habitats, where a given plant or animal species is dependent on the plant community for food, cover, or reproduction at some stage or all of its life cycle. Additional consideration of habitat elements, such as snags and logs, together with vegetation dominance or unique characteristics to which wildlife are thought to respond allows for predictions of use based on species associations (Mayer and Laudenslayer 1988). Appendix D provides the complete list of macrogroups in California, including their USNVC classification and common name used in California, as well as the ecological description and relationship to the California Wildlife Habitat Relationship (CWHR) classification system. In addition, Appendix D provides the list of provinces that each macrogroup occurs within and the provinces where it was selected a priority conservation target.

SWAP 2015 aspired to meet two immediate project goals for creating regional conservation projects: (1) every macrogroup occurring in California would be selected as a conservation target and at least one regional conservation project would be developed for the target to address the conservation issues; and (2) every conservation unit would have at least one selected target occurring within the unit and a conservation project would be developed to address the conservation issues. SWAP 2015 achieved these goals, summarized in Appendix D.

SWAP 2015 set these two immediate project goals so that the update would provide more details beyond the scope of SWAP 2005 that would better assist various conservation activities undertaken by resource managers, conservation partners, and the public, within the capability of CDFW. They were also selected so that the outcomes would give enough information to be able to infer the overall status of the ecological health across the state (see Chapter 4).

The prioritization of conservation targets to be addressed within the conservation unit is based on an analysis of the species deemed to be most rare, imperiled, and in-need of conservation (see Appendix D). Habitat types with high levels of species richness, high counts of rare and endemic species, and high counts of vulnerable species (including declining and at-risk species and SGCN) were prioritized for terrestrial conservation targets. CDFW used information on species geographic distributions, together with species habitat relationship ratings from the CWHR program (Mayer and Laudenslayer 1988), to determine which terrestrial vertebrate species rely on the habitats present within each conservation unit for feeding, cover, or reproduction. Measures of biodiversity (the number of native species), vulnerability or rarity (the number of SGCN), and endemism (the sum of endemism scores from the SSC documents for mammals, birds, reptiles, and amphibians), along with local expert knowledge, were used to prioritize the selection of a target for the individual conservation unit. The selection was finalized by considering the conservation status of the candidate habitat types in the area. Terrestrial targets, therefore, could be viewed as biologically rich areas with a higher risk of losing native species. Focusing conservation strategies on such targets will have direct benefits to SGCN and other species that occur or otherwise depend on the habitat.

Freshwater aquatic targets were prioritized based on evaluation of native fish and aquatic species assemblages within each hydrologic unit. Native fish and freshwater aquatic species assemblages are a group of species, often morphologically similar within groups, which segregate on the basis of habitat, sub-habitat, or diet; exhibit persistence in composition through many generations; and have high resiliency (Grossman et al. 1982). In relatively undisturbed streams, species assemblages may consist of co-evolved species, which are usually tied to factors such as elevation, gradient, channel size, and shape (Moyle et al. 2003). Often imperiled because of anthropogenic habitat degradation, native species assemblages selected as targets are frequently confined to or occur totally within a single sub-hydrologic unit, such as a lake or stream. Expert opinion and knowledge were employed to identify the highest priority freshwater aquatic targets for each hydrologic unit.

Marine ecosystem targets were prioritized through work recently completed as part of the Marine Life Protection Act (MLPA). The MLPA Initiative was a public-private partnership established to help California implement the MLPA. This was accomplished by using the best readily available science and the advice and assistance of scientists, resource managers, experts, stakeholders, and members of the public. The goals of the MLPA go beyond the scope of traditional management of activities affecting living marine resources, which has focused upon maximizing yield from individual species or groups of species. For example, the first goal of MPLA emphasizes biological diversity and the health of marine ecosystems, rather than the abundance of individual species. The second goal recognizes a role of Marine Protected Area (MPA) system as a tool in fisheries management. The third goal recognizes the importance of recreation and education in MPAs, and balances these with the protection of biodiversity. The fourth goal recognizes the value of protecting representative and unique marine habitats for their own value. The fifth and sixth goals address the deficiencies in California's existing MPAs that the MLPA identifies in the law (MLPA 2008).

MPA networks include key marine habitats, each of these habitats being represented in multiple MPAs across biogeographic regions, upwelling cells, and environmental and geographic gradients. The strong association of most demersal marine species (i.e., living on or near the ocean bottom) with particular habitat types (e.g., sea grass beds, submarine canyons, shallow and deep rock reefs), and variation in species composition across latitudinal, depth clines, and biogeographic regions, implies that habitat types must be represented across each of these larger environmental gradients to capture the breadth of biodiversity in California's waters. Different species use marine habitats in different ways. As a result, protection of all the key habitats along the California coast is a critical component of MPA network design. Key habitat types provide particular benefits by harboring a different set of species or life stages, having special physical characteristics, or being used in ways that differ from the use of other habitats.

As stated previously for each natural resource category, a project goal of SWAP 2015 was to develop at least one conservation project, or set of strategies, directed at a high priority conservation target, and that would have broad benefits to multiple species and SGCN. Some regional teams exceeded this project goal, by developing multiple conservation projects for multiple targets. CDFW also met the other project goal to create conservation strategies for every vegetation type (macrogroup) as described in Appendix E. Despite this, the number of conservation targets that deserve some conservation strategies outweighed the capacity of CDFW. While SWAP 2015 succeeds in developing nearly 70 conservation projects and over 250 regional conservation strategies, an ever growing need for additional conservation planning remains, as more and more stresses are experienced by California ecosystems. The targets that were chosen and are presented in SWAP 2015 represent an initial foundation upon which the future conservation needs and priorities of California's natural resources can be built.

The question will undoubtedly arise in many minds why one target was selected over another or why an important target was not chosen. Given the limitations of time and staffing for the SWAP program, firm priorities were set based on strict target selection criteria applied a priori to all targets. Additional consideration was provided by local experts regarding conservation needs and imperatives. Some highly rated macrogroups were not selected as targets for SWAP 2015, because they were being conserved under another plan or strategy, such as a Natural Community Conservation Plan or Habitat Conservation Plan. Other lower rated macrogroups may have a greater conservation need due to pending or ongoing direct or intense pressures. Therefore, target selection (or non-selection) should not be interpreted as the state's priority based on the ecological values, although all selected targets have high ecological value.

Implementation of SWAP 2015 will result in measurable progress in meeting the conservation needs of the selected targets and individual SGCN. As progress is made, CDFW and its partners can begin the identification of other high priority targets and define conservation strategies. Similar to the targets developed herein, they will include clear goals and objectives with strategies that are measurable, attainable, relevant, and time bound. Strategies developed subsequent to the publication of SWAP 2015 will be adopted through the revision process described in Chapter 7. Appendix E lists the conservation strategies for all macrogroups in California, freshwater aquatic species assemblages, marine ecosystems, and anadromous fish.

Table 1.5-1 provides a summary of priority conservation targets selected for conservation units organized by province.

Table 1.5-1 California SWAP 2015 Provinces, Conservation Units, and Conservation Targets

Province	Conservation Unit	Conservation Target	
North Coast and Klamath	Northern California Coast Ecoregion	Coastal Dune and Bluff Scrub Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland Pacific Northwest Conifer Forests
	Northern California Coast Ranges Ecoregion	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest
	Northern California Interior Coast Ranges Ecoregion	California Foothill and Valley Forests and Woodland	
	Klamath Ecoregion	Alpine Vegetation Fen (Wet Meadow) Montane Upland Deciduous Scrub Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands Western Upland Grasslands Wet Mountain Meadow
	Klamath-Northern California Coastal HUC 1801	Native Aquatic Species Assemblages/Communities	
Cascades and Modoc Plateau	Southern Cascades Ecoregion	North Coastal Mixed Evergreen and Montane Conifer Forests	Western Upland Grasslands
	Modoc Plateau Ecoregion	Big Sagebrush Scrub Great Basin Dwarf Sagebrush Scrub	Great Basin Upland Scrub
	Northwest Basin and Range Ecoregion	Great Basin Pinyon-Juniper Woodland	
	North Lahontan HUC 1808	Eagle Lake Native Fish Assemblage	
	Sacramento HUC 1802	Goose Lake Native Fish Assemblage	
Bay Delta and Central Coast	Central California Coast Ecoregion	American Southwest Riparian Forest and Woodland California Grassland, Vernal Pools, and Flowerfields Coastal Dune and Bluff Scrub	Coastal Sage Scrub Northwest Coast Cliff and Outcrop North Coast Deciduous Scrub and Terrace Prairie
	Central California Coast Ranges Ecoregion	American Southwest Riparian Forest and Woodland	California Grassland, Vernal Pools, and Flowerfields
	San Francisco Bay Conservation Unit	American Southwest Riparian Forest and Woodland Freshwater Marsh	Salt Marsh
	Central California Coast HUC 1806	Coastal Lagoons	
Central Valley and Sierra Nevada	Great Valley Ecoregion	American Southwest Riparian Forest and Woodland Freshwater Marsh	
	Sierra Nevada Foothills Ecoregion	California Foothill and Coastal Rock Outcrop Vegetation California Foothill and Valley Forests and Woodlands	Chaparral Desert Transition Chaparral Montane Chaparral
	Sierra Nevada Ecoregion	Alpine Vegetation North Coastal Mixed Evergreen and Montane Conifer Forests	Pacific Northwest Supalpine Forest Western Upland Grasslands Wet Mountain Meadow
	Sacramento HUC 1802	Clear Lake Native Fish Assemblage	
	Central Lahonton HUC 1605	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage
	San Joaquin HUC 1804	San Joaquin Native Fish Assemblage	
	Tulare-Buena Vista Lakes HUC 1803	Upper Kern River Native Fish Assemblage	

Table 1.5-1 California SWAP 2015 Provinces, Conservation Units, and Conservation Targets

Province	Conservation Unit	Conservation Target	
South Coast	Southern California Coast Ecoregion	American Southwest Riparian Forest and Woodland California Grasslands and Flowerfields Freshwater Marsh	
	South Coast Mountain and Valleys Ecoregion	American Southwest Riparian Forest and Woodland California Grasslands and Flowerfields	
	Southern California Coastal HUC 1807	Native Fish Assemblage	South Coast Native Aquatic Herp Assemblage
Deserts	Mono Ecoregion	Big Sagebrush Scrub	Great Basin Pinyon-Juniper Woodland
	Mojave Desert Ecoregion	Shadscale-Saltbush Scrub	
	Sonoran Desert Ecoregion	Mojave and Sonoran Desert Scrub	
	Colorado Desert Ecoregion	Desert Wash Woodland and Scrub	Sparsely Vegetated Desert Dune
	Southeastern Great Basin Ecoregion	American Southwest Riparian Forest and Woodland Great Basin Upland Scrub High Desert Wash and "Rangeland" Scrub	
	Central Lahonton HUC 1605	Walker River Native Fish Assemblage	
	Northern Mojave-Mono Lakes HUC 1809	Anthropogenically Created Aquatic Features Cienegas	Springs and Spring Brooks
	Southern Mojave-Salton Sea HUC 1810	Anthropogenically Created Aquatic Features	Cienegas
Marine	North Coast	Embayments, Estuaries, and Lagoons Intertidal Zone Nearshore Subtidal Zone (0-30m) Mid-Depth Zone (30-100m) Deep Zone (>100m)	Offshore Rocks
	North Central Coast		
	Central Coast		
	South Coast		

Note: See Chapter 6 for description of aquatic ecoregions applied to anadromous fish.
HUC – Hydrologic Unit Code

1.5.4 Open Standards for the Practice of Conservation – Planning Framework

The *Open Standards for the Practice of Conservation* developed by the Conservation Measure Partnership (http://www.conservationmeasures.org) was used as the framework for updating SWAP 2015 and will be used as the framework for ongoing implementation and adaptive management. The *Open Standards* process was employed for analysis of macrogroups (terrestrial plant communities), freshwater aquatic species assemblages, and marine ecosystems, but not for anadromous fish (Chapter 6). The use of a standardized process allowed for analysis across conservation units to summarize information at a province or statewide level.

The *Open Standards* is an internationally accepted conservation planning framework that brings together common concepts, approaches, and terminology in conservation project design, management, and monitoring to help practitioners improve the practice of conservation. The

Open Standards offers an adaptive management approach that helps conservation practitioners systematically design their conservation strategies, and determine if their strategies are on track, why they are on track or not, and what adjustments they need to make. The five steps composing the adaptive project management cycle supported by *Open Standards* are: (1) conceptualizing the project vision and context; (2) planning actions and monitoring; (3) implementing actions and monitoring; (4) analyzing data, using the results, and adapting the project; and (5) capturing and sharing what has been learned (Figure 1.5-5).

Figure 1.5-5 Adaptive Project Management Cycle

The steps of the *Open Standards* process are consistent with those needed to fulfill the eight elements required by the USFWS for SWAPs described in Section 1.4.1, and the framework proposed by the AFWA Teaming with Wildlife Coalition for measuring the effectiveness of State Wildlife Grants (AFWA 2011).

Open Standards is based on a simple premise. The ecological conditions of selected targets are compromised by some negative impacts to the targets. The set of strategies developed for a given target are meant to work together to ameliorate the negative impacts to the target and to enhance the ecological conditions. Under SWAP 2015, as targets are ecosystems (i.e., plant communities, native species assemblages, or marine ecosystems), this translates into SWAP 2015 developing a set of strategies to improve the degraded ecological conditions of selected ecosystems as depicted in Figure 1.5-6.

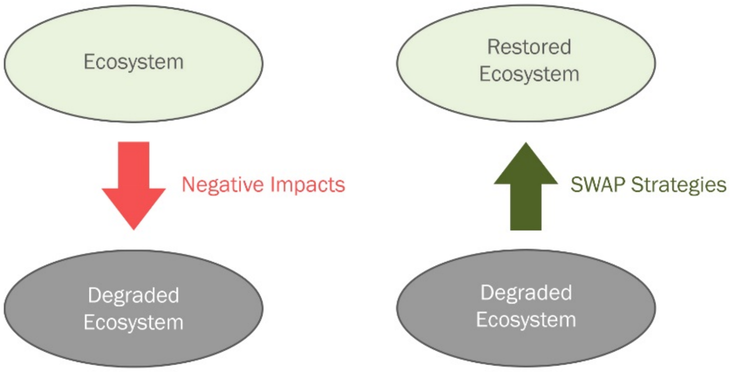


Figure 1.5-6 Ecosystem Condition Before and After SWAP 2015 Implementation

Definitions Important to SWAP 2015

Conservation Target: An element of biodiversity at a project site, which can be a species, habitat/ecological system, or ecological process on which a project has chosen to focus.

Goal: A formal statement detailing a desired outcome of a conservation project, such as a desired future status of a target. The scope of a goal is to improve or maintain *key ecological attributes* (defined below).

Key Ecological Attribute (KEA): Aspects of a target's biology or ecology that, if present, define a healthy target and, if missing or altered, would lead to the outright loss or extreme degradation of the target over time.

Objective: A formal statement detailing a desired outcome of a conservation project, such as reducing the negative impacts of a critical *pressure* (defined below). The scope of an objective is broader than that of a goal because it may address positive impacts not related to ecological entities (such as getting better ecological data or developing conservation plans) that would be important for the project. The set of objectives developed for a conservation project are intended, as a whole, to lead to the achievement of a goal or goals, that is, improvements of key ecological attributes.

Pressure: An anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of the target. Pressures can be positive or negative depending on intensity, timing, and duration. Negative or positive, the influence of a pressure to the target is likely to be significant.

Species of Greatest Conservation Need (SGCN): All state and federally listed and candidate species, species for which there is a conservation concern, or species identified as being vulnerable to climate change.

Strategy: A group of actions with a common focus that work together to reduce pressures, capitalize on opportunities, or restore natural systems. A set of strategies identified under a project is intended, as a whole, to achieve goals, objectives, and other key results addressed under the project.

Stress: A degraded ecological condition of a target that resulted directly or indirectly from negative impacts of pressures (e.g., habitat fragmentation).

Standardized Approach Used by CDFW

By definition, key ecological attributes (KEAs) for a conservation target are attributes for which the future viability of the conservation target most depends. If the KEAs are degraded, then the target is experiencing some type of stresses, such as habitat fragmentation, changes in community structure, or changes in fire regime. A stress is caused by the negative impacts of a pressure or multiple pressures, which are anthropogenic (human-induced) or natural drivers that have strong influences on the health of the target. Examples of pressures include housing and urban development, invasive plants and animals, excessively frequent or intense fire, and suppression of natural fire frequency.

The high-level conceptual model for the *Open Standards* process (Figure 1.5-7) shows how conservation strategies work together to improve target conditions. For example, if the negative impacts of pressures are reduced, then stresses on the KEAs will be reduced, which would help maintain or improve the viability of the conservation target. Conservation strategies can also work directly on the conservation target, as opposed to relieving pressures, to enhance the target's ecological conditions.

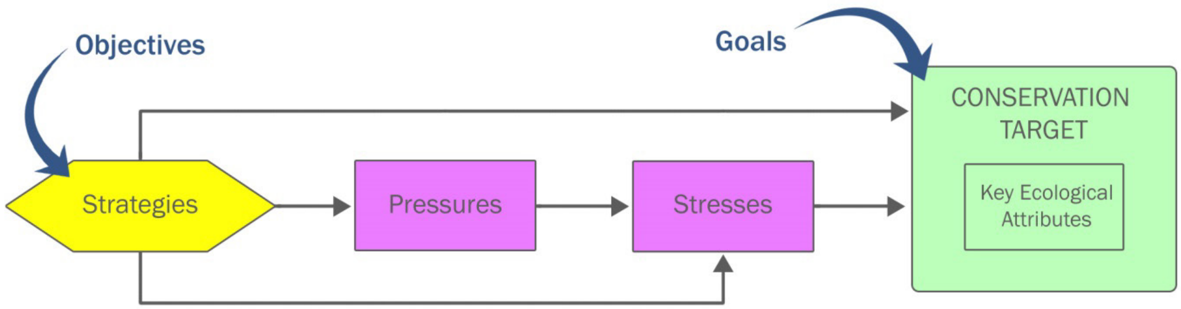


Figure 1.5-7 Conceptual Model - How Strategy Implementation Improves Target Condition

CDFW provided *Open Standards* training via three-day workshops and web conferences to its regional teams to develop strategies for high priority conservation targets for SWAP 2015. Then the CDFW regional teams completed a seven-step process for each target. These steps included:

1. The geographic conservation unit (e.g., ecoregion, hydrologic unit, or marine conservation unit) and the target (e.g., macrogroup, native fish/freshwater aquatic species assemblages, or marine ecosystem) were identified. If the target was a macrogroup, the most appropriate CWHR habitat type(s) was identified and cross-referenced.

2. SGCN or other focal species that use the conservation target as habitat were identified.

3. The most important KEAs for each conservation target were selected from a standardized list (Table 1.5-2). The viability of each KEA was classified, based on the current condition and the desired future condition.

Table 1.5-2 Standardized Key Ecological Attributes and Indicators Used in SWAP 2015

Key Ecological Attributes	Status Indicator	
Area and extent of community	Amphibian distribution Area of habitat	Fish distribution Reptile distribution
Community structure and composition	Age class heterogeneity Level of debris and other key organic materials* Endemic diversity Key species population level	Native versus non-native species diversity Structural diversity
Connectivity among communities and ecosystems	Level of connectivity	Level of genetic connectivity
Fire regime	Fire frequency, extent, and intensity	
Hydrological regime	Channel pattern Depth of groundwater	Water yield/capacity Level of natural hydrologic regime Snowpack
Nutrient concentrations and dynamics	Nutrient load	
Pollutant concentrations and dynamics	Concentration of pollutants	
Soil quality and sediment deposition regime	Stable bank Suitable soil characteristics	Total dissolved solids (parts per million)
Successional dynamics	Stage of succession	
Surface water flow regime	Water volume	
Water level fluctuations	Hydroperiod	Water level
Water quality	Level of water quality	Level of water yield
Water temperature and chemistry	Alkalinity	Water temperature
Weather regime	Rainfall	

*This includes floating and deposited organic materials.

4. For each KEA, the relevant stresses, including those related to climate change, were identified using a standardized list (Table 1.5-3) and ranked by scope and severity. Scope is the proportion of the distribution of the target that can reasonably be expected to be affected by the stress within 50 years given the continuation of current circumstances and trends. Severity is the level of damage to the target, where it occurs, from the stress that can reasonably be expected within the next 50 years given the continuation of current circumstances and trends.

Table 1.5-3 Standardized List of Stresses Used in SWAP 2015

Carbon Dioxide (Climate Related Factor)	**Hydrology and Water Characteristics**
Change in carbon dioxide levels	Change in runoff and river flow***
Temperature (Climate Related Factor)	Change in water temperature
Change in annual average temperatures	Change in water chemistry
Change in temperature extremes	Change in water levels and hydroperiod
Precipitation (Climate Related Factor)	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)
Change in annual average precipitation	
Change in spring average precipitation	Change in groundwater tables
Change in summer average precipitation	Change in nutrients
Change in fall average precipitation	Change in pollutants
Change in average winter precipitation	**Soil and Sediment Characteristics**
Snow or Ice Regimes (Climate Related Factor)	Change in nutrients
Change in snow pack	Change in pollutants
Change in snow cover period	Change in soil chemistry
Coastal and Oceanic Characteristics (Climate and Non-Climate Related Factor)	Change in soil moisture
Sea level rise	Change in soil temperature
Change in oceanic water chemistry and quality*	Change in sediment quality
Change in ocean inputs	**Ecosystem Conditions and Processes**
Change in oceanic hydrodynamics**	Change in spatial distribution of habitat types
Change in surface area	Change in community structure or composition
Geophysical and Disturbance Regimes	Change in biotic interactions (altered community dynamics)
Change in sediment erosion-deposition regime	Change in functional processes of ecosystem
Change in natural fire regime	Change in succession processes and ecosystem development
Change in extreme events	Habitat fragmentation

*This includes oceanic hypoxia, acidification, and aragonite saturation level.
**This includes changes in current, circulation, upwelling, tidal, wave, and spray patterns.
***This includes freshwater inputs into the marine system.

5. The pressures that cause the stresses were identified (Table 1.5-4) and rated according to their level of contribution and irreversibility. Other socio-economic factors that contribute to create those pressures (e.g., increase interests in rural lifestyle related to the housing development in natural areas) were also identified.

6. Strategies were developed to reduce the negative impacts of high-rated pressures and were then ranked based on their potential positive impact (the degree to which the strategy would lead to desired changes) and feasibility (the degree to which the strategy could be implemented given time, financial, staffing, legal, or other constraints).

7. The highest ranking strategies and objectives (the desired outcomes) were identified. These strategies were then compiled into a database for analysis in SWAP 2015 (see below).

Table 1.5-4 Standardized List of Pressures Used in SWAP 2015	
Agricultural and forestry effluents	Livestock, farming, and ranching
Airborne pollutants	Logging and wood harvesting
Annual and perennial non-timber crops	Marine and freshwater aquaculture
Catastrophic geological events[1]	Military activities
Climate change	Mining and quarrying
Commercial and industrial areas[2]	Other ecosystem modifications[6]
Dams and water management/use	Parasites/pathogens/diseases
Fire and fire suppression	Recreational activities
Fishing and harvesting aquatic resources	Renewable energy
Garbage and solid waste	Roads and railroads
Household sewage and urban waste water[3,4]	Shipping lanes[7]
Housing and urban areas[2]	Tourism and recreation areas
Industrial and military effluents[4, 5]	Utility and service lines
Introduced genetic material	Wood and pulp plantations
Invasive plants/animals	

Pressures include the following:

1 Volcano eruption, earthquake, tsunami, avalanche, landslide, and subsidence
2 Shoreline development
3 Urban runoff (e.g., landscape watering)
4 Point discharges
5 Hazardous spills
6 Modification of mouth/channels; ocean/estuary water diversion/control; and artificial structures
7 Ballast water

Miradi Database

CDFW needed to have a robust database that allows complex ecological data to be stored, managed, and analyzed during the development of regional conservation projects. For this purpose, the Miradi Adaptive Management Software Program (http://www.miradi.org) was used to guide CDFW regional teams going through the steps above. These Miradi database files were then uploaded into a cloud-based software system, called Miradi Share (http://www.miradishare.org), which enabled CDFW to aggregate and analyze the gleaned information across the provinces and the state for reporting in SWAP 2015. The *Open Standards* framework, Miradi software, and Miradi Share internet system will be used as ongoing management tools for tracking implementation and updating conservation data; conducting monitoring, evaluation, and adaptive strategy formulation; and preparing performance reporting towards goals and objectives for each conservation unit and across the SWAP program to document and share learning.

1.6 Companion Plans

Because of California's tremendous biodiversity and the broad spectrum of actions needed to implement conservation strategies across a full array of resources, land uses (including public access), government activities, and resource-consumptive industries, CDFW determined that a coordination framework for SWAP 2015 implementation is needed beyond the presentation in SWAP 2015. Called "companion plans," these sector-specific action plans will be instrumental in the implementation of SWAP 2015. CDFW, in partnership with other state and federal agencies and organizations involved in use, management, and/or conservation of California's natural resources and cultural heritage, will create the following nine sector-specific plans.

Nine Sector-Specific Companion Plans:

- Agriculture
- Consumptive and Recreational Uses
- Energy Development
- Forests and Rangelands
- Land Use Planning
- Transportation Planning
- Tribal Lands
- Water Management
- Marine Resources

Companion plans support development of well-coordinated, collaborative, multi-stakeholder efforts that leverage human and financial resources, as well as increase efficiencies for implementation of strategies, to achieve goals and objectives described in SWAP 2015. These plans will identify shared priorities of SWAP 2015 and CDFW partners and mutually strengthen the conservation capabilities of CDFW and participating organizations involved in the use, management, and/or conservation of natural and cultural heritages, as illustrated in Figure 1.6-1.

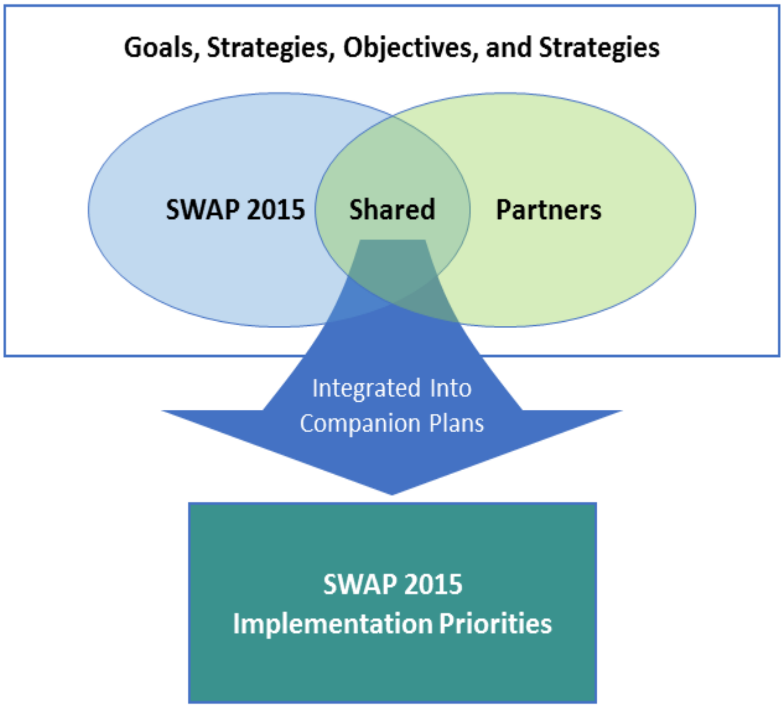


Figure 1.6-1 Identifying and Aligning SWAP 2015 and Partners' Priorities to Create Companion Plans

The companion plans explore solutions to the complexities of collaborative conservation actions to implement SWAP 2015. These plans go beyond the basic requirements of SWAPs and strengthen implementation of SWAP 2015 by engaging partners through identification of shared conservation goals, objectives, and strategies to be highlighted as the plan's highest implementation priorities. The companion plans also fulfill the strong suggestion of AFWA to incorporate more partner engagement as a best practice in wildlife conservation planning.

The companion plan concept stems from growing interests and needs for inter-agency and partner coordination and collaboration in the state, as indicated in the adoption of a 2013 resolution by the California Biodiversity Council (2013) to promote better alignment among California and federal resource agencies for natural resource conservation priorities. The companion plan process brought agencies and partners (such as other state agencies, local and regional agencies, California tribes and tribal governments, nongovernmental organizations, academic institutions, and industry associations) together to identify aligned priorities, leverage human and financial resources, and ultimately implement conservation actions effectively. Each companion plan supplements SWAP 2015 by:

- elaborating on how SWAP 2015 conservation strategies could be implemented collaboratively;
- identifying sector-specific shared conservation goals, objectives, and strategies for mutual supports;
- outlining linkages within and among sector plans;
- sharing opportunities to leverage financial or other resources for conservation actions among sectors;
- identifying actions that sector partners are already taking or could take to support overall implementation of SWAP 2015; and
- serving as a way to engage and encourage collaboration among agencies and partners.

To develop the nine sector-specific companion plans, CDFW created a development team for each sector composed of key agencies, government representatives, and partners. Facilitated meetings were conducted to gather information from experts within the nine development teams regarding how to mutually support implementation of SWAP 2015 and partners' efforts, including partnership opportunities, areas of alignment between partners, and opportunities to leverage existing efforts to achieve the goals of SWAP 2015 and of partners' efforts. Information about how to be involved in the planning process for the companion plans, including drafts for public review, will be posted on CDFW's SWAP website. Each companion plan:

- describes the scope of the sector;
- describes goals in common with SWAP 2015 and partners' efforts;
- highlights SWAP 2015 goals, objectives, and strategies that are aligned with sector priorities;
- outlines the alignment of goals, objectives, and strategies with other existing plans and strategies;

- describes leverage points and opportunities for implementing SWAP 2015 (e.g., key partners and potential sources of funding); and
- explains a timeline and measures of success for implementing joint actions.

Through cooperation and teamwork during the development, companion plans are fostering greater engagement with partners from key sectors in SWAP 2015 implementation. The companion plans are critical for determining feasible conservation actions addressed in SWAP 2015 and help allocate human and financial resources to support implementing those actions. Together, SWAP 2015 and associated companion plans set the context and strategic direction for integrated planning and management more broadly, and help effective use of funding to support these efforts for the state and its partners.

When completed, the companion plans will be posted on the CDFW website at http://www.wildlife.ca.gov/SWAP.

2 California's Natural Diversity and Conservation Issues

> "It is that range of biodiversity that we must care for – the whole thing – rather than just one or two stars."
>
> – Sir David Attenborough

California has incredible wildlife diversity. The state's varied topography and climate have given rise to this remarkable diversity of habitats and a correspondingly varied array of both plant and animal species. California has more native species than any other state in the nation and also has the greatest number of endemic species, those that occur nowhere else in the world (CDFG 2003). One of 25 global hotspots for conservation is located in California, because of the remarkable biodiversity and significant threat of losing habitats and wildlife species unique to California (Myers et al. 2000).

California's biodiversity stems from exceptional variation in landscape features, latitudinal range, geological substrates and soils, and climatic conditions, resulting in a wide range of ecosystems to support plant and animal species. Alpine meadows; desert scrub; oak woodlands; diverse grasslands; vernal pool complexes; moist redwood forests; spring-fed lakes; freshwater streams, rivers, and marshes; coastal wetlands, beaches, dunes and bluffs; and giant marine kelp beds provide a wide variety of habitats that support a correspondingly diverse array of both plant and animal species.

Conserving the state's outstanding biodiversity creates many values. Wildlife provides significant economic and quality of life benefits to the state through recreation, tourism, sport and commercial harvest, and ecological services, such as pollination. Many of the places where wildlife thrives are often the same as those valued for recreation and other human activities. By learning the causes of impacts to the state's wildlife and the steps that can be taken to reduce those impacts, California's residents have the opportunity to become more active stewards of this precious natural treasure, ensuring that the Golden State remains an important place for viable wildlife populations for generations to come.

This chapter presents required Elements 1, 2, and 3 of SWAP 2015. After describing the context for biodiversity, it explains the distribution and abundance of wildlife, defines the Species of Greatest Conservation Need (SGCN), and discusses common pressures found throughout the state that are resulting in stresses to the SGCN.

2.1 Geographic and Topographic Diversity

Much of California's natural diversity is derived from the range of physical geography, with the primary drivers being regional shifts in geology, soils, topography, and climate. From the Pacific Ocean to the crest of the Sierra Nevada, California's topographic variety is unparalleled. Within 80 miles of one another lie the highest and lowest points in the lower 48 states - Mount Whitney at 14,495 feet and Death Valley at 282 feet below sea level. In California's offshore waters, rocky reefs, offshore banks, and underwater canyons also create a diverse marine landscape. The geology of California is primarily the result of volcanic activity and upheavals from tectonic shifts, which were then shaped by glaciers and erosion along the Pacific Ocean. Glaciation, sedimentary and volcanic deposits, movement along fault zones, the uplift of subterranean rock and sediment layers, and gradual erosion created unique topographical features and a mosaic of bedrock and soil types.

Uncommon geologic features, such as the Traverse Ranges that run east to west in southern California, contain a wide variety of vegetation types ranging from desert to subalpine, which results in high levels of biodiversity. California's many islands create diverse marine habitats in the surrounding ocean, and provide a natural separation from mainland species resulting in the evolution of unique island species. Geology and soil are critical in the distribution of plants and associated animals throughout California. California exhibits 10 of the world's 12 soil orders. Unique soils types, such as serpentine and carbonite soils derived from bedrock, are uncommon outside of California and plants have evolved specifically to survive in these soils, creating a large number of endemic California plant species (CDFG 2003).

California's land is divided into 11 Geomorphic Provinces, many which include volcanic features. The Geomorphic Provinces are: Sierra Nevada, Cascade Range, Coast Ranges, Transverse Ranges, Peninsular Ranges, Klamath Mountains, Great Valley, Basin and Range, Modoc Plateau, Mojave Desert, and Colorado Desert (CERES 2014). California's offshore waters are divided into the San Diegan zoographic province to the south and the Oregonian Provence to the north (Briggs 1974).

2.2 Climatic Diversity

The state's geography and topography have created distinct local climates ranging from high rainfall in northwestern mountains to the driest place in North America, Death Valley. North to south, the state extends for almost 800 miles, bridging the temperate rainforests in the Pacific Northwest and the subtropical arid deserts of Mexico. Many parts of the state experience Mediterranean weather patterns, with cool, wet winters and hot, dry summers. Summer rain is indicative of the eastern mountains and deserts, driven by the western margin of the North American monsoon. Along the northern coast abundant precipitation and ocean air produces foggy, moist conditions. High mountains have cooler conditions, with a deep winter snow pack in normal climate years. Desert conditions exist in the rain shadow of the mountain ranges.

While the state is largely considered to have a Mediterranean climate, it can be further subdivided into six major climate types: Desert, Marine, Cool Interior, Highland, Steppe, and Mediterranean. California deserts, such as the Mojave, are typified by a wide range of elevation with more rain and snow in the high ranges, and hot, dry conditions in valleys. Cool Interior and Highland climates can be found on the Modoc Plateau, Klamath, Cascade, and Sierra ranges. Variations in slope, elevation, and aspect of valleys and mountains result in a range of microclimates for habitats and wildlife. For example, the San Joaquin Valley, exhibiting a Mediterranean climate, receives sufficient springtime rain to support grassland habitats, while still remaining hot and relatively dry in summer. Steppe climates include arid, shrub-dominated habitats that can be found in the Owens Valley, east of the Sierra Nevada, and San Diego, located in coastal southern California.

The marine climate has profound influence over terrestrial climates, particularly near the coast. Additionally, the state is known for variability in precipitation because of the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). Oscillations are the cyclical shifting of high and low pressure systems, as evidenced by the wave pattern of the jet stream in the northern hemisphere. The ENSO is the cycle of air pressure systems influenced by the location of warm and cold sea temperatures. El Niño events occur when waters are warmer in the eastern

Pacific Ocean, typically resulting in greater precipitation in southern California and less precipitation in northern California, and La Niña events occur when waters are colder in the eastern Pacific resulting in drier than normal conditions in southern California and wetter conditions in northern California during late summer and winter. The warmer ocean temperatures associated with El Niño conditions also result in decreased upwelling in the Pacific Ocean.

2.3 Habitat and Species Diversity

California's varied geography, topography, soils, expanse of ocean waters, and climate have created a variety of habitats across the state, supporting many native plant and animal species found only in California.

2.3.1 Plant Diversity

California has the highest numbers of native and endemic plant species of any state, with approximately 6,500 species, subspecies, and varieties of plants, representing 32 percent of all vascular plants in the United States (CDFG 2003; University of California, Berkeley 2014). Nearly one-third of the state's plant species are endemic (Stein et al. 2000), and California has been recognized as one of 34 global hotspots for plant diversity (Conservation International 2015). Within the California Floristic Province, which encompasses the Mediterranean area of Oregon, California, and northwestern Baja, 2,124 of the 3,488 species are endemic, representing a 61 percent rate of endemism (Willoughby 2011).

Over 200 species, subspecies, and varieties of native plants are designated as rare, threatened, or endangered by state law, and over 2,000 more plant taxa are considered to be of conservation concern.

The state's native flora includes many unique or unusual species. The giant sequoia, an ancient species that has survived from the Tertiary Age, is one of the most massive living organisms known. Coastal redwoods are the tallest trees in the world, reaching as high as 321 feet, taller than a 30-story building (Faber 1997). A 4,846-year-old bristlecone pine in California's White Mountains, called Methuselah, was considered the oldest living non-clonal organism (Vasek and Thorne 1988), until superseded by the discovery in 2013 of another bristlecone pine in the same area with an age of 5,064 years (Rocky Mountain Tree Research 2012). California is home to the smallest flowering plant in existence, the pond-dwelling water-meal, less than one-tenth of an inch across. The state also supports nine species of carnivorous plants, including sundews, butterworts, and the California pitcher plant. Numerous species have adapted to grow on serpentine soils that are low in calcium and high in magnesium, chromium, nickel, and other heavy metals toxic to most plant species. Closed-cone conifer species, such as pygmy cypress and some chaparral plants need hot fires to complete their life cycles (Faber 1997).

California contains examples of most of the major biological provinces, or biomes, in North America, including grassland, shrubland, deciduous forest, coniferous forest, tundra (alpine), mountains, deserts, rainforest (temperate), marine, estuarine, and freshwater habitats. Each of these biomes contains many different types of plant communities, such as redwood forests, vernal pool wetlands, or blue oak woodlands. Altogether, the state supports over 100 types of forests and woodlands, over 200 types of shrublands, and over 150 plant communities dominated by herbaceous plants (Sawyer et al. 2009). Some of California's plant species and communities, such as mixed conifer forests, chamise chaparral, and creosote scrub, are widespread. Others are highly restricted in their distributions, such as unique stands of Crucifixion-thorn, Gowen cypress, Hinds walnut, and Torrey pine.

Some parts of the state are particularly rich in plant species diversity. Areas with the greatest number of plant species are the Klamath and inner North Coast ranges, the high Sierra Nevada, the San Diego region, and the San Bernardino Mountains. Other regions with considerable plant diversity are the North and Central Coast Ranges, the Cascade Range, the Sierra Nevada foothills, and the western Transverse Range (CDFG 2003).

2.3.2 Terrestrial Wildlife Diversity

California has a large number of animal species, representing a substantial proportion of the wildlife species nationwide. The state's diverse natural communities provide a wide variety of habitat conditions for wildlife. The state's wildlife species include approximately 100 reptile species, 75 amphibian species, 650 bird species, and 220 mammal species (CDFW 2014b). Additionally, 48 mammals, 64 birds, 72 amphibians and reptiles, and 20 freshwater fish live in California and nowhere else (CDFG 2008; Shuford and Gardali 2008.)

The state has remarkable native fauna, including the largest bird in North America, the California condor (Poole and Gill 2002); the Blainville's horned lizard, which squirts blood from its eyes as a defense mechanism (Stebbins 2003); the tailed frog, which is among the most primitive living frog species (Ford and Cannatella 1993); four newly described species of legless lizards (Papenfuss and Parham 2013); and the once-endangered California gray whale. Wolverines had been extirpated from the state since the 1930s (Schwartz et al. 2007), but recently an individual has taken up residence in the Sierra Nevada near Truckee (Moriarty et al. 2009). In addition, a rare Sierra Nevada red fox (*Vulpes vulpes necator*) was sighted in January 2015 in Yosemite National Park for the first time in nearly 100 years.

In 2011, an individual gray wolf became the first wolf since 1924 to explored the northeastern portion of state (see *The Story of Wolf OR7*, below).


Shasta Pack, CDFW 2015

In June 2014, the California Fish and Game Commission voted to list gray wolves as endangered under the California Endangered Species Act (CESA). The gray wolf is also listed as endangered in California, under the federal Endangered Species Act (ESA). In August 2015, a litter of five wolf pups and two adults were discovered near Mount Shasta. The CDFW designated this group as the Shasta Pack.

Some of California's natural communities are particularly rich in wildlife species, supporting hundreds of species each. Twenty-four habitats—including valley foothill riparian, mixed conifer, freshwater wetlands, mixed chaparral, and grasslands in the state—support more than 150 terrestrial animal species each (CDFW 2014a). Oak woodlands also are among the most biological diverse communities in the state, supporting 5,000 species of insects, more than 330 species of amphibians, reptiles, birds, and mammals, and several thousand plant species (CDFG 2003).

The Story of Wolf OR7

The male wolf known as "OR7" was born in northeastern Oregon in spring 2009. The Oregon Department of Fish and Wildlife (ODFW) fitted it with a radio-collar in February 2011. Biologists designated the wolf OR7, because it was the seventh wolf radio-collared in Oregon. Its collar transmits location information to satellites daily and is continuing to function in 2015.

Until spring 2011, OR7 was a member of northeastern Oregon's Imnaha pack. The Imnaha pack was first documented in 2009 and currently occupies much of the Imnaha River drainage (east of the communities of Enterprise and Joseph) in Wallowa County. The founding members of this pack migrated into Oregon from Idaho.

In 2011, OR7 dispersed from the Imnaha pack. The dispersal of younger individuals from a pack is common. Dispersing wolves generally attempt to join other packs, carve out new territories within occupied habitat, or form their own pack in unoccupied habitat. From 2011-2013, OR7 continued to make short and long distance movements between southern Oregon and Northern California. He traveled thousands of miles across Oregon and back and forth into Northern California before finding a mate in the southern Cascades on the Rogue River-Siskiyou National Forest. In early spring 2014, OR7 and his mate had pups, marking the first known wolf reproduction in the Oregon Cascades since the mid-1940s. In January 2015, Oregon wildlife officials designated OR7, his mate and their pups the Rogue Pack.

For more information about OR7 or the Rogue Pack, see http://www.dfw.state.or.us/wolves/. For information about wolves in California, see https://www.wildlife.ca.gov/Conservation/Mammals/Gray-Wolf.

California's species display a variety of life histories, illustrating the many ways wildlife can adapt to a wide variety of habitats. Some of California's wildlife species are habitat specialists, adapted to the vegetation, forage resources, landscape features, or climate of a particular natural community and are found almost exclusively in these communities. Other species depend on a number of specialized plants, landscape features, or other resources within close proximity to each other. As with plant species, some wildlife species are not only dependent on a certain habitat type, but are also restricted to a very small geographic range, perhaps occurring at only one site in the world.

The valley elderberry longhorn beetle, for example, eats and reproduces only on the elderberry bushes found in Central Valley riparian habitats (U.S. Fish and Wildlife Service [USFWS] 2014a). The marbled murrelet, a seabird, spends most of its life swimming and foraging in the ocean, but flies inland to nest, where it relies almost entirely on the branches of old-growth redwood and Douglas fir trees to provide wide nesting platforms (USFWS 1997). The willow flycatcher is dependent on willow thickets for feeding, cover, and reproduction (CDFW 2014a). The endangered salt marsh harvest mouse prefers pickleweed stands for cover and reproduction (CDFW 2014a). The bank swallow nests in natural river banks (CDFW 2014a).

Some species are restricted to a very small geographic range, because the species is strongly associated with a habitat that is naturally limited in extent or that has grown scarce. This geographic restriction can also occur when a new subspecies has evolved as a result of being isolated from other populations of the same species by geological or climatic changes. The desert slender salamander (state and federally listed as endangered), for example, is known only from two small populations in the Santa Rosa Mountains in Riverside County. The species is a relic of cooler, moister climate regimes, but now is restricted to canyon areas that provide cliffs and rock crevices where there is continuous water seepage (CDFW 2014a). The Mount Hermon June beetle and Zayante band-winged grasshopper (both federally listed as endangered) are restricted to small outcrops of sandstone and limestone soils derived from marine sediments, known as Zayante sandhills habitat, in the Santa Cruz mountains (USFWS 1998). The island fox, the world's smallest grey fox (state listed as threatened), occurs only on the six largest Channel Islands off the coast of Santa Barbara and Ventura counties (USFWS 2005b). There are many other examples of species with very limited ranges in California, including invertebrates limited to a particular group of vernal pools and invertebrates, reptiles, and amphibians restricted to particular desert dune or spring systems.

Several animals forage primarily on one or very few plant species. One such species is the greater sage grouse, which feeds primarily on sagebrush. The red tree vole lives in northern California coastal fog forests and eats only the soft inner tissue of Douglas fir needles (Williams 1986); pinyon jays seek pinyon, ponderosa, or Jeffrey pine seeds (CDFW 2014a); the chisel-toothed kangaroo rat of the northeastern Great Basin is largely dependent on one species of saltbush (CDFW 2014a); and larval geometrid moths of the genus *Drepanulatrix* eat only leaves of ceanothus species (CDFW 2014a).

Some of California's unique wildlife species are adapted to survive in harsh environments. In the Central Valley, coastal southern California, and elsewhere, seasonal vernal pools evaporate quickly in the hot, dry summer conditions, leaving behind cracked and dry ground. Invertebrates, such as fairy shrimp species, are adapted to this cycle, producing a tough casing that allows their eggs to remain dormant in desiccated conditions, only to emerge the following summer after winter rains refill pools (USFWS 2005a). Kangaroo rat species that inhabit the deserts, eastern Modoc plateau, coastal southern California, and southern San Joaquin Valley are all well suited for extremely dry conditions (Williams et al. 1998). They have specialized kidneys that enable them to excrete solid urine, conserving water and allowing them to survive for long periods without drinking. The alpine chipmunk lives in the Sierra Nevada, typically at elevations higher than 9,000 feet, where in average or wetter years the ground is covered with a snow pack from 5 to 10 feet deep for nearly five months of each year. It survives by storing adequate seeds and other food resources during the summer months to sustain it through the winter (CDFW 2014a).

Some species are habitat generalists, able to survive in many different conditions and to make use of many resources to meet their needs for survival. While some entire species' populations are restricted to small areas, there are also wildlife species that are notable for their ability to travel widely, or for their large home ranges occupied by just one individual or family of the species.

Herds of mule deer and pronghorn antelope, for instance, will migrate distances of more than 100 miles traveling between their summer and winter ranges in northern California. The California bighorn sheep summers in the high elevations of the Sierra Nevada (up to 14,000 feet) and migrates to lower-elevation sagebrush-steppe habitat (below 5,000-6,000 feet) to escape deep winter snows (Zeiner et al. 1990). Some predators, such as the mountain lion, badger, and fisher, may cover thousands of acres when hunting; much larger areas are required to sustain entire populations (Pierce et al. 2000). Predators also exist in close proximity to the urban areas and rely on remnant habitat corridors, although they face population pressures from lack of prey, inbreeding, and direct threats from urbanization, such as vehicle strikes and public safety concerns.

Many of California's species also travel substantial distances over the course of their seasonal migrations. The Pacific Flyway and Central Valley supports some of the greatest concentrations of wintering waterbirds in the world, including millions of waterfowl and shorebirds. Birds that spend their summers in the upper mountainous elevations, such as the yellow-rumped warbler and cedar waxwing, descend tens or hundreds of miles during the wintertime to forage in the milder climates of the Central Valley or along the coast. Long-distance migrating birds, including numerous species of swallows, terns, hawks, shorebirds, and songbirds, forage or nest seasonally in California. The golden-crowned sparrow uses California as a winter home and spends summer months far to the north and the Swainson's hawk migrates between California and South America, as far south as Argentina. Other species travel from elsewhere to overwinter in California. One such species, the monarch butterfly, takes multiple generations to make the migration to and from overwintering sites. Conserving the diversity of these migratory species not only conserves California's diversity, but also the diversity of many other countries.

Pacific Flyway

The Pacific Flyway is a major north-south migratory pathway for birds in America, extending from Alaska and the Canadian Artic through Central and South America. Every year, migratory birds travel some or all of this distance in the spring and fall, following food sources, heading to breeding grounds, or travelling to overwintering sites. Each bird species travels roughly the same route every year, at almost the same time. Each year at least a billion birds migrate along the Pacific Flyway, but these birds are only a fraction of those that used the flyway a century ago. The birds of the Pacific Flyway depend on a diverse chain of habitats, from Arctic tundra and northwestern rainforest to tropical beaches and mangroves. California is a major component of the Pacific Flyway. Many species stop and rest in coastal and inland wetlands, such as the Salton Sea, Monterey Bay, Suisan Marsh, and Humboldt Bay, or use natural wetland or surrogate wetland habitats, such as flooded fields in the Central Valley. Migrating birds may gather, sometimes numbering in the millions, to feed and regain their strength before continuing their migration. Some species may remain in these rest stops for the entire season, but most stay a few days before moving on. Connectivity of habitat for migratory species is essential to their conservation, especially in light of habitat loss, water shortages, diminishing food sources, and climate change.

2.3.3 Aquatic and Marine Diversity

Dave Feliz, CDFW

California exhibits a wide range of aquatic habitats from the Pacific Ocean to isolated hillside seeps, to desert oases that support both water-dependent species and provide essential seasonal habitat for terrestrial species. Perennial and ephemeral rivers and streams, riparian areas, vernal pools, and coastal wetlands support a diverse array of flora and fauna, including 150 animal and 52 plant species that are designated special-status species (California Coastal Conservancy 2001). The California Natural Diversity Database identifies 123 different aquatic habitat-types in California, based on fauna. Of these, 78 are stream habitat-types located in seven major drainage systems: Klamath, Sacramento-San Joaquin, North/Central Coast, Lahontan, Death Valley, South Coast, and Colorado River systems (Jensen et al. 1993). These drainage systems are geologically separated and contain distinctive fishes and invertebrates. California has approximately 70 native resident and anadromous fish species (Moyle and Davis 2001), and 72 percent of the native freshwater fishes in California are either listed, or possible candidates for listing as threatened or endangered, or are extinct (Moyle et al. 1989).

From the steep creeks of the Sierra Nevada to the wide and powerful rivers of the Central Valley, California's streams and rivers are the life-blood of the watersheds they occupy, supporting an array of invertebrates, fishes, amphibians, reptiles, birds, and mammals. The cool, steep headwater streams join with strong rivers, which (when unhindered by human activity) slow and meander, depositing fertile sediments and recharging underground aquifers in their floodplains before heading out to sea or ending in a land-locked basin. This headwater-to-sea connectivity is critical for California's anadromous fish, which rely on rivers and perennial streams for spawning habitat and safe passage to the Pacific Ocean for later life stages.

Two of the largest coastal rivers are the Klamath River, which runs for 263 miles, and the Eel River, which runs for 196 miles, both in the northern Coast Range. These two rivers support the second and third largest salmon and steelhead populations in California (with the Sacramento River being the largest) (Taylor 1978). Coastal rivers are also home to aquatic mammals, such as river otters and beavers, and amphibians and riparian birds, including endemic species.

Two major river systems drain and define the two parts of the Central Valley. The Sacramento River, supported by its major tributaries, the Feather River, Yuba River, and American River, flows south through the Sacramento Valley for about 450 miles. The Sacramento River carries far more water than the San Joaquin River and is one of the largest U.S. rivers that empty into the Pacific Ocean, second only to the Columbia River in Oregon (Sacramento River Watershed Program [SRWP] 2015). The Sacramento River also supports one of the most important salmon fisheries in California, with four separate runs of Chinook salmon (SRWP 2015). In the San Joaquin Valley, the San Joaquin River flows north for about 365 miles, supported by several tributaries, such as the Merced, Tuolumne, Stanislaus, and Mokelumne rivers. Historically, the extensive marsh system along the San Joaquin River hosted one of the largest concentrations of wintering waterfowl in the world (USFWS 2006). Although much of this habitat has been lost, the Central Valley and the San Joaquin River continue to provide critical habitat for migrating waterfowl.

The rivers of the Central Valley converge in the Sacramento-San Joaquin Delta (Delta), a complex of fresh and brackish water wetland channels and sloughs that wind around islands mainly used for agriculture. Freshwater from the rivers mingles with saltwater from the Pacific Ocean, creating the San Francisco Bay estuary system, the West Coast's largest estuary (California Department of Water Resources [DWR] 2015). The Delta provides a rich and productive environment for more than 500 species of wildlife, including 20 endangered species, such as the salt marsh harvest mouse and the delta smelt (DWR 2015). Additionally, the Delta serves as a vital migration path for the single largest run of salmon in California. The Delta is also the hub of the state's water distribution system and provides water for two-thirds of all Californians and millions of acres of irrigated farmland.

Coastal and freshwater wetlands provide important wildlife habitat and critical ecological services, including altering and transforming pollutants in runoff water, controlling floods, moderating sediment delivery, promoting groundwater recharge, sequestering carbon, and protecting shorelines from erosion. Coastal wetlands include brackish and saltwater wetlands, such as saltmarsh that are found within a variety of estuary types, including river-mouth, canyon mouth, lagoon, coastal dune-creek, bay, structural basin, and artificial drain estuaries. Freshwater wetlands are not connected to the ocean and they can be found along the boundaries of streams, lakes, ponds, or even large shallow holes that fill up with rainwater. They may stay wet all year long, or the water may evaporate during the dry season. California's many estuaries provide invaluable habitat for birds, mammals, fish, and other wildlife. The sheltered waters of estuaries provide a safe haven and protective nursery for small fish, shellfish, migratory birds, and coastal shore animals. Estuaries include habitat for numerous special status or declining species of mammals (e.g., Southern California salt marsh shrew), birds (e.g., Belding's savannah sparrow), fish (e.g., tidewater goby), and insects (e.g., mudflat tiger beetle) (Ferren et al. 1996). An example of this diversity is found in the Elkhorn Slough estuary near Monterey Bay, which is home to more than 100 sea otters, as well as over 100 species of fish and 550 species of invertebrates (National Estuarine Research Reserve System [NERRS] 2015).

Vernal pools are a unique type of rain-fed seasonal wetland that occurs in depressions underlain by poorly drained or restrictive soil types. California vernal pools contain standing water during the winter and spring and are completely dry during the hot Mediterranean summer. As the standing water evaporates the pool and the surrounding soils can become saline, alkaline, or acidic. Many specially-adapted crustaceans, amphibians, insects, and plants occur only in vernal pools (CDFW 2015).

Athena Maguire, CDFW

California's rocky offshore islands typically support a limited number of species, but are nonetheless important habitats for those species that depend on them. The Channel Islands provide habitat for numerous endemic species, including 23 species of terrestrial wildlife. The Farallon Islands host some of the largest breeding colonies of seabirds in the United States, and numerous marine mammals, including California sea lions and endangered blue and humpback whales (Farallones Marine Sanctuary Association 2014).

Rocky reefs, offshore banks, underwater canyons, coral gardens and kelp forests harbor an extraordinarily diverse number of marine species. Intertidal zones provide habitat for worms, clams, crabs, small fishes, and shorebirds, while the pelagic zone of the open ocean supports species of plankton, fish, marine birds, and marine mammals, such as whales and dolphins. Giant kelp beds within the nearshore waters off of southern and central California are one of the most diverse biological communities known to exist in the world's oceans, with over 800 species of marine organisms dependent on the kelp forests at some point in their life history. While many variations in marine fauna and habitat types exist at numerous scales, many marine species along the California coast generally occur either north or south of Point Conception (34.5° North Latitude), with warm and temperate habitat to the south in the San Diegan zoographic province and cool temperatures of the Oregonian Province to the north (Briggs 1974). The marine biome is the major producer of plant biomass from sunlight and nutrients (primary productivity). These plants, ranging from small phytoplankton to large macro-algae, represent the basic food source for all life in the ocean, and support the extensive biodiversity of this system. In areas where northwest winds cause cold, nutrient-rich water to move towards the surface from the deep, a process known as upwelling, plankton abound attracting squid, sardines, krill, and other forage species. These species, in turn, attract predatory animals, including sharks, marine birds, and whales.

2.4 Species of Greatest Conservation Need

A key element of updating the SWAP is identifying and compiling information on the species of wildlife that are indicative of the state's biological diversity and have the greatest need for conservation. These species are referred to as Species of Greatest Conservation Need (SGCN). For SWAP 2015, technical teams developed criteria and evaluated species, resulting in a revised SGCN list of invertebrates, amphibians, reptiles, fish, birds, mammals, and plants. The improved set of criteria was developed to ensure a more scientifically rigorous and focused list compared to the list of SWAP 2005.

2.4.1 Criteria to Select Species of Greatest Conservation Need

Criterion 1 includes species listed as threatened, endangered or candidate species in California under the federal ESA or CESA. State and Tribal Wildlife Grants (SWG) discourages the use of funds solely on federally listed species and on species that already have dedicated funding. Although these species are included in the SGCN list, it does not imply a funding preference or prioritization.

Criterion 2 includes species for which there is a conservation concern. The species under the second criterion are generally equivalent to the California Species of Special Concern (SSC) designation. Other conservation concern designations are described below under each category of species. The SSC designation carries no formal legal protection; the intent of the designation is to focus attention on animals of conservation risk, stimulate research on poorly known species, and achieve conservation and recovery of these animals before they meet criteria for listing as threatened or endangered. More information about CDFW's process of evaluating SSC, as well as their lists by taxa and life history accounts, including habitat association, population trends, and range maps, can be found online at http://www.dfg.ca.gov/wildlife/nongame/ssc/.

Criterion 3 includes species that were identified by CDFW as being highly vulnerable to climate change. The methods used to identify SGCN are described below for each category of species.

Invertebrates

Invertebrates that are state or federally listed are included under Criterion 1. Invertebrate species under Criterion 2 have a NatureServe State Conservation Rank of S1. The NatureServe ranking represents a score that reflects a combination of Rarity, Threat, and Trend factors within

California's state boundaries. Rarity is weighed heavier than the other two factors. An S1 ranking is defined as Critically Imperiled in the state because of extreme rarity (often five or fewer populations) or because of factor(s), such as very steep declines, making it especially vulnerable to extirpation from the state. Marine invertebrates are included under Criterion 2 if they are subject to a take or harvest prohibition by CDFW or National Marine Fisheries Service (NMFS), if they are under a federal rebuilding plan, or if they are considered to be overfished.

Fishes

Fishes that are state or federally listed are included under Criterion 1. Freshwater and anadromous fish species identified under Criterion 2 include SSC and species subject to a take or harvest prohibition by CDFW or NMFS, a federal rebuilding plan, or consideration of being overfished. The SSC report update from the 1995 report for fish includes information on the distribution, abundance, and status of species (http://www.dfg.ca.gov/wildlife/nongame/ssc/fish.html). Climate vulnerability for fish was determined using the methods and evaluation presented in Moyle et al. 2012. The methodology uses expert opinions of the authors and literature reviews of the status and biology of the fishes to score both status of each species ("baseline vulnerability") and likely impact of climate change ("climate vulnerability"). When the total scores for baseline and climate vulnerability were combined, they produced a score that indicated the overall vulnerability to climate change. Species with a highly vulnerable or critically vulnerable score are included as SGCN under Criterion 3.

Amphibians and Reptiles

Amphibians and reptiles that are state or federally listed are included under Criterion 1. CDFW updated the list of amphibian and reptile SSC (Thomson et al. 2012) and those species are included as SGCN under Criterion 2. The SSC report (in process, see http://www.dfg.ca.gov/wildlife/nongame/ssc/amphibian-reptile.html) contains species accounts and distribution maps for 48 amphibian and reptile special concern taxa (11 salamanders, 14 anurans, 2 turtles, 12 lizards, and 9 snakes). Each species account contains a description of the animal, taxonomic remarks, distribution and life history information, habitat description, status, management recommendations, and a range map. Under Criterion 3, a highly vulnerable status was assigned to amphibians and reptiles, if any of the following occurred:

- 90-100 percent of the (sub)species' currently occupied cells were predicted to decline in suitability by 2050 (Warren et al. 2014);
- greater than 40 percent of currently occupied localities and/or greater than 50 percent of the species' range were predicted to become unsuitable by 2050 (Wright et al. 2013); or
- expert opinion by the SSC Technical Advisory Committee predicted the (sub)species would be highly sensitive to climate change over the next 100 years (Thomson et al. 2012).

Birds

Birds that are state or federally listed are included under Criterion 1. Since the 2005 version of the SWAP, CDFW updated the bird SSC list (BSSC; Shuford and Gardali 2008) and those are included as SGCN under Criterion 2. The BSSC report includes species accounts for the 63 ranked taxa to document general range and abundance, seasonal status in California, historical range and abundance in California, ecological requirements, and threats; additionally, management, research and monitoring recommendations are presented (http://www.dfg.ca.gov/wildlife/nongame/ssc/birds.html). Species with a high vulnerability score are included as SGCN under Criterion 3. These species were determined through an extensive climate change vulnerability assessment for birds (Gardali et al. 2012). The methodology is described below.

To quantify climate vulnerability, a taxon's sensitivity and exposure were considered. Sensitivity was determined by intrinsic traits of species (habitat specialization, physiological tolerances, migratory status, and dispersal ability) that make them vulnerable to climate change. Exposure was determined by the extrinsic factors (habitat suitability, food availability, and extreme weather) that will result from climate change. Sensitivity and exposure were scored independently; then, the two scores were multiplied to generate a climate change vulnerability index. To integrate the climate change vulnerability index with the BSSC list, Gardali et al. (2012) took a similar approach to that proposed by the U.S. Environmental Protection Agency (EPA) to integrate climate change vulnerability with existing stresses for threatened and endangered species (EPA 2009). A matrix combined the priority Climate Change Vulnerability of California ranks from each list to produce a final integrated list.

Mammals

Mammals that are state or federally listed are included under Criterion 1. Since the 2005 version of the SWAP, CDFW is in the process of updating the mammal SSC list (MSSC). Species listed on the current MSSC list are included as SGCN under Criterion 2. The MSSC report (in process, see http://www.dfg.ca.gov/wildlife/nongame/ssc/mammals.html) lists 36 species and subspecies of land mammals native to California determined to be potentially threatened with extinction in California. Species accounts for each taxon include initial description references, information on distribution, population status, and habitat, recommendations for additional assessment and conservation actions, taxonomic remarks, and distribution records. The vulnerability of California's land mammals was assessed for SWAP 2015 using scores developed for the MSSC update. For the MSSC project, a team of experts used a scoring system to quantify the conservation status of all the approximately 580 native land mammal taxa (species and subspecies) in California. Score definitions were developed for eight conservation factors, including population size, population trend, range size, range trend, population concentration, threats, endemism, and climate change. Mammals with a high risk ranking are included as SGCN under Criterion 3.

Plants

Plants that are state or federally listed are included under Criterion 1. Marine plant species where take or harvest is prohibited by CDFW or NMFS are included under Criterion 2. Plants with a California Rare Plant Rank of 1B.1, which indicates they are rare or endangered in California and elsewhere and are seriously threatened, are also included as SGCN under Criterion 2.

2.4.2 List of Species of Greatest Conservation Need

The list of SGCN for SWAP 2015 is included in Appendix C. The list includes 414 fish and wildlife species, 264 invertebrate species, and 475 plant species. Appendix C also lists SGCN by ecoregion and province. In Chapter 5, common stresses and pressures affecting SGCN habitats are described. Conservation strategies intended to relieve conservation targets from negative impacts and/or enhance habitat conditions are also identified in Chapter 5.

While plants are included in the list of SGCN, presence of SGCN plants were not included as a separate criterion used to prioritize or select targets when developing regional SWAP strategies. USFWS accepts plants as SGCN, but they are not currently eligible for SWG funding. However, plants will benefit from implementation of SWAP 2015 strategies incidentally when occurring in habitats conserved for animal SGCN. CDFW has chosen to include plants on the SGCN list, so SWAP 2015 would be a comprehensive conservation planning document.

2.5 Challenges in California Ecosystems

The condition of many of the state's natural communities and wildlife is impaired. This impaired or degraded condition, which can be manifested in many ways, is referred to as a stress in SWAP 2015. Stress results from the negative impacts of a pressure, which is usually, but not always, related to human activities. This section describes commonly identified stresses and pressures to the priority conservation targets across the state. The order in which they are described is not indicative of their level of importance or severity.

Key Ecological Attribute (KEA): Aspects of a target's biology or ecology that if present, define a healthy target and if missing or altered, would lead to the outright loss or extreme degradation of that target over time.

Pressure: An anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of the target. Pressures can be positive or negative depending on intensity, timing, and duration. Negative or positive, the influence of a pressure to the target is likely to be significant.

Stress: A degraded ecological condition of a target that resulted directly or indirectly from the negative impacts of pressures (e.g., habitat fragmentation).

2.5.1 Major Stresses

A stress is a degraded key ecological attribute (KEA) of a target that results from the negative impacts of a pressure. Understanding the ecological stresses experienced by California wildlife and ecosystems is one of the critical steps to define conservation strategies needed to counteract them.

Categories of Stresses

- **Geophysical and Disturbance Regimes**
- **Soil and Sediment Characteristics**
- **Hydrology and Water Characteristics**
- **Ecosystem Conditions and Processes**
- **Coastal and Oceanic Characteristics**
- **Climate Related Factors (Discussed in Section 2.5.3)**

CDFW and its partners identified and rated the primary stresses that are affecting each priority conservation target. From these assessments, they have compiled a standardized set of stresses (Table 1.5-3). This standardized set is being used to identify the most important stresses to ecosystems within conservation units, provinces, and statewide. While the categories are general, CDFW is identifying to the extent possible the direction, magnitude, and variability in these stresses as the affect the priority conservation targets. As additional information becomes available, it will be dynamically incorporated into the assessment for each target.

Stresses related to Climate Factors are discussed in Section 2.5.3. Several categories of stresses described below are interrelated and many of these stresses will be exacerbated by climate change as discussed in Section 2.5.3.

Geophysical and Disturbance Regimes

Change in Sediment Erosion-Deposition Regime

Natural geomorphic processes (i.e., sediment deposition and transport) are very important to the quality of California's aquatic habitats. Altered soil and sediment deposition in California is an important ecosystem stress primarily caused by human modification of physical river processes. Gravels and sediments within riverine systems provide microhabitats for invertebrate species, and are essential for spawning and nesting of many freshwater and anadromous fish species. Release of fine sediments from water projects, agriculture, and construction can be equally damaging. Fine sediments and silt cover natural creekbed substrates and fill in deep pools, degrading important habitats for native amphibians, fishes, and invertebrates. Additionally sediments can bind to and carry pollutants through the water column and cause increased turbidity reducing photosynthesis and interrupting the aquatic food chain (Newcombe 2003).

Historically, sediment was deposited at the river delta or along the river's banks by flood events, creating deep floodplain soils (Busch and Smith 1995; Poff et al. 1997). Over-bank flooding also flushed the soils of built-up salts, creating more favorable soil-nutrient conditions for vegetation growth. As a result of dams, flood control facilities, and water diversion structures, natural sediment transport has been severely diminished or blocked, and natural flooding has been reduced in frequency and magnitude in downstream river reaches. Altered hydrologic regime has resulted in unnatural changes in vegetation communities along rivers and estuaries, such as a documented change from high quality habitat dominated by native cottonwoods and willows to invasive tamarisk, which can withstand drier conditions and saltier soils (Briggs and Cornelius 1998; Poff et al. 1997). Reductions in the amount of sediment transported to the ocean can decrease beach or sandy subtidal habitat available to marine species. As another example, arroyo toad breeding sites that are created when floods deposit sediments as sandbars have been diminished by altered hydrologic regimes. Where human activities have fragmented watersheds and changed natural sediment dynamics and flow regimes, sediment deposition has been interrupted, reducing the extent of sandbars and gravel habitats necessary for this species' survival (USFWS 2014b). Similarly, habitat for the Coachella Valley fringe-toed lizard has been degraded by alterations to the sand transport processes that maintain dunes in the Coachella Valley.

Change in Natural Fire Regime

The frequency, intensity, and seasonal timing of fire in the landscape have been major factors determining the composition of flora throughout the state. Fire-dependent vegetation types cover over half the surface area of California (Sugihara et al. 2006). Alteration of natural fire regime is an important ecosystem stress, particularly in forest and shrub-dominated habitats (Ainsworth and Doss 1995). Widespread forest management practices, including fire suppression without active forest management, as well as increases in human-caused wildfires, have altered fire regimes. Due to fire suppression, the Sierra Nevada and northwestern California have experienced less frequent fires than have historically occurred, causing a buildup of forest fuels. However, southern California is experiencing larger and more frequent fires than under historic conditions (Safford and Van de Water 2014). In some cases these altered fire regimes have caused dramatic changes in regional habitats. For instance, because of altered natural fire regimes, densities of white fir and incense cedar have increased at the expense of live and black oaks, which are very important to many wildlife species, including acorn woodpecker, band-tailed pigeon, black bear, and dusky-footed woodrat. Drought-stressed forest may already be more prone to fire because of tree deaths from pests and drought, and are made even more vulnerable to fire because of an increased buildup of fuels from altered fire regimes. These drought-stressed conditions can be exacerbated by climate change. Fire suppression in forested areas leads to dense, even-aged forest stands that lack habitat complexity. It can also cause a build-up of fuels that can result in higher-than-natural intensity and heat of wildfires, which can destroy otherwise fire-adapted plants and damage soil structure (Baker and Shinneman 2004; Kauffmann 2004).

National Park Service

The effects of wildfires differ among ecological communities. In sage scrub, chaparral, and grassland systems, lightning-induced fires are relatively frequent and plants have evolved to germinate post-fire. Human-caused fires, however, have resulted in unnaturally high fire frequencies, especially along roads and near the urban-wildland interface, interrupting the natural successional dynamics of these habitats. These more frequent fires can decrease the quality of aquatic habitats by reducing shading and woody debris, as well as directly damaging terrestrial habitats.

Areas where fire was relatively rare, such as the high desert, have experienced an increase in fire frequency because of changes in vegetation. Increased fuel loads associated with invasive species have resulted in an increased number of fires (Brooks 1999). The increased fire frequencies then favor the Mediterranean grasses that were introduced to California with the arrival of European settlers and livestock. Once established, the non-native grasses grow in a dense-thatch pattern that chokes out native vegetation, lowers habitat quality for wildlife, and provides additional fuel for the cycle of frequent burning (Keeley 2009).

Change in Extreme Events

The change in the type, frequency, intensity, or length of climatic extreme events in California is closely related to the effects of climate change. Climate change may alter the frequency and/or intensity of extreme weather events such as severe storms, winds, droughts, and frosts. For example:

- In southern California, any increase in Santa Ana wind conditions, combined with warmer, drier summers, could escalate economic and environmental loss to wildfires in California.
- An increase in the number or intensity of thunderstorms, which form over land and pick up more acids and other pollutants than Pacific frontal storms, may mean more acid rain and increased murkiness in Sierra lakes (from nutrient enrichment).
- Pests, such as pine bark beetles, could become more prominent or more destructive, if shifts in climate conditions stress trees.
- El Niño warming may encourage toxic algal blooms in bays and estuaries and depress offshore ocean productivity.
- On shore, heavier, and/or more frequent rains induced by El Niño could increase the frequency of the rodent population booms that precede hantavirus outbreaks (Field et al. 1999).

Hydrology and Water Characteristics

Change in Runoff and River Flow

Dave Feliz, CDFW

Rivers, streams, and estuaries in California have been substantially modified and controlled since the Gold Rush. As a result, the natural hydrologic processes of the state's system of rivers, lakes, streams, and estuaries have also been substantially altered, which has created significant ecosystem stress on native aquatic species. Land development, construction of dams, flood control structures, diversions of water, and groundwater withdrawal all change the volume, timing, hydraulics, sediment load, and temperatures of water that runs off the landscape into the ground and/or streams. These impacts are exacerbated by drought conditions and climate change. These changes affect aquatic habitats necessary for species survival.

As a result of these alterations, natural riverine habitat is lost and fish migration routes are disrupted. In many regions of the state, diversions and groundwater pumping deplete river basins to the point where river reaches regularly dry up or are diminished to such low flows that native species cannot survive. As examples, this has occurred in the Carmel River on the Central Coast (CDFG 1996), the Colorado River in the Colorado Desert (Pitt 2001), the Mojave River in the Mojave Desert (CDFG 2004a), and the Scott and Shasta rivers in the North Coast-Klamath Region (CDFG 2004b). The impacts of river diversions and groundwater depletion become much more pronounced during drought conditions.

Change in Water Temperature

Water temperatures can be affected by many variables including drought, the presence or absence of riparian vegetation, stream diversions, the temperature of discharged water from reservoirs, and other factors. Many aquatic species are cold blooded and are easily affected by changes in temperature. A change in temperature of 5°C (41°F) can be harmful to fish species and a difference of only 2°C (35.6°F) can mean the success or failure of an egg hatch (Poff et al. 2002). In most cases, changes in temperature resulting from human activities trend upward, an exception would be the release of cold bottom water from a reservoir. The drop in water temperature from such a release can impact a warm water fishery for miles downstream. In general, most other activities will raise the temperature of receiving waters resulting in reduced dissolved oxygen content of the water, increased metabolism and oxygen demand for aquatic species, higher solubility of toxic substances, increased algae growth and eutrophication, and ultimately (if temperature maximums are exceeded) death (Poff et al. 2002).

Change in Water Chemistry

As discussed above, increases in water temperature can reduce the amount of dissolved oxygen in water and increase the solubility of toxins. Water chemistry can also be altered by the consistency of waste water discharges, contaminated or acidic surface runoff, excessive evaporation during dry periods, or saltwater intrusion. Increases in salinity and contaminants, or changes in water pH have direct impacts on aquatic species which are typically adapted to a narrow range of conditions. Additionally, heavy metals such as cadmium, lead, and chromium dissolve more easily in acidic water, leading to bioaccumulation and toxicity issues higher in the food chain. In extreme cases, the chemistry of a water body can be altered to the extent that is no longer suitable as a water source for terrestrial wildlife (such as in the case of streams effected by acid mine drainage).

Change in Water Levels and Hydroperiod

Hydroperiod refers to the length of time that a wetland, lake, or pond holds water. Hydroperiod can vary from as short as a few weeks for some seasonal wetlands, to very long or permanent for lakes and ponds. The hydroperiod of a wetland is critical for determining what amphibian species can successfully breed in the wetland. Hydroperiod determines the length of time amphibians larvae have for developing to the point where they can leave water for land as well as determining the predators to which they are exposed. If a pond or wetland remains dry during the breeding and egg laying season for any amphibian species, it will likely not provide breeding habitat for those amphibians that year, regardless if conditions change later in the season (Tarr and Babbitt 2012). Extending the hydroperiod, such as through the discharge of urban runoff into seasonal wetlands and vernal pools, allows perennial species to gain a foothold, and results in a shift to perennial wetland habitat, which can be no longer suitable for the unique flora and fauna that have adapted to the seasonal nature of these features.

Change in Flood Occurrence, Frequency, Intensity, and Area Flooded

The shallow and nutrient dense waters of flooded areas provide excellent habitat for immature fish and other aquatic species. Many bird species rely on floodplains to provide wintering habitat or stop-over nutrition during migrations. Changes in the season of flooding can affect the availability of seed for migrating birds. Unseasonably high flows from hydroelectric projects, or urban runoff, can flush amphibian and fish spawning sites, or deposit sediment on egg masses, while the restriction of seasonal high flows to conserve water and electricity storage can interrupt the regeneration of riparian habitats that rely on flood events and lead to unsuitably high water temperatures.

Michael Nevins, USACE

Change in Groundwater Tables

Springs are locations where groundwater naturally emerges from the Earth's surface in a defined flow. Springs can form seasonal or perennial pools, support wetlands, or form the headwaters of streams. A seep is a moist or wet area where groundwater reaches the surface but does not pond. Fluctuations in the groundwater table alter the seasonality or flow rates of these water features. Groundwater withdrawals in an area can reduce the pressure in an aquifer, causing groundwater levels to drop and decreasing flows from springs and seeps. Fractured bedrock aquifers found in mountainous areas typically have smaller watersheds and water storage capacity than deep alluvial aquifers found in valley areas. These smaller groundwater resources are more easily affected by periods of drought or groundwater withdrawal, but also rebound quickly in wet years. Groundwater decline can result in reduced habitat or loss of water sources for wildlife species. This can be a critical issue in the case of isolated springs and seeps, where wildlife species may be unable to relocate or may have to travel long distances to reach the next available water source.

Change in Nutrients

The amount of nutrients in a stream or lake is a function of the geology and vegetation within its watershed, and the amount of sediment that has been deposited. Newly formed lakes typically have rocky bottoms and very limited fertility. As a lake ages, nutrient rich sediments are washed into the bottom of the lake, increasing its fertility. Although this is a natural process, it can be accelerated by man-made nutrient sources such as runoff from urban and agricultural areas. As the nutrient level of a water body increases, so does the productivity of algae and aquatic plants. This increase in productivity is accompanied by increases in decomposition which uses up oxygen. In small or shallow lakes, the entire lake can become oxygen starved, resulting in the death of fish and other aquatic species.

Change in Pollutants

California's waters have been exposed to pollutants as a result of intensive agriculture, industrial activity, mining, and other human activities. Some pollutants can be toxic to wildlife and can affect the food chain. The concentration of some pollutants can be amplified as they are passed from prey to predator in a process known as bioaccumulation. An example of this would be mercury concentrations in water accumulating in the tissue of certain fish species.

Soil and Sediment Characteristics

Soils act as water reservoirs and filters, provide nutrient cycling for the plant community, and offer habitat to an incredible diversity of microorganisms, insects, and burrowing animals. The soil and above ground communities are inextricably linked and changes in one have repercussions in the other. Soil organisms depend on aboveground vegetation for the sugars and carbohydrates produced during photosynthesis, and plant growth is dependent on the microbial community's ability to convert and release mineral nutrients so that they are available for plant uptake. The soil community metabolizes organic and inorganic pollutants, releasing them as carbon dioxide and water and preventing contamination of water sources. Maintaining the biodiversity of the soil ecosystem is a crucial factor ensuring the success of these processes.

Change in Nutrients

The nutrient availability within a soil ecosystem is tied directly to organic matter inputs from the plant and wildlife community and the biodiversity of the soil community. Nutrient availability is cyclical and the amount of nutrients released for use by the above ground community must be balanced by organic matter inputs. As native ecosystems are converted for other uses, the soils community undergoes a series of changes related to nutrient cycling. Soils disturbed for agricultural use experience accelerated rates of organic matter decomposition, gradually depleting the soils nutrient reserves. Additionally, soil compaction reduces the available habitat for the microbial community and can slow nutrient processing. In areas where native plant species are removed or replaced, their symbiotic fungi are cut off from their primary food source and disappear from disturbed site. These fungi are critical in obtaining nutrients for their host plants and their loss can make reestablishment of native species difficult even after other habitat conditions have been met. These stresses on the soil ecosystem ultimately result in reduced quantity and quality of food and habitat for wildlife species, for example, by reducing plant cover and species richness or by simplifying community structure.

Change in Pollutants

California's soils have been exposed to pollutants as a result of intensive agriculture, industrial activity, mining, and other human activities. Some pollutants can be toxic to members of the soil community, which can affect the food chain. Additionally, when a soil contains high concentrations of heavy metals such as lead, zinc, and copper, or constituents such as mercury, arsenic, hydrocarbons or pesticides, these contaminants can be mobilized by the soil community and can accumulate in plant and animal tissues (Smical et al. 2008). The concentration of some pollutants can be amplified as they are passed from prey to predator in a process known as bioaccumulation. An example of this would be lead concentrations in soil accumulating in earthworms and being transferred to moles and shrews (Pierzynski et al. 2000).

Change in Soil Chemistry


Scott Bauer, USDA

Changes in soil pH have a strong effect on the relative availability of nutrients and minerals. Acidification of soils can lead to excessive availability of some minerals, including aluminum, which can be toxic to plants at high levels. Soil chemistry is also highly dependent on the presence of very small soil colloid particles which are found in clay minerals and soil organic matter. These colloids hold a static electrical charge which allows the soil to bond with and retain excess nutrients and pollutants that are carried into the soil. As soil organic matter is depleted through erosion, ground disturbance, vegetation removal, or lowering of the water table, the soil loses its ability to filter out pollutants which can lead to impacts on surface and groundwater quality (Pierzynski et al. 2000).

Change in Soil Moisture and Soil Temperature

The availability of soil moisture has a direct impact on the number of soil animals that a given area can sustain. This is evident in the relative abundance of biological activity in mountain compared to desert soils (Hendricks 1985). Additionally, the moisture content of a soil is directly correlated to the soil temperature. Changes in moisture and temperature can affect the suitability of a soil to provide habitat for burrowing animals (Kumar and Pasahan 1993).

Change in Sediment Quality

Sediment quality has a strong influence on the environment, because it often characterizes the quality of the substrate where vegetation occurs. Sediment-enriched soils directly contribute to enhanced biodiversity. Riverine systems experiencing diminished or altered hydrodynamics suffer from the lack of disturbance and sediment input, which contributes to the degradation of biological diversity and habitat variability.

Sediments not only influence the environment, but in some cases they define the environment. Sand dunes are made of rocky sediment worn down and transported by wind. The dune systems found in the desert regions are the results of this sand transport/deposited regime. The establishment of invasive species on dunes upsets the deposition/active movement equilibrium by over-stabilizing the active sand, thereby affecting sediment quality and dune specialists that require active sand, such as Coachella Valley fringe-toed lizard (Coachella Valley Association of Governments [CVAG] 2007).

Ecosystem Conditions and Processes

Change in Spatial Distribution of Habitat Types

Habitat loss, through permanent or temporary conversion to other purposes, is another important stress that occurs throughout California. It is often the result of land development, infrastructure projects, and agricultural activities. Habitat loss can result in the elimination of individuals or populations from the area that is converted. Habitat loss is typically permanent when it is the result of development. However, habitat loss caused by agricultural use, pollution, and invasive species can sometimes replace the existing habitat with a different seral stage or habitat type that still retains value; this change can also sometimes be reversed. In a recent study, rangeland conversion in California between 1984 and 2008 was analyzed using time series Geographic Information Systems (GIS) data and classified resulting land uses with aerial imagery (Cameron et al. 2014). In total, over 195,000 hectares (480,000 acres) of rangeland habitats, or about three percent of available rangelands were converted during this 24-year period. Residential and associated commercial development was the primary reason (49 percent of conversions), but agricultural intensification was also a major cause (40 percent).

Much of California's wetland habitat loss was from the conversion of wetlands for agriculture during the late 19th and early 20th century (Garone 2011). More recently, urban and suburban development has resulted in the loss of additional upland and aquatic habitat. Some habitat types have been reduced to a small fraction of their historic extent. For example, vernal pool habitats, which are the home of many endemic species, such as the delta green ground beetle and the conservancy fairy shrimp, have been reduced to less than five percent of their historic area (USFWS 2005a). Estuaries in the San Francisco Bay system have been reduced to about 15 percent (CalEPA 2015) and coastal sage scrub to about 18 percent (Pollak 2001) of historic extent. An estimated 90 percent of the historic acreage of all wetland types has been lost (Dahl and Johnson 1991).

Populations of species that depend upon these habitats have declined significantly. Development throughout the historic range for Swainson's hawk has reduced available foraging and breeding habitat, and the loss of marsh habitat has led to a dramatic reduction in tricolored blackbird populations resulting in a recent revaluation of the species' listing status.

Change in Community Structure or Composition; Change in Functional Processes of Ecosystem

Degraded terrestrial habitat quality is one of the state's most widespread stresses. It can occur in many forms, such as loss of community structure and composition or changes to ecosystem processes. It can result in diminished ecosystem functions, such as food, water, or cover, which are critical to species survival. Examples of common pressures resulting in habitat degradation include pollution, invasive species introduction, livestock grazing, intensive recreation, or soil erosion. Natural phenomena that are altered or intensified by human activities, such as droughts, flooding, or wildfire, can also result in habitat degradation.

Degradation of aquatic habitat quality is also a major stress in California. Land reclamation and water projects have fundamentally altered the historic connection between land and water in California. The reduced hydrologic connectivity between primary aquatic habitat and areas that were periodically flooded by tides and spring flows has decreased the abundance of key habitats for native aquatic species, simplified edge conditions that supported diversity, and diminished important habitat gradients. Installation of dams and diversions on major rivers has cut off historic fish migration routes. However, recent restoration projects along the Klamath River, in the Central Valley, and along coastal streams seek to restore fish passage and habitat for anadromous species.

Marine habitat degradation is also a widespread stress in the state. Degradation can occur from stormwater runoff and other non-point source pollution; contamination from pesticides, trash, heavy metals, or pathogens; or alteration of adjacent lands, such as alterations to estuaries or flow regimes. Invasive species can also cause marine habitat degradation and are easily transported into California waters in the ballast water of out-of-state or international ships.

Development adjacent to freshwater waterways and riparian corridors has limited natural river processes and meander by reducing floodplains and riparian and adjacent upland vegetation. The reduced riparian and adjacent upland vegetation is less effective in buffering waterways from urban runoff, providing essential vegetative structure for shading streams, and supporting upland activities of amphibians, reptiles, birds and mammals that use riparian habitat for nesting, foraging, roosting, or basking. Even in areas with no direct development or apparent human influence, upstream activities from dam or culvert installation, water diversion, or loss of abutting riparian or upland habitat can degrade aquatic habitats. Also, changes in the volume, character, and hydrograph of stormwater flows or dam releases within streams that have otherwise natural features can lead to unfavorable water temperatures and reduction in foraging, spawning, and rearing habitat quality.

Loss of physical community structure and vegetation composition has been documented to directly reduce animal species diversity. In areas with heavy recreational use, construction of rock dams, deposition of trash and human waste, or trampling lead to habitat degradation and increased stresses on native species. Upland habitat degradation can occur from off-highway activities, loss of natural disturbance regimes (such as fire), or invasive plant and animal species. Feral domestic dogs and cats harass and prey upon wildlife near residential neighborhoods or outdoor recreation areas. Ornamental plants in urban edge areas change the vegetation composition and result in the loss of necessary host plants for specialized species and pollinators, as well as increased vulnerability to other stresses (e.g., fire, disruption of successional dynamics and increased exposure to existing or novel diseases).

Change in Biotic Interactions and Habitat Fragmentation

The stress of habitat fragmentation is a secondary effect of habitat loss and a process where natural areas are divided into smaller, isolated remnants by the loss of plant communities or change in ecosystem processes. This can occur through degradation or removal of a portion of originally connected habitats or construction of linear features that divide habitats. Habitat fragmentation in California occurred in pre-history from natural climatic or geological processes that transformed the landscape, such as glacial advances, volcanic activity, geologic faulting and tectonic movement, and mass land slumping. Significant habitat fragmentation in historic times was almost entirely because of direct or indirect human pressures, including alterations of water regime, conversion of land for development, mining, agriculture, and construction of linear projects, such as highways or canals.

Habitat fragmentation often causes decreases in biodiversity and impairment of ecosystem functions. Fragmentation reduces the amount of functional habitat in an area and can isolate species into subpopulations that are more susceptible to extinction from other causes, including natural disasters, disease, invasive species, or climate change.

Habitat fragmentation inhibits the movement of individuals travelling between separate populations. This reduced movement leads to inbreeding, which reduces genetic diversity and a population's ability to adapt to environmental changes. In the case of plants, habitat fragmentation can reduce the movement of animals that carry pollen or propagules, and prevent plant communities from moving over time in response to climate change. For some species with relatively small ranges—especially reptiles, plants, and small mammals—the lack of connectivity to movement corridors threatens survival of many populations. Maintaining connectivity allows these limited-home-range species to shift habitats to adjacent areas, if populations experience habitat loss or degradation. For species with larger home ranges, habitat connectivity may be required across a much larger swath of the landscape. Because resources for these species are dispersed across a broader area, habitat fragmentation may result in the loss of a necessary constituent for survival (e.g., sufficient breeding or foraging habitats).

Examples of habitat fragmentation in California include the conversion of native grasslands to agricultural uses in the Central Valley, which fragmented once continuous grasslands into remnant patches surrounded by other vegetation types. In southern California habitat fragmentation has occurred as historic movement corridors between mountain ranges were urbanized.

Changes in Succession Processes and Ecosystem Development

Successional dynamics is the process of ecological succession or the typically predictable change in species composition of a community over time. Ecological succession follows either the creation of new unoccupied habitat, such as after a lava flow or severe landslide, or the disturbance of an existing vegetation community by natural or human-induced actions, such as fire, timber harvesting, landscape grading, or grazing. It is characterized by early rapid changes in community composition shortly after a disturbance, which is typically dominated by fast-growing or pioneering species, followed by a slower rate of changes that gradually leads to a stable climax community composition in late succession.

Disruption of natural successional dynamics is an important stress. It can occur either because natural succession is inhibited or repeated disturbances by human activities take place. The lack of ongoing disturbance over time, such as an ecologically isolated habitat that is not allowed to burn because of human safety concerns, prevents the regeneration of those early successional, pioneering species. Agriculture, timber harvest, and heavy recreational uses can interrupt the establishment of late successional or climax species, which are typically less tolerant of disturbance and require a longer time to become established.

Changes in Coastal and Oceanic Characteristics

Change in Oceanic Inputs

Ocean waters may flow into semi-enclosed basins, such as embayments, estuaries, and lagoons, occurring at the watershed-ocean interface when these basins are connected to the ocean. The amount of ocean flow depends upon the tidal range and river flows, the coastal exposure and shoreline gradient, the sediment deposition regime, and the morphology of the basin. The mixing that occurs between these ocean waters and the waters from the terrestrial drainage (usually freshwater) results in salinity and density profiles that vary both horizontally (front to back of system) and vertically (surface to bottom). These differences provide the forcing (thermohaline) for circulation.

Change in Oceanic Hydrodynamics

Both large-scale and local processes affect the ocean dynamics off the coast of California. For much of the year, the California Current brings colder northern waters southward along the shore as far as Baja California, while the Southern California Countercurrent flows into the Santa Barbara Channel. Seasonal changes in wind direction commonly create seasonal patterns for this large-scale ocean current. For example, beginning around March, northwesterly winds combine with the rotation of the Earth to drive surface waters offshore. This movement of water draws cold, nutrient-rich water from the depths (upwelling). When these northwesterly winds die down in the fall each year, a surface current, known as the Davidson Current, develops and flows in a northerly direction north of Point Conception and inside the California Current. The Davidson Current usually persists through February.

Laid over this pattern are both short-term and long-term changes. Local winds, topography, tidal processes, and discharge from rivers generate currents close to shore that can persist for hours, days, weeks or months. Local winds and storms generate waves that break upon the shoreline. These winds and currents also mix the surface waters, dispersing nutrients and oxygen in this upper mixed layer. Multi-year oscillations in the atmospheric pressure in the South Equatorial Pacific can result in El Niño conditions offshore of California (warmer waters, suppressed upwelling, and occasionally severe storms) or La Niña conditions (colder waters, enhanced upwelling, and less precipitation). Oscillations in the atmospheric pressure in the North Pacific control low-frequency upwelling and along-shore currents, resulting in consistently cooler or warmer waters off of California with each phase persisting for several decades.

Change in Surface Area

The surface area of embayments, estuaries, and lagoons can vary through increased terrestrial drainage and freshwater input from higher rainfall amounts and from sea level rise and greater ocean in-flow. Coastal storms with accompanying decreases in atmospheric pressure create a slowing of outgoing tidal exchange along with an increase in oceanic storm surge entering an estuary or embayment. Higher water levels within these basins can cause flooding of habitats, such as salt marshes and riparian areas, and infrastructure. This variation in ocean and freshwater inflow will cause salinity fluctuations, tidal mixing, vertical stratification in salinity, variation in oxygen levels, and variation in connectivity throughout the estuary. In addition, oceanic upwelling increases hypoxia and acidification in the coastal ocean, which affects the biota inhabiting both nearshore areas and estuaries.

2.5.2 Major Pressures on Ecosystems

As recognized in the Governor's most recent Environmental Goals and Policies Report, California's population is projected to add 12 million residents between 2013 and mid-century, growing to 50 million people by 2050 (Office of Planning and Research 2013b). The state's continued growth leads to an array of human-induced pressures that make supporting this growth in harmony with the state's wildlife a distinct challenge.

CDFW and partners are identifying and assessing the major pressures to each priority conservation target. From these assessments, CDFW has compiled a standardized set of pressures (Table 1.5-4). This standardized set is being used to identify the most important pressures to ecosystems within conservation units, provinces, and statewide. While the categories are general, CDFW is identifying to the extent possible the direction, magnitude, and variability in these pressures as the affect the priority conservation targets. As additional information becomes available, it will be dynamically incorporated into the assessment for each target.

Pressures

- Agricultural and forestry effluents
- Airborne pollutants
- Annual and perennial non-timber crops
- Catastrophic geological events
- Climate change (discussed in Section 2.5.3)
- Commercial and industrial areas
- Dams and water management/use
- Fire and fire suppression
- Fishing and harvesting aquatic resources
- Garbage and solid waste
- Household sewage and urban waste water
- Housing and urban areas
- Industrial and military effluents
- Introduced genetic material
- Invasive plants/animals
- Livestock, farming, and ranching
- Logging and wood harvesting
- Marine and freshwater aquaculture
- Military activities
- Mining and quarrying
- Other ecosystem modifications
- Parasites/pathogens/diseases
- Recreational activities
- Renewable energy
- Roads and railroads
- Shipping lanes
- Tourism and recreation areas
- Utility and service lines
- Wood and pulp plantations

Housing and Urban Areas; Commercial and Industrial Areas

Economic and population growth is a driver for development, leading to an increased need for housing, commercial development, services, transportation, and other infrastructure, which places pressure on the state's land, water, and other natural resources. California's population grew by nine percent between the 2000 census and the 2010 census (California Department of Finance [CDOF] 2014a). From 2000 to 2010, California gained 3.4 million residents (CDOF 2014b), which is a decrease in the rate of growth from the 1990 to 2000, when over 4 million residents were added (CDOF 2005). Although the rate of growth is estimated to continue to gradually slow over time, substantial additional population increase is projected at the rate of 2.5 to 3.5 million people per decade between 2015 and 2050 (CDOF 2014c).

Growth and development, including urban, commercial, and industrial development, can contribute to all of the major stresses described above. Conservation strategies need to take into account the pressures of continuing development demand. Progressive conservation planning on state, federal, and local levels has tempered the ecological effects of growth through conservation and mitigation requirements, such as policies requiring no net loss of California wetlands, and the creation of reserves for species and habitats. Smart growth principles have incentivized infill projects, higher urban density, and transit-oriented development where the ecological impact is typically less than exurban locations. These smart growth principles are being integrated into regional land use and transportation planning through the creation of legislatively-required sustainable communities' strategies, such as the Plan Bay Area. Additionally, demographic shifts are predicted to result in a decreased demand in traditional single family homes and an increased demand for transit-oriented or walkable multifamily-density communities. Large public works and infrastructure projects focused on repair of existing roads, and implementation of additional transit options are expected, including a state-sponsored high speed rail system, beginning in the Central Valley and ultimately extending from San Francisco and Sacramento to San Diego. Additional urban and infrastructure development will continue to lead to habitat loss, habitat fragmentation, and decrease in the quality of remaining natural areas.

As growth and development occur, artificial night lighting increases. Ecological light pollution is artificial light that alters natural light regimes in terrestrial and aquatic ecosystems and includes chronic or periodically increased illumination, unexpected changes in illumination, and direct glare. Wildlife may experience increased orientation or disorientation from additional illumination and may be attracted to or repulsed by light and glare, which may affect survival, foraging, reproduction, communication, and other critical behaviors (Longcore and Rich 2004).

Garbage and Solid Waste; Household Sewage and Urban Waste Water; Industrial and Military Effluents; Airborne Pollutants

Along with growth and development come pressures from excess waste and pollutants from point and nonpoint sources. Garbage and solid waste may directly entangle wildlife. Runoff from residential and commercial areas, landscaped yards, roads and parking lots, and domesticated animal feces include pollutants and pathogens. Particulates, pollutants, and pathogens deposited from the air can degrade aquatic and terrestrial ecosystems and marine habitats. Discharges from power plants, sewage plants, and other industrial facilities are high in pollutants and pathogens.

Roads and Railroads; Utility and Service Lines; Shipping Lanes

Existing transportation infrastructure, such as roads and highways, can be a barrier to wildlife movement, creating fragmented habitats and direct mortality from vehicle and wildlife collisions. Continued population growth increases the demand for transportation facilities for urban, regional, intercity, and long-distance travel. Caltrans estimates that the capacity of existing rail, air, and highway transportation systems will need to be increased (Caltrans 2015). The California Transportation Plan calls for an increase in intermodal transportation systems, including increased freeway reliability, express and high occupancy vehicle lanes, and increased connectivity between transportation types and across modes of transportation (Caltrans 2015). The majority of these connections will occur along existing transportation corridors and increase mobility between existing modes of transportation including intercity bus and rail (Caltrans

2015). The focus on improvements to existing corridors and connections between travel modes should minimize new habitat fragmentation from state highways. However, local roadways and other infrastructure have the potential to create additional habitat fragmentation.

In addition to habitat fragmentation, roads and traffic can result in direct mortality. In most cases, an animal that has been hit by a vehicle dies immediately or shortly after a collision. Many different wildlife species representing a wide variety of species groups have been observed as roadkill, sometimes in massive numbers. According to Caltrans and California Highway Patrol statistics, there are about 1,000 reported accidents each year on state highways involving deer, other wildlife, and livestock (Shilling 2015).

University of California Davis Road Ecology Center and Interactive Roadkill Map

The University of California (UC) Davis Road Ecology Center brings together researchers and policy makers from ecology and transportation to design sustainable transportation systems based on an understanding of the impact of roads on natural landscapes and human communities. Researchers at UC Davis have developed a statewide monitoring system for wildlife-vehicle collisions. The data could help state highway planners take measures to protect both drivers and wildlife.

The California Roadkill Observation System, a volunteer-submitted database of instances where wildlife and vehicles collided over the past five years, features more than 30,000 observations of over 400 species. The data can be seen in detail through the system's interactive map, which assigns different colored dots for various sizes of species. The public can submit entries, including photographs, to add to the map. The database can be assessed at http://www.wildlifecrossing.net/california/.

Using the roadkill data, the Road Ecology Center has mapped stretches of highway that are likely to be hotspots for wildlife-vehicle collisions (Shilling 2015).

Major hot spots include:

- Sacramento area: Where I-80 and I-5 run across bypasses along the Pacific Flyway, marshy areas attract birds during migration and result in high rates of roadkill.
- Bay Area: I-80 and U.S. Highway 101 run alongside the bay, where high numbers of wading birds and water birds are killed. Large animals are more likely to be hit on I-280 and State Route 17, particularly near areas of parks and open spaces.
- Southern California: Many areas along State Route 94 in San Diego County have high rates of collisions where the highway runs through wildlife habitat.
- Sierra: State Route 70 in Plumas County and near Portola has high rates of roadkill, particularly deer.
- North Coast: Both U.S. Highway 101 and State Route 20 show high rates of collision between Willits and Lake Mendocino.

The development of new infrastructure and expansion of existing infrastructure can also result in direct habitat loss. The construction of California's high speed rail system, when completed, will become the largest infrastructure development project in the state's history. The first phase of a high speed rail system to connect Sacramento, San Francisco, Los Angeles, and San Diego broke ground in January 2015 and it is eventually expected to extend from Sacramento to San Diego, totaling 800 miles. In addition, the High Speed Rail Authority (Authority) is working with regional partners to implement a statewide rail modernization plan to upgrade local and regional rail lines. Like many large-scale transportation projects, without proper planning and consideration during the design phase to anticipate species and habitat needs, these rail projects may result in devastating impacts to biological resources, including loss or degradation of habitat for threatened and endangered species and wetlands through land conversion, loss of habitat connectivity, and construction related impacts (Authority and Federal Railroad Administration 2005).

California has numerous shipping lanes along its coast connecting ports to the rest of the world. In recent years, a record number of whales have been hit and killed by ships sailing along the California coast. Changes have been made to the mile-wide shipping lanes that funnel traffic into the San Francisco Bay and to the ports in Los Angeles and Long Beach. Some modifications have been made specifically to reduce the presence of ships in areas whales are known to frequent (Perlman 2014). In addition to direct mortality on species, shipping lanes introduce pollutants, pathogens, and invasive species to California marine ecosystems.

In addition, secondary roads are built and maintained on public lands. Land management agencies, such as U.S. Forest Service (USFS) and U.S. Bureau of Land Management (BLM), have Resource Management Plans that determine management of secondary road systems within their jurisdiction.

Parasites, Pathogens, and Disease

Growth and development and the infrastructure that follows bring humans and domesticated animals in contact with wildlife species and ecosystems. Harmful plants, animals, or pathogens and other microbes may be introduced to these ecosystems and species. Parasites, pathogens, and diseases that affect wildlife populations may be released directly or indirectly due to human activities (see more information about wildlife diseases in the text box below).

Wildlife Diseases

Pressures and stresses resulting from development, environmental degradation, and habitat reduction are the focus of the wildlife conservation strategies in SWAP 2015. These strategies are designed to enhance ecosystems by reducing the negative impacts of pressures on targets, which are habitat-based (e.g., plant communities, fish assemblages, and marine ecosystems). Wildlife species are also subject to stress from diseases resulting from exposure to pathogens, parasites, toxins, and other biological and physical agents. This disease-related stress is not necessarily based on habitat condition.

Wildlife diseases sometimes result in significant mortality events. Disease may be broadly defined as a physiological disturbance that compromises health. If applied on a wildlife population or ecosystem scale, it can be defined as a physiological disturbance resulting in disruption of demographic functions that compromise population or ecological health. If affected substantially by disease, wildlife populations can become unhealthy, losing resilience and self-sustainability.

The conservation strategies in SWAP 2015 promote functioning ecosystems and enhancing wildlife habitats. Wildlife within healthy, functioning ecosystems are more resilient at a population level to diseases than wildlife in degraded habitats. In this way, the SWAP 2015 strategies help address wildlife disease issues in California.

Although not explicitly identified as a stress in the SWAP analysis, CDFW is fully involved in wildlife disease research, monitoring of wildlife disease effects, and identifying management programs to reduce and mitigate disruption of wildlife populations. The Wildlife Investigations Lab (WIL) is CDFW's center for tracking, understanding, and responding to wildlife diseases in California. WIL's mission is to investigate, monitor, and manage population health issues in California's wildlife. WIL staff provides expertise, service, training, and resources to assist in assessing wildlife populations, wildlife mortality response, biological sampling, study design, and analyses of events and disease effects. WIL's responsibilities have increased over time to include the statewide investigation of all wildlife mortality events, research studies and surveillance of diseases, wildlife health and condition monitoring, prevention of zoonotic diseases (animal disease that can be transferred to humans), and wildlife rehabilitation, among other non-disease duties.

Research funding for ecological studies of disease has increased over the past decade due, in part, to the human health risks posed by emerging zoonotic, infectious diseases in wildlife and domestic animals (e.g., hantavirus, West Nile virus, avian influenza, and severe acute respiratory syndrome [SARS]). More research, diligent monitoring and investigation of observed wildlife disease, and innovations in wildlife management are needed and will continue to be pursued by CDFW. With effective treatment and time, unhealthy wildlife populations and degraded ecosystems can recover.

Dams and Water Management/Use

The management of water resources in California results in numerous stresses on rivers, the Delta, wetlands, estuaries, and aquifers in the state. Across all regions of the state, limited water resources are managed to meet water and power supply needs and to accommodate urban communities and agricultural production. Agriculture is the dominant user of surface and groundwater in the state. Water management activities include the operation of dams and diversions, development and operation of irrigation canal systems, extraction of groundwater, and construction of flood-control projects such as levees and channelization. Coastal lagoons and rivers suffer from the historic and ongoing conversion of tributary waterways into constructed stormwater infrastructure. The stormwater conveyances are managed to convey urban runoff and floodwater and can alter the hydrologic processes that are important to ecosystem function, such as sediment deposition, water filtration, support of riparian vegetation and wildlife movement corridors. These activities can reduce the amount of water available for fish and wildlife, obstruct fish passage, and result in numerous other habitat alterations. In all regions of the state, aquatic, wetland, and riparian habitats support rich biological communities, including many special status species, and degradation of these habitats represents a serious threat to the state's biological heritage.


California Department of Water Resources

Increasing pressures from development and agriculture, as well as the expectation of longer droughts resulting from climate change, have exacerbated California's water shortages. Additionally, climate change is expected to result in more precipitation falling as rain rather than snow, which could lead to severe flooding and further straining our aging water management infrastructure. It is anticipated that additional water conservation, water recycling, watershed management, managed wetland water supply, conveyance infrastructure, desalination, water transfers, and groundwater and surface storage will be necessary. Reduction in snowpack storage, due to climate change, affects water supply reliability, hydropower, and the amount of runoff during extreme precipitation that leads to flooding. Increased flooding potentially causes more damage to the levee system and other infrastructure (DWR 2013b).

Conservation strategies in the aquatic ecosystems of the state will be heavily influenced by the ongoing efforts to manage water supplies. Many of California's water supply and flood protection infrastructure are no longer functioning properly or have exceeded their life cycles. This aging water supply and flood management infrastructure, badly in need of maintenance or replacement, has led to declines in species and ecosystems. The California Water Plan Update (DWR 2013b) identified strategies for establishing reliable water supplies and restoring ecologically sensitive areas.

The U.S. Bureau of Reclamation (USBR), in coordination with DWR and other local agencies, is conducting planning for three large surface water storage projects (i.e., raising Shasta Dam, the proposed Temperance Flat Reservoir, and expansion of the San Luis Reservoir), along with off-stream storage in the Sacramento River watershed, such as Sites Reservoir.

Extended Drought – A California Reality

In 2015, California entered the fourth year of an ongoing drought. The state is no stranger to long periods of drought. This is the tenth widespread, multi-year drought period within the state's history since 1900. Stream flow reconstructions based on tree-ring data show that far more severe and long-lasting droughts have occurred in California prior to historic record keeping, albeit with 30 million fewer people. Although the severity of the drought varies across the state, no area remains unaffected.

Drought-related wildlife effects begin with decreased vegetation growth, or in food-chain terms, reduced primary plant productivity for wildlife food that decreases ecological energy flow. As grasses and other wildlife food plants are less productive, food availability diminishes for herbivorous species. Exemplary of the interconnected food web, reduced vegetative food energy ripples up trophic levels as a stress of insufficient nutritional energy available to insects, small mammals, reptiles, and carnivorous predators, as well. Undernourished animals with fat must draw from these reserves, which can lead to weakened health and ultimately starvation. During the current drought, CDFW's Wildlife Investigations Lab discovered poor body condition, emaciation, and secondary infections in young red-tailed hawk carcasses in central and southern California (Batter 2014).

As the drought lingers, water-associated and more deeply rooted plants are affected. Gradually, water sources and availability shrink or disappear completely. Some plants species will go dormant in response to lack of water; others will simply die and depend on seed banks to support later regeneration. The lack of water reduces a plants ability to resist insect infestations and disease, leading to additional mortality. An increase in dormant and dead vegetation sets the stage for more frequent and overly severe wildfires, followed by accelerated wind and water erosion.

As water bodies shrink, their wildlife inhabitants and migratory visitors are forced into concentrated areas. Migrating ducks, geese, and swans that reside or spend the winter on California's ponds, wetlands, and lakes must cope with smaller water areas. Lack of precipitation reduces the amount of habitat available for migratory and resident waterfowl and shorebirds, forcing them to become concentrated in the smaller water bodies and wetlands. Large numbers of confined waterfowl make infection by a bacterial disease, such as avian cholera, easier, so it can spread rapidly, and potentially cause the death of thousands of birds.

Rising water temperatures in the state's aquatic systems also occur because of greater warming of smaller water bodies or the lack of cold water reserves in reservoirs from reduced snowpack. Cold water fisheries can lose their eggs, fry, or fingerling fish, as the low flows in streams are heated to near-fatal temperatures. Warm water species are not immune. The combination of warmer water and concentrated nutrients can lead to algal blooms, stressing the fish because of decreased dissolved oxygen resulting in the potential for suffocating fish.

It is important to remember that drought as a stress, by itself, is a part of California's history and ecological processes—a natural phenomenon. Native plant and animal species have survived droughts for centuries with adaptation strategies for times of drought stress and the opportunity for rapid recovery when the water regime improves.

The challenge for wildlife conservation is when drought stress exacerbates other occurring pressures, causing extirpation or, in the extreme, extinction. The potential for the imminent extinction of the endangered delta smelt (*Hypomesus transpacificus*) has been recognized, because the current drought has worsened the negative impacts of pressures that have led to the species' endangerment, such as competition and predation by non-native species, altered food supply, contaminants, and water exports (Moyle 2015). Although this is a high-profile example at the heart of often intense debates about water allocation and aquatic habitat management decisions in California, it is emblematic of the difficulties experienced by a number of fish and wildlife species in drought-affected habitats where the natural drought stress combines with other existing pressures on wildlife.

SWAP 2015 provides strategies that address water management and maintenance of the quality of aquatic habitats and terrestrial habitats that are affected by drought stress. Also, CDFW has been pursing many urgent actions to protect fish and wildlife species and habitats that face these challenges. Actions include fish rescues, anadromous fish migration assistance, wildlife rescue and relocation where they interact more with urban areas, well installations and improved water systems for CDFW Wildlife Areas, agreements with water users to reduce surface water diversions, consultation with state and federal water agencies about water system operations to protect aquatic habitat and species, habitat restoration projects, and more extensive monitoring of fish and wildlife conditions. Funding for drought responses such as these will continue to be one of the important fiscal strategies for fish and wildlife conservation employed by CDFW in times of extended drought.

Fire and Fire Suppression

Harry Morse, CDFW

Many of California's ecosystems are fire-adapted; however, many semi-arid forests and grasslands are not experiencing fire as frequently as needed to maintain their ecological structure and function. Other ecosystems, such as coastal sage scrub and chaparral, are experiencing fires too frequently, resulting in changes to their ecology (Sugihara et al. 2006).

Natural causes of fire include lightning, sparks from falling rocks, volcanic activity, and the spontaneous combustion of plant materials and other organic matter (Barbour et al. 1980). Of these, lightning is the most influential factor, and in California lightning strikes have occurred over 62,000 times a year on average (Sugihara et al. 2006). In California, the most common cause of the state's 20 largest fires was lightning, followed by human-related causes, including power lines, arson, and vehicles (CAL FIRE 2015). Lightning-caused fires typically occur above 5,000 feet in altitude, but are recorded to have occurred at much lower elevations (Burcham 1957).

Wildfire risk reduction and suppression activities are designed to address the most common fire ignition causes. Risk reduction actions can include fuel reduction through mechanical or herbicide treatment and establishment of fire breaks. Wildfire in the wildland-urban interface poses a threat to human safety and structures. Fire risk reduction and suppression activities can have variable effects on wildlife, depending on the specific management actions and environment in which the actions occur. For example, in some areas bird and mammal diversity and abundance can increase with moderate levels of forest thinning for fire fuel management, but decline with heavier levels of thinning (Verschuyl et al. 2010).

Control of invasive plants is another fire risk reduction action. For instance, red brome (*Bromus madritensis* ssp. *rubens*) and other invasive annual grasses increase fire frequencies in the western Mojave Desert in California, and cheatgrass has been part of the fuel in sagebrush fires in the Owens Valley (Lambert 2010). In a study of fires over the past decade in the Great Basin, which includes parts of California, cheatgrass fueled the majority of the largest fires and influenced 39 of the largest 50 fires (Balch et al. 2013). In cheatgrass grasslands, the average size and frequency of fire is greater compared to other vegetation types. The authors conclude that cheatgrass is creating a novel grass-fire cycle that makes future fires more likely (Balch et al. 2013).

Climate is also a primary determinant of fire patterns (Halsey 2004). Risk of large wildfires is projected to increase as a result of climate change influences, most substantially in the Sierra Nevada foothills, Trinity Alps, Great Basin, and Coast Range (CNRA 2014). In light of this, climate change will add a significant variable to efforts to understand future fire regimes and to identify fire risk management measures that can adjust to changing fire risks and maintain the mosaic of habitats (Grissino-Mayer and Swetnam 2000). Additionally, the expansion of residential communities into fire-dependent ecosystems creates a conflict between maintaining ecological integrity and protecting property. The expansion of new development into fire-dependent ecosystems can be partially mitigated through the application of smart growth principles that concentrate new development near existing communities.

Annual and Perennial Non-Timber Crops; Livestock, Farming, and Ranching; Agricultural and Forestry Effluents

Agriculture is an essential component of California's economy. The state is a major producer in the fruit, vegetable, tree nut, and dairy sectors (U.S. Department of Agriculture [USDA] 2014). Historic conversions of native habitat to agriculture in California have been significant. Today approximately 70 percent of the Central Valley is used for agriculture, with the vast majority of this land conversion occurring prior to the 1970s (USGS 2014). While agricultural lands no longer represent native vegetation types, they can provide important habitat for wildlife species, such as flooded rice fields of the Central Valley that provide waterfowl habitat. Habitat loss and or degradation can occur through land conversion from one type of agriculture to another, including conversion of field and row crops or grazing lands to orchards or vineyards. Deep ripping of fields to create subsurface conditions conducive to orchards and vineyards can destroy wetlands as well as essential upland habitat for sensitive species such as California tiger salamander, and lead to habitat fragmentation. Diversion of water for irrigation can contribute to altered hydrologic regimes, and nutrient laden runoff can degrade aquatic habitat. Other impacts from agricultural practices include the use of chemical fertilizers, herbicides, rodenticides, and other chemicals that can affect non-target species and degrade water quality. Illegal marijuana groves, particularly in the northern portions of the state, have similar but more pronounced impacts than other agriculture, because of their location in remote and otherwise undisturbed areas and lack of regulatory oversight.

Ongoing agricultural practices can have a range of direct and indirect ecosystem consequences, positive or negative, based on timing, duration, and intensity. In addition, different cropping systems (e.g., organic versus conventional farming, or highly diversified fields versus large monocultures) can have different levels of impacts to natural ecosystems across the landscape.

Many on-farm practices for conservation can reduce impacts/benefit ecosystems. The location of certain cropping systems and crop types are important factors in moving toward a long-term sustainable agricultural system.

Field crops can provide foraging habitat for raptors, such as Swainson's hawk, and rice fields and stock ponds can provide foraging and aquatic habitat for reptiles such as giant garter snake (federal and state threatened), amphibians, bats and birds, such as tricolor blackbird. Agriculture can harm those same species through chemical treatments, removal of nesting habitat, or direct mortality from harvesting and maintenance activities. Agricultural runoff containing fertilizers and pesticides can also pollute and degrade aquatic and marine habitat. Conversely, crop damage from wildlife can cause substantial economic loss and public health risks necessitating enhanced measures to control access to crops by wildlife.

Legislation, public policies, and landowner conservation practices have helped slow impacts of agricultural practices to species and habitats. For example, farmers can apply for subsidies to avoid disruption of tricolored blackbird nesting, to restore wetlands and other waters, to implement best management practices for grazing, and to manage field crops for the benefit of wildlife (e.g., rice field management to provide habitat for giant garter snake and migratory birds) (USDA 2015).

Belsky et al. (1999) found that studies overwhelmingly show that livestock grazing negatively affects water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife. Other researchers have found benefits from grazing and have advocated for grazing as a useful and necessary conservation tool.

Good grazing practices are much preferred, compared to poor grazing practices, and both are preferred to residential development or habitat conversion and loss. Central Valley agriculture contributes to the conservation of numerous species of waterfowl and shorebird along the Pacific Flyway, and significantly in the maintenance of winter habitat for the greater sandhill crane, a California-listed threatened species. In the absence of native habitats, grain crop fields provide essential winter flooded roost habitat for sandhill cranes, ameliorating the effects of ongoing conversion of farmlands to incompatible crops such as orchards and vineyards (Ivey et al. 2014). There is clearly a balance that can be achieved through incentive based, non-regulatory collaboration and partnerships with conscientious ranchers and farmers. SWAP 2015, as well as the California Climate Adaptation Strategy, relies upon fostering this balance as much as possible, but will require a concerted effort to sustain a dialog with farmers, ranchers, land managers, agency staff, and the public about the benefits of working together for the benefit of fish and wildlife.

Grazing, an Essential Conservation Tool

SWAP 2015 recognizes the importance and application of appropriate, well-managed grazing practices and the benefit to many of California's plant and animal communities. Livestock grazing confers many direct benefits upon wildlife and wildlife habitat, as well as many indirect benefits, such as reduction of invasive plants and fuels that contribute to catastrophic wildfire.

There are many instances where well-managed ranching activities directly benefit species identified as SGCN. For example, stockponds maintained for livestock watering have proven to provide highly suitable habitat for tiger salamander and red-legged frogs (US Fish and Wildlife Service 2002), two species listed as SGCN in the SWAP 2015. Vernal pool complexes become over-run by invasive species reducing species richness and pool inundation period without needed disturbance. In the absence of native herbivores, cattle provide this benefit (Marty 2005).

Additionally, cattlemen in northeastern California have been instrumental in restoring habitat for sage grouse, and improved grazing practices together with voluntary habitat restoration and conservation efforts by ranchers to protect the Modoc sucker have contributed to the proposed delisting of that species from the Federal Endangered Species Act (US Fish and Wildlife Service, 2014c). These are a few of the many examples where grazing activities and proactive ranch-management strategies have conferred direct benefits upon California wildlife.

The vast majority of cattle ranchers throughout California are responsible and conscientious stewards of the land, water, and wildlife resources of the state and are employing practices firmly rooted in the best available science. Ranchers strive to conserve our natural resources not only because it makes environmental sense, but because it makes sense from a family-planning perspective. Ranching is a family business, and many of California's cattlemen are fourth- or fifth-generation ranchers. If California's ranchers hope to pass their livelihood on to the next generation, they know they must preserve the state's resources for their children and grandchildren, and they practice stewardship activities that will permit them to do so. Their contributions compliment their rich heritage, the natural resources, and the people of California.

Logging and Wood Harvesting; Wood and Pulp Plantations

California has approximately 99.6 million acres of land area, of which 33.2 million acres are forested. Of the total forest land in California, private landowners hold 13.0 million acres (39 percent). National forest lands account for 15.8 million acres (48 percent). Other public lands account for the remaining 13 percent or 4.2 million acres. Approximately 19.5 of the 33.2 million forested acres in California are classified as timberland. Timberland is forest land that is producing or capable of producing more than 20 cubic feet of wood per acre per year. National forests contain 9.8 million acres (51 percent) of timberland. Private landowners hold approximately 8.9 million acres (45 percent). The remaining four percent (less than 1 million acres) is held by other public landowners (Morgan et al. 2012).

California's timber harvest was 1,733 million board feet (MMBF) during 2006. Nearly 60 percent (996 MMBF) of the timber harvest came from five counties. Humboldt County had the largest proportion at 20 percent (356 MMBF), followed by Shasta County with a timber harvest of 209 MMBF. A total of 77 primary forest products facilities operated in California during 2006. These included 33 sawmills, 25 bioenergy plants, 10 bark and mulch plants, four reconstituted board plants, two veneer plants, and three manufacturers of other primary wood products (Morgan et al. 2012).

While managed forests provide significant habitat for fish and wildlife, timber harvest can fragment forest habitat, with adverse effects on wildlife and ecosystems. Forest roads can introduce invasive plant and animal species. Poorly constructed or maintained roads and ground disturbance resulting from timber harvest can also result in soil erosion and increased surface-water runoff. While temporary in nature, these impacts can have short-term or cumulative effects when concentrated in space and time.

Renewable Energy; Mining and Quarrying

As of 2011, 70 percent of the electricity used within the state was generated in California (California Energy Commission [CEC] 2014a), with natural gas comprising 45 percent of the electrical energy generation source. Renewable energy generation represents a needed and major response by California to green-house gas emissions and the threat of global climate change. Under the Renewable Portfolio Standard (California Public Utilities Commission [PUC] 2014), California has a goal to increase the electricity generated from renewable energy sources by 33 percent by 2020. Renewable generation is expected to be achieved through increased development of solar and wind generation, as well as biomass, geothermal, small hydroelectric, and possibly wave energy generation sources. Energy generation projects and transmission infrastructure have the potential to result in the loss of and degradation of wildlife habitat, as well as direct mortality. Stresses on wildlife habitat include temporary or permanent habitat loss, habitat fragmentation, and indirect impacts from disturbance, such as vehicle traffic, noise, the introduction of non-native or invasive species, and predator subsidies (e.g., perching sites) that increase predation. Development of new energy projects and the ongoing operations and maintenance of existing and future projects have the potential to result in direct mortality and species displacement. Siting of industrial-scale solar and wind generation projects may require locations in remote areas with existing high-value habitats.

Most utility-scale solar generation projects are located in the California desert, remote agricultural lands, or remote rangelands, increasing impacts to otherwise undeveloped lands, and requiring additional electrical transmission facilities. Solar plants have been built or are planned in San Luis Obispo County and rural southern California, including Riverside, Kern, Inyo, San Diego, San Bernardino, Imperial, and Los Angeles Counties. The ecological impacts of these large solar plants are primarily habitat loss, degradation, and fragmentation because of the solar array fields, and the associated transmission infrastructure. Impacts may also include risks to desert aquifers due to groundwater pumping. The USFWS recently identified risks to birds because of solar flux, impact trauma, and predation associated with the operation of large solar facilities in southern California (Kagan et al. 2014). In addition, a canine distemper virus outbreak that resulted in the deaths of several desert kit foxes inhabiting a solar development area raised questions regarding potential interactions between disturbance from large-scale renewable energy development, disease transmission dynamics, and disease resistance (Clifford et. al 2013). The impacts of solar and other renewable energy development are being addressed through comprehensive regional conservation planning efforts, such as the Desert Renewable Energy Conservation Plan (DRECP) and the Bureau of Land Management's Western Solar Program. Other programs, such as the California Solar Initiative and Self-Generation Incentive Program (SGIP), provide incentives for customers to install renewable distributed generation technologies that directly serve their on-site load. This type of solar production does not require development of natural lands and minimizes habitat loss.

Biomass is energy production from wood waste, agriculture and food processing wastes, organic urban waste, waste and emissions from water treatment facilities, landfill gas and other organic waste sources and makes up about 2 percent of current energy production (PUC 2012). The use of fuels from high fire risk areas as biomass has biomass production potential that would both reduce fire risk that damages natural lands and produce renewable energy (CALFIRE 2010; PUC 2012).

Geothermal comprised 4.4 percent of energy generation in the state in 2014 and has one of the lowest life-cycle emissions of any energy production source (Matek and Garwell 2014). Half of the known geothermal resources are untapped, including the Salton Seas Known Geothermal Resource Area. The Salton Sea Restoration and Renewable Energy Initiative proposed to finance air quality management and habitat restoration activities in the Salton Seas Area with funds from geothermal energy production (Imperial Irrigation District 2015). While geothermal typically has a smaller footprint than other energy production and therefore leads to less impact to many habitats, as with other energy production resources, transmission infrastructure would be required for further geothermal development.

Existing and new hydroelectric projects affect fish migration, sediment and gravel transport, and hydrology, which results in habitat loss below and above dams. The alteration of natural river flows through dam release schedules that prioritize energy generation can change flow volumes and water temperatures, creating stressed or lethal conditions for aquatic species, or strand fish along stream margins.

Wind energy currently accounts for approximately 6 percent of California's energy production and is expected to continue to grow under renewable energy mandates, primarily though the utility-scale wind farms located in areas with wind speeds of at least 13 miles per hour. Wind farms exist throughout California with major concentrations in the Burney, Solano, Altamont, Pacheco, Tehachapi, Palmdale, San Gorgonio, Kumeyaay, and Ocotillo areas. The CEC has identified additional areas with high wind resource potential in the primarily undeveloped areas along the eastern slopes of the Sierra Nevada Mountains, along the Peninsular and Cascade Ranges, the Channel Islands, and throughout the Mojave Desert (CEC 2014b). Installation of large wind farms in these areas may lead to new pressures from energy generation developments, which can lead to direct wildlife mortality or diminishment of habitat quality. Direct mortality concerns relate primarily to the risk of avian and bat collisions with wind turbines and associated wires. Habitat degradation can occur from landscape alteration and fragmentation and introduction of invasive species from access and service roads and energy infrastructure that eliminates native vegetation, modifies drainage, or increases human activity in remote areas. Large-scale wind energy facilities have the potential to alter localized micro habitats associated with areas downwind of the rotor turbulence zone. The potential impacts range from alterations in wind, surface temperatures, precipitation and evaporation levels, and soil moisture levels (Lovich and Ennen 2013).

California's existing coastal and bay-side power plants use antiquated cooling technology that pulls in over 16 billion gallons of cold seawater per day (State Water Resources Control Board 2008). This "once-through cooling" technology kills fish and other marine species each year in California, including endangered Chinook salmon and Delta smelt. California also includes existing on and off-shore oil and gas wells. Development of oil and gas reserves can result in direct habitat loss and fragmentation from infrastructure development, direct mortality from spills, and indirect impacts from increased human activity in otherwise undisturbed areas. Regional habitat conservation plans can offset some of the impacts of energy production by developing comprehensive protection and mitigation strategies for multiple species and habitats.

Approximately 44.7 million acres of subsurface mineral estate underlies federal surface land, 2.5 million acres underlies private lands, and 592,000 acres underlies Native American Tribal land. There are 166 active mineral sales contracts in California and 165,000 ounces of gold produced annually (BLM 2014).

Recreational Activities; Tourism and Recreation Areas

Outdoor recreation and exposure to nature is important to foster an appreciation of nature; however, recreation in sensitive habitats could result in habitat degradation. Recreational use of public lands in California involves a large number of visitors, both from state residents and out-of-state tourists. Extensive areas of federal and state lands offer high-quality outdoor recreation opportunities. Visitation data (BBC Research and Consulting 2011) from federal agencies (National Park Service [NPS], USFS, BLM, USFWS, and U.S. Army Corps of Engineers) indicate that federally managed lands in California average approximately 90 million visitor days per year. The California State Parks System averages approximately 78 million visitor days per year.

Large numbers of outdoor recreation users in sensitive areas can directly damage natural systems by reducing vegetative cover, compacting soil, disturbing biotic soil crusts (i.e., cryptogams), increasing soil destabilization and erosion, disturbing breeding and foraging areas, contaminating natural lands and waterways through inappropriate disposal of trash and human waste, and by introducing non-native species. Indirect impacts may also occur to natural areas through increased development of recreational access points and supporting infrastructure such as roads, visitor facilities, and campgrounds. Visitor litter in parks and public lands can encourage increased corvid populations (jay, crow, and raven), which contributes to greater competition with and predation upon other native wildlife.

Recreational off-highway vehicle (OHV) use can have adverse effects on soil conditions, native plant communities, and sensitive species. On public lands, authorized and unauthorized OHV trails open relatively undisturbed areas to increased use. The vehicles can disturb or run over wildlife, crush and uproot plants, spread invasive plants, and disturb soils, contributing to erosion and sedimentation of aquatic habitats.

Concentrated recreational use in highly sensitive areas, such as streams, coastal habitats, and riparian zones by hikers, picnickers, mountain bikers, and equestrians can damage these systems, reducing vegetative cover and disturbing sensitive species. Concentrated fishing, especially in populated area can lead to localized depletion of fisheries. Illegal trampling, and collecting, can deplete floral and faunal populations, reduce biodiversity, and alter trophic and community structures in frequently visited natural habitats. The negative impacts of pressures from recreation can be reduced through proactive recreation planning and public education.

North American Model of Wildlife Conservation

The Critical Role of Sports Men and Women in Wildlife Conservation

North America's approach for wildlife conservation has proven to be one of the most effective strategies in the world due in large part to early conservationists who – over a century ago – recognized that to protect wildlife, we must preserve their habitats. As a result of this forward thinking, wildlife and their habitats in California and throughout North American have been preserved and promoted through the application of sound science and proactive wildlife management. At the forefront of this unique strategy – known as the North American Model of Wildlife Conservation – are hunters and anglers, who serve as the primary funding source for wildlife conservation efforts in California and North America.

In 1937, hunters sought passage of legislation that self-imposed taxes on hunting and shooting sports equipment to generate funding for habitat preservation. Eighty years later, federal excise taxes placed on these goods, as well as angling equipment, have generated more than $10 billion towards wildlife conservation. In addition, license, stamp and tag fees paid by hunters and anglers currently generate roughly $80 million annually in California alone – paying for the vast majority of our state's wildlife conservation and research efforts. These revenues, other hunter-generated dollars, and the funding and efforts of private hunter-related conservation organizations have helped purchase and maintain over one million acres of state-owned and managed wildland and protected, restored, and enhanced over 700,000 acres of wetlands – California's most threatened habitat type – in the past quarter-century alone. Hundreds of thousands of acres of additional wildlands have been preserved by private landowners with hunting as their primary motivation. Though these efforts may have been originally motivated by concern for hunted species, non-hunted species and Species of Greatest Conservation Need have also benefitted.

Hunting and angling also provide a substantial stimulus to our state's economy. Hunters and anglers spend an estimated $3.5 billion annually – directly supporting 56,000 California jobs, paying over $2.3 billion in salaries and wages, and generating nearly $500 million each year in state and local taxes. Combined, the economic stimulus of hunting and fishing equates to an estimated $18 million each day being pumped into California's economy.

With no other adequate alternative conservation funding system in place or available, the future of California's wildlife and fisheries depend upon a robust future for hunting and fishing in California. The State of California recognizes the substantial benefits hunting and angling provide to all of our native flora and fauna, and seeks every opportunity to embrace these important traditions in SWAP 2015 and the roadmap it is intended to provide for all conservation strategies and undertakings statewide for the next decade.

Invasive Plants/Animals; Introduced Genetic Material

Human introduction (directly or indirectly) of invasive species is a critical existing pressure that is expected to continue, and be exacerbated by climate change. Introduction of invasive species into the California ecosystem has occurred since the earliest European settlements. Some of these introductions have been intentional, such as the plants imported as ornamentals for horticulture, while other introductions have been unintentional when species arrive in the state along with the movement of people and goods. As California's population and economic activity has grown into its current size, the points of origin for people and goods coming to the state now span the globe. This has led to a diverse society and economy, but also has left California vulnerable to introductions of species from all around the world.

California is particularly vulnerable to invasive species because of its diverse ecosystems and communities. This ecosystem diversity, however, also means that species from all over the world may be able to find suitable habitat somewhere in the state. When species are introduced into these habitats they often find conditions similar to their home range that will allow for the establishment of reproducing populations. For preventing the spread of invasive weeds, the area affected currently is only part of the equation; it is also important to consider the area that could be affected in the future, if a species is allowed to spread.

The quantity of potential habitat and the high volume of transportation into California from other states and countries have had the unintended effect of introducing so many invasive species into the state that management of these non-native organisms is now a high priority for resource managers. Efforts are underway to combat invasive species and prevent new introductions such as new regulations on the release of ballast water in California waters and mandatory inspections of recreational boats in some lakes. Although most of the thousands of species brought into our state cause no harm, a small percentage is able to thrive in California to the detriment of native plants and wildlife. The colonization by invasive species, particularly invasive grasses, is expected to increase with climate change (Sandel and Dengermond 2011).

Invasive species harm California's wildlife by disrupting native plant and animal communities. Some introduced species are voracious predators, such as introduced trout species that have significantly contributed to the decline in mountain yellow-legged frog (Hammerson 2008). Others out-compete native species for resources, some spread diseases, and some are capable of re-engineering the environment to suit their needs, changing hydrology, soil chemistry, and fire regimes. In addition, some are transmitting novel diseases into the state. Many also degrade recreational activities from hunting to boating, camping, and hiking. The introduction of invasive species has been an especially detrimental pressure on estuaries such as the San Francisco estuary, which is likely the most invaded estuary in the world with over 230 species of invasive species (Cohen and Carlton 1998). Though it is difficult to quantify harm from invasive species in financial terms, a conservative estimate places the cost to the United States at over $100 billion each year, including damage to agriculture and infrastructure (Pimentel et al. 1999). In California alone, invasive plants cost the state $82 million each year (Cal-IPC 2008).

Appendix F describes major invasive species in California, state and interagency programs to address invasive species, and recommendations and strategies for invasive species management in California.

California Invasive Plant Council and CalWeedMapper

The California Invasive Plant Council's (Cal-IPC) mission is to protect California's lands and waters from ecologically-damaging invasive plants through science, education, and policy. The Cal-IPC CalWeedMapper (http://calweedmapper.cal-ipc.org/) provides a dynamic tool for mapping invasive plant distribution at the landscape level using expert knowledge. CalWeedMapper enables natural resource managers, scientists, and others to create maps and reports of invasive plant distribution, to identify management opportunities in a county, Weed Management Area or region, and to maintain up-to-date species distribution data statewide.

Cal-IPC is working with regional partners to set landscape-level strategies, secure implementation funding, and build a coordinated approach statewide (http://calweedmapper.cal-ipc.org/regions/). Each region will have a Strategic Plan and Eradication Workplan, as well as identify priority species.

Fishing and Harvesting Aquatic Resources; Marine and Freshwater Aquaculture

Fishing activity in California has changed over time largely due to increased regulation (to conserve resources) and environmental, social and economic factors. In 2013, commercial fisherman landed more than 363 million pounds of seafood at California's coastal ports. Top fisheries included California spiny lobster, Chinook salmon, Dungeness crab, groundfish (rockfish, roundfish, flatfish), market squid, red sea urchin, and coastal pelagic fish (sardine, anchovy, mackerel) (California Sea Grant 2013).

Fishing activity varies within and among California's coastal regions as a function of the distribution of species, ocean environment, management context, port infrastructure, and market demand. In 2012, approximately 1,900 commercial fishing vessels landed catch at California ports. Mendocino, Monterrey, and Los Angeles counties had the greatest number of vessels with landings at their ports (California Sea Grant 2013).

Direct collection of marine resources for food, fish bait, or decoration can deplete populations, reduce biodiversity, and alter habitat structure. Removal of species may also result in indirect effect on other populations by disrupting the ecological balance within the ecosystem.

Aquaculture is the process of raising and harvesting plants or animals in an aquatic environment. Marine aquaculture has a long history in California beginning with oyster culture in the late 1800s. CDFW is the lead agency for leasing and permitting of marine aquaculture on state and private water bottoms in bays and estuaries, and ensures that marine resources and essential habitat are protected. In California, marine aquaculture for commercial purposes is currently limited to oysters, abalone, clams, and mussels.

Military Activities

Military bases in California include Air Force Bases, Army Bases, Coast Guard Bases, Marine Corps Bases, and Navy Bases. Military operations associated with these bases may include both ground and aerial warfare training and testing.

For example, Edwards Air Force Base (AFB) is an approximately 306,700-acre facility bordered by Kern, Los Angeles, and San Bernardino counties. Edwards AFB has been operational since 1948 and provides military aircraft testing and training. Activities include bombing ranges, low-altitude high-speed maneuvers, radar intercept areas, and weapons testing and training.

Catastrophic Geological Events

Volcanoes

More than 500 volcanic vents have been identified in California. At least 76 of these vents have erupted, some repeatedly, during the last 10,000 years (Miller 1989). Volcanoes can have devastating effects on habitats and ecosystems. Ecosystems may be destroyed by direct impact from pyroclastic flows or buried by hot rock debris and indirect impacts resulting from melted snow or burnt vegetation.

Earthquakes and Tsunamis

Dominant losses from earthquakes are to structures and potentially to humans; however, these events can also result in environmental consequences. Species and ecosystems may be damaged by the shocks and shifts in land surfaces, as well as alterations in local hydrologic systems. Coastal ecosystems may be directly damaged by tsunamis or indirectly through changes in water chemistry or the introduction of invasive species.

Avalanches, Landslides, and Subsidence (Sinkholes)

Avalanches, landslides, and sinkholes have a variety of ecological effects, and many of these effects can be amplified by other factors. Generally, avalanches and landslides bring additional sediment into river systems, degrading water quality and silting reservoirs. Timber harvests and fires that remove vegetation increase the incidence of landslides and the probability of slope failure during the wet season. Landslides create bare ground that is subject to erosion and to invasion by non-native species. Sinkholes may directly impact species and ecosystems.

Adam Dubrowa, FEMA

Other System Modifications

Pressures in the "Other System Modifications" are a broad range of activities that have potential to convert or degrade ecological conditions of targets that have not been captured by other pressures identified in the standardized list of pressures (Table 1.5-4). For example, floating and submerged artificial structures along the shoreline (including pier pilings) belong to this pressure category.

2.5.3 Vulnerability to Climate Change

Ascent Environmental

Global climate change is a major challenge to the conservation of California's natural resources. To address this challenge, CDFW has been at the forefront of research, policy development, and implementing actions in statewide and national efforts to assess the potential effects of climate change, and to assess and minimize the vulnerability of California's wildlife and habitat to these effects.

This section addresses the degree to which climate change is affecting California, both statewide and for the provinces addressed in SWAP 2015. Projected climate change effects (i.e., exposure) are summarized, along with associated stresses to wildlife species and habitat. Stresses include changes in the duration, frequency, or severity of extreme events, such as wildfire, storms, floods, and extreme temperatures. Also, longer-term climate trends and associated ecological vulnerabilities in response to these stresses may directly threaten sensitive habitats and species, particularly those with limited adaptive capacity (e.g., sea-level rise, ocean acidification, vegetation shifts, and modified hydrology).

This section describes a sampling of work accomplished to date by CDFW and other agencies and partners at the local, state, and national level to identify climate adaptation strategies and implementing actions. CDFW and partners are identifying the most important climate change stresses for which each conservation target is potentially sensitive. These climate factors are being integrated into the assessment and rating of human-induced pressures (describe in the previous section) to each target. As additional information becomes available, the assessment of each priority conservation target will be dynamically updated and strategies adapted as necessary.

Climate Change Exposure in California

The effects of climate change can be described in terms of primary exposure to various physical changes in the climate and environment caused by global climate change, such as temperature, precipitation, and sea level rise, as well as stresses experienced by vulnerable wildlife and habitats as a result of these exposures (e.g., habitat loss and fragmentation, migration barriers, increases in presence and prevalence of invasive species). These vary considerably from region to region within California. An overview of statewide exposure to climate change is presented below. Summaries of regional variations in each SWAP province are included in appropriate sections of Chapter 5.

Temperature

According to the Intergovernmental Panel on Climate Change (IPCC), global average temperature is expected to increase by 0.3 to 4.8°C (0.5 to 8.6°F) by the end of the 21st century, depending on future greenhouse gas emission scenarios (IPCC 2014). In California, average temperatures are likely to increase significantly by the end of the 21st century with a projected increase of approximately 1.5°C (2.7°F) above 2000 averages by 2050 and, depending on emission levels, 2.3 to 4.8°C (4.1 to 8.6°F) above 2000 averages by 2100 (California Natural Resources Agency [CNRA] 2014).

Precipitation

In addition to projected increases in average temperature, precipitation levels in California will also be affected by climate change. Many climate models predict that the disparity in precipitation between various parts of the state will be even greater in the future, with the southern part of California becoming drier (DWR 2013b). The projected drying trend is caused by an expected decline in the frequency of rain and snowfall. In projections with relatively small or no declines in precipitation, central and southern parts of the state can be expected to be drier from the warming effects alone, because the spring snowpack will melt sooner, and the moisture contained in soils will evaporate during long dry summer months (CEC 2012a).

The volume of precipitation falling as snow at higher elevations in California is expected to decrease, along with an overall reduction in snowpack levels in the Sierra Nevada and other mountain ranges. Based on historic data and modeling, DWR predicts that the Sierra Nevada snowpack will experience a 25 to 40 percent reduction from its historic average by 2050 (DWR 2008). Most of the snowpack decrease is expected to occur in the northern portion of the Sierra Nevada, where mountain peak elevations are lower. An increase in precipitation falling as rain rather than snow in the Sierra Nevada could lead to increased flows in rivers and streams after storms, with increased potential for floods and erosion, because water that would normally be held as snow and ice in the Sierra Nevada until spring could flow into the Central Valley concurrently with winter storm events.

Increases in extreme precipitation events could also result from warmer temperatures, including the phenomenon of "atmospheric rivers," wherein warmer winter weather systems could bring more intense, narrow bands of heavy precipitation in a river-like manner over parts of the state in a relatively short time period (CEC 2012a). Flood events coinciding with high tide events could result in widespread low land flooding and pollution, followed by proliferation of mosquito borne pathogens (CNRA 2009).

Sea Level Rise and Ocean Acidification

Global climate change is already contributing to sea-level rise, which will continue at increasing rates as warming continues. Along California's coastline, the average sea level rose approximately 7 inches during the 20th century (CEC 2012a). Assuming that sea level rise along the California coast continues to track global trends, projected sea levels along the state's coastline south of Cape Mendocino are expected to increase from 12 to 61 cm (5 to 24 inches) by 2050, compared to 2000 levels, and 42 to 167 cm (17 to 66 inches) by 2100 compared to 2000 levels. North of Cape Mendocino, geologic forces are causing much of the land to uplift, resulting in a slower projected rate of sea level rise than California's coastline to the south. Between 2000 and 2100, sea level north of Cape Mendocino is projected to rise approximately 10 to 143 cm (4 to 56 inches) (California Ocean Protection Council [OPC] 2013).

Increases in carbon dioxide and other gases from human activities are changing the chemistry of the world's oceans. These gases are absorbed into the oceans' surface water, which results in a decline in pH. This process, known as ocean acidification, threatens marine ecosystems. The current rate of ocean acidification is unprecedented over the past hundreds of millions of years; similar past events have been accompanied by major marine species extinctions (Feely et al. 2012). While oceanic uptake of carbon dioxide from the atmosphere provides a valuable service to human societies by moderating the severity of climate change, it is having a profound long-term impact on marine chemistry and biology (Bille et al. 2013).

Change in Freshwater Hydrologic Regimes

Increases in temperature, along with changes in precipitation and snowpack, are already contributing to hydrologic change across numerous California watersheds. Further changes are projected as a result of climate change by the end of the 21st century, with effects varying throughout the state. Many regions are projected to experience overall drier average conditions, while others could see slightly wetter conditions depending on specific regional characteristics. Watersheds located in the Sierra Nevada, Cascade Range, and Northwestern ecoregions are expected to be drier, whereas some watersheds in the Central western and Southwestern areas show increasing hydrologic activity under a wetter scenario. The degree of change in watersheds already characterized by low rainfall (e.g., deserts) is expected to be minimal (Thorne et al. 2015).

Wildfire Risk

As noted earlier in this chapter, wildfire risk is expected to increase as a result of climate change throughout California. This increase in risk is caused by a number of climatic changes, including earlier snowmelt, higher temperatures, and longer dry periods resulting in a longer fire season. Potential climate-related changes in vegetation (e.g., proliferation of invasive species or reduced moisture content in vegetation), and ignition potential from lightning may indirectly contribute to increases in wildfire risk. Under a higher global emissions scenario, increases in the occurrence of large fires statewide are projected to increase from 58 to 128 percent above historical levels by 2085 and estimated burned areas are projected to increase from 57 to 169 percent, depending on location (CEC 2012a).

Climate Change Stresses in California

The secondary effects of climate change on wildlife can be described as stresses to species and their habitats in response to the primary exposure impacts described above. They are either additive to or amplify existing stresses to wildlife and habitat that may already exist due to land use change, development, or other human-induced pressures. These secondary effects have the potential to significantly increase the risk of biodiversity loss and species extirpation or extinction. Statewide climate change stresses to wildlife and habitat were identified in the 2009 *California Climate Adaptation Strategy* (CCAS) and supplemented by the updated 2014 report, *Safeguarding California* (CNRA 2009; CNRA 2014):

Temperature

- Temperature-sensitive terrestrial plant and animal species will be exposed to thermal stress as a result of warmer temperatures and, thus, may need to either shift within their existing ranges and/or shift their geographic range in response to climate changes. These shifts may occur towards higher latitudes, higher elevations, cooler coastal environments, or local microclimatic refuges, depending upon interactions with precipitation, topography and soils, and species behavioral and life history characteristics.
- The amount of additional warming and associated thermal stress may exceed the tolerance of some terrestrial species, particularly endemic ones. Where relocation access is blocked off by natural landscape features or human development, species will need corridors to establish habitat connectivity or face a growing risk of extinction.

- Similar stresses and barriers apply to aquatic species, but their migratory limitations may be greater. For example, vernal pool and freshwater lake species are likely to be more susceptible to extirpation, because of disappearance of habitats or inability to move to new aquatic environments. Additionally, warming of lake and stream temperatures will adversely affect food supply and fitness of aquatic species.
- The problem of invasive species is likely to become more challenging in the future, as climatic changes may favor the spread of these species. Invasive species are typically more competitive than native species, especially those in damaged/degraded environments.
- Species migration/movement and invasions, along with changes in behavior of climate-sensitive species, will alter species interactions and community dynamics; these changes may have negative effects on critical ecosystem services.
- Changes in the timing of seasonal life-cycle events (i.e. phenology) can lead to mismatches in the timing of migration, breeding, pollination, and food availability.

Precipitation

- Changes in precipitation patterns will alter stream flow and severely affect fish and amphibian populations during their life cycle (e.g., spawning, migration), because of changes in timing and volume of flows. For example, low-flow conditions and higher stream flow temperatures are particularly threatening to cold-water fish. Flooding as a result of earlier or more rapid snowmelt could also lead to increases in soil erosion, sedimentation, and pollution affecting aquatic habitats.
- Changes in the composition and structure of riparian communities may result from changes in precipitation and flow and could contribute to increased management conflicts as the needs of humans and wildlife compete for limited resources.
- Projected increases in drought conditions, including prolonged and more intense drought, will reduce stream flows and increase water temperatures, further degrading stream and terrestrial habitat quality, as well as the adaptive capacity of ecosystems. Drought also exacerbates other climate-related exposures, such as saltwater intrusion in coastal areas and increased wildfire risk in forests or grassland.

Lawrence Erikson, North American Field Herping Association

- Longer fire season trends over the last three decades and increased number of large, intense wildfires are projected to continue, increasing the risk of vegetation and habitat conversion, spread of invasive species, and losses in biodiversity and ecosystem services.

Sea Level Rise and Ocean Acidification

- Accelerating sea level rise, especially at the increasing rates projected for the 21st century, may result in the loss of substantial areas of important habitat for a variety of coastal species. For example, coastal marshes are often constrained by deep water on one side and development on the upland side. Sea level rise could convert some of this habitat to open water, causing intertidal, salt marsh habitat to disappear, because it cannot move upslope.

- Both aquatic and terrestrial coastal ecosystems may see growing problems with invasive species.
- Sea level rise will result in increased salt water intrusion into fresh water resources near the coast and reduce the amount of fresh water available for plants, wildlife, and competing agricultural and metropolitan uses.
- Changing ocean conditions, such as changes in ocean chemistry (i.e., acidification), can directly impede the growth and development of certain species at various life stages, and may have broader impacts on the marine food web. Ocean acidification leads to decreased shell growth in key species such as sea urchins, mussels, oysters, abalone, and crabs, thus making the animal more susceptible to predation, as well as decreased skeleton production of deep sea corals and hydrocorals (Largier et al. 2010).

Vulnerability of Species and Habitats to Climate Change

Vulnerability to climate change can be defined as the degree to which a system is exposed to, sensitive to, and unable to cope with or adapt to the adverse effects of change (CEC 2012a). The degree of vulnerability of California's wildlife to climate change will vary considerably depending on many factors, such as the intrinsic sensitivity of a given species and/or its habitat to climate exposure and related stresses, the adaptive capacity of species and habitat to these effects, and other existing environmental stresses unrelated to climate change. Thus, the projected effects of climate change within specific regions in the state must be examined in light of all of these factors.

Numerous studies have been conducted or are underway in California to assess the vulnerability of species and habitats to climate change, particularly those already considered to be critical or at risk. These include (but are not limited to) the following examples:

- A study of the vulnerability of California's at-risk birds to climate change (Gardali et al. 2012) found that 128 out of 358 avian taxa are classified as vulnerable to climate change. The study found that wetland species are the dominant group of those considered vulnerable to climate change, compared to other habitat groups. Out of the 29 avian taxa listed as state and federal species of concern, 21 are also classified as vulnerable to climate change. Integration of the findings from this study resulted in the addition of five taxa to the California's Bird Species of Special Concern list and an increase in the priority rank for ten.
- CDFW, with support from the California Landscape Conservation Cooperative, conducted a vulnerability assessment of 156 rare plant species in California to determine which will be subject to negative impacts from climate change (Anacker et al. 2011). This study employed the NatureServe Climate Change Vulnerability Index (CCVI) to assess vulnerability. Future habitat suitability was examined for these 156 species to assess potential range shifts under various climate change scenarios. Of the 156 rare plant species studied, 99 (63 percent) were determined to be moderately or more vulnerable to climate change.

- UC Davis, with support from CDFW, conducted a climate vulnerability assessment of 153 reptile and amphibian species in California (Wright et al. 2013). The study found that approximately 60 to 75 percent of reptile and amphibian species were predicted to experience little direct loss of climatically suitable habitat by 2050. Reductions in climatically-suitable habitat were predicted to be largest for reptiles in the southern mountains and deserts, with reductions for amphibians occurring statewide. The species ranked highest for climate risk include many that are already of conservation concern and tend to be endemic species with small ranges.
- A study on climate vulnerability of freshwater fish in California (121 native fish taxa and 43 non-natives) found that native species had greater climate change vulnerability than non-native species (Moyle et al. 2012). Of the species studies, 83 percent of native fish had critical or high climate change vulnerability versus 19 percent for non-native species.
- UC Davis, with support from CDFW, is currently undertaking an assessment of the climate impacts to vegetative communities in California state-wide. Results of the assessment will be available on the California SWAP website https://www.wildlife.ca.gov/SWAP.
- The Gulf of Farallones and Cordell Bank National Marine Sanctuaries conducted a joint study in 2010 on climate change effects and potential impacts on marine species and habitat along the north-central California coast (Largier et al. 2010).

Climate Adaptation Strategies

CDFW recognizes the important role that healthy natural ecosystems have in making California more resilient to climate change.

In 2008, Governor Arnold Schwarzenegger signed Executive Order S-13-08, which called on state agencies to develop California's first strategy to identify and prepare for the expected impacts of climate change. In 2009, the first CCAS was completed in response to the executive order. The CCAS was developed under the leadership of CNRA, working through the state's Climate Action Team. Projected climate change impacts, risks and strategies to address these risks were identified for seven sectors, including biodiversity and habitat. Six adaptation strategies were identified, along with near-term and long-term implementing actions for each. The six strategies include:

- establish a system of sustainable habitat reserves;
- management of watersheds, habitat, and vulnerable species;
- regulatory requirements;
- research and guidelines;
- education and outreach; and
- implementation of adaptation strategies.

Since the CCAS was completed in 2009, there have been numerous accomplishments applicable to the biodiversity and habitat sector. Several key examples from CDFW include the following:

- February 2010 Essential Habitat Connectivity Project Report and Data (Spencer et al. 2010): CDFW and Caltrans commissioned a team of consultants to produce a statewide assessment of essential habitat connectivity using the best available science, data sets, spatial analyses, and modeling techniques. The goal was to identify large remaining blocks of intact habitat or natural landscape and model essential connectivity areas between them that need to be maintained, particularly as corridors for wildlife.
- CDFW Vision for Confronting Climate Change in California: In 2011, CDFW issued a vision statement entitled "Unity, Integration, and Action: CDFW's Vision for Confronting Climate Change in California." This report outlined CDFW's objectives for responding to climate change.
- CDFW Climate College and Climate Education: In early 2012, CDFW launched a ten-month climate literacy program to build staff capacity for incorporating climate considerations into existing professional responsibilities. Although the CDFW Climate College was designed to provide a basic foundation of climate literacy to CDFW staff, the course was open to the public. The inaugural year of the CDFW Climate College was completed in June 2013. More than 340 participants participated in the first year of the CDFW Climate College. A second iteration of the Climate College was carried out in 2014, and was focused on climate change impacts and issues in the marine environment. The CDFW Climate Science Program also features a variety of online educational materials related to biodiversity and climate change including resources for teachers, a collection of relevant vulnerability assessment tools and guidance, and information on CDFW projects helping to plan for or minimize impacts associated with climate change.
- First-of-its-kind Statewide Network of Marine Protected Areas: In 2012, 19 Marine Protected Areas (MPAs) became effective in the northern California coastal region, completing the nation's first statewide coastal system of marine protected areas.
- National Fish, Wildlife, and Plants Climate Adaptation Strategy (National Fish, Wildlife and Plants Climate Adaptation Partnership 2012): CDFW collaborated with federal, tribal, and state partners and played a lead role in creating the first National Climate Adaptation Strategy for fish, wildlife, and plants. This strategy promotes a nationwide unified approach to climate driven adaptation strategies, reflecting shared principles and science-based practices to safeguard the nation's biodiversity, ecosystem function and sustainable human uses of fish, wildlife and plants. The National Climate Adaptation Strategy was released in 2012.

CNRA updated the CCAS in 2014, and published the report, *Safeguarding California: Reducing Climate Risk* (CNRA 2014). CDFW led the development of the Biodiversity and Habitat Sector chapter, which contains key strategies and actions that build upon the 2009 CCAS strategies, including the following:

- Develop management practices to help safeguard species and ecosystems from climate risks.
    - Improve habitat connectivity and protect climate refugia.
    - Implement adaptive management studies to refine approaches for conserving biodiversity, especially for species and communities vulnerable to climate change.

- Enhance biodiversity monitoring in California to detect climate impacts and inform responses.
- Support environmental stewardship across sectors.
  - Promote nature-based solutions for adapting to climate risks.
  - Create, maintain and support tools that help resource managers determine when and where to focus conservation activities that will protect biodiversity in the face of climate risks.
- Improve understanding of climate risks to biodiversity and habitats.
  - Complete habitat and vegetation mapping.
  - Refine regional connectivity analyses.
  - Perform additional climate vulnerability analyses.
  - Improve understanding of extreme events and disturbance regimes.
  - Identify opportunities to address the emissions that contribute to climate change.
- Information Sharing and Education.
  - Create and maintain partnerships that support biodiversity conservation in a changing climate.
  - Promote public education and outreach on climate change impacts to biodiversity.
  - Provide support for the continuation of the CDFW Climate College and educational outreach efforts and link those efforts to broader state climate literacy programs.

The climate adaptation strategies and implementing actions in both the 2009 CCAS and the 2014 *Safeguarding California* have informed the SWAP conservation strategies presented in Chapter 4. California's climate adaptation strategies are also consistent with the strategic framework provided in the National Fish, Wildlife, and Plants Climate Adaptation Strategy. Additionally, the tables shown in Appendix G identify how the SWAP conservation strategies outlined in Chapter 4 align with these state and federal strategies and thus achieve important climate adaptation co-benefits.

3 Existing Conservation Approaches

3.1 Regulatory Framework

Many natural resources in California are protected and activities affecting them are regulated by federal and state laws and regulations, as well as local ordinances. Federal, state, and local governments have also adopted plans and policies to protect and manage natural resources. Many of these are designed to provide for the conservation and management of wildlife habitats and sensitive species. SWAP 2015 operates within and assists in achieving compliance with applicable federal, state, and local laws and regulations, but it is not, itself, a regulatory document. This section describes the key laws, regulations, plans, and policies that create the framework for wildlife conservation planning in California.

3.1.1 Federal Laws and Regulations

Federal Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) regulate the take and incidental take of a species listed as threatened or endangered under the federal Endangered Species Act (ESA; 16 U.S.C. section 1531 et seq.). USFWS has jurisdiction over terrestrial and inland aquatic species and NMFS has jurisdiction over anadromous fish and marine species, including marine mammals. In general, persons subject to ESA (including private parties) are prohibited from “take” of endangered or threatened fish and wildlife species on non-federal property, with this prohibition expanded to also prohibit removing and possessing endangered or threatened plants in areas under federal jurisdiction or in violation of state law. Under ESA, the definition of “take” is “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” USFWS and NMFS have defined “harm” to include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. If a proposed project would result in take of a federally listed species, the project applicant must either acquire an incidental take permit under Section 10(a) of ESA, or if a federal discretionary action is involved, take authorization is acquired through a consultation process under Section 7 of ESA between a federal agency with jurisdiction over the project and, as applicable, either USFWS, NMFS, or both.

Marine Mammal Protection Act

The Marine Mammal Protection Act (16 U.S.C. section 1361 et seq.) prohibits, with certain exceptions, the "take" of marine mammals in U.S. territorial waters. NMFS administers the Marine Mammal Protection Act and is charged with protecting whales, dolphins, porpoises, seals, sea lions, and manatees and other species of marine mammals. Sea otters are protected by the USFWS. NFMS or USFWS can authorize take for a limited set of activities including: scientific research, enhancing the survival or recovery of a marine mammal species or stock, commercial and educational photography, incidental take during commercial fishing operations, and incidental take during non-fishery commercial activities.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA; 16 U.S.C. section 703 et seq.), first enacted in 1918, provides for protection of international migratory birds and authorizes the Secretary of the Interior to regulate the taking of migratory birds. The MBTA provides that it shall be unlawful, except as permitted by regulations, to pursue, hunt, take, capture or kill, possess, offer for sale, sell, offer to purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, or any part, nest, or egg of any such bird. The current list of species protected by the MBTA can be found in Title 50 of the Code of Federal Regulations (CFR), Section 10.13 (50 CFR 10.13). The list includes nearly all birds native to California.

Clean Water Act

The Clean Water Act (CWA; 33 U.S.C. section 1251 et seq.) establishes structure for regulating discharges of pollutants into waters of the Unites States and regulating quality standards for surface waters. Section 404 of CWA establishes a requirement for a project applicant to obtain a permit before engaging in any activity that involves any discharge of dredged or fill material into waters of the United States, including wetlands. Waters of the United States include navigable waters of the United States, interstate waters, all other waters where the use or degradation or destruction of the waters could affect interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet any of these criteria or that are adjacent to any of these waters or their tributaries. Under Section 404 of CWA, the US Army Corps of Engineers (USACE) regulates and issues permits for activities that involve the discharge of dredged or fill materials into waters of the United States. Under Section 401 of CWA, an applicant for a Section 404 permit must also obtain a certificate from the appropriate state agency stating that the intended dredging or filling activity is consistent with the state's water quality standards and criteria. In California, the authority to grant water quality certification is delegated by the State Water Resources Control Board (SWRCB) to the nine Regional Water Quality Control Boards.

National Invasive Species Council

On February 3, 1999, Executive Order 13112 was signed establishing the National Invasive Species Council (NISC). The Executive Order required that a Council of Departments dealing with invasive species be created. The federal government defined invasive species as "a species that is non-native to the ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health." Federal agencies were directed to prepare an invasive species management plan. In 2008, the National Invasive Species Council revised the federal management plan, laying out a blueprint for action (NISC 2008).

3.1.2 State Laws and Regulations

California Endangered Species Act

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The California Endangered Species Act (CESA; Fish and Game Code [FGC] section 2050 et seq.) prohibits the import, export, take, possession, purchase, or sale within California of any CESA-listed or candidate species. The California Fish and Game Commission is responsible for listing or delisting a species under CESA and CDFW acts as the Commission's scientific advisor during that process. CDFW is also responsible for regulating the take of listed and candidate species through various provisions of the FGC (see e.g., 2081[a] for scientific, educational, or management purposes; 2081[b] incidental take; Voluntary Local Program [section 2086 et seq.]; California State Safe Harbor Agreement Program Act [section 2089.2 et seq.]; and Natural Community Conservation Planning Act [section 2800 et seq.]).

California Native Plant Protection Act

The Native Plant Protection Act (NPPA; FGC section 1900 et seq.) was enacted in 1977 and allows the Fish and Game Commission to designate native plants as rare or endangered. There are 64 species, subspecies, and varieties of plants that are protected as rare under the NPPA. The NPPA prohibits take of endangered or rare native plants, unless authorized by CDFW via a permit or other agreement pursuant to the applicable regulations, or under certain other limited circumstances.

California Desert Native Plants Act

The purpose of the California Desert Native Plants Act (CDNPA; Food and Agriculture Code section 80001 et seq.) is to protect certain species of California desert native plants from unlawful harvesting on both public and privately owned lands. The CDNPA only applies within the boundaries of Imperial, Inyo, Kern, Los Angeles, Mono, Riverside, San Bernardino, and San Diego Counties. Within these counties, the CDNPA prohibits the harvest, transport, sale, or possession of specific native desert plants unless a person has a valid permit or wood receipt, and the required tags and seals. The appropriate permits, tags and seals must be obtained from the sheriff or commissioner of the county where collecting will occur.

California Safe Harbor Agreement Program Act

The California Safe Harbor Agreement Program Act (FGC section 2089.2 et seq.) allows CDFW to enter into safe harbor agreements (SHAs) with landowners as an incentive for them to manage their lands for the benefit of state-listed endangered, threatened, or candidate species. SHAs provide landowners with a safe harbor assurance that the landowners will not be subjected to additional regulatory restrictions in the future because of their conservation efforts. A SHA must result in a net conservation benefit to the covered species and cannot result in the reduction of an existing population of a state-listed species present at the time the baseline is established.

Fully Protected Species

The designation and protection of fully protected species is established by FGC sections 3511, 4700, 5050, and 5515. Except in very limited circumstances such as pursuant to necessary scientific research, including efforts to recover a species, or an approved Natural Community Conservation Plan (NCCP), fully protected species may not be taken or possessed.

Protection for Bird Nests and Raptors

FGC section 3503 states that, except as otherwise provided by the FGC or any of its implementing regulations, it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Subject to the same exception, FGC section 3503.5 states that it is unlawful to take, possess, or destroy any raptors (e.g., hawks, owls, eagles, and falcons), including their nests or eggs. FGC section 3513 provides that it is unlawful to take or possess any migratory nongame bird as designated by the MBTA or any part of such bird except as provided by rule and regulations adopted pursuant to the MBTA.

Ascent Environmental

Lake and Streambed Alteration Program

For the protection and conservation of California's fish and wildlife resources, the FGC requires an entity to notify CDFW prior to commencing any activity that may: substantially divert or obstruct the natural flow of any river, stream, or lake; substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or deposit debris, waste, or other materials that could pass into any river, stream, or lake (FGC section 1602). "Any river, stream, or lake" includes perennial, intermittent, and ephemeral waterbodies including desert washes and playas (i.e., seasonally dry lakes). It may also apply to work undertaken within the flood plain of a body of water. Pursuant to FGC section 1602, CDFW requires a Lake and Streambed Alteration (LSA) Agreement when it determines that the activity may substantially adversely affect existing fish or wildlife resources. An LSA Agreement includes measures necessary to protect existing fish and wildlife resources. CDFW may suggest ways to modify the project that would eliminate or reduce harmful impacts to fish and wildlife resources.

CDFW Implements Program for Simpler and Faster Approval of Small Habitat Restoration Projects

Many voluntary habitat restoration and water quality improvement projects are relatively small, but can have important environmental benefits for fish and wildlife, sensitive species, and water quality. Even for this type of beneficial work, however, obtaining the proper permits and regulatory approvals can sometimes be a complex and lengthy process, which can discourage some landowners from taking action.

CDFW has implemented a special program based upon the efforts of a nonprofit organization, Sustainable Conservation, which sponsored the Habitat Restoration and Enhancement Act (Assembly Bill 2193, Statutes of 2014). The Restoration and Enhancement Act was signed into law by Governor Jerry Brown in 2014. CDFW offers private and public landowners a simpler and faster permitting approval process for small restoration projects. The new approval process is an alternative to the existing Section 1600 Lake and Streambed Alteration Agreement (LSAA) and Section 2081 California Endangered Species Act permit processes.

The Restoration and Enhancement Act applies to voluntary restoration projects with a primary purpose of restoring fish and wildlife habitat, and is coordinated with similar general permits from other agencies, particularly the State Water Resources Control Board. Qualifying projects can receive CDFW approval within 30-60 days. The approval can be used for many common types of habitat improvements such as replacing undersized culverts, removing concrete crossings and sills that block fish passage, removing invasive plants and planting native vegetation along stream corridors, erosion control along waterways, and more. Qualifying projects must be voluntary and should follow techniques and priorities specified in restoration guidelines, manuals, recovery plans or other accepted guidance documents. All appropriate environmental protection measures should be incorporated into the project design.

CDFW encourages landowners with habitat restoration or water quality improvement projects to take advantage of this new, efficient approval process. For more information, contact CDFW's Habitat Conservation Planning Branch at (916) 653-3559, or visit:

https://www.wildlife.ca.gov/Conservation/Environmental-Review/HRE-Act

California Environmental Quality Act

The California Environmental Quality Act (CEQA) serves to: inform governmental decision makers and the public about the potential, significant environmental effects of proposed activities; identify ways that environmental damage can be avoided or significantly reduced; prevent significant, avoidable damage to the environment by requiring feasible project alternatives and mitigation measures; and disclose to the public the reasons for a governmental approval despite the project causing significant environmental effects. State and local public agencies must comply with CEQA before making a discretionary approval of a project. Such compliance can be met by determining a project is exempt from CEQA or preparing an environmental analysis, typically a mitigated negative declaration (MND) or environmental impact report (EIR). MNDs and EIRs identify and contain an analysis of a project's significant environmental effects and discuss feasible measures to avoid or mitigate those effects. EIRs also analyze a reasonable range of potentially feasible alternatives to the proposed project that would avoid or substantially lessen the project's significant effects. Compliance with other environmental laws and regulations is also typically discussed in an MND or EIR.

Natural Community Conservation Planning Act

The Natural Community Conservation Planning Act (FGC section 2800 et seq.) provides for the development of effective, broad-based conservation plans that focus on the needs of natural communities and the range of species that inhabit them while allowing compatible and appropriate economic activity. The NCCP program has provided the basis for successful collaborations throughout California between state and federal agencies, local governments, community groups, and private interests that have resulted in long-term, habitat-based protections for regional biodiversity and related ecosystems. It has also proved to be an effective tool in achieving these protections while reducing conflicts between achieving conservation goals and allowing the reasonable use of natural resources and lands for economic development. The NCCP Act authorizes CDFW to enter into agreements for developing and implementing regional multispecies conservation plans and to authorize take of species covered by a plan.

Marine Life Protection Act

The Marine Life Protection Act (MLPA; FGC section 2850 et seq.) requires CDFW to develop a master plan for modification of existing and designation of new marine protected areas (MPAs). MPAs function as a network to: increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance.

Invasive Species Council of California

Assembly Bill 2763 (Laird), signed by the governor in 2008, directed state agencies under the leadership of the California Department of Food and Agriculture (CDFA) to strengthen planning to anticipate the potential responses needed for future invasive species. This resulted in the formation of the Invasive Species Council of California (ISCC; comprising secretaries of six state agencies) and the California Invasive Species Advisory Committee (CISAC; comprising 24 stakeholder representatives and expert advisors). In 2011, CISAC completed (and ISCC approved) *Stopping the Spread: A Strategic Framework for Protecting California from Invasive Species* (ISCC 2011). This plan built on two previously existing plans, the *California Noxious and Invasive Weed Action Plan* (CDFA 2005) and the *California Aquatic Invasive Species Management Plan* (CDFG 2008a). The plan includes 40 recommendations for strengthening the state's response to invasive species.

3.1.3 Local Ordinances, Plans, and Policies

Cities and counties establish goals and policies for directing and managing important community issues (such as growth, housing, and environmental protection) and adopt ordinances to protect important local resources. Local governments use a variety of tools in the planning process including the general plan, specific plans, zoning, CEQA review, conditions of approval for approved projects, and ordinances. Examples of natural resource protection on a local level are plans, policies, or ordinances that protect riparian buffers, native and heritage trees, lakes and ponds, and locally important plants and animals (e.g., rare plant preserves, bird nesting areas, monarch butterfly migration roosts).

3.2 CDFW Planning Tools

All aspects of wildlife management, particularly efforts to restore species at risk, depend on biological information. The increasing stresses on wildlife resources, including the loss, degradation, and fragmentation of habitats, effects of water diversions, and proliferation of invasive species, have further increased the need to assess the status and trends of wildlife species and ecosystems in California.

Synthesizing and disseminating the research and monitoring data of wildlife and natural communities are important for informing conservation decisions throughout the state. This section describes current CDFW planning tools used for the conservation of species and habitats in California.

3.2.1 Resource Assessment

Resource assessment is essential to providing scientifically based data for informing models and decision making. CDFW recognizes the importance of collecting scientifically based data on the distribution and abundance of fish, wildlife, and native plant species and the natural communities and habitats in which they live.

CDFW monitors species and habitat in the form of collection and analysis of observations or data repeated over time in relation to a conservation or management objective. Monitoring efforts develop information on trends (increasing, decreasing, static) in species or habitats that can be related to conservation and management activities. Resource assessment may also include inventories, which present a snapshot-in-time or an initial baseline set of observations or data collected for a monitoring effort on the distribution and abundance of species and habitats.

In addition to efforts by CDFW, numerous state and federal natural resources agencies, private landowners and firms, and dozens of academic and research institutions are involved in monitoring wildlife and ecosystems in the state, and each agency usually conducts field research to support its specific management needs. In addition, consulting firms conduct wildlife and natural resource surveys to support CEQA documentation for projects.

Ecoregional Baseline and Trend Monitoring of Wildlife Species and Communities of Northern California

CDFW Region 2, in conjunction with Region 1, is conducting a multi-species wildlife monitoring project (Ecosystem Biodiversity Monitoring [EBM] Project) to alert conservation planners about long-term trends in population status before species become threatened or endangered, and to provide information on wildlife habitat relationships.

The purpose is to monitor avian, mammal, and botanical communities in mid- to high-elevation habitats for changes in population status over time periods of 10-20 years. Additionally, data will be collected about the current distributions of many terrestrial vertebrates, to improve the understanding of their habitat relationships, and quantify baseline conditions and stressors potentially affecting individual species and wildlife communities.

The project will provide conservation planners with strategic information about the status, population trend, and habitat associations of numerous wildlife and botanical species. The project also records important documentation of occurrences of uncommon species or Species of Greatest Conservation Need (SGCN), such as wolverine, porcupine, and American badger, though data may not be sufficient for quantitative analyses regarding these species.

3.2.2 Data Sets and Decision Support Tools

Compiling and organizing data and information involves designing common formats and protocols, developing programs to manage databases, providing access to the information, and facilitating the sharing of wildlife and ecosystem information by land managers, wildlife managers and researchers, private landowners, and others involved in making conservation decisions.

CDFW maintains and supports biological data development programs that are especially dependent and closely linked with GIS and emerging related technologies. These data development activities include vegetation mapping, rare species tracking, species range mapping, aggregation of existing incongruent data sources and decision-support systems. Some of these activities are described below.

California Essential Habitat Connectivity Map and Regional Connectivity Analyses

The Essential Habitat Connectivity Map is one of three primary products to come from the Essential Habitat Connectivity Project (CDFG and Caltrans 2010). CDFW and Caltrans commissioned the California Essential Habitat Connectivity Project to produce a statewide assessment of essential habitat connectivity using the best available science, data sets, spatial analyses, and modeling techniques. The project identifies large remaining blocks of intact habitats or natural landscapes and models linkages between them that need to be maintained, particularly as corridors for wildlife.

The Essential Habitat Connectivity Map identifies areas that represent principle connections between areas of relatively natural habitat blocks that support native biodiversity where conservation and management actions should be prioritized to maintain and enhance ecological connectivity. At the statewide scale, the California Essential Habitat Connectivity Project was intended to support large-scale ecosystem based conservation plans like the SWAP and the California Climate Adaptation Strategy, and to integrate with infrastructure plans such as California Transportation Plan 2040.

California Transportation Plan 2040

The California Transportation Plan (CTP) provides a long-range policy framework to meet our future mobility needs and reduce greenhouse gas emissions. The CTP defines goals, performance-based policies, and strategies to achieve our collective vision for California's future statewide, integrated, multimodal transportation system. The plan envisions a sustainable system that improves mobility and enhances our quality of life.

The CTP 2040 is scheduled for approval by the California State Transportation Agency in December 2015. The Public Draft CTP 2014 was prepared with extensive input and collaboration between Caltrans, its regional partners, and the public. The CTP 2040 references the California Essential Habitat Connectivity Project and Regional Advance Mitigation Planning as a statewide planning tools available to align transportation development with regional wildlife connectivity planning. The CTP 2040 identifies strategies and recommendations to preserve and enhance natural resources with the early integration of environmental considerations into system planning and project scoping. (Caltrans 2015).

At regional and local scales, similar products can be used to inform a wide array of planning efforts, such as NCCPs and habitat conservation plans (HCPs), transportation Blueprint Plans, city and county General Plans, and land acquisition, management or restoration plans by conservancies, land trusts, and other nongovernmental organizations. These finer scale analyses (https://www.wildlife.ca.gov/Conservation/Planning/Connectivity) have been completed for several regions in California. Private landowners may want to use this information to understand how they can be a part of a regional conservation goal or engage in the discussion.

Ecoregional Analyses within California

- Bay Area Critical Linkages
- Sierra Nevada Foothills Wildlife Connectivity Modeling Project
- Safe Passages Project – San Joaquin Valley
- South Coast Missing Linkages Project
- California Deserts Connectivity Project

Crucial Habitat Assessment Tool

The Western Governors' Association represents the governors of 19 western states and three U.S.-flag islands. The association created the Western Governors' Wildlife Council and tasked its members with developing policies and tools to identify and conserve crucial wildlife habitat and corridors across the region. The Crucial Habitat Assessment Tool (CHAT; http://westgovchat.org/) is an online system of maps that display crucial wildlife habitat based on commonly agreed upon definitions by the Western Governors' Wildlife Council. The common definitions of crucial habitat and corridors and issued guidelines are intended to help each state prioritize habitat and meet specific conservation objectives. The west-wide definitions support compatibility and consistency across state boundaries and address certain discrepancies that may exist in identifying habitat and natural features along state borders. California has developed state-specific information on priority habitat to contribute to CHAT (Areas of Conservation Emphasis described below).

Areas of Conservation Emphasis

Areas of Conservation Emphasis (ACE-II) is a CDFW project that began in 2009 to provide data to help guide and inform conservation priorities in California (CDFG 2010). ACE-II provides an easily-accessible and standardized way to view the best available statewide spatial data on California's biological richness and biodiversity, including species richness, rarity, endemism, and sensitive habitats. These datasets have many uses ranging from ecological research and modeling to local land-use planning and conservation decision making. The ACE-II data are dynamic and updated periodically as new data warrant.

Products of the ACE-II project (http://www.dfg.ca.gov/biogeodata/ace/) include a set of maps summarizing biological data that can be used to identify areas of potential biological or conservation interest and may be useful during conservation prioritization as an interactive, online ACE-II viewer. The viewer allows the ACE-II biological richness maps, stressors, protected status of lands, and connectivity and corridors to be overlaid. The viewer allows the user to display and contrast the arrangement and relative value of California's unique biological resources, providing a first step toward setting conservation priorities statewide. The viewer also provides a weighted-additive model interface that allows for custom calculation of a biological index using user-defined weights, which is a preliminary step in developing a flexible framework to address specific land acquisition or management questions.

Biogeographic Information and Observation System

CDFW's Biogeographic Information and Observation System (BIOS) is a system that enables the management and visualization of biogeographic data collected by CDFW and partner organizations. Partner organizations that provide data layers to BIOS include the U.S. Geological Survey (USGS), U.S. Bureau of Land Management (BLM), USFWS, California Coastal Conservancy, California Geological Survey, and U.S. Forest Service (USFS). BIOS facilitates the sharing of data within the BIOS community through integrating GIS, relational database management, and ESRI's ArcGIS Server technology to create a statewide, integrated information management tool that can be used on any computer with access to the Internet (http://www.dfg.ca.gov/biogeodata/bios/).

California Natural Diversity Database/Rarefind

The California Natural Diversity Database (CNDDB; http://www.dfg.ca.gov/biogeodata/cnddb/) is a program that inventories the status and locations of rare plants and animals in California. CNDDB staff work with partners to maintain current lists of rare species as well as maintain an ever-growing database of GIS-mapped locations for these species. The goal of the CNDDB is to provide the most current information available on the state's most imperiled elements of natural diversity and to provide tools to analyze these data. The CNDDB concentrates its work on areas with active NCCP/HCPs, and high priority areas identified by CDFW and other biologists.

Rarefind is an internet application that allows for more robust querying and reporting of the CNDDB data than the BIOS Data Viewer, but with no direct map interface.

California Wildlife Habitat Relationships

California Wildlife Habitat Relationships (CWHR; http://www.dfg.ca.gov/biogeodata/cwhr/), developed in 1988, contains life history, geographic range, habitat relationships, and management information for 712 species of amphibians, reptiles, birds, and mammals known to occur in the state. The CWHR system is composed of several components. These include:

- a complete species list of California's terrestrial vertebrates;
- life history information and geographic range data by season for 712 regularly-occurring species;
- a standardized habitat classification scheme for California containing 59 habitats, structural stages for most habitats, and 124 special habitat elements;

- a community-level matrix model associating 712 wildlife species to these standard habitats and stages with ratings of habitat suitability for reproduction, cover, and feeding; and
- a software application containing all system components.

CWHR products are available to anyone interested in understanding, conserving, and managing California's wildlife. CWHR has been used for several large wildlife resource conservation efforts.

Vegetation Classification and Mapping Program

The Vegetation Classification and Mapping Program develops and maintains (http://www.dfg.ca.gov/biogeodata/vegcamp/) California's expression of the National Vegetation Classification System (USNVC website: http://usnvc.org/). CDFW implements its use through assessment and mapping projects in high-priority conservation and management areas, through training programs, and through working continuously on best management practices for field assessment, classification of vegetation data, and fine-scale vegetation mapping.

The principal roles of the program include:

- developing and maintaining a standardized vegetation classification system for California;
- implementing and updating best methods of vegetation assessment including sampling, analyzing, reporting, and mapping vegetation at multiple scales;
- training resource professionals on these techniques and coordinating with other agencies and organizations to ensure a statewide, standardized approach toward collecting, reporting, and interpreting vegetation data;
- developing best practices for using these data for long-range conservation and management of natural lands in the state;

The vegetation classification system consists of an eight-tier hierarchy with the finest resolution consisting of locally-appropriate floristic associations at the bottom, and the globally applicable "Class" units at the top. Among the most useful units for general habitat evaluation are several of the mid-level classification units. The California SWAP 2015 technical team has adopted the macrogroup as the basic unit for regional habitat description. Macrogroup concepts are familiar to most wildlife biologists. Typical macrogroup concepts for California vegetation include; Chaparral, Coastal Scrub, Mojave and Sonoran Desert Scrub, and California Foothill and Valley Forest and Woodland. These vegetation types are defined by certain floristic and structural criteria that can be repeatedly and accurately inventoried and mapped, making them useful for developing correlations with wildlife habitats. Habitat correlations vary between species and may match one or more of these units at different levels of the vegetation hierarchy. The vegetation macrogroup can also be further broken down floristically and structurally into progressively more discrete hierarchical "groups," "alliances," or the finest level; "associations" on an as needed basis depending upon the individual correlations between vegetation and certain vertebrate species:

- conducting integrated vegetation assessments throughout the state in areas with high conservation and management interest to the Department of Fish and Wildlife and other agencies;
- archiving and distributing quality vegetation data;
- coordinating with other state, federal, and local agencies and organizations involved in vegetation assessment; and
- integrating standard vegetation classification systems with species distributions to encourage unified habitat assessments and conservation efforts.

Applications of the Vegetation Classification and Mapping Program efforts to analyze statewide spatial data include:

- regional conservation planning;
- wildland fire and fuels modeling for improved preparedness;
- identifying individual plant and animal species distributions;
- predicting the spread of invasive species;
- early scoping for transportation projects to minimize impacts;
- prioritizing land acquisitions for parks and ecological reserves;
- identifying important wildlife corridors; and
- setting a baseline for monitoring impacts of global climate change.

Data Portal

The Data Portal provides a single point of entry to data sources which serve the needs of staff and programs throughout CDFW (https://nrm.dfg.ca.gov/). These data are made available for reporting, querying and (in some cases) editing via a series of dynamic web applications. CDFW employees, affiliated cooperators and the public have ready access from any computer with an internet connection. Special client applications or direct connection to the CDFW wide area network are not required.

The applications on the Data Portal employ similar user-friendly interfaces. Users will find that if they are familiar with one application in the portal, they are familiar with many elements of the other applications. In addition to live data from CDFW databases, users may retrieve data from a reporting data warehouse optimized for searching, browsing and intuitive data extraction. Users can also easily generate and print reports or query, browse, and download data which support the CDFW's conservation mission.

A central purpose of the Data Portal is to provide useful and intuitive tools for examining data. Tools for data access have been grouped into topics that have been designed to mirror CDFW programs and initiatives. The topics include:

- species and vegetation
- fisheries
- habitat conservation
- water policy
- wildlife

Examples of applications available through the Data Portal include: Ecosystem Restoration Program Projects, Habitat Tracking and Reporting Reports, Coho Salmon Recovery Tasks, Angling Records, CDFW Special Hunts, Wildlife Incident Reporting, Environmental Document Review, and Lake and Streambed Alterations (Project Tracking).

California Fish Passage Assessment Database

The Passage Assessment Database (PAD) can be accessed through the CDFW Data Portal (https://nrm.dfg.ca.gov/PAD/). PAD is an ongoing map-based inventory of known and potential barriers to anadromous fish in California. PAD compiles data from more than 100 agencies, organizations, and landowners throughout California, and allows past and future barrier assessments to be standardized and stored in one place, and enables the analysis of cumulative effects of passage barriers in the context of overall watershed health.

PAD is maintained by CalFish, a California Cooperative Anadromous Fish and Habitat Data Program, involving a number of agency and organization partners including CDFW.

3.2.3 Conservation Plans

The local project-by-project approval of new development can lead to the slow dismantling and fragmentation of important wildlife habitats, migratory corridors, and ecosystems without measures to address cumulative effects of projects over time and across the region. A development decision may appear to have negligible consequences for wildlife populations, if it is converting a small percent of the remaining habitat or wildland in the project area to something else. Over time, the conversion of even small pieces of habitat will add up. Without the benefit of a regional conservation analysis, a land use decision may develop a small patch of land that indefinitely blocks an important regional wildlife migratory corridor or degrades a key ecosystem component important to wildlife diversity in the broader region. Accordingly, in many circumstances, it is prudent to approach species and habitat conservation at a regional scale. Discussed below are current CDFW large scale regional conservation programs.

Large-Scale Regional Conservation Efforts

Conservation plans are addressing conservation of over 11 million acres in California. These include three different types of large-scale, regional conservation plans: joint HCP/NCCPs; HCPs that are not NCCPs; and other large-scale regional conservation efforts that to date are neither HCP nor NCCP. As of August 2014, nine plans were in process of implementation and 14 were in various stages of planning.

Regional HCPs and NCCPs

An HCP is a long-term agreement between USFWS and an applicant (private landowner or non-federal land manager) under Section 10 of ESA that allows for the incidental take of federally listed species and their habitats. It describes the anticipated effects of the proposed taking; how those impacts will be minimized or mitigated; and how the HCP implementation is to be funded. HCPs can apply to both listed and non-listed species, including those that are candidates or have been proposed for listing. HCPs may cover large areas or a single project. Many of the large-scale, multispecies HCPs are habitat-based plans that allow development to occur in certain areas, while setting up a coordinated system of protected land reserves that provide a coordinated, landscape-level conservation strategy.

California has implemented its own voluntary multispecies regional approach to wildlife habitat conservation. The California NCCP, administered by CDFW, allows for the incidental take of California listed and fully protected species and their habitats. Within California, joint NCCPs and HCPs are common, because they cover species being listed under ESA and CESA and both USFWS and CDFW participate in the review and permitting process.

An NCCP provides regional protection for plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The NCCP standard goes beyond mitigating for the effects of development to providing for the conservation and management of covered species and habitats in the plan area. The NCCP approach or similar regional multispecies approaches to conservation planning are essential to conserve habitats and ecosystems at a scale necessary to ensure long-term survival of species.

Creating a conservation plan involves a diverse array of stakeholders who represent their interests in a negotiated process. The process also provides opportunities for participation by the general public. In a typical conservation plan, a local lead agency (either city or county) coordinates a collaborative planning process. Working with landowners, development interests, environmental organizations, and other interested parties, the local agency oversees the numerous activities that constitute the development of a conservation plan, including collecting ecological data; designing a reserve system; identifying proposed development; creating a monitoring and adaptive management program for the reserve lands; and determining funding for implementation. The state and federal wildlife agencies (CDFW, USFWS, and, where appropriate, NMFS) are relied upon during all of these activities to provide the necessary support, direction, scientific expertise, and guidance to the conservation planning participants.

The desired result of this process is a comprehensive plan that provides for species conservation and management and, at the same time, guides development towards areas that are less critical for wildlife. Under an approved HCP, wildlife agencies may issue permits to authorize the take of species under federal ESA. Species whose conservation and management are provided by the plan are called “covered” species. The NCCP Act gives CDFW the authority to permit take of any covered species (whether or not it is listed as threatened or endangered under CESA, or fully protected).

This authority provides an incentive to local applicants to cover certain species not currently listed, eliminating the need to reapply for additional permits should those species become listed in the future. Covering non-listed species requires that those species be treated as if they were listed and can mean the protection of additional habitats, core areas, linkages, ecological processes, and improved reserve configurations that bolster the overall conservation strategy.

California Water Plan

The California Water Plan is developed by staff from DWR and other agencies, including CDFW, through rigorous public involvement and state and federal agency coordination processes. The California Water Plan provides a collaborative planning framework for elected officials, agencies, tribes, water and resource managers, businesses, academia, stakeholders, and the public to develop findings and recommendations and make informed decisions for California's water future. The California Water Plan also evaluates different combinations of regional and statewide resource management strategies to reduce water demand, increase water supply, reduce flood risk, improve water quality, and enhance environmental and resource stewardship.

As the trustee agency for California's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitats necessary for biologically sustainable populations of those species. In support of that trustee role, CDFW participates in various advisory committees responsible for guidance and development of the California Water Plan. CDFW provides input to DWR on environmental water needs, including water use and water quality. CDFW's role in the development of the Water Plan is to identify opportunities to increase fish, wildlife, and other environmental benefits associated with efficient water management strategies.

Marine Protected Areas


Matt Elyash, CDFW

MPAs are separate geographic marine or estuarine areas designed to protect or conserve marine life and habitat. There are three types of MPAs designated (or recognized) in California: state marine reserves, state marine parks, and state marine conservation areas. As required by the MLPA, CDFW prepared a *Draft Master Plan for Marine Protected Areas* (CDFG 2008b) which provides guidance on: context for implementing the MLPA goals and objectives; background information on California's marine resources and policies; description of the process for designing alternative MPA proposals; and overviews on the design, management, enforcement, monitoring, and funding of California's MPAs.

California covers a total of approximately 5,285 square miles of coastal state waters (excluding state waters in San Francisco Bay which represent approximately 473 square miles). The statewide coastal network of marine managed areas (including 119 MPAs and five state marine management areas) covers approximately 852 square miles of state waters or about 16 percent (CDFW 2013). For the purposes of MPA planning, the state was split into five distinct regions (four coastal and the San Francisco Bay). Planning is still in progress for the San Francisco Bay.

The Northern California Region encompasses approximately 1,027 square miles of state waters from the California-Oregon border south to Alder Creek, near Point Arena (Mendocino County). A network of 20 marine managed areas (including 19 MPAs and one State Marine Recreational Management Area [SMRMA]) covers approximately 137 square miles, or about 13 percent, of northern California state waters (CDFW 2014a).

The North-Central California Region encompasses approximately 763 square miles of state waters from Alder Creek (just north of Point Arena, Mendocino County) south to Pigeon Point (San Mateo County). A network of 25 marine managed areas (including 22 MPAs and three SMRMAs) covers approximately 152 square miles, or 20 percent, of state waters off North Central California (CDFW 2014b).

The Central California Region encompasses approximately 1,144 square miles of state waters from Pigeon Point (San Mateo County) south to Point Conception (Santa Barbara County). A network of 29 marine managed areas (including 28 MPAs and one SMRMA) covers approximately 207 square miles, or about 18 percent, of state waters off central California (CDFW 2014c).

The Southern California Region encompasses approximately 2,351 square miles of state waters from Point Conception (Santa Barbara County) south to the California-Mexico border, including state waters around the Channel Islands. A network of 50 MPAs and two special closures (including 13 MPAs previously established at the northern Channel Islands) covers approximately 355 square miles, or about 15 percent, of state waters off Southern California (CDFW 2014d).

Regional Advance Mitigation Planning

In 2008, a coalition of infrastructure and natural resource agencies, nongovernmental organizations, and academic researchers launched an effort to develop a more comprehensive approach to mitigating unavoidable biological resource impacts potentially caused by state infrastructure projects, such as roads and levees. This approach, called Regional Advance Mitigation Planning (RAMP), allows for natural resources to be protected or restored as compensatory mitigation before infrastructure projects are constructed, often years in advance. Leadership of the various agencies signed or supported a Memorandum of Understanding including: DWR, Caltrans, U.S. Environmental Protection Agency, USFWS, USACE, National Oceanic Atmospheric Administration (National Marine Fisheries Service), CDFW, California Wildlife Conservation Board, Natural Resources Agency, and the California Business, Transportation and Housing Agency (Caltrans et al. 2010).

RAMP is an approach that seeks to deliver infrastructure projects more effectively than through project-by-project approaches to mitigation, by providing a more comprehensive mitigation approach such as mitigation banks and in-lieu fee programs. RAMP can be integrated with and add benefits to other regional mitigation and conservation planning efforts such as HCPs, NCCPs, and species recovery plans. In this approach, incorporating environmental benefits at a meaningful scale could address long-term economic, social, and environmental sustainability. RAMP identifies three statewide program-level goals: (1) Improved Regional Mitigation and Conservation Planning; (2) Improved Mitigation and Conservation Effectiveness; and, (3) Improved Efficiency (Bailey, pers. comm., 2015).

3.3 CDFW Conservation Programs

CDFW has conservation programs in addition to the land and habitat based conservation programs described in this section.

***Nongame Wildlife Program*. The Nongame Wildlife Program's mission is to conserve the rich diversity of California's native nongame wildlife. Their work emphasizes Species of Special Concern and Threatened and Endangered Species and includes resource assessment, research, conservation planning, recovery planning, permitting, and outreach activities. Duties of the Nongame Wildlife Program include, but are not limited to:**

- **coordinating statewide conservation efforts;**
- **evaluating petitions and conducting status reviews for listing under CESA ;**
- **evaluating and prioritizing Traditional and Non-Traditional Section 6 grants;**
- **evaluating and prioritizing State Wildlife Grant applications;**
- **prioritizing statewide drought response;**
- **partnering with USFWS on developing conservation strategies and assisting with development of recovery plans; and**
- **issuing permits for research, management, education, and propagation for SGCN and other wildlife.**

***Game Management Programs*. CDFW manages the following programs for the benefit of wildlife: Bear Management Program, Deer Management Program, Elk Management Program, Wild Pig Management Program, Pronghorn Antelope Management Program, Bighorn Sheep Management Program, the Shared Habitat Alliance for Recreational Enhancement Program, Lead Free Ammunition, Private Lands Management, Upland Game Resource Management, and the Waterfowl Program.**

***Private Lands Management Program.* The Private Lands Management (PLM) Program offers landowners incentives to manage their lands for the benefit of wildlife. This increases benefits to a landowner while preventing the conversion of private lands to land uses that are not compatible with wildlife, such as urban development, grazing, and logging. Landowners who enroll in this "ranching for wildlife" program consult with biologists to identify biologically sound habitat improvements that benefit wildlife, like providing water sources, planting native plants for food, and making brush piles for cover. In return for these habitat improvements, landowners can charge fees for wildlife viewing, hunting and fishing. This partnership between wildlife managers and private landowners helps conserve and maintain wildlife habitat in California.**

3.3.1 Mitigation and Conservation Banking

A conservation or mitigation bank is privately or publicly owned land managed for its natural resource values. A privately owned conservation or mitigation bank is a free-market enterprise that offers landowners economic incentives to protect natural resources, and that can save time and money for parties with mitigation responsibilities by simplifying the state regulatory compliance process. A publicly owned conservation or mitigation bank offers the sponsoring public agency advance mitigation for larger or multiple projects and/or operations and maintenance that spans longer term project planning horizons.

The terms “conservation bank” and “mitigation bank” are defined in FGC section 1797.5. In exchange for permanently protecting and managing the land and resources according to a written agreement with CDFW, the bank sponsor is issued credits that it may sell to project proponents who need to satisfy legal requirements for mitigating the environmental impacts of projects, or that it may use for its own project mitigation needs.

Conservation banks generally protect threatened or endangered species habitat or other sensitive resources, while mitigation banks conserve existing, restored, enhanced, or created wetland habitats that may also provide habitat for listed species. CDFW has actively supported banking to provide an incentive to conserve lands, consolidate mitigation into larger, more ecologically viable properties, and assist CDFW in meeting its conservation goals. Conservation and mitigation banking is important to the state because banks provide regulatory efficiencies, environmental benefits, and economic advantages.

3.3.2 Habitat Acquisition, Conservation Easements, and Land Management

CDFW Lands Program

CDFW manages wildlife areas, ecological reserves, and wildlands specifically for the benefit of wildlife and important habitats. In total CDFW manages 711 properties throughout the state. These lands represent or support a cross section of California’s remarkable natural diversity of animals, plants, habitat types, and ecosystems. Some of the state’s finest-quality wildlife habitats are represented in these holdings. But acreage of lands managed by CDFW has quadrupled in the last 25 years, from 250,000 acres in 1980 to 1 million acres today, and funding to manage these lands has not kept pace. Major bond acts and some appropriations have funded acquisition of new lands for wildlife, but there is not a corresponding source of funding to maintain, restore, and manage these lands. Land management entails providing site security, managing public health and safety on the lands, managing wildlife and natural resources, maintaining infrastructure, and managing recreation and other uses. The Lands Program also administers the California Landowner Incentive Program, an effort intended to reverse the decline of at-risk species on private lands in California’s Central Valley. The California Landowner Incentive Program provides monetary incentives and technical assistance to private landowners to enhance and manage the region’s three predominant historic habitat types: riparian, wetland, and native grassland; however, the Program is largely nonexistent due to lack of funding.

Wildlife Conservation Board

The State of California Wildlife Conservation Board (WCB) is an independent Board with authority and funding to carry out an acquisition and development program for wildlife conservation (FGC section 1300 et seq.). WCB and CDFW work cooperatively to implement mutual conservation efforts. About one-half of WCB funding is derived from California bonds authorized by public vote with the remainder coming from other state funds, local matching funds, partner donations, and federal money (WCB 2012). The primary responsibilities of WCB are to select, authorize and allocate funds for the purchase of land and waters suitable for recreation purposes combined with the preservation, protection and restoration of fish and wildlife habitat. WCB can also authorize the construction of facilities for fish and wildlife-related recreational purposes. WCB's functions are carried out through its programs: Land Acquisition, Public Access, Habitat Enhancement and Restoration, Inland Wetlands Conservation, California Riparian Habitat Conservation, Natural Heritage Preservation Tax Credit, Oak Woodland Conservation, Rangeland and Grassland Protection, Forest Conservation, and Ecosystem Restoration on Agricultural Lands (WCB 2014).

CDFW Grant Program

Payable grant funds are awarded by CDFW programs to various entities for projects that sustain, restore and enhance California's fish, wildlife, plants and their habitats. Grant opportunities available through CDFW are:

Drought Response:
- CDFW Drought Response

Fish and Wildlife Management:
- Fisheries Restoration Grant Program (FRGP)
- Steelhead Report Card
- Big Game Management
- Upland Game Management
- California Duck Stamp
- Endangered Species Conservation and Recovery Grant Program
- Endangered Species Conservation and Recovery Land Acquisition

Habitat Management:
- Ecosystem Restoration Program (ERP)
- Local Assistance Grants
- Endangered Species Conservation and Recovery Land Acquisition
- Habitat Conservation Land Acquisition
- Habitat Conservation Planning Assistance
- Natural Community Conservation Planning
- Watershed Restoration Grant Program – Proposition 1 Funded Program
- Wetlands Restoration for Greenhouse Gas Reduction Program

Oil Spill Prevention and Response:
- **Environmental Enhancement Fund**
- **Harbor Safety Committee**
- **Local Government Contingency Plan**
- **Oil Spill Response Equipment**

More information about these opportunities can be found at https://www.wildlife.ca.gov/Explore/Grant-Opportunities.

3.3.3 Habitat Conservation Planning Branch Habitat Conservation Programs

The mission of CDFW's Habitat Conservation Planning Branch (HCPB) is to provide for the conservation, protection, restoration, and management of fish, wildlife, and native plants and to preserve and restore the ecosystems (including ecological processes) on which they depend for use and enjoyment by the public.

Environmental Review and Permitting

The HCPB Permitting Program implements CESA, LSA, and CEQA. The permitting program administers the incidental take provisions of CESA to ensure regulatory compliance and statewide consistency. CDFW consults with lead and responsible agencies and provides the requisite biological expertise to review and comment upon environmental documents and impacts arising from project activities under the CEQA. State law requires an LSA Agreement when CDFW determines that the activity, as described in a complete LSA Notification, may substantially adversely affect existing fish or wildlife resources. HCPB Environmental Review and Permitting Program is an important part of conservation carried out by CDFW.

Invasive Species Program

The mission of the Invasive Species Program is to reduce the negative effects of non-native invasive species on the wildlands and waterways of California. CDFW is involved in efforts to prevent the introduction of these species into the state, detect and respond to introductions when they occur, and prevent the spread of invasive species that have become established. CDFW projects address problems with introduced animals and plants, both terrestrial and aquatic. More fundamentally, CDFW tries to identify and address the ways by which the species are introduced, typically inadvertently, by human activities. Studies show that preventing introductions is the most efficient and cost-effective way to manage invasive species. CDFW conducts work in coordination with other government agencies and non-governmental organizations.

In 2014, CDFW held the first Invasive Species Action Week, seeking to engage the many volunteers across the state who help control invasive species. The Invasive Species Program continues to grow, but does not yet have full capacity to take a comprehensive approach to addressing the impact of invasive species on wildlife statewide (CDFW 2015a).

CDFW maintains a regulatory list of live restricted animals (Title 14, sec. 671), through which several invasive animals, among other species, are prohibited from importation, possession, and transportation unless under a permit issued by CDFW. The FGC also prohibits the sale, possession, import, transport, transfer, or live release of *Caulerpa* spp. and live or dead mussels of the family Dreissenidae (e.g., quagga, zebra, dark false), unless under CDFW permit. CDFW also regulates the aquaculture industry, including the import, sale, and placement of aquatic plants and animals into state waters.

Native Plant Program

The Native Plant Program coordinates CDFW's statewide plant conservation efforts, issues scientific, educational and management permits for state-listed plants, manages grants for plant research and conservation through the Cooperative Endangered Species Conservation Fund (section 6) of FESA, evaluates CESA, and provides education and outreach regarding California's native plants.

Timberland Conservation Program

Forests maintain water quality, provide recreation opportunities, and generate economic activity and jobs. CDFW protects the natural resources of forests by reviewing timber harvest plans (THPs) to harvest trees from private or state-owned forest land. CDFW reviews THPs for potential significant impacts to wildlife, plants, and water quality. As a result of its review, CDFW may recommend changes to the THP necessary to avoid significant impacts to natural resources and take of a protected species.

3.3.4 Law Enforcement

CDFW employs wildlife officers/wardens to protect California's wildlife and natural resources. Wildlife officers are armed law enforcement officers with statewide arrest authority. They enforce California state laws related to hunting, fishing, pollution, endangered species, and wildlife habitat destruction. Wildlife officers are also expected to promote and coordinate hunter education programs, collect and report information on the conditions of fish and wildlife and their habitat, and represent the CDFW at local schools and meetings of special interest groups, e.g., hunting and fishing clubs, Lions Club, Rotary, Audubon.

Wildlife officers have assignments in both rural and urban areas of the state. They are typically assigned to and responsible for enforcing the law in a specific geographical area of the state. They enforce all fish and wildlife laws related to hunting, recreational and commercial fishing, trapping, pollution, falconry, and exotic animal laws.

The Law Enforcement Division maintains a confidential witness program, CalTIP (Californians Turn in Poachers and Polluters) that encourages the public to provide CDFW with factual information leading to the arrest of poachers and polluters.

The Law Enforcement Division also has a K-9 Program to assist wildlife wardens. The warden/dog teams are trained and certified to locate people, protect officers, and apprehend suspects, as well as detect certain odors and evidence.

Marijuana Cultivation's Effect on the Environment

Outdoor marijuana cultivation is damaging the state's natural resources. Marijuana cultivation sites (MCS), found on both public and private lands, are destroying critical fish and wildlife habitat through unpermitted substantial diversion of water from streams, removal of native riparian and upland vegetation, illegal take of fish and wildlife, harmful disposal of garbage and human waste, and chemical contamination and alteration of sensitive watersheds. Land is being converted for marijuana cultivation faster than ever before.

California produces more marijuana from outdoor grows than any other state. Marijuana may be the state's largest cash crop, with some publications estimating that value at $10-$14 billion annually. Large-scale cultivation of marijuana has proliferated in remote forested areas throughout California in response to ballot Proposition 215, the Compassionate Use Act (1996), which legalized the use and cultivation of marijuana for medical purposes. Nearly all of the marijuana cultivation on private lands is occurring without regard to other applicable laws and regulations because cultivators do not apply for permits intended to protect water quality and fish and wildlife resources. Illegal marijuana cultivators and the cumulative effects of growing marijuana on public and private lands threaten public safety, impact wildlife, pollute the land and streams, and destroy habitat.

On June 20, 2014, the California Legislature approved the Governor's proposed budget which included a Budget Change Proposal that requested resources and staff for both CDFW and the State Water Resources Control Board (SWRCB) to reduce environmental damage caused by marijuana cultivation on public and private lands in California. CDFW created the Watershed Enforcement Team (WET) which is composed of seven staff: an enforcement Lieutenant as lead, two game wardens, two environmental scientists, an assistant government program analyst, and an attorney. The goal of the team is to work collaboratively with the water board to investigate environmental impacts associated with marijuana cultivation (i.e., infrastructure development and water diversions) which substantially impact the state's fish and wildlife resources.

CDFW also maintains a Wildlife Forensic Laboratory (WFL). To protect wildlife from abuse by poaching, CDFW Officers must be able to determine as much as possible about the sex, species, age, and origin of bloodstains and tissue they confiscate or find. For example, in the course of an investigation, tissue samples may be collected at the site of a kill, bloodstains and hairs may be found in a vehicle, and frozen meat seized at a residence. Such samples can provide not only investigative information, but can also later be used as evidence in a court of law. A critical link in the impact of this evidence is the amount of information that can be obtained through analyses at a forensics laboratory.

The term "forensic" is most simply defined as the application of science to the purposes of the law. "Crime labs" are laboratories which, as their primary function, conduct forensic analyses on physical evidence exclusively in criminal cases and provide legally acceptable reports and expert testimony regarding their findings. WFL is the sole molecular biology laboratory for CDFW and fulfills a crucial and ever-expanding role in protecting California's wild resources. Maintained since the early 1950s, WFL's sole purpose and mission is to use accepted forensic science procedures to examine, analyze, report and testify at criminal trials on physical evidence seized by CDFW officers in criminal cases. During the past sixty plus years, thousands of poachers have been convicted of crimes perpetrated on wildlife partially because of results provided by WFL on evidence submitted by CDFW Officers.

The primary duties of CDFW's Wildlife Forensic Laboratory include:

- assisting CDFW Officers in determining if a wildlife law has been broken;
- identifying the species and subspecies of fish and wildlife evidence, including blood, tissues, hairs, and illegally marketed products;
- utilizing the most modern forensic DNA and serological techniques in the physical examination of evidence; and
- providing objective, independent scientific analysis of evidence to identify the guilty and exonerate the innocent.

3.3.5 Office of Spill Prevention and Response

The 1989 Exxon Valdez oil spill in Alaska was a wake-up call for the United States. It clearly identified the need to develop a comprehensive oil spill prevention and response program. In no place, outside of Alaska, was that call heard louder than in California. Public concern hit a threshold, in February 1990, when the tanker vessel American Trader discharged 10,000 barrels of oil into Southern California waters, oiling an estimated 3,400 birds and forcing the closure of 25 kilometers of prime beach for five weeks. As a direct result of the public's demand for action, the California legislature passed the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990 that established the Office of Spill Prevention and Response (OSPR). OSPR, as a division of the CDFW, is the lead state agency charged with the mission:

> "…to provide the best achievable protection to California's natural resources by preventing, preparing for, and responding to spills of oil and other deleterious materials, and through restoring and enhancing affected resources."

OSPR, and its mission, is unique in that it is one of the only state agencies in the United States with combined regulatory, law enforcement, pollution response, and public trust authority for waters of the state. Thus, OSPR's dual regulatory / trustee authority assures that oil spill prevention and response to spills will safeguard wildlife and the ecosystems in which they live and restore these resources when injured by pollution incidents.

In 2014, Governor Edmund G. Brown Jr. signed Senate Bill 861, expanding the OSPR program from marine-only to cover all statewide surface waters at risk of oil spills from any source, including pipelines and the increasing shipments of oil transported by railroads. This bill provided critical authority and administrative funding for increased spill response staffing for inland areas, wildlife rescue and care, industry preparedness, and continued coordination with local, state and federal government along with industry and non-governmental organizations. Key objectives for implementing a comprehensive statewide program of oil spill prevention, preparedness, and response are:

- establish spill staffing and resources in strategic inland areas of the state;
- develop and implement effective spill response planning regulations to ensure industry readiness for responding to spills;
- work with the Oiled Wildlife Care Network (UC Davis) to identify and prepare for wildlife response needs in inland environments; and
- forge strong partnerships with local, state, and federal governmental agencies to facilitate coordinated planning efforts and effective responses to spills.

Marine Invasive Species Program

Marine Invasive Species Program within OSPR coordinates with the California State Lands Commission (SLC) to control the introduction of Non-Indigenous Species (NIS) from the ballast of ocean-going vessels. Marine Invasive Species Program is responsible for conducting biological surveys to assess the amount and types of marine invasive species present in state coastal and estuarine waters, and the degree of success of ballast water management activities. OSPR manages the California Aquatic Non-Native Organism Database and is working to establish consistency among the various major databases being used to analyze similar types of aquatic invasive species-related information (CDFW 2015b).

3.3.6 Office of Communications, Education, and Outreach

The Office of Communications, Education, and Outreach was formed in October 2005 with the intention for CDFW to more effectively engage with constituents. Communications, education and outreach activities are a valuable means to reach the people served by CDFW. It is evident the state's ongoing population growth, especially in urban areas, continues to put pressure on fish and wildlife resources, thus increasing the challenges of resource management.

CDFW continues to identify, connect with, and provide education to targeted audiences who are traditionally not reached as potential partners in conservation without excluding traditional constituencies (e.g., hunters, commercial and recreational anglers, conservation groups). Marketing specialists have been targeting non-traditional groups with like interests for partnerships. An example is the "Be Bear Aware" program which partners with sanitation officials in the Lake Tahoe Basin to reduce bear/human conflicts.

CDFW works to instill conservation education in California's youth through strong community outdoors programs (e.g., Fishing in the City, Nature Bowl) as well as classroom education programs (e.g., Archery in the Schools Program, Classroom Aquarium Education Program).

- The Fishing in the City Program, established in 1993, serves Californians living in the Sacramento, San Francisco, and Los Angeles metropolitan areas. The Program gives city dwellers an opportunity to learn how to fish, and to fish close to home. Ponds are stocked with trout in winter and catfish the rest of the year.
- The Nature Bowl is an annual science based educational program for 3rd – 6th graders that increases ecological knowledge and conservation literacy. In team settings, students learn about the environment while building teamwork skills and creative and critical thinking skills. The Nature Bowl Program includes teams of Sacramento Valley and Northern/Central Sierra Nevada elementary students.
- The National Archery in the Schools Program (NASP) is an international-style archery program taught by teachers and delivered to students in physical education classes in grades 4-12. In California, the program CalNASP is administered by CDFW with the Department of Education.
- The Classroom Aquarium Education Program allows students to experience the hatching of fish eggs and coordinated activities to teach them first-hand the value of aquatic environments. Students learn the balance that must be met to maintain and preserve California's fisheries and aquatic habitats, and how their personal actions affect these resources.

Aquatic Education Programs

CDFW leads Aquatic Education Programs on CDFW lands throughout California, such as those that occur at the Back Bay Science Center and Elkhorn Slough National Estuarine Research Reserve.

Back Bay Science Center **(http://www.backbaysciencecenter.org/programs/). Education programs on the island are led by CDFW staff with the help of volunteers from the Newport Bay Conservancy. Programs involve several learning stations including an investigation of plankton, animals living in the mud, the watershed, birds and water quality.**

Elkhorn Slough National Estuarine Research Reserve **(https://www.wildlife.ca.gov/Lands/Places-to-Visit/Elkhorn-Slough-ER#973290-recreation). Each year, about 5,000 students experience the Reserve as an outdoor classroom as part of a school field trip. They can choose to do a variety of field activities from plankton sampling to bird monitoring. Another targeted audience for education is the coastal decision makers of the region. Topics include special status species workshops, coastal management issues as well as professional training regarding meeting facilitation.**

3.3.7 Wetland Restoration for Greenhouse Gas Reduction Program

The CDFW Wetlands Restoration for Greenhouse Gas Reduction Program was developed in response to the Global Warming Solutions Act of 2006. Pursuant to Assembly Bill 32 (AB 32), the Air Resources Board created a market-based Cap-and-Trade Program as a key element of its overall greenhouse gas (GHG) reduction strategy. The program establishes a statewide emissions limit on the sources responsible for 85 percent of GHGs and creates a financial incentive for investment in clean and efficient technologies. California's Cap-and-Trade Program includes an auction system where tradable permits (called *allowances*) can be purchased from the state at quarterly auctions. The state's portion of the proceeds from Cap-and-Trade auctions is deposited in the Greenhouse Gas Reduction Fund (GGRF), and is used to fund projects that support efforts to reduce GHG emissions.

The Budget Act of 2014 appropriated $25 million to CDFW for restoration or enhancement of wetlands in the Sacramento-San Joaquin Delta, coastal wetlands statewide, mountain meadow habitat, and for improving water use efficiency/restoring wetlands on CDFW lands. This funding is being administered through the Wetland Restoration for GHG Reduction Program to support projects that reduce GHG emissions and provide co-benefits such as enhancing fish and wildlife habitat, protecting and improving water quality and quantity, and helping California adapt to climate change.

3.3.8 Proposition 1 Restoration Grant Programs

The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1), which California voters passed in November 2014, provided funding to implement the three broad objectives of the California Water Action Plan: (1) more reliable water supplies; (2) the restoration of important species and habitat; and (3) a more resilient, sustainably managed water resources system (e.g., water supply, water quality, flood protection, environment) that can better withstand inevitable and unforeseen pressures in the coming decades.

Proposition 1 amended the California Water Code to add, among other articles, Sections 79737 and 79738, authorizing the Legislature to appropriate $372,500,000 to CDFW to fund multi-benefit ecosystem and watershed protection and restoration projects. CDFW is distributing these funds on a competitive basis through two grant programs established in July 2015, collectively referred to as the Proposition 1 Restoration Grant Programs.

The Watershed Restoration Grant Program ($285,000,000) is focused on watershed restoration and protection projects of statewide importance outside of the Sacramento-San Joaquin Delta (Delta). The Delta Water Quality and Ecosystem Restoration Grant Program ($87,500,000) is focused on water quality, ecosystem restoration and fish protection facilities that benefit the Delta.

4 Statewide Conservation Strategies

> "The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired in value."
>
> – Theodore Roosevelt

CDFW and its partners have developed standardized categories of conservation strategies for SWAP 2015. Conservation strategies are a set of actions intended to reduce pressures and improve the viability of targets. Conservation strategies have been designed to achieve desired outcomes for the conservation targets, called goals. In the most general sense, the overall goal of SWAP 2015 is to enhance the viability of ecosystems. Therefore, the conservation strategies are meant to work toward the ultimate goal of enhancing ecosystems. Figure 4-1 is an expanded version of Figure 1.5-6 and shows the conceptual relationship among conservation strategies, pressures, stresses, key ecological attributes (KEAs), and ecosystem targets developed for SWAP 2015. In most cases, multiple conservation strategies are needed to work together to achieve the desired outcomes for ecosystems.

Recognizing that many conservation practitioners, whether federal, state, or local agencies; tribal governments; non-governmental organizations; or private land-owners, are working toward the goal of conserving natural resources, CDFW has chosen to use standardized terms consistent with the *Open Standards for the Practice of Conservation* to assess and describe conservation strategies. The conservation strategies are also classified into broad categories to facilitate communication both among CDFW staff and with external conservation partners and the public.

This chapter presents the statewide goals for SWAP 2015 and describes each category of conservation strategy to achieve those goals. The specific strategies for each target are presented by province in Chapter 5 and for anadromous fish in Chapter 6. Chapter 8 illustrates the rationales behind choosing those strategies for SWAP 2015 by showing the chain of expected results derived through strategy implementation and how the progress of implementation and the accompanying sequence of expected interim results eventually lead to the achievement of desired outcomes.

4.1 Statewide Goals

Three statewide goals to enhance California ecosystems have been identified for SWAP 2015 as described below. These overarching goals, with their associated sub-goals, represent the desired ecological outcomes of SWAP 2015 implementation.

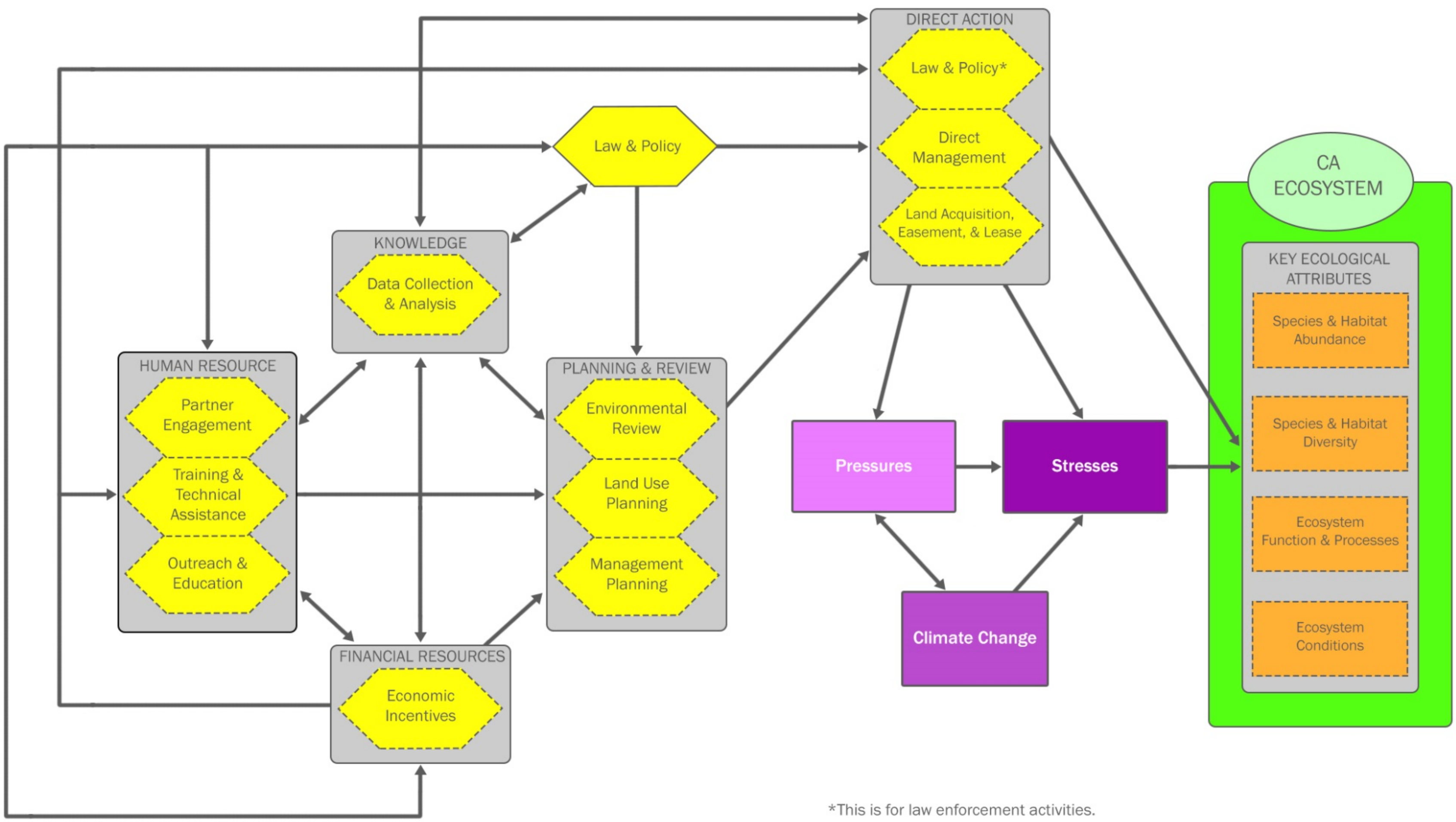


Figure 4-1 Conceptual Model for Conservation Strategies

Goal 1 – Abundance and Richness: Maintain and increase ecosystem and native species distributions in California while sustaining and enhancing species abundance and richness.

- *Goal 1.1 (Ecosystem Distribution):* Maintain and increase ecosystem distributions.
- *Goal 1.2 (Native Species Range and Distribution):* Maintain and increase native species ranges and distributions.
- *Goal 1.3 (Native Species Abundance and Richness):* Sustain and enhance native species abundance and diversity, including genetic diversity.
- *Goal 1.4 (Ecosystem Richness):* Sustain and enhance ecosystem diversity.

Goal 2 - Enhance Ecosystem Conditions: Maintain and improve ecological conditions vital for sustaining ecosystems in California.

- *Goal 2.1 (Connectivity):* Maintain and improve connectivity vital for sustaining ecosystems (including those relevant to vegetation, wildlife corridors, genetic permeability, water flow, floodplains [longitudinal and lateral], and groundwater.)
- *Goal 2.2 (Community Structure and Composition):* Maintain and improve community structure and composition vital for sustaining ecosystems (including age structure, structural heterogeneity, habitat richness, and native and key species population levels).
- *Goal 2.3 (Water Quality, Quantity and Availability):* Maintain and improve water quality (including temperature, chemistry, and pollutant/nutrient concentrations and dynamics) and water quantity and availability vital for sustaining ecosystems and their attributes (including ocean, lakes, rivers, streams, groundwater, and snowpack).
- *Goal 2.4 (Soil and Sediment Quality):* Maintain and improve soil and sediment quality vital for sustaining ecosystems (including soil moisture, chemistry, and pollutant/nutrient concentrations and dynamics).

Goal 3 - Enhance Ecosystem Functions and Processes: Maintain and improve ecosystem functions and processes vital for sustaining ecosystems in California.

- *Goal 3.1 (Successional Dynamics):* Maintain or improve successional dynamics vital for sustaining ecosystems.
- *Goal 3.2 (Disturbance Regime):* Maintain or improve disturbance regimes vital for sustaining ecosystems (including fire, flooding and grazing regimes).
- *Goal 3.3 (Hydrological Regime):* Maintain or improve hydrological regimes vital for sustaining ecosystems (including riverine, lacustrine, and estuarine hydrodynamics).
- *Goal 3.4 (Sediment Deposition Regime):* Maintain or improve sediment deposition regimes vital for sustaining ecosystems (including hydro-geomorphic processes, wind-driven processes, and soil stability).

4.2 Categories of Conservation Strategies

Standardized categories of conservation strategies have been developed in SWAP 2015 to organize the specific conservation strategies developed for each of the conservation targets. The use of categories allows the SWAP program to aggregate and analyze information across scales. For example, Table 4.2-1 shows, at a state-wide level, the strategies that are most commonly applied to each pressure identified for the priority conservation targets. Implementation of these strategies are not limited to CDFW actions or confined to CDFW lands. Forming and facilitating partnerships, alliances, and networks of organizations is vital to implementation of SWAP 2015. These strategies are not limited to the targets and conservation units described in Chapter 5, but should be considered appropriate to apply to any and all habitats or SGCNs in California when relevant.

Eleven categories of conservation strategies have been identified that provide overall conservation benefits statewide and are described below. These categories contain the strategies to achieve the goals presented in Section 4.1. The overall objective of each strategy is to reduce the negative impacts of pressures and stresses resulting in maintained or improved viability of the conservation targets, or to create and enhance conditions so that those actions can occur. Strategies can be applied to pressures, stresses, or directly to the KEAs. Some categories are intended as precursors to other categories as show in Figure 4-1. They are aimed at the development and implementation of other conservation strategies. The first three categories discussed below, Data Collection and Analysis, Partner Engagement, and Management Planning, are examples of these precursors that improve the capability of direct conservation actions on the ground.

The standardized categories of conservation strategies for SWAP 2015 are based on the categories developed by the Effectiveness Measures Working Group of the Associated of Fish and Wildlife Agencies' (AFWA) Teaming with Wildlife Committee (AFWA 2011). The categories are also based on conservation actions that are most commonly funded by State Wildlife Grants (SWG). CDFW adapted the categories to meet the needs of conservation in California. Using the standardized categories of conservation strategies allows CDFW to evaluate the desired outcomes and effectiveness measures across the state. The desired results, including goals, objectives, and effectiveness measures for the categories of conservation strategies, are described in Chapter 8.

Categories of Conservation Strategies

- Data Collection and Analysis
- Partner Engagement
- Management Planning
- Direct Management
- Economic Incentives
- Environmental Review
- Land Acquisition, Easement, and Lease
- Land Use Planning
- Law and Policy
- Outreach and Education
- Training and Technical Assistance

The specific conservation strategies developed for each conservation target are contained within these standardized categories and are described in more detail at the province level in Chapter 5. Appendix E identifies the strategies proposed for each conservation target.

Table 4.2-1 Number of Conservation Strategy Categories Addressing Each Pressure

Pressure	Strategy Category										
	Data collection and analysis	Partner engagement	Management planning	Direct management	Economic incentives	Environmental review	Land acquisition, easement, and lease	Land use planning	Law and policy	Outreach and education	Training and technical assistance
Agricultural and forestry effluents	○	○	○	○		○		○	○	○	○
Airborne pollutants	○	○	○			○		○	○		
Annual and perennial non-timber crops	●	○	○	●	○		●	○	○	○	○
Catastrophic geological events	○										
Climate change	●	●	○	○	○	○		○	○	○	○
Commercial and industrial areas[1]	○	○	○	○	○	○	●	○	○	○	
Dams and water management/use[2]	○	●	○	○	○	○	○	○	○	○	
Fire and fire suppression	▣	▣	○	▣				○	○	○	○
Garbage and solid waste	○	○	○			○			○	○	○
Household sewage and urban wastewater[3]	○		○					○	○	○	○
Housing and urban areas[1]	●	●	○	○	○	○	▣	○	○	○	
Industrial and military effluents[4]		○	○					○	○	○	
Fishing and harvesting aquatic resources		○	○			○			○	○	
Introduced genetic material	○	○	○	○						○	○
Invasive plants/animals	▣	▣	▣	■	○		○	○	○	◉	○
Livestock, farming, and ranching	○	●	●	▣	○		●		●	●	○
Logging and wood harvesting	○	○	○			○	○		○	○	
Marine and freshwater aquaculture	○	○	○	○				○	○	○	
Military activities		○									
Mining and quarrying			○	○							
Other ecosystem modifications[5]			○	○				○	○	○	
Parasites/pathogens/diseases	○	○	○	○	○			○	○	○	
Recreational activities	○	○	○	○				○	○	○	○
Renewable energy	○	●	○	○			○	○		○	
Roads and railroads	○	●	○	○	○	○	○	○	○	○	
Shipping lanes[6]	○	○	○					○	○	○	
Tourism and recreation areas	○	○					○	○	○		
Utility and service lines	○	○	○				○	○		○	
Wood and pulp plantations	○			○			○		○		○

Number of strategies: ○ = 1-9, ● = 10-19, ▣ = 20-29, ◉ = 30-39, ■ = 40-49

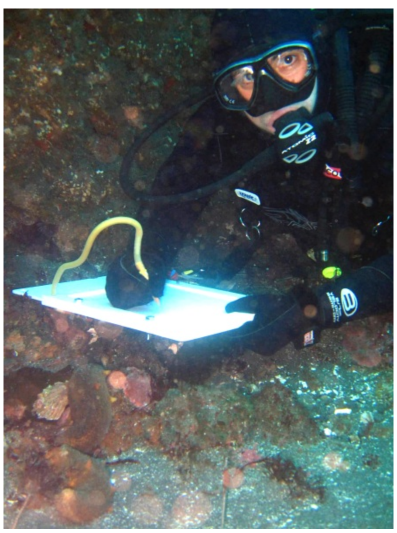
Pressures include the following, which are unique to the Marine Province:

[1] Shoreline development, artificial structures
[2] Urban runoff
[3] Point discharge
[4] Hazardous spills and point discharge
[5] Modification of mouth/channels and ocean/estuary water diversion/control
[6] Ballast water

Table 4.2-1 also shows the pressures that were most commonly identified across the state and what types of conservation strategies will be used to address those pressures. For example, invasive plants and animals was the most commonly identified pressure across all conservation targets. Direct Management and Outreach and Education are the most common strategies identified to reduce the pressure, followed by Data Collection and Analysis, Partner Engagement, and Management Planning.

SWAP 2015 helps implement national and state programs for climate adaptation and invasive species management. Appendix G identifies how SWAP 2015 conservation strategies align with the federal and state climate adaptation strategies described in Section 2.5.3, so important climate adaptation co-benefits are obtained while implementing SWAP 2015 strategies. Appendix F identifies the relationship between SWAP 2015 strategies and the National Invasive Management Plan (NISC 2008) and California's strategic framework for managing invasive species (ISCC 2011).

4.2.1 Data Collection and Analysis


Athena Maguire, CDFW

Data collection and analysis of Species of Greatest Conservation Need (SGCN), their habitats, and the pressures affecting them are needed to help identify appropriate conservation strategies. Robust data and thorough analysis facilitate more effective implementation of conservation strategies under the other categories. This category may also include data collection on performance and compliance measures. This conservation category includes data compilation, management, synthesis, analysis, and reporting of spatial and non-spatial data. It includes stand-alone research conducted to fill basic knowledge gaps and does not include research that is a minor component of implementing another action. Development and implementation of effective conservation strategies require that state natural resource managers and their partners have data available to them that answer specific resource management questions related to conservation targets and relevant pressures. As such, data collection and analysis is one of the most common conservation categories identified by the CDFW. Specific conservation strategies in this category may include:

- Collect baseline and long-term data for conservation targets and SGCN to understand their viability status and trends. This includes universally applicable information on multiple species throughout the state, such as vegetation and habitat inventory and mapping for terrestrial species, water quality and seasonality data for aquatic and amphibious species, and basic census techniques for groups of vertebrates (e.g., breeding bird census, live mammal trapping, radio collaring large mammals, herpetological census).

- Conduct research to design more effective conservation strategies.
- Collect data on climate impacts and climate refugia.
- Analyze impacts of a particular pressure on a conservation target and explain correlations of human and abiotic effects on species distribution and demographics.
- Conduct comprehensive ecological assessment on individual species, guilds, and ecosystems.
- Conduct groundwater and surface water assessment.
- Include performance monitoring.

The steps to achieve the desired outcomes of the Data Collection and Analysis category are: (1) identify information needs in coordination with state agencies and other partners; (2) collect data to answer relevant questions; (3) convey data to the correct people in appropriate format; (4) use data to inform more effective conservation strategies (see outcomes for other strategies); (5) apply the strategies to reduce the negative impacts of pressures and stresses on the conservation target(s); and (6) achieve improved or maintained viability of conservation target(s).

4.2.2 Partner Engagement

This conservation strategy category includes engaging state and federal agencies with natural resources responsibilities, tribal entities, non-governmental organizations, private landowners, and other partners to achieve shared conservation goals and objectives encompassing broader coordination and collaboration across jurisdictions, geographies, or areas of interest. CDFW's Partner Engagement category includes strategies that create positive work environments through developing and sustaining solid partnership that lead to the development and implementation of more effective conservation strategies. CDFW recognizes the importance of Partner Engagement to successfully manage ecosystems and their associated SGCN. As a result, Partner Engagement is one of the most common categories of conservation strategies identified in SWAP 2015. Specific conservation strategies in this category may include:

- Establish partnerships with other agencies, governments, organizations, and private landowners.
- Maintain and enhance partnerships.
- Engage in decision-making process of partner entities.

The steps to achieve the desired outcomes of the Partner Engagement category are: (1) identify the outcomes that require a strategic partnership; (2) identify natural resource managers and other stakeholders for partnering; (3) engage partners; (4) develop more effective conservation strategies with partners (see outcomes for other strategies); (5) apply the strategies to reduce the negative impacts of pressures and stresses on the conservation target(s); and (6) achieve improved or maintained viability of conservation target(s).

4.2.3 Management Planning

The category of Management Planning includes development of management plans for species, habitats, and natural processes and conditions. Development of management plans for conservation targets will lead to the development and implementation of more effective conservation strategies. Therefore, it allows for more effective implementation of conservation strategies under the other categories. Management Planning will typically undergo a public process and will serve as the road map of conservation strategies and implementation for the agency adopting the plan. For example, CDFW's Marine Region has been involved in a process to revise its "Master Plan, A Guide to the Development of Fishery Management Plans." During that time, a few Fishery Management Plans have been developed, such as for lobster, and more are planned in various formats, including a potential scaled-down versions.

Specific conservation strategies in this category may include:

- Develop and implement Habitat Conservation Plans (HCPs), Natural Community Conservation Plans (NCCPs), and land, aquatic, or marine resource management plans that incorporate long term management and monitoring.
- Update existing management plans.
- Include best management practices (BMPs) to guide conservation strategies in management plans.
- Develop basin management plans to provide guidance on a watershed basis.
- Integrate resource management for multiple objectives, including developing wildlife-friendly fire management, outdoor recreation management, or watershed management.
- Provide meaningful input and engage with local and state agency planning and decision-making processes.

The steps to achieve the desired outcomes of the Management Planning category are: (1) identify the compelling need for a management plan; (2) involve key stakeholders to support the development of the plan; (3) develop a complete management plan; (4) consider and evaluate alternative strategies in the planning process; (5) secure agreement among key agencies and stakeholders a to implement the plan, implement the actions, and monitor the plan's effectiveness; (5) use the plans to implement more effective conservation strategies (see outcomes for other strategies); (6) apply the strategies to reduce the negative impact of pressures and stress on the conservation target(s); (7) achieve improved or maintained viability of conservation target(s); and (8) management plan leads to more effective conservation strategies.

4.2.4 Direct Management

The conservation category of Direct Management involves the stewardship of habitats and natural processes to maintain, increase, and/or restore species populations and ecological functions and ecological conditions. Direct Management is one of the most common and fundamental conservation categories used by CDFW to manage ecosystems and their associated SGCN. Partner Engagement strategies in conjunction with Direct Management strategies will allow efforts to occur on non-CDFW lands. Before implementing a Direct Management strategy, a management plan may be needed (see Management Planning category). Management Planning informs the Direct Management strategies that should occur. Specific conservation strategies in this category may include:

- Protect, restore, and enhance habitat for SGCN.
- Protect and restore floodplain function.
- Manage dams and other barriers and impediments to water flow or fish movement.
- Manage water, including restoration of natural flows and flow patterns, promotion of water conservation, and development of alternative water sources.
- Manage invasive species.
- Promote hunting and fishing as a conservation tool to use when working to eradicate or control invasive or non-native game species.
- Implement BMPs.
- Promote responsible grazing as a conservation tool.
- Implement controlled burns and other fuel-reduction treatments.
- Translocate or reintroduce native species.
- Maintain roads and manage off-highway vehicle use.
- Develop protective buffers to sensitive ecosystems.

The steps to achieve the desired outcomes of the Direct Management category are: (1) implement management actions; (2) reduce the negative impact of identified pressures; (3) reduce stresses to conservation target(s). If desired pressure and/or stress reduction does not occur, then (4) adjust management actions as appropriate, based on monitoring efforts; and (5) achieve improved viability of conservation target(s).

4.2.5 Economic Incentives

The Economic Incentives category includes development and delivery of economic incentives to private landowners and other stakeholders to implement responsible stewardship of landscapes, ecological processes and conditions, and specific species. It is first expected that a project team would clearly define appropriate incentives for sound stewardship that is designed to improve the status of conservation target(s). Incentives could come in a variety of forms, such as compensation for stewardship costs or loss of income as a result of the stewardship; assistance with efficient compliance with regulatory requirements, which allows them to save money or time; added value from responsible stewardship (e.g., obtaining certifications, attracting hunters or eco-tourists); and technical assistance, which could also help them to apply for money or other incentives programs. The incentives should provide an impetus to start or continue effective management, but the long-term goal is for stakeholders to recognize the benefit of continuing those practices for an extended duration and to work with managers to implement these practices. Specific conservation strategies in this category may include:

- Develop and provide economic incentives and assurances.
- Seek funding through grants, cooperation with other agencies, and other opportunities as a source for economic incentives.

The steps to achieve the desired outcomes of the Economic Incentive category of strategies are: (1) convey incentives to stakeholders for responsible stewardship; (2) use the incentive to motivate stakeholders to continue responsible stewardship; (3) apply responsible stewardship practices to reduce the negative impacts of pressures and stresses on conservation target(s); and (4) achieve improved viability of conservation target(s).

4.2.6 Environmental Review

The Environmental Review category is fundamentally intended to avoid, minimize, or mitigate/compensate for pressures that may adversely affect conservation targets. The Environmental Review category may be supported by strategies in the Laws and Policy category that trigger reviews. This can include review during the California Environmental Quality Act (CEQA) process of conservation and non-conservation-oriented policies, projects, and plans. Under CEQA, CDFW may provide comments to a lead agency for a project either as a "responsible agency," when it has approval authority over some aspect of a project, and/or as a "trustee agency" with the legal jurisdiction to protect fish and wildlife of the state. Where significant effects on wildlife are identified, CDFW makes recommendations to avoid, minimize, and/or mitigate those significant effects. Specific conservation strategies in this category may include:

- When acting as lead agency, prepare environmental documents that fully meet the requirements and intent of CEQA, including ensuring that project impacts on conservation targets are mitigated to below a level of significance, as possible, as defined in CEQA, as feasible.
- When acting as a responsible agency, provide input during CEQA review to lead agencies to require that project impacts on conservation targets are mitigated to below a level of significance, to the extent feasible, in the area subject to CDFW approval authority. As a responsible agency, CDFW also acts as a trustee agency with the authority to provide input on project impacts outside of its approval authority, as described below.
- When acting as a trustee agency, provide input during environmental review to lead agencies to promote mitigation of project impacts on conservation targets to below a level of significance, to the extent feasible, recognizing that CDFW has a trustee responsibility for fish and wildlife resources.

The steps to achieve the desired outcomes of the Environmental Review category are: that (1) sufficient CDFW staff capacity exists to provide input; (2) gather sufficient information for use in providing input to lead agencies; (3) provide input during environmental review to lead agencies; (4) recommend actions to help achieve conservation needs during the CEQA public comment periods; (5) require the lead agency to incorporate CDFW recommendations as conditions of project approval, if serving as a responsible agency, or promote voluntary implementation of those recommendations, if serving as a trustee agency; (6) implement the CDFW-recommended strategies intended to benefit the conservation target(s); (7) apply the strategies to reduce the negative impacts of pressures and stresses on conservation target(s); and (8) achieve improved viability of conservation target(s).

4.2.7 Land Acquisition, Easement, and Lease

Obtaining land or water rights through fee-title acquisition, conservation easement, lease, contract, or related means are included in the Land Acquisition, Easement, and Lease category. Partner Engagement strategies in conjunction with these strategies will allow actions to take place on non-CDFW lands. The success of the conservation strategies in the Land and Water Acquisition, Easement, or Lease category depends on securing sufficient funds for the initial transaction and then purchasing, leasing, or obtaining a conservation easement for the prioritized lands and water. Steps include developing a management and monitoring plan and allocating funds for implementation. The responsible party then needs to implement the management and monitoring work, which would ameliorate the negative impacts of pressures to the conservation target. If the land or water is leased, over time the responsible entity will need to renew the lease or convert to a more permanent form of protection. If the land or water is placed under conservation easement, the easement conditions must be monitored to ensure they stay in compliance. Specific conservation strategies in this category may include:

- Protect land and/or water through acquisition fee-title ownership or preferably conservation easements.
- Acquire or protect through conservation easements habitat areas important for the conservation target.
- Acquire water rights to protect aquatic habitat including use of Water Code Section 1707.
- Acquire lands or protect through conservation easements, and/or water to maintain wildlife corridors to connect parcels of protected (conserved lands and/or water).
- Create refuges/protected areas.
- Create and expand existing CDFW Wildlife Areas and Ecological Reserves.
- Authorize acquisition or protection through conservation easements of property and/or water rights.

The steps to achieve the desired outcomes in the Land Acquisition, Easement, and Lease category are: (1) obtain sufficient funds for the initial transaction; (2) priority lands or water with high conservation value are identified; (3) purchase, lease, or secure a conservation easement to protect priority lands and water; (4) develop management and monitoring plans; (5) allocate funding for management and monitoring on an annual basis; (6) implement appropriate management and monitoring; and adjust management actions to reduce the negative impacts of identified pressures and stresses, as needed, based on monitoring (see Direct Management category); (7) apply strategies to reduce the negative impacts of pressures and stresses on conservation target(s); (8) maintain compliance of the easement or lease on the land or water being protected in perpetuity; and (9) achieve improved viability of conservation target(s).

4.2.8 Land Use Planning

The Land Use Planning category includes leading or participating in planning activities for rural, urban, agricultural, or coastal lands where conservation targets are present. It involves understanding the decision-making process and identifying a mechanism to inform planning decisions. It may also involve using data collection and analysis to identify wildlife needs and habitat priorities within the involved government jurisdictions (see Data Collection and Analysis category). These results will encourage Land Use Planning actions that are consistent with conservation needs. If this happens as anticipated, Land Use Planning will need to be implemented consistent with the identified conservation needs. In these circumstances, expected negative impacts of pressures and/or stresses will be minimized to help improve the viability of the conservation target(s). Specific conservation strategies in this category may include:

- Provide input on local land use plans and participate in local decision-making processes that affect conservation targets.
- Develop regional HCPs and NCCPs that integrate conservation planning with local land use planning.
- Develop statewide strategies for siting major infrastructure projects, such as roads, water conveyance facilities, desalination plants, and renewable energy development.
- Incorporate BMPs for land use development and public infrastructure that may affect conservation targets, such as roads, transmission lines, or railroads.

The steps to achieve the desired outcomes of the Land Use Planning category are: (1) identify stakeholders and mechanisms to effectively inform decisions; (2) provide guidance for land use and development decisions identified and articulated in the plan; (3) encourage the preparation of a land use plan that is consistent with the input being provided by CDFW; (4) implement the land use plan with conservation strategies consistent with CDFW input; (5) apply the strategies to reduce the negative impacts of pressures and stresses on conservation target(s); (6) stresses are reduced; (7) adjustments are made based on monitoring; and (8) achieve improved viability of conservation target(s).

4.2.9 Law and Policy

The Law and Policy conservation category includes strategies to develop, change, influence, and implement legislation, regulations, policy, and voluntary standards that improve the practice of conservation of target species and habitats. This category also includes law enforcement to ensure legislation, regulations, policies, and voluntary standards are being effectively enforced. Specific conservation strategies in the Law and Policy category may include:

- Develop and support laws, policies, and regulations to protect natural resources.
- Support effective law enforcement.
- Develop BMPs for activities which could harm wildlife (e.g., mosquito abatement) or degrade or eliminate habitats.
- Participate in the legislative and regulatory decision-making process.
- Increase enforcement capacity to support compliance with environmental laws.

The steps to achieve the desired outcomes of the Law and Policy category, in addition to seeking substantial political and constituent support, are: (1) provide input from appropriate agencies and/or stakeholders regarding law or policy; (2) approve law or policy that is consistent with agency and/or stakeholder input; (3) effectively enforce laws or policies that are consistent with conservation objectives; (4) improve compliance with laws and policies that lead to strategies benefiting conservation targets; (5) apply strategies to reduce the negative impacts of pressures and stresses on conservation target(s); and (6) achieve improved viability of conservation target(s).

4.2.10 Outreach and Education

The Outreach and Education category involves the social sciences and reaches out to specific important groups, communities, resource users, policy makers, stakeholders and/or the public with information to improve awareness, gain knowledge, and change attitudes, and behaviors regarding protection of natural resources. It includes both formal (e.g., classroom or workshop) and informal education efforts (e.g., one-on-one or small group meetings and pamphlets). The strategies in the Outreach and Education category focus on providing information and materials to key resource users and stakeholders to inspire the adoption or reinforcement of behaviors that support SGCN and habitat conservation. The start of any outreach initiative involves being clear about the target audience and the effective messages and communication methods. If the audience receives the message, then the expectation is that they will have the desired knowledge, attitudes, and values to be better stewards of natural habitats and resources. This will, in turn, lead them to adopt or continue a practice that is consistent with the conservation message. The practice should result in a reduction in the negative impacts of pressures and/or stresses which would help improve the viability of the conservation target(s). Specific conservation strategies in this category may include:

- Develop and implement education and outreach programs, including those for wildlife-friendly fire management, outdoor recreation management, recreational and commercial fisheries management, agricultural activities, urban runoff, and the impact of invasive species.
- Engage urban and suburban residents about stewardship of natural resources.
- Develop partnerships for joint advocacy of conservation causes.
- Conduct demonstration management.

The steps to achieve the desired outcomes of the Outreach and Education category are: (1) identify the target audience, message, and appropriate media; (2) the target audience receives the desired conservation message; (3) the target audience adjusts behavior consistent with the conservation needs of the SGCN and their habitats; (4) the target audience adopts or continues behaviors consistent with the message resulting in improved conservation; (5) secure the support of stakeholders and the public to reduce the negative impacts of pressures and stresses on conservation targets; and (6) achieve improved viability of conservation targets.

4.2.11 Training and Technical Assistance

The Training and Technical Assistance category includes providing professional scientific training to managers, scientists, key stakeholders, or others involved in resource conservation to facilitate improved or new management activities and techniques. It includes stand-alone training efforts, workshops, collaborative technical assistance, and technical information sharing. Prior to developing and conducting the training sessions, a need and goal for the training must be determined, and specific skills to be delivered and audiences to receive these must be identified. Once these are determined, the curricula can be selected from existing sources or newly developed, and suitable trainers must be identified. Once the training itself takes place, trainees must demonstrate learning of the new skills and then ultimately apply these skills to development and implementation of more effective conservation strategies.

Technical assistance follows a similar pattern to training, but focuses more on solving immediate problems and practical skills delivery “on the ground” rather than developing capacity. First, a need and goal for technical assistance must be defined and specific skills to be delivered and audiences to receive these must be identified. Once these are determined, the method and providers of the assistance must be identified. Trainees or recipients of the assistance must demonstrate learning of the new skills and then ultimately apply these skills to development and implementation of more effective conservation strategies. Specific conservation strategies in this category may include:

- Develop training materials and information.
- Conduct training and technical assistance.
- Provide science-based application and tools that are useful for conservation activities.

The steps to achieve the desired outcomes of the Training and Technical Assistance category are: (1) identify needed skills/technical assistance and targeted audiences; (2) develop the appropriate curriculum and identify trainers or technical assistance providers; (3) assemble sufficient participants being trained or assisted; (4) educate the participants about the needed skills; (5) empower the sufficiently trained people to apply the learned skills; (6) apply the learned skills to reduce the negative impacts of pressures and stresses on conservation targets; and (7) achieve improved viability of conservation targets.

4.3 Statewide Summary of Most Common Key Ecological Attributes, Stresses, Pressures, and Strategies

Input provided by the regional teams was summarized using available data through June 2014 (Tables 4.3-1 through 4.3-4). This summary depicts a current statewide trend regarding the overall status of the state's ecosystem health, key conservation factors, and conservation actions needed to improve the ecosystem conditions. Several strategies have been created or refined since June 2014 and these changes are not reflected in the summary below. In addition, the pressure of "climate change" has not been included in this summary. Climate change is discussed in more detail in the province sections (Chapter 5).

Table 4.3-1 Most Commonly Identified Key Ecological Attributes

Key Ecological Attributes	Conservation Unit Type	
	Terrestrial	Aquatic
Area and extent of community	X	X
Community structure and composition	X	X
Connectivity among communities and ecosystems	X	X
Fire regime	X	
Successional dynamics	X	
Surface water flow regime		X

Table 4.3-2 Most Commonly Identified Stresses

Stress	Conservation Unit Type	
	Terrestrial	Aquatic
Change in annual average temperatures [climate related factor]	X	X
Change in annual average precipitation [climate related factor]	X	X
Change in natural fire regime	X	
Change in runoff and river flow		X
Change in water level and hydroperiod		X
Change in groundwater table		X
Change in spatial distribution of habitat types	X	
Change in community structure or composition	X	
Change in biotic interactions (altered community dynamics)	X	
Change in succession processes and ecosystem development	X	
Habitat fragmentation	X	

Table 4.3-3 Most Commonly Identified Pressures

Pressures	Conservation Unit Type	
	Terrestrial	Aquatic
Agriculture and forestry effluents		X
Annual and perennial non-timber crops	X	X
Dams and water management		X
Fire and fire suppression	X	X
Housing and urban development	X	
Introduced genetic materials		X
Invasive plants and animals	X	X
Livestock, farming, and ranching	X	X
Recreational activities	X	X
Roads and railroads	X	X
Utility and service lines	X	

Table 4.3-4 Most Commonly Identified Strategies

Strategies	Conservation Unit Type	
	Terrestrial	Aquatic
Data Collection and Analysis	X	X
Partner Engagement	X	X
Management Planning	X	X
Direct Management - Manage Invasive Species	X	X
Direct Management - Habitat Restoration	X	
Direct Management - Manage Dams and Other Barriers		X
Direct Management - Species Reintroductions		X
Land Acquisition, Easements, and Lease	X	X
Law and Policy	X	
Outreach and Education	X	X

5 Province-Specific Conservation Strategies

SWAP 2015 uses three geographic scales to differentiate and organize conservation strategies: conservation unit, province, and statewide. The conservation units are grouped into seven provinces that comprise the entirety of the state (Figure 5-1). This chapter describes regional conservation strategies organized by these seven provinces. The statewide conservation strategies are addressed in Chapter 4. Regional strategies provided in this chapter went through a statewide analysis to evaluate the overall status of the state's ecosystems as summarized in Chapter 4.

The seven provinces are:

- North Coast and Klamath
- Cascades and Modoc Plateau
- Central Valley and Sierra Nevada
- Bay Delta and Central Coast
- South Coast
- Deserts
- Marine

The conservation strategies for anadromous fish, however, have been developed at a statewide scale, because the geographic ranges of anadromous fish span many of the provinces developed for SWAP 2015. The organization of conservation strategies by conservation unit (i.e., ecoregion or hydrologic unit) or province does not adequately address their conservation needs. To capture their full lifecycle and geography, the conservation strategies for anadromous fish are discussed separately in Chapter 6.

In the following sections, information on provinces and conservation units are considered along with targets in those conservation units, as well as the strategies developed for the selected targets. The following is a more detailed overview of this chapter.

First the physical landscape, major natural features, and important terrestrial or aquatic resources of each province are described. A map at the beginning of each section shows land ownership in the province. The conservation units (i.e., ecoregions, hydrologic units, and marine conservation units) within each province are identified and are shown on province level maps. A map of the plant communities (i.e., macrogroups) occurring within each province is also provided.

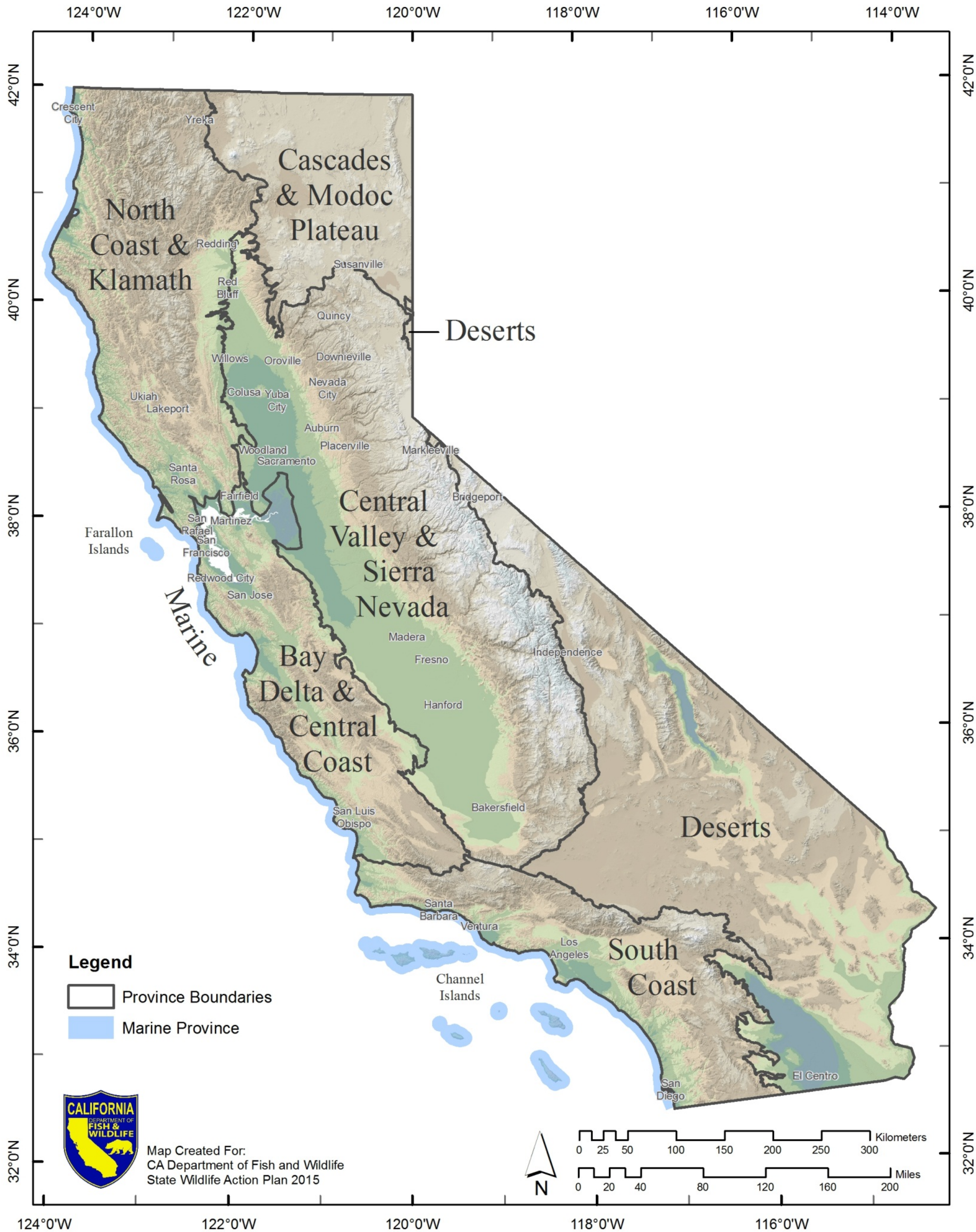


Figure 5-1 SWAP 2015 Provinces

A high-level description of the selected conservation targets (i.e., plant community, native aquatic species assemblage, or marine ecosystem) within each conservation unit is provided. CDFW regional teams conducted comprehensive analyses of the selected targets through a series of meetings during spring and summer of 2013. The major results from the undertaking comprise the remainder of the content in the subsections for each province.

The essential conservation factors for each target, referred to as key ecological attributes (KEAs), are identified along with the key species associated with the conservation target (i.e., focal species), including Species of Greatest Conservation Need (SGCN).

The status of the KEAs for each target was then investigated by analyzing the level of the degradation of the KEAs and other correlated ecological factors that are degraded (stresses). The sources of the degradation, called pressures, were analyzed further along with the level of negative impacts to the individual targets. Based on the information developed by CDFW regional teams, the most commonly identified stresses and pressures for the targets within each province were evaluated and are described.

A set of conservation strategies, including goals and objectives, were developed for each target and are described for each province. Goals articulate the desired future outcomes of the ecological condition of the target by implementing the strategies created. The objectives describe the desired future outcomes for some of the identified strategies that would become stepping stones to achieve the goals.

The individual conservation strategies are classified by the statewide categories described in Chapter 4, but include details specific to the target for each conservation unit. The measurable quantification of the goals is set initially at 5 percent (e.g., increase by 5 percent), but will be refined over time using the adaptive management process described in Chapter 8.

In addition, the regional analyses for each province are summarized at the end of each section.

This chapter presents Elements 1, 2, 3, and 4 of the SWAP required elements. At a province scale, the distribution and abundance of wildlife, conservation targets, stresses and pressures to priority conservation targets, and conservation strategies are described.

North Coast and Klamath Province

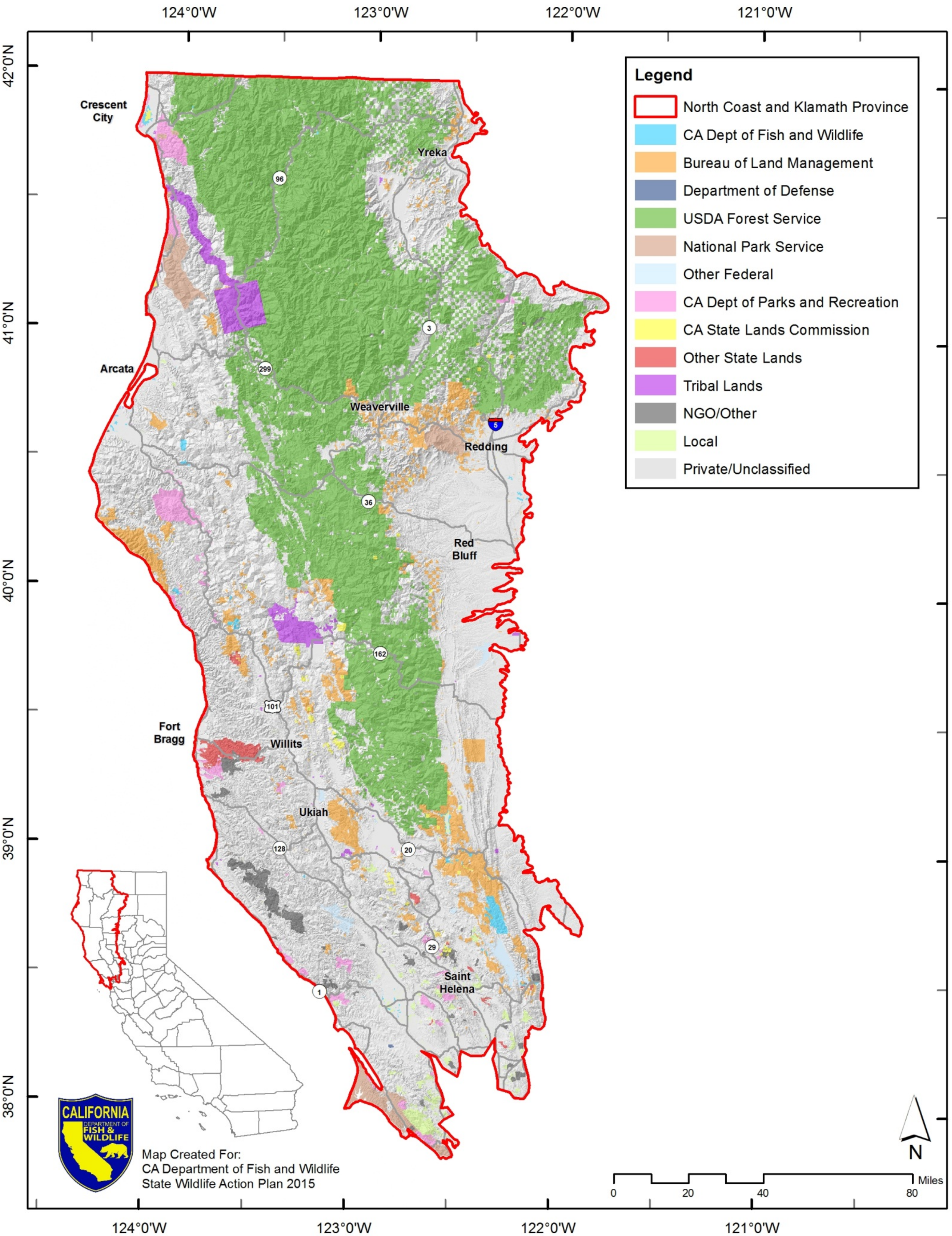
5.1 North Coast and Klamath Province

5.1.1 Geophysical and Ecological Description of the Province

Patricia Bratcher, CDFW

Encompassing approximately 14 million acres, the North Coast and Klamath Province extends along the Pacific coast from the California-Oregon border in the north to the San Francisco Bay watershed in the south (Figure 5.1-1). The province's eastern (inland) boundary is formed by the Cascade Range along the northern portion of the province and by the transition to the Sacramento Valley along the southern portion. The province is characterized by large expanses of rugged, forested mountains that range in elevation from 200 feet to 8,000 feet (U.S. Department of Agriculture [USDA] 1994), and includes the Klamath, Siskiyou, Marble, Trinity, and North Coast ranges. The Klamath Mountains consist of low- to moderate-elevation mountains or uplifted and dissected granitic, sedimentary, and volcanic rock formations that rise up to 8,000 feet. The coastal mountain ranges within the province are aligned somewhat parallel and rise to low to moderate elevation (i.e., up to about 7,500 feet). The climate varies considerably across the province, with high precipitation levels and moderated temperatures in many coastal areas and dry conditions with rain shadow effects and more extreme temperatures in some inland valleys. Overall, the province has a fairly wet climate and receives more rainfall than any other part of the state, feeding more than ten river systems.

The province's major inland waterways are part of the Klamath River system, which includes the Klamath, Scott, Shasta, Salmon, and Trinity rivers. In the upper portions of their watersheds, these rivers are centered in alluvial valleys that historically supported freshwater marshes and grasslands, but now have been converted to agriculture. Below these alluvial valleys, the Klamath-system rivers are generally confined between steep mountain slopes over most of their length and support fairly narrow riparian habitats. Most rivers in this province flow westerly in deeply incised canyons with bedrock controlled channels. Some easterly flowing streams, also in deeply incised canyons, flow inland to the Sacramento River. Dams are present on both the Klamath and Trinity Rivers. A significant portion of the Trinity River is diverted to the Sacramento River. Dams on the Klamath River divert mainly to local agricultural areas. Additionally, numerous lakes and meadows associated with glaciated areas occur above 5,000 feet within this province.



Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands

Figure 5.1-1 Land Ownership of the North Coast and Klamath Province

River systems draining the province's Coast Ranges include the Eel, Russian, Mattole, Navarro, Smith, Mad, and Gualala rivers, as well as Redwood Creek, numerous smaller coastal streams, and Humboldt Bay. Because the Coast Range is composed of soft, easily eroded soils, these rivers carry high sediment loads and have carved extensive floodplains that support riparian habitats. Most of the North Coast and Klamath Province's large rivers widen as they approach their ocean outlets, forming alluvial floodplains and deltas. These floodplains once supported mixed-conifer, extensive black cottonwood, willow, and red alder forests, but have now been largely converted to agricultural uses and rural developments.

North Coast and Klamath Province vegetation consists predominantly of conifer and mixed-conifer forests dissected by chaparral stands, riparian forests, and wetlands. Valley and foothill grassland and woodland communities emerge along the central and southern eastern border of the province, while coastal wetlands and marshes appear along the coastline. Specifically, Douglas-fir, mixed-evergreen, western hardwoods, and chaparral-mountain shrub dominate the province.

Along the coast, sandy beaches host snowy plover, willet, and sanderling, while rocky shoreline habitats support black oystercatcher, ruddy turnstone, and surfbird. Coastal wetland communities, including estuaries, lagoons, marshes, and open-water bays, are also important for shorebirds and provide nursery habitats for anadromous, oceanic, and near-shore fish. Among the province's notable coastal wetlands are the estuary at the mouth of the Smith River, Lake Talawa, Lake Earl, Klamath River Estuary, Humboldt Bay, the mouth of the Eel River, Bodega Bay, Tomales Bay (Page and Shuford 2000), and Big and Stone Lagoons.

Terrestrial communities along the coast include grasslands, coastal shrub, pine forests, mixed evergreen forests, and redwood forests. Unique, geographic limited habitats include sphagnum bogs and pygmy scrub forests. The province's coastal redwoods are among the largest, tallest, and oldest trees in the world, often exceeding 200 feet in height, 15 feet in diameter, and 2,000 years in age. Redwood groves are patchily distributed across the coastal fog belt that extends up to 40 miles inland and where winter rains and summer fog provide a persistent moist environment. Some inhabitants of coastal redwood forests include black bear, Roosevelt elk, Wilson's warbler, pacific-slope flycatcher, pacific wren, varied thrush, Northern spotted owl, marbled murrelet, Pacific giant salamander, rough-skinned newt, and banana slug.

The province's inland Klamath-Siskiyou mountain ranges are recognized for their biological diversity (Whittaker 1960; Whittaker 1961); they have been designated as an area of global botanical significance by the World Conservation Union, as one of 200 global conservation priority sites by the World Wildlife Fund, and as a proposed United Nations' biosphere reserve (Ricketts et al. 1999). These mountains harbor some of the most floristically diverse temperate coniferous forests in the world, attributable in part to the province's variable climate, geography, and soil types that create a variety of ecological communities. Unique, localized conditions have given rise to endemic species that have evolved to specialize in these areas, including nearly 100 plant species that are restricted to serpentine soils.

Ecological communities of the inland mountain ranges include moist inland forests dominated by Douglas fir, ponderosa pine, and sugar pine mixed with a variety of other conifers and hardwoods; drier oak forests and savannas; serpentine soil–associated plant communities; shrublands, including such species as mountain heather-bilberry, mountain whitethorn, and manzanita; high-elevation subalpine forests dominated by white and red fir, western white pine, and mountain hemlock; and less-widespread cranberry and pitcher plant fens and alpine grasslands on high peaks. More than 3,000 plant species are known from these mountains, and the area supports some 30 temperate conifer tree species, more than any other ecosystem in the world. Wildlife inhabitants include such sensitive species as the Northern spotted owl, Northern goshawk, Humboldt marten, and Pacific fisher, as well as common species like mule deer, black bear, and red-tailed hawk.

Portions of the province remained unglaciated during the last ice ages and have served as centers of distribution for numerous species that sought refuge there. These mountains represent the intersection of coastal ecosystems with the inland Klamath Basin. As a result, the inland mountains and river systems support a rich flora and fauna that include species from both coastal and inland regions. The Klamath River system, for instance, harbors both anadromous fish, including coho salmon, steelhead, cutthroat trout, Pacific lamprey, and sturgeon; estuarine and coastal fish such as tidewater goby and coast range sculpin; and inland fish such as the Klamath tui chub.

The province is known for these extensive river systems and the anadromous fish populations they support. The majority of California's river segments with state or federal Wild and Scenic River designations are in the North Coast and Klamath Province, including portions of the Klamath, Trinity, Smith, Scott, Salmon, Van Duzen, and Eel Rivers. Anadromous fish species include coho and Chinook salmon, steelhead, coastal cutthroat trout, green and white sturgeon, Pacific lamprey, eulachon, and longfin smelt. The province has seen sharp declines in its fish populations, with an 80 percent decline in salmon and steelhead between the 1950s and 1990s (California State Lands Commission 1993). These declines have resulted from degradation of river systems by forestry and other land uses; decreased instream flows resulting from small and large scale water diversions and agricultural water use; migration barriers to spawning grounds;

overharvesting of fish (beginning in the mid-1800s and lasting until the late 1970s, at which time substantial restrictions on ocean harvest were enacted by the Pacific Marine Fisheries Council); and natural and human-influenced variation in oceanic conditions, such as plankton densities and temperatures. The Smith and South Fork Eel River have been designated by CalFish (a cooperative program of agencies and organizations) as "salmon strongholds." Salmon strongholds are watersheds supporting "wild, diverse, and abundant" salmon populations that make the greatest contribution towards regional conservation goals. See Chapter 6 for a detailed discussion of anadromous fish.

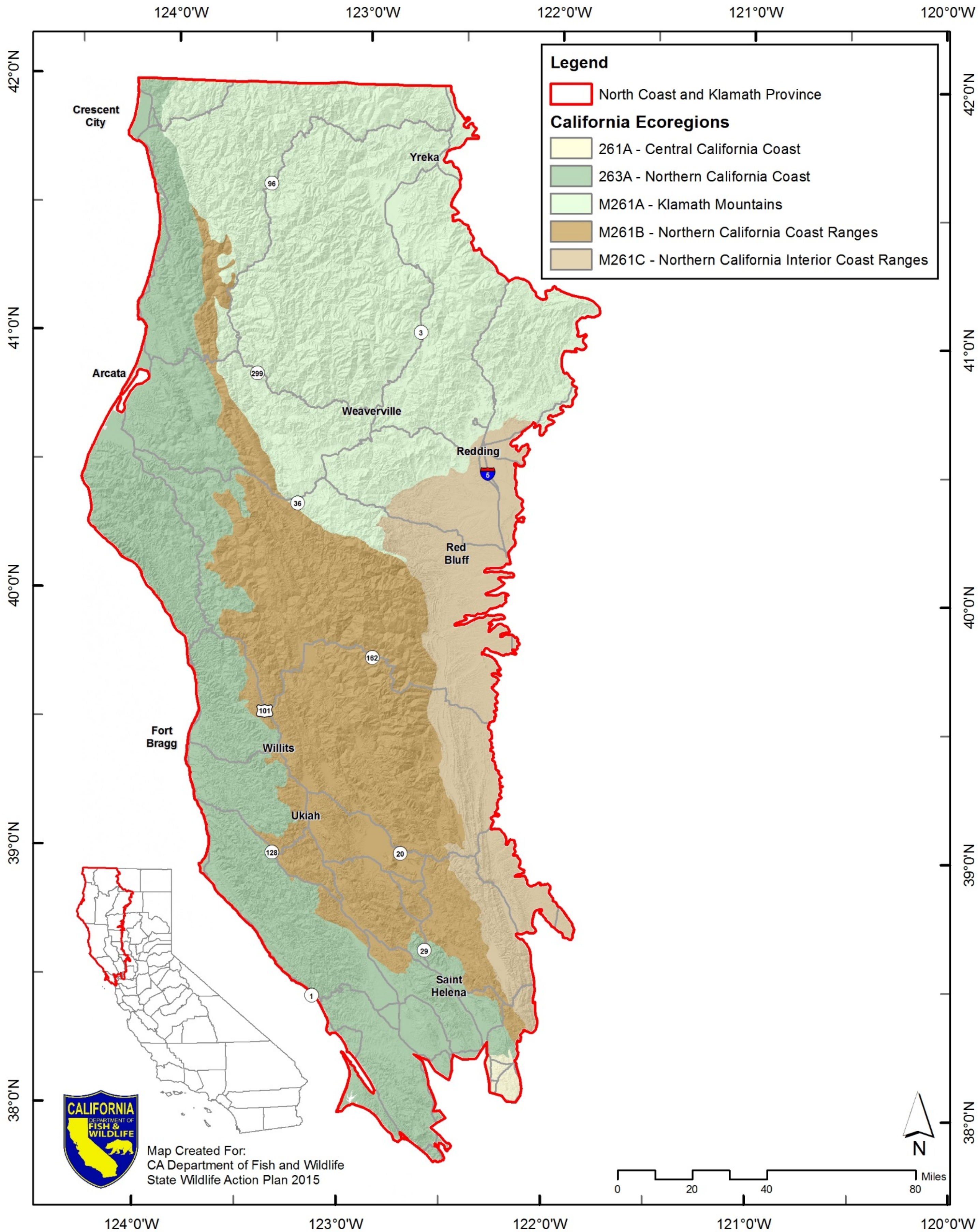
The province's rivers support one-third of the state's Chinook salmon, most of the state's coho salmon and steelhead, and all of the coastal cutthroat trout (California State Lands Commission 1993). Other native fresh water fish, like the Lost River sucker and shortnose sucker, have also experienced substantial population declines because of alterations of the province's freshwater river systems (California Department of Fish and Game [CDFG] 2005).

5.1.2 Conservation Units and Targets

The conservation units associated with the North Coast and Klamath Province include the Northern California Coast, Northern California Coast Ranges, Northern California Interior Coast Ranges, and Klamath Mountains ecoregions (Figure 5.1-2) and the Klamath-Northern California Coastal hydrologic unit (Figure 5.1-3).

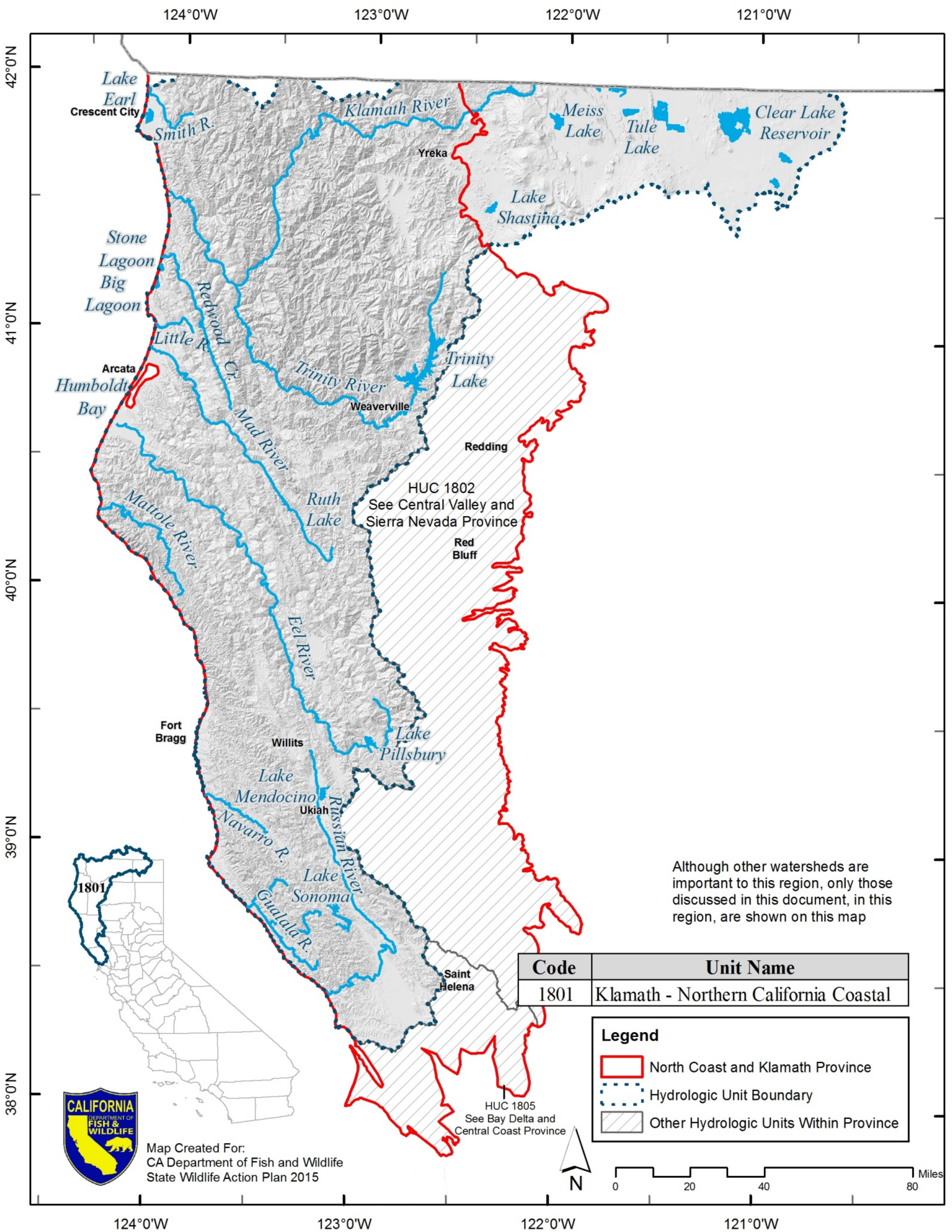
Fourteen conservation targets were selected in this province as priorities for conservation planning within the conservation units (Table 5.1-1). These conservation targets include: alpine vegetation, California foothill and valley forests and woodlands, coastal dune and bluff scrub, fen (wet meadow), freshwater marsh, montane upland deciduous scrub, mountain riparian scrub and wet meadow, north coastal and montane riparian forest and woodland, native aquatic species assemblages/communities of coastal watersheds, pacific northwest conifer forest, pacific northwest subalpine forest, subalpine aspen forests and pine woodlands, western upland grasslands, and wet mountain meadow. Information about the methods used to prioritize conservation targets is presented in Appendix D.

Figure 5.1-4 shows the distribution of the plant communities within the province. Some of the plant communities identified as conservation targets occur in areas smaller than the mapping unit and do not appear on the figure.



Data Source: USDA Forest Service (ecoregions); US Geological Survey (hillshade)

Figure 5.1-2 Ecoregions of the North Coast and Klamath Province



Data Source: National Hydrologic Dataset (NHD); US Geological Survey (hillshade)

Figure 5.1-3 Hydrologic Units of the North Coast and Klamath Province

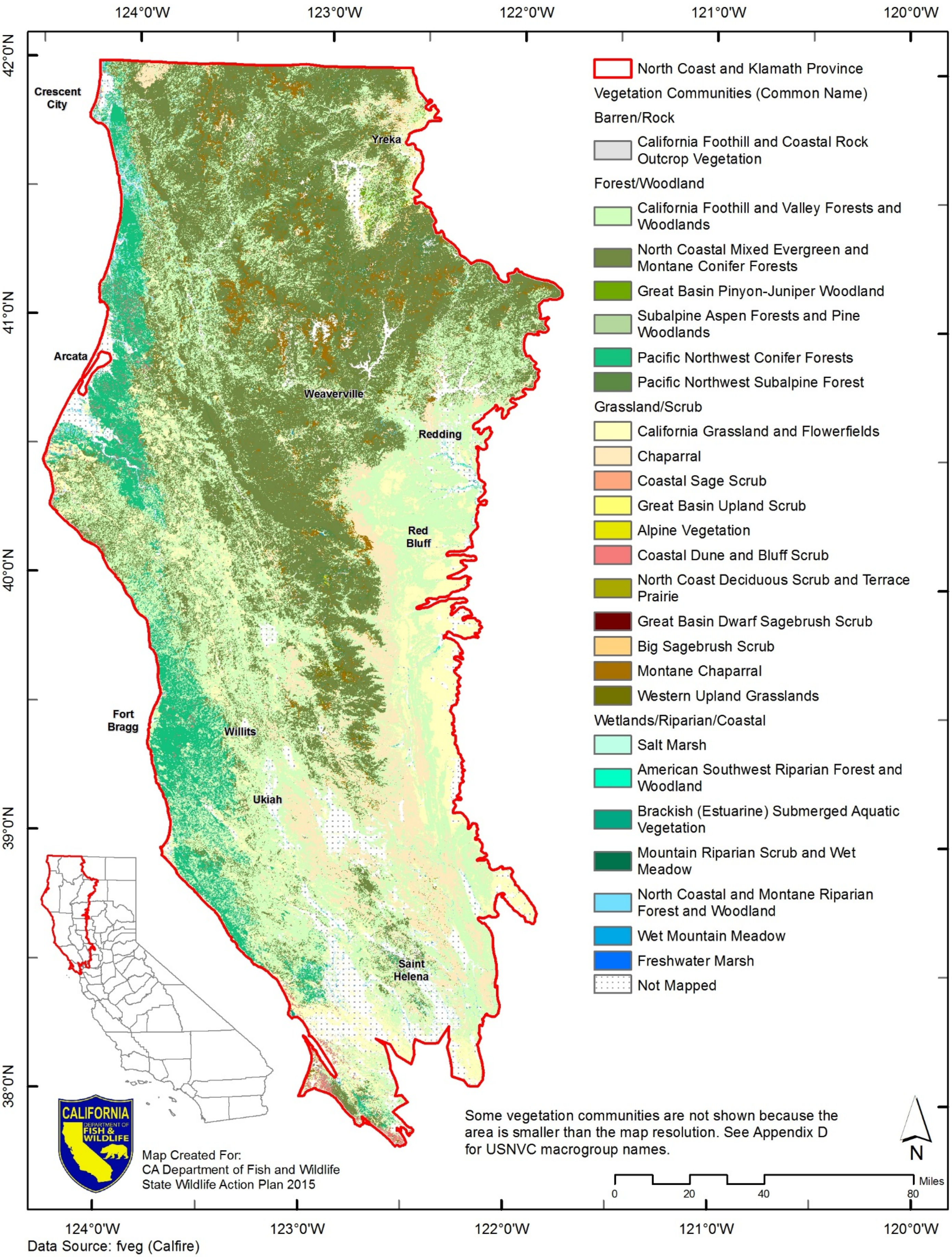


Figure 5.1-4 Plant Communities of the North Coast and Klamath Province

Table 5.1-1 Conservation Units and Targets – North Coast and Klamath Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Northern California Coast Ecoregion	Encompasses mountains, hills, valleys, and plains in the northern California Coast Ranges and small parts of the Klamath mountains. Climate modified greatly by marine influence. Summers are characterized by fog, cool temperatures, and high humidity. Predominant vegetation communities consist of redwood, Douglas-fir-tanoak, Oregon white oak, broom, tanoak, and coast live oak. 0 to 3,000 feet	Pacific Northwest Conifer Forests	Restricted to coastal areas. All variations of topography exist, from gradual elevational changes to steep, abrupt mountain ranges, common in the central north coast. Dominant tree species include: Sitka spruce, grand fir, redwood, red alder, and Douglas-fir. Western red cedar and western hemlock are also associates, but rarely compose the major portion of a stand.	Redwood
		Freshwater Marsh	This vegetation type consists of freshwater emergent marshes and coastal/tidal marshes and meadows. It can be found surrounding streams, rivers, lakes and wet meadows. These habitats occur on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. Dominant species are generally perennial monocots including graminoids such as rushes, reeds, grasses and sedges. Dominant species include: common reeds, hardstem bulrush, small-fruited bulrush, water parsley, slough sedge, soft rush, salt rush, and pacific silverweed.	Fresh Emergent Wetland
		North Coastal and Montane Riparian Forest and Woodland	These riparian forests occur along the major rivers and streams in the outer and middle North Coast Ranges, and along the foothill and lower montane reaches of rivers and streams. Predominant vegetation includes black cottonwood, Oregon ash, red alder, white alder, and shining willow. Most of stands are surrounded by cool temperate coniferous forest either from the coastal belt or the mid elevation montane coniferous belt. Thus, lesser numbers of conifers may intermix with the deciduous dominants. These include redwood, Douglas-fir, Sitka spruce, grand fir, and western hemlock in the north coastal stands, while ponderosa pine, incense-cedar, white fir, and red fir, may mix with the montane stands.	Montane Riparian
		Coastal Dune and Bluff Scrub	Stands of coastal dune and bluff vegetation are limited to salty, rocky or sandy settings immediately adjacent to the open coast. Adaptations to salt spray, wind and shifting sands, result in several lifeforms including succulent or hairy leaves, long underground roots and stolons (adaptation to shifting sands), and good colonization of relatively unstable and sterile substrates.	Coastal Scrub
Northern California Coast Ranges Ecoregion	Interior part of the northern California Coast Range mountains, north of the Carquinez Straight. Marine air modifies winter and summer temperatures, but oceanic effects are greatly diminished because of distance from coast. Predominant vegetation communities include Douglas-fir-tanoak, blue oak, Oregon white oak, chamise, cheatgrass, mixed conifer, and white fir. 300 to 8,100 feet	North Coastal and Montane Riparian Forest and Woodland	See description under Northern California Coast Ecoregion.	Montane Riparian
		Pacific Northwest Subalpine Forest	Occurs on ridges and rocky slopes around timberline in north California. Includes montane conifer forests and woodlands adapted to very high winter snowfall, from montane to subalpine altitudes. Characterized by short, cool summers, rainy autumns and long, cool, wet winters with heavy snow cover for 5-9 months. The heavy snowpack is ubiquitous and is required for soil moisture by many of the tree species. Dominant tree species include red fir, western hemlock, western white pine, and lodgepole pine.	Red fir; Subalpine Conifer

Table 5.1-1 Conservation Units and Targets – North Coast and Klamath Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Northern California Interior Coast Ranges Ecoregion	Located in the southeastern edge of the northern California Coast Ranges mountains, south of Cache Creek, and hills and terraces along the west side and north end of the Sacramento Valley. Predominant vegetation communities in this section include blue oak, foothill pine, and chamise. 200 to 3,000 feet	California Foothill and Valley Forests and Woodlands	Includes all Mediterranean climate woodlands and forests in California from sea level to the point where snow and frost in combination with high winter precipitation enables cool temperate species of trees to dominate the overstory layer. These forests and woodlands are composed of tree species largely adapted and endemic to the warm, dry summers, and cool rainy winters of California's Mediterranean climate, including foothill oak-riparian, oak-conifer, pine-cypress, and juniper vegetation types. Coastal oak woodlands are primarily dominated by coast live oak, California bay, Shreve oak, and Engelmann Oak. Foothill oak woodlands stands are either dominated by valley oaks, blue oaks, blue oak-foothill pine mixes, valley oak –riparian mixes, or montane hardwoods such as California buckeye, California bay, and California walnut. The coniferous component within the broad habitat category consists of closed cone pine-cypress dominant and juniper dominant vegetation types. Dominant cypress species include McNabe cypress, Monterey cypress, and Sargent cypress. Dominant pines include knobcone pine and foothill pine.	Coastal Oak; Blue Oak Woodland; Blue Oak–Foothill Pine; Montane Hardwood; Valley Foothill Riparian; Valley Oak Woodland; Closed-Cone Pine-Cypress
Klamath Mountains Ecoregion	Located between the Southern Cascades Mountains and the Coast Range mountains. The southern limit is the northern end of the Great Valley. Predominant vegetation communities in this section include Douglas-fir, Douglas-fir – tanoak, Jeffrey pine, mixed conifer, white fir, Douglas-fir – ponderosa pine, canyon live oak, Oregon white oak, mixed chaparral shrublands, red fir, and mixed subalpine forest. 200 to 9,000 feet	Subalpine Aspen Forests and Pine Woodlands	This vegetation type represents the cold but less snowy subalpine areas of the Klamath Mountain ranges. This vegetation type includes higher elevation forested stands dominated by aspen, subalpine conifer, and lodgepole pine. Aspen stands are limited to cooler, riparian drainages at mid to high elevation in montane regions. Small stands are scattered generally north and westward into northern Trinity and western Siskiyou Counties. Conifer habitats are dominated by lodgepole pine, Engelmann spruce, subalpine fir, foxtail pine, and whitebark pine.	Aspen; Subalpine Conifer; Lodgepole Pine (not red fir or mountain hemlock)
		Alpine Vegetation	Limited to the highest elevations and generally above timberline on slopes and ridgelines, on the highest peaks of the Klamath Range. Characteristic species are either herbaceous (many are cushion plants, some tufted or rhizomatous graminoids) or low prostrate or dwarf shrubs. Different groups segregate based on substrate type (scree, talus, felfield) and moisture regime (snowbank, felfield, etc.). Common shrubs occurring are creambush, oceanspray, Greene goldenweed, and mountain white heather. Felfield indicators include alpine reedgrass, Congdon sedge, alpine goldenbush, and Phlox species, among others. Alpine turf indicators include dwarf willows, dwarf huckleberry, Muir's hairgrass, and several sedges.	Alpine Dwarf-Shrub
		Wet Mountain Meadow	Typical of low lying sites in the mountains and in some lower elevation valleys and depressions. Widespread throughout the state wherever freshwater meadows and seeps occur. Saturated soil or standing water through the growing season are key characteristics. Wet mountain meadows are generally characterized by herbaceous plants with shrubs or trees absent or sparse (<20 percent cover), or along the edges. Most species are perennial and canopy cover is generally dense (60-100 percent).	Wet Meadow

Table 5.1-1	Conservation Units and Targets – North Coast and Klamath Province*			
Conservation Unit	**Geographic and Ecological Summary**	**Conservation Target**	**Target Summary**	**Focal CWHR Types Associated with Target**
Klamath Mountains Ecoregion (continued)		Mountain Riparian Scrub and Wet Meadow	This macrogroup contains montane meadow grasses, graminoids, and forbs and shrublands associated with meadows, riparian terraces, and seeps in the higher mountains of the state from the Peninsular and Transverse Ranges through the Sierra-Cascade Ranges and including the higher mountains of the Modoc Plateau, the Klamath Mountains and the high Inner North Coast Ranges. The vegetation tends to make small stands sorting ecologically based on moisture availability and on tolerance of disturbance. This concept joins both low riparian shrublands and associated wet meadows based on their overlap in ecologies and floristic composition.	Montane Riparian; Wet Meadow
		Fen (Wet Meadow)	Fens are hydrologically and chemically unique wetlands, which are typically nutrient-poor and support many endemic vascular and non-vascular plants (mostly mosses). In California, fens are typically small in size and occur in the Sierra, Klamath, and Cascade ranges and the north coast. Characteristic plants include both low woody shrubs such as laurel, bog Labrador tea, as well as specialized carnivorous herbs such as pitcher plant, sundew, and bladderworts, along with many species of rushes, sedges, grasses and mosses.	Wet Meadow; Fresh Emergent Wetland
		Montane Upland Deciduous Scrub	Characteristic species include drought or winter deciduous montane chaparral species. Dominant species include deer brush ceanothus, Garry oak, bitter cherry, chokecherry, basket bush sumac, and oak gooseberry. Any of these species may be dominated under various environmental regimes. Understory vegetation in the mature stages is generally largely absent. Various grasses and forbs grow in interstitial spaces sparsely or moderately depending on shrub type. Conifer and oak trees such as Ponderosa pine, canyon oak and live oak may occur in sparse stands or as scattered individuals within the chaparral type.	Montane Chaparral
		Western Upland Grasslands	Dominated by grasses, which are typically not restricted to moisture surrounding landscape (not seeps, riparian, or wet meadows). Dominant vegetation generally includes native grasslands of Idaho fescue, Great Basin wild rye, blue wild rye, one-sided bluegrass. It also includes the non-native grasslands that are from cool temperate settings in Eurasia such as creeping bentgrass, velvetgrass, Kentucky bluegrass, and Harding grass and cheat-grass.	Perennial Grassland; Annual Grassland

Table 5.1-1 Conservation Units and Targets – North Coast and Klamath Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
The Klamath-Northern California Coastal Hydrologic Unit (HUC 1801)	Includes two major watershed basins: Klamath River Basin and North Coastal River Basin. The Klamath River Basin covers approximately 10,830 square miles. It is bounded by the Oregon border on the north, the Pacific Ocean on the west, Redwood Creek and Mad River hydrologic units on the south, and by the Sacramento Valley to the east. The North Coastal Basin covers approximately 8,560 square miles located along the north-central California Coast. The Basin is bounded by the Pacific Ocean on the west, by the Klamath River and Trinity River Basins on the north, by the Sacramento Valley, Clear Lake, Putah and Cache Creeks and the Napa River Basin on the east, and by the Marin-Sonoma area on the south. This unit is characterized by distinct temperature zones. Along the coast, the climate is temperate and foggy with minimal temperature variation. Precipitation is greater than for any other part of California. 0 to 10,700 feet	Native Aquatic Species Assemblages/ Communities of Coastal Watersheds	20 species of fish, 12 amphibians and reptiles, and five species of aquatic invertebrates are included in the aquatic assemblage for this area. • Chinook salmon (spring and fall runs) • Coho salmon • Steelhead and resident rainbow trout (summer, winter runs) • Coastal cutthroat trout • Pacific lamprey • River lamprey • Western brook lamprey • Green sturgeon • White sturgeon • Tidewater goby • Eulachon • Longfin smelt • Reticulate sculpin • Navarro roach • Gualala roach • Lost River sucker • Shortnose sucker • Klamath large scale sucker • Blue chub • Hitch • Russian river tule perch • Southern torrent salamander • Coastal tailed frog • California giant salamander • Foothill yellow-legged frog • California red-legged frog • Northern red-legged frog • Cascades frog • Oregon spotted frog • Southern long toed salamander • California tiger salamander • Red-bellied newt • Northwestern western pond turtle • Klamath crayfish • California Linderiella (fairy shrimp) • California freshwater shrimp • California floater mussel • Western ridgemussel • Other freshwater mussels	N/A

* Description referenced from CDFG 1988, USDA 1994, USDA 2007, and Keeler-Wolf 2010.

5.1.3 Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the North Coast and Klamath Province are listed in Table 5.1-2. The most commonly identified attributes for the North Coast and Klamath Province are:

- area and extent of community;
- connectivity among communities and ecosystems;
- successional dynamics;
- community structure and composition; and
- hydrological regime.

Table 5.1-2 Key Ecological Attributes – North Coast and Klamath Province

Key Ecological Attributes	Conservation Units and Targets															
	Northern California Coast				Northern California Coast Ranges		Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	Coastal Dune and Bluff Scrub	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Wet Meadows)	Montane Upland Deciduous Scrub	Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands (Meadows)	Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	Western Upland Grasslands	Wet Mountain Meadow	Native Aquatic Species Assemblages/Communities
Area and extent of community	X	X	X	X	X	X		X	X		X	X	X	X	X	X
Fire regime				X		X	X		X	X	X	X	X	X	X	
Connectivity among communities and ecosystems	X	X		X	X			X		X			X			
Successional dynamics	X	X	X		X	X	X		X	X	X	X	X	X	X	
Community structure and composition	X		X	X		X	X	X	X	X	X	X	X	X	X	X
Hydrological regime		X	X		X				X		X	X		X	X	
Soil quality and sediment deposition regime			X	X			X						X			X
Surface water flow regime	X															X
Water temperatures and chemistry																X
Pollutant concentrations and dynamics																X

5.1.4 Species of Greatest Conservation Need in the North Coast and Klamath Province

The North Coast and Klamath Province's wide range of habitats has given rise to remarkable biological diversity. In SWAP 2005, it was noted that there are 501 vertebrate species that inhabit the North Coast and Klamath Province at some point in their life cycle, including 282 birds, 104 mammals, 26 reptiles, 30 amphibians, and 59 fish. Of these species, 13 are endemic to the North Coast and Klamath Province, and nine other species found here are endemic to California, but not restricted to this province.

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.1-3). Not all of the focal species meet the criteria to be considered Species of Greatest Conservation Need (SGCN). SGCN are indicated with an asterisk. SGCN associated with the North Coast and Klamath Province are shown by ecoregion in Tables C-8 through C-11 in Appendix C.

Table 5.1-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the North Coast and Klamath Province

Common Name	*Scientific Name*	Conservation Units and Targets[1]: Northern California Coast			Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
		Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	Coastal Dune and Bluff Scrub	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Wet Meadow)	Montane Upland Deciduous Scrub	Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands (Meadows)	Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	Western Upland Grasslands	Wet Mountain Meadow	Native Aquatic Species Assemblages/ Communities
Invertebrates																	
California floater mussel	*Anodonta californiensis*																X
Western ridgemussel	*Gonidea angulata*																X
California Linderiella (fairy shrimp)	*Linderiella occidentalis*																X
Vernal pool tadpole shrimp*	*Lepidurus packardi*							X							X		
Conservancy fairy shrimp*	*Branchinecta conservatio*							X							X		
Klamath crayfish*	Pacifastacus *leniusculus klamathensis*																X

Table 5.1-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the North Coast and Klamath Province

Common Name	*Scientific Name*	Conservation Units and Targets[1]															
		Northern California Coast			Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
		Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	Coastal Dune and Bluff Scrub	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Wet Meadow)	Montane Upland Deciduous Scrub	Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands (Meadows)	Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	Western Upland Grasslands	Wet Mountain Meadow	Native Aquatic Species Assemblages/ Communities
California freshwater shrimp*	*Syncaris pacifica*																X
Fishes																	
River lamprey*	*Lampetra ayresi*																X
Western brook lamprey	*Lampetra. richardsoni*																X
Pacific lamprey*	*Lampetra tridentata*																X
Green sturgeon*	*Acipenser medirostris*																X
White sturgeon*	*Acipenser transmontanus*																X
Coastal cutthroat trout*	*Oncorhynchus clarkii clarkia*																X
Steelhead* (and resident rainbow trout) (summer, winter runs)	*Oncorhynchus mykiss*																X
Coho salmon*	*Oncorhynchus kisutch*																X
Chinook salmon* (Spring and fall runs)	*Oncorhynchus tshawytscha*																X
Chinook salmon* (Spring and fall runs)	*Oncorhynchus tshawytscha*																X
Longfin smelt*	*Spirinchus thaleichthys*																X
Eulachon*	*Thaleichthys pacificus*																X
Blue chub*	*Gila coerulea*																X
Hitch	*Lavinia exilicada*																X
Navarro roach*	*Lavinia symmetricus navarroensis*																X
Gualala roach*	*Lavinia symmetricus parvipinnis*																X
Klamath largescale sucker*	*Catostomus snyderi*																X
Shortnose sucker*	*Chasmistes brevirostris*																X
Lost River sucker*	*Deltistes luxatus*																X

Table 5.1-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the North Coast and Klamath Province

Common Name	Scientific Name	Conservation Units and Targets[1]															
		Northern California Coast			Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
		Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	Coastal Dune and Bluff Scrub	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Wet Meadow)	Montane Upland Deciduous Scrub	Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands (Meadows)	Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	Western Upland Grasslands	Wet Mountain Meadow	Native Aquatic Species Assemblages/ Communities
Tidewater goby*	*Eucyclogobius newberryi*																X
Reticulate sculpin*	*Cottus perplexus*																X
Amphibians																	
California tiger salamander*	*Ambystoma californiense*							X									X
Southern torrent salamander*	*Rhyacotriton variegatus*		X	X		X				X		X	X		X	X	X
Red-bellied newt*	*Taricha rivularis*		X	X		X											X
California newt*	*Taricha torosa*	X						X		X	X	X	X		X	X	
Southern long-toed salamander*	*Ambystoma macrodactylum sigillatum*																X
California giant salamander*	*Dicamptodon ensatus*		X	X		X											X
Shasta salamander*	*Hydromantes shastae*											X		X			
Scott Bar salamander*	*Plethodon asupak*											X		X			
Dunn's salamander*	*Plethodon dunni*		X	X													
Del Norte salamander*	*Plethodon elongatus*		X	X		X											
Siskiyou Mountains salamander*	*Plethodon stormi*											X		X			
Coastal tailed frog*	*Ascaphus truei*		X	X			X			X		X	X		X	X	X
Western spadefoot toad*	*Spea hammondii*				X			X									
Northern red-legged frog*	*Rana aurora*	X								X		X	X		X	X	X
Foothill yellow-legged frog*	*Rana boylii*		X			X											X
Cascades frog*	*Rana cascadae*									X		X	X		X	X	X
California red-legged frog*	*Rana draytonii*	X						X									X

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Oregon spotted frog*	*Rana pretiosa*																X
Reptiles																	
Northwestern western pond turtle*	*Actinemys marmorata*	X	X			X		X									X
Western skink	*Plestiodon skiltonianus*							X									
Forest sharp-tailed snake*	*Contia longicauda*		X	X													
Ring-necked snake	*Diadophis punctatus*							X									
Birds																	
Pacific brant*	*Branta bernicla*	X															
Aleutian Canada goose	*Branta canadensis leucopareia*	X															
Sooty grouse	*Dendragapus fuliginosus*			X			X							X			
California quail	*Callipepla californica*							X									
Great egret	*Ardea alba*	X															
Great blue heron	*Ardea herodias*	X															
Snowy plover (coastal population)*	*Charadrius nivosus*				X												
Tufted puffin*	*Fratercula cirrhata*				X												
California condor*	*Gymnogyps californianus*						X										
Osprey	*Pandion haliaetus*			X			X	X									
Northern goshawk*	*Accipiter gentilis*		X	X		X	X	X	X					X			
Golden eagle*	*Aquila chrysaetos*						X	X	X								
Northern harrier*	*Circus cyaneus*	X															
White-tailed kite*	*Elanus leucurus*				X			X									
Bald eagle*	*Haliaeetus leucocephalus*							X									
Short-eared owl*	*Asio flammeus*	X															
Long-eared owl*	*Asio otus*		X			X		X			X						
Burrowing owl*	*Athene cunicularia*							X			X						

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Northern spotted owl*	*Strix occidentalis caurina*		X			X	X							X			
Great gray owl*	*Strix nebulosa*						X										
Barn owl	*Tyto alba*										X						
Vaux's swift*	*Chaetura vauxi*			X						X		X	X	X	X	X	
Black swift*	*Cypseloides niger*									X	X	X	X	X	X	X	
Pileated woodpecker	*Dryocopus pileatus*													X			
Clark's nutcracker	*Nucifraga columbiana*						X										
White-headed woodpecker	*Picoides albolarvatus*													X			
American peregrine falcon*	*Falco peregrinus anatum*				X		X	X									
Olive-sided flycatcher*	*Contopus cooperi*			X			X			X		X	X		X	X	
Willow flycatcher*	*Empidonax traillii*	X								X		X	X		X	X	
Hutton's vireo	*Vireo huttoni*							X									
Purple martin*	*Progne subis*	X	X	X		X				X		X	X		X	X	
Bank swallow*	*Riparia riparia*		X			X				X		X	X		X	X	
Marsh wren	*Cistothorus palustris*	X															
Saltmarsh common yellowthroat/San Francisco common yellowthroat*	*Geothlypis trichas sinuosa*	X	X														
Yellow warbler*	*Setophaga petechia*							X			X						
Bryant's savannah sparrow*	*Passerculus sandwichensis alaudinus*				X												
Spotted towhee	*Pipilo maculatus*							X									
Tricolored blackbird*	*Agelaius tricolor*							X									
Yellow-headed blackbird*	*Xanthocephalus xanthocephalus*	X															
Mammals																	
Suisun shrew*	*Sorex ornatus sinuosus*		X			X											

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Pallid bat*	*Antrozous pallidus*				X			X									
Townsend's big-eared bat*	*Corynorhinus townsendii*		X	X		X		X				X					
Big-brown bat	*Eptesicus fuscus*													X			
Silver haired bat	*Lasionycteris noctivagans*													X			
Hoary bat	*Lasiurus cinereus*													X			
Long-eared myotis (bat)*	*Myotis evotis*		X	X		X				X		X	X		X	X	
Fringed myotis (bat)*	*Myotis thysanodes*		X			X											
Long-legged myotis (bat)*	*Myotis volans*		X			X											
Oregon snowshoe hare*	*Lepus americanus klamathensis*									X		X	X		X	X	
Riparian brush rabbit*	*Sylvilagus bachmani riparius*			X													
Point Arena mountain beaver*	*Aplodontia rufa nigra*		X			X	X										
Northern flying squirrel	*Glaucomys sabrinus*			X			X							X			
San Joaquin pocket mouse*	*Perognathus inornatus inornatus*							X									
North American beaver	*Castor canadensis*	X	X			X											
Sonoma tree vole*	*Arborimus pomo*			X													
White-footed vole	*Arborimus albipes*		X			X											
Dusky-footed woodrat	*Neotoma fuscipes*			X													
Pacific jumping mouse	*Zapus trinotatus*			X						X		X	X		X	X	
Sierra Nevada red fox*	*Vulpes vulpes necator*								X								
Ringtail*	*Bassariscus astutus*			X	X			X									
Pacific marten*	*Martes caurina (=americana)*		X	X		X	X		X	X		X	X	X	X	X	
Humboldt marten*	*Martes caurina [=americana] humboldtensis*		X			X											
American badger	*Taxidea taxus*							X			X						

Table 5.1-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the North Coast and Klamath Province

Common Name	*Scientific Name*	Conservation Units and Targets[1]															
		Northern California Coast			Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
		Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	Coastal Dune and Bluff Scrub	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Wet Meadow)	Montane Upland Deciduous Scrub	Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands (Meadows)	Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	Western Upland Grasslands	Wet Mountain Meadow	Native Aquatic Species Assemblages/ Communities
Fisher - West Coast DPS*	*Pekania [=Martes] pennant*		X	X		X	X							X			
River otter	*Lontra canadensis*	X						X									
Western spotted skunk	*Spilogale gracilis*			X	X			X									
Mountain lion	*Puma concolor*			X				X									
Tule elk*	*Cervus canadensis nannodes*							X									
Roosevelt Elk	*Cervus canadensis roosevelti*									X		X	X		X	X	
Columbia black-tailed deer	*Odocoileus hemionus columbianus*			X				X		X		X	X	X	X	X	

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion, see Appendix C.

* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.1.5 Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have strong influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified for conservation targets in the North Coast and Klamath Province are summarized in Table 5.1-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.1.6. Some of the major pressures for the province are discussed in more detail below.

Table 5.1-4 Key Pressures on Conservation Targets – North Coast and Klamath Province

Pressure	Conservation Units and Targets															
	Northern California Coast				Northern California Coast Ranges		Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	Coastal Dune and Bluff Scrub	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Wet Meadow)	Montane Upland Deciduous Scrub	Mountain Riparian Scrub and Wet Meadow	Subalpine Aspen Forests and Pine Woodlands (Meadows)	Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	Western Upland Grasslands	Wet Mountain Meadow	Native Aquatic Species Assemblages/ Communities
Agricultural and forestry effluents	X	X	X		X											X
Airborne pollutants				X												
Annual and perennial non-timber crops	X	X			X											X
Climate change	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X			X				X								
Dams and water management/use	X	X			X											X
Fire and fire suppression			X	X		X	X		X	X	X	X	X	X	X	X
Garbage and solid waste																X
Household sewage and urban wastewater	X	X			X											X
Housing and urban areas	X	X		X	X					X						X
Industrial and military effluents	X															X
Introduced genetic material			X													X
Invasive plants/animals	X	X	X	X	X		X	X	X		X	X		X	X	X
Livestock, farming, and ranching	X	X	X		X		X	X	X		X	X		X	X	X
Logging and wood harvesting			X						X	X	X	X	X	X	X	X
Marine and freshwater aquaculture																X
Mining and quarrying	X															X
Parasites/pathogens/diseases			X			X							X			X
Recreational activities				X		X	X	X								
Renewable energy																X
Roads and railroads	X	X	X	X	X											X
Wood and pulp plantations			X													

Annual and Perennial Non-Timber Crops

Agriculture occupies about seven percent of the province (California Department of Conservation 2002). However, in flatter coastal areas and valleys, urban and agricultural land uses cover a much larger proportion of the land and have substantially reduced and altered wildlife habitats.

Agricultural development has occurred primarily in the major river valleys, where common crops are alfalfa and irrigated pasturelands. Agricultural uses also occur on coastal grasslands, where dairy operations are widespread, and on alluvial plains formed at the coastal outlets of large rivers. Some southern portions of the province support wine grapes, nursery stock, and orchards. Vineyard acreage, in particular, is expanding from Napa and Sonoma counties to Mendocino and Lake counties.

In some river valleys, agricultural use of alluvial plain and delta areas has virtually eliminated native riparian black cottonwood, willow, and red alder forests, limiting habitat for riparian species like willow flycatcher (Riparian Habitat Joint Venture [RHJV] 2004). In these areas, berms and canals prevent flooding of agricultural fields and pastures, which disconnects the rivers from their natural floodplains and eliminates benefits of natural flooding regimes, such as deposition of river silts on valley-floor soils, recharging of wetlands, and flushing flows that prevent clogging of coastal outlets. Braided channel structure and backwaters are eliminated, resulting in higher velocity flows. These changes lower habitat suitability for anadromous fish, which need refuges to keep from being flushed out of river channels during flood flows.

Many of the province's coastal agricultural lands were created by draining and diking wetlands and salt marshes, particularly around Humboldt Bay and the Eel River estuary, where more than 90 percent of the historical tidal marshlands have been lost (CDFG 2010). The resulting habitat includes coastal grasslands that are extensively used for grazing, especially by dairy cattle. Creating these grasslands reduced marsh and wetland habitats used by shorebirds and estuarine nursery areas important for anadromous and marine fish. The one benefit is that these newly created agricultural grasslands now provide valuable habitats for many bird species (Page and Shuford 2000). If improperly managed, livestock uses can result in eutrophication of wetlands and coastal waters. Similarly, in the Eel River watershed leading up to Humboldt Bay, much of the historic connectivity between tidal flow and salt marsh has been blocked by levees and flood gates. This has led to a reduction in tidal connectivity and loss of estuary habitat. Additionally, mining, timber logging, grazing and agriculture uses removed historic forests, riparian and wetlands habitat, increasing sedimentation and decreasing the ability of the Eel River Basin to support anadromous fisheries, aquatic invertebrates, and other wildlife.

In agricultural river valleys, substantial habitat alteration results from river diversions and water use. Many small-scale irrigation diversions and small dams deplete the flows of river systems in the province, sometimes resulting in complete drying of rivers. In livestock production areas, water is also diverted to provide cattle-watering sources.

In the southern portion of the province, irrigated vineyards use large amounts of water during the grape-production season, sometimes resulting in streams completely drying up. Stream habitats are also adversely affected by sedimentation, because some irrigated vineyards tend to be erosion-prone, especially if located on hillsides. Vineyards also fragment habitats and restrict wildlife movement to a greater degree than do pasturing or the cultivation of alfalfa.

Marijuana Cultivation

Ideal for growing marijuana because of the sparse human population and the remote and forested landscape, Humboldt, Mendocino, and Trinity counties are the three main counties known for legal and illegal marijuana cultivation in California. Recently, the number and size of marijuana cultivation sites has increased in response to Proposition 215, the Compassionate Use Act (1996). The law allows medical marijuana users to cultivate their own plants and has led to widespread and unregulated (but state legal) cultivation. While it has been cultivated in the wildlands of Northern California for many years, there have been few, if any, documented environmental impacts, until recently. Studies and observations are beginning to show that illegal and legal marijuana cultivation is resulting in a broad array of environmental impacts on aquatic and terrestrial communities including degradation, loss and fragmentation of sensitive habitats, reduced water quality and stream flow, and mortality of fish and wildlife.

Water Diversion and Water Quality

Water diversion and water quality are of particular importance in this province with its high abundance and diversity of aquatic and riparian dependent species. Marijuana plants require large amounts of water and are often planted illegally near waterways as a result. Medical marijuana cultivation diversions on private lands also divert water illegally for use. This province is home to some of the southernmost native populations of Pacific Coast salmon and trout (i.e., salmonids) and stream flow is necessary for their diversity and survival. Stopping diversions such as these could be critical to their survival. Private crops alone have been shown to reduce streamflow 23 percent in some streams and then almost entirely dewater other streams during low flow periods (Bauer et al. 2015). Utilizing stream flow data provided by staff at the National Oceanic and Atmospheric Administration (NOAA), Bauer et al. (2015) determined water demand for cultivation could use more than 100 percent of stream flow during the summer dry season in three of their four study watersheds in northern coastal watersheds. Stream flow monitoring conducted by CDFW in the summer of 2014, which was a drought year, appeared to verify these results. Reduced stream flows can also impact aquatic species by diminishing water quality parameters such as temperature and sedimentation, decreasing habitat availability, stranding fish, delaying migration, increasing intra and interspecific competition, decreasing food supply, and increasing the likelihood of predation. This flow reduction can have lethal or sub-lethal effects on SGCN aquatic species such as coho salmon, steelhead, and sensitive amphibians, such as the southern torrent salamander and coastal tailed frog. Stopping this streamflow diversion is especially important moving into the future as water scarcity and resulting habitat degradation is likely to worsen because of climate change. This could be seen last year in Sproul Creek in the Eel River watershed which supports up to five listed salmonid species, including one of the most important populations of coho salmon. (See Chapter 6 for detailed discussion of anadromous fish.) This stream went dry last year for the first time in many years (CDFW 2015). This was most likely a result of water diversions for marijuana cultivation combined with the ongoing drought conditions. As future hydrologic scenarios anticipate less water for ecosystem services, climate change is expected to result in higher air and surface water temperatures (Bauer et al. 2015). Both of these impacts will result in warming up coldwater streams that would no longer support coldwater fishes such as trout and salmon. According to Bauer et al. (2015) "Given the specter of climate change induced more severe and prolonged droughts and diminished summer stream flows in the region [northwestern California], continued diversions at a rate necessary to support the current scale of marijuana cultivation in northern California could be catastrophic for aquatic species."

Chemicals

Chemicals used in the illegal cultivation such as rodenticides, fertilizers, and herbicides negatively affect aquatic and non-aquatic species. Chemicals used during cultivation result in hazardous water quality and mortality of fish and wildlife. The use of concentrated fertilizers that leach into streams which may be toxic to amphibians, fish, or invertebrates at high concentrations or promote excessive algal growth leading to reduced oxygen levels. The excessive use of herbicides and their surfactants can also be toxic to many organisms. Pesticides and rodenticides used in these illegal and legal farms kill target and non-target animals indiscriminately. The Pacific fisher and Northern spotted owl have been found to be impacted by rodenticide by either direct ingestion or bioaccumulation (toxins accumulate in the body from feeding on contaminated prey). The recent threat from rat poison used in these illegal marijuana plantations even prompted the U.S. Fish and Wildlife Service (USFWS) to propose Endangered Species Act protection for West Coast populations of the Pacific fisher because of a number of recent deaths linked to rat poison ingestion (USFWS 2014).

Habitat Loss

Habitat loss from marijuana cultivation includes loss and degradation of forested and riparian areas through vegetation removal, as well as damage and loss to waterways through vegetation removal and burying of streams during soil preparation. Illegal farms have removed whole sections of forest and hilltops removing sensitive forested and aquatic habitats. The use of bulldozers to form growing sites has increased the threat of landslides and buried streams. Sedimentation of streams as a result of grading can destroy spawning areas, kill bottom dwelling organisms and injure fish. Even natural fens are at risk. Recently in this province, a case was successfully prosecuted where peat materials taken from natural fens were illegally harvested for the marijuana industry (van Hattem, pers. comm., 2015). Bauer et al. (2015) studied three watersheds in Humboldt County totaling approximately 82,000 acres. Examining them closely using Google Earth and Geographic Information Systems (GIS), they counted legal marijuana crops and greenhouses. In these watersheds, the group calculated that there were 846 greenhouses and 26,606 outdoor plants on legal and illegal farms. Natural habitat was likely removed and damaged in a large portion of these areas.

Strategies

Cracking down on illegal marijuana operations and improving legal production regulation and oversight are the most active ways the state is trying to deal with this new-found environmental pressure.

To crack down on illegal marijuana cultivation, the state of California funds the Campaign Against Marijuana Production (CAMP) along with local and federal partner agencies. Run by the California Attorney General and financed in part by the federal government, it funds sheriffs and park law enforcement officers to find and remove illegal marijuana gardens. Unfortunately, controlling illegal marijuana crops is difficult because the economic incentive and the availability of private and public lands on which to cultivate within this province are enormous. The available lands within Humboldt, Trinity and Mendocino counties, the prime areas of cultivation, constitute 7 percent of California's landbase -- a huge area to hide illegal farms. While over 70 percent of Humboldt County's landbase is composed of forestland, 50 percent (on over 8,000 parcels) is private and zoned for timber production (Bauer et al. 2015). This makes Humboldt County a feasible place for illegal and legal marijuana cultivation. In 2013, according to some estimates, Humboldt country's marijuana crops brought in $415 million (Moxley 2014). Illegal farms can produce anywhere from 1,000 to 10,000 plants, with each plant selling for $500 to $1,000 each. In 2009, 77 percent of the 4.3 million illegal plants brought in by CAMP were from public lands (CAMP 2009). According to the CAMP 2009 Report, approximately 839,860 plants were seized from

Humboldt, Trinity and Mendocino counties. Shasta and Lake counties had over a million plants seized. Much like a game of Whac-A-Mole, when one farm is found and removed, another one pops up somewhere else to take its place.

To reduce environmental damage caused by state-legal marijuana cultivation on public and private lands, the approved 2014 California budget requested resources and staff for both CDFW and the State Water Resources Control Board (SWRCB). With this funding, CDFW created the Watershed Enforcement Team (WET) whose goal is to work collaboratively with the water board and local agencies to investigate environmental impacts associated with medical marijuana cultivation. The goal of this program is to be proactive with enforcement in highly impacted watersheds, hold those responsible for existing environmental damage accountable, and provide a pathway toward compliance for those operators who want to cultivate in an environmentally sound manner. Initially, the funding was used to educate and reach out to growers and local agencies. The two agencies developed a coordinated strategy titled "Strategy – Regulation and Enforcement of Unauthorized Diversions; Discharges of Waste to Surface and Groundwater Caused by Marijuana Cultivation" (CSWRCB 2014). This document describes the new program development in WRCB Region 5 (Central Valley), as well as a statewide program, and also describes efforts underway and proposed expansions to that program in Region 1 (North Coast). Recently, pilot inspections have taken place in some interior counties along the north coast. One of the first north coast inspections occurred in January 2015 in the Eel River Watershed in Humboldt County. The WET team included staff from SWRCB, Division of Water Rights, North Coast Regional Water Quality Control Board (NCRWQCB), biologists and wildlife officers CDFW and members of the Humboldt County Sheriff's Office and Humboldt County staff. Together they inspected 14 properties with active marijuana grow operations along Sproul Creek for violations of state environmental laws and regulations. The WET team is trying to help those growers obtain the necessary permits and waivers to comply with state laws and regulations and protect critical watersheds like the Eel River. In parallel with this new partnership, the NCRWQCB is creating a process to help regulate environmental impacts for cultivation by creating a conditional waiver. The General Waiver will regulate the discharges of waste and use of surface waters associated with the cultivation of marijuana. Because grow operations are not currently regulated for potential environmental impacts, this waiver will allow them to better monitor and regulate activities associated with cannabis cultivation in the region.

Dams and Water Management/Use

With relatively high precipitation levels across most of the province, the North Coast and Klamath Province produces about 40 percent of California's total natural runoff (California Department of Water Resources [DWR] 2005). Large-scale dams and diversions on many of the province's major river systems supply water and hydropower, most of which is exported out of the province. The province's water resources are also taxed by smaller-scale water diversions for local use and by groundwater extraction. In this province, the Cape Horn and Scott Dams from the upper Eel River, Dwinnel dam on the Shasta River, and dams from upper Klamath and Trinity Rivers have all been major sources of pressures for declining native anadromous fish species in these watersheds. Additionally, numerous dams are constructed on small streams for agriculture irrigation, frost protection use; many of the dams and water diversions are not in compliance with state regulations.

Dams and diversions reduce the amount of water in rivers and change the timing of seasonal high- and low flows. In shallow waters, temperatures can rise to levels unsuitable for aquatic species and important habitat features such as deep pools may be eliminated. For example, damming of the Trinity River increases the amount of deep water along shores and promotes the formation of undercut banks, but it eliminates low-velocity areas preferred by western pond turtles and lowers water temperatures degrading habitat for the pond turtle (Reese and Welsh 1998). This can stunt pond turtle growth and affect reproduction. Aseasonal flows resulting from dam releases have impacted foothill yellow-legged frogs that survive below the dams. The aseasonal pulse flows create stressful or fatal velocity conditions for early life stages and reduce survival of young. Changed water levels and temperatures also create habitat for invasive species like warmwater fishes such as largemouth bass and bluegill and predatory bullfrogs. For fish species, movement is limited when dams and diversions cause some river reaches to dry out, severing the connectivity between different sections of a river basin. Fish can be stranded in isolated river sections without access to tributaries or river reaches that provide cool temperatures or important habitat features like pools and cover. Additionally, without flood flows, willow trees and other vegetation can encroach into river channels—as has occurred in portions of the Klamath basin and below the Trinity Dam—resulting in narrower channels and reduced instream habitat.

Dave Feliz, CDFW

Dams and diversion structures also restrict fish movement. For the province's anadromous species, such as Pacific lamprey, steelhead, Chinook and coho salmon, cutthroat trout, and white and green sturgeon, these structures can hinder migration and block access to important spawning and rearing habitats. For other fish species that move widely within rivers, such as coastal cutthroat and rainbow trout, Klamath River lamprey, Sacramento pikeminnow, and Klamath smallscale sucker, dams can isolate population segments and disrupt gene flow. Sediment movement is also blocked by dams. Coupled with altered flows, restricted sediment supply can result in substantial alteration of channel structure and degradation of instream and riparian habitats downstream of dams.

Joe Ferreira, CDFW

Reduced flows and reservoir conditions can contribute to water quality problems. In the Klamath system, for example, agricultural runoff in the upper basin, including fertilizers and animal wastes, favors algae growth and depletes oxygen levels in reservoirs. Flow levels below dams are not sufficient to flush away or dilute these poor water quality conditions. Low flows also diminish aquatic systems' capacity to transport and discharge sediment, sometimes resulting in increased turbidity or sediment deposition. In fall 2002, on the Klamath River below Iron Gate Dam, low flows coupled with poor water quality conditions contributed to the deaths of more than 33,000 fish, largely Chinook salmon (CDFG 2003).

The cumulative effects of small-scale surface water diversions have substantial consequences for some of the province's river systems. Agricultural and domestic water use has resulted in low flows and has dried up river segments. Increasing numbers of groundwater wells are being used to supply water for expanding agricultural and residential development, further contributing to lower flows and drying. Small-scale diversions (livestock, agriculture, marijuana cultivation) to provide livestock water sources have depleted instream flows in some waterways, such as the Navarro River and Mad River, Eel and Van Duzen watersheds. These changes will be compounded by longer, drier summers brought on by the effects of climate change.

Housing and Urban Areas

When compared to other areas of California, the North Coast and Klamath Province is sparsely populated. Rugged topography has limited urban and agricultural development across much of the province. Currently, urban land use occurs on about two percent of the province's area, and low-density rural residential development is found on less than two percent (DWR 2004; California Department of Forestry and Fire Protection, Fire and Resource Assessment Program [FRAP] 2003).

The province's population centers include coastal cities (e.g., Eureka, Arcata, Fort Bragg, and Crescent City) and inland cities (e.g., Santa Rosa and Redding). In the interior portions of the province, residential growth has closely followed agricultural development in the major valleys. Some areas, like Humboldt and Siskiyou counties, are seeing increasing subdivision of large landholdings into smaller parcels for second-home and rural residential development. The most significant population pressures are felt in the southern portion of the province and in the Russian River basin, with population growth in Napa and Sonoma counties beginning to expand to Mendocino and Lake Counties. Development removes and fragments habitat, increases the spread of invasive species (through increased human use of the nearby landscape), and increases demand for limited water resources. As development expands on the private lands adjacent to major highways, and traffic increases, migrating mule deer, elk, and antelope will be less able to move between seasonal ranges. Increased traffic loads also increase the frequency of bird deaths, small mammal, reptile, and amphibian mortalities as they attempt to cross the highways. Without conservation planning, future development along these corridors will likely have a significant impact on the region's wildlife. As seasons change in the mountainous areas of the province, the survival of many mammal, bird, amphibians, reptiles and fish species depends on their ability to migrate between higher and lower elevations. Because of development and even roads, these species are cut off from necessary uplands or aquatic habitats. For instance, turtles and garter snakes inhabiting streams leave to nest and overwinter in the uplands, and pond-breeding amphibians migrate en masse from the uplands to aquatic habitat when the winter rains hit. But opportunities to migrate successfully have been compromised by dams, reservoirs, highways, altered stream flows, residential community development, and predation by free-roaming domestic pets.

Invasive Plants/Animals

As in other provinces, invasive species present a noteworthy pressure on biodiversity. In addition to introduced invasive species, some native species have been favored by human activity to the point where they have become pests, threatening sensitive, native species. Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

Coastal beach and dune habitats are threatened by a number of invasive plant species. These habitats support unique plant and animal communities, including sensitive species like western snowy plover and beach layia, a small succulent plant endemic to the province. Dune habitats are naturally dynamic, with dune migration serving as a natural disturbance that keeps early successional dune and beach habitat available. Because coastal development and urbanization have occurred along many of the province’s sandy beach areas, dunes are limited in their ability to migrate. This problem is exacerbated by colonization by non-native plants, including European beach grass and yellow bush lupine, which form dense monocultures of vegetation and result in unnatural stabilization of beach and dune systems (Bossard et al. 2000). These invasive plants also displace native vegetation, including short-grass areas, degrading the habitat of such sensitive species as western lily and hippolyta fritillary. In salt marshes and coastal estuaries, particularly around Humboldt Bay, native plant communities are threatened by introduced dense-flowered cordgrass. Coastal wetlands are also threated by invasive reed canary grass.

The greatest invasive threats to the integrity of north coast redwood forests results from the pathogen that causes Sudden Oak Death (SOD), and the invasion of Jubata grass and Selloana grass. Tanoak is particularly susceptible to this disease, and given its importance in the lower canopies of most upland forests its loss will radically alter competitive dynamics, increase coarse woody fuel loads, alter surface fire weather conditions and fire behavior, and remove an important food source for wildlife. Because of these likely effects, SOD should not be seen as a typical forest disturbance; it is likely to bring a profound and essentially permanent change to the coast redwood landscape.

Populations of Jubata grass and Selloana grass have been detected in north coast redwood-Douglas fir forests in recent years. Initially brought in as ornamental plants, these grasses have begun to dominate young clearcuts across the North Coast and many naturally disturbed areas. Establishment of these invasive grasses can reduce or preclude fir or redwood seed establishment through competition of seedlings. This is of concern because of the current loss of tanoak from SOD and the historically moderate fire behavior associated with hardwood litter. The change in forest understory and increased grass cover may change small mammal assemblages and could reduce the quality of foraging habitat for sensitive species such as the Northern spotted owl. Because of the natural openness of redwood-Douglas fir forests, the imminent loss of tanoak to SOD, and the elevated wildfire risk because of increased fuel and possibly climate change, forest canopies may never close enough to shade out this invasive completely (USFS 2015).

Inland areas of the province are being invaded by such invasive weeds as yellow starthistle, spotted knapweed, and Scotch broom (Bossard et al. 2000). Medusa head, barbed goat grass, and perennial pepperweed are causing major problems in the Northern California Interior Coastal Ranges by invading and taking over native perennial grassland areas. Additionally, these annual plants increase the risk of fire in the system by becoming dry earlier in the season than native grasses. Most of these invasive plants spread via roadways and river corridors and then invade surrounding lands as a consequence of disturbance by fire, forest management practices, or agricultural practices and livestock grazing.

Native and non-native avian species causing problems in the province include brown-headed cowbirds, European starlings, common ravens, and jays. Native brown-headed cowbirds thrive in grazing lands, where they are attracted to livestock droppings and feed. With the historic growth of grazing lands, cowbirds have greatly expanded their range and have experienced population increases. Cowbirds can lower the reproductive success of native birds by laying their eggs in other birds' nests, causing them to raise the cowbird nestlings at the expense of their own. Native common ravens, Steller's jays, and introduced European starlings also thrive in human-altered environments, including recreational areas and have increased their populations to coincide with humans. Starlings compete with native birds, while ravens and jays prey on many native bird species. Ravens and jays, in particular, are one of the main causes for marbled murrelet nest failures within coastal redwood forests. Studies and monitoring in Redwood National State Parks, and elsewhere, have demonstrated that where there are high numbers of park visitors with food, like in campgrounds, there are very high numbers of Steller's jays and common ravens and high number of murrelet eggs predated (NPS 2015).

There are two invasive mammalian species that threaten ecosystem changes within the province: feral pigs and nutria. Feral pigs are highly destructive in Lake, Colusa, Marin, Tehama and Sonoma counties. They forage on blue oak acorn crops which are vital to mule deer and other wildlife as a fall food source. By removing this critical resource, mule deer and other wildlife no longer have forage when resources are limited. Additionally, because they are omnivorous and forage by rooting, feral pigs have the potential to impact a wide variety of plants and animals directly by consumption and indirectly through disturbance. In particular, rooting disturbance reduces survival of tree seedlings, and limits tree regeneration in oak woodlands. Nutria, a semiaquatic rodent native to South America, has become established just north of the California/Oregon border in Klamath Falls. Nutria can be extremely damaging to freshwater wetlands, turning marsh and wetlands into open water. Avid foragers, nutria can devour and destroy native aquatic vegetation, crops, and wetland areas. Their potential range expansion and dispersal puts northern California wetlands and (potentially) agricultural crops in Siskiyou County, at risk in the not-so-distant future (Cook-Fletcher, pers. comm., 2015).

Invasive aquatic invertebrates, which have become a problem in California waterways in recent years, may critically threatened the waterways and open water habitat within the North Coast and Klamath in the near future. Quagga mussels, zebra mussels, and New Zealand mud snails (NZMS) are a large focus of the California Aquatic Invasive Species Management Plan (CDFG 2008) and a standard decontamination protocol is being implemented to prevent spread by recreational users. State run fish hatcheries inspect and ensure their facilities and fish are not contaminated by these mollusks, which would hitchhike on hatchery raised fish into waters when planted (McAlexander, pers. comm., 2015). These species proliferate rapidly once introduced within waterways and threaten native habitat and species by changing ecosystem dynamics. For instance, once introduced into an area, NZMS can reach densities exceeding 500,000 per square meter. Such high densities, when reached, can have a negative effect on populations of other aquatic organisms, such as native snails and the insects and fish that feed on them. These species threaten to outcompete and displace native macroinvertebrates that are important food sources for trout and salmon, alter community composition, stream productivity, and nutrient cycling.

As of 2014, data show that quagga mussels and zebra mussels are not recorded within the province and have only taken a foothold in southern California (CDFW 2014). Prevention of quagga and zebra mussel introduction and establishment of these in any northern California waterbodies are critical parts of the state management plan. Keeping these two species from North Coast and Klamath waterbodies is critical for water quality, the economy, native fish and aquatic invertebrates, and recreation within the province. NZMS have been detected in several waterbodies throughout the province in Del Norte, Humboldt, Mendocino, Sonoma, Marin, Napa, Yolo, Solano, Shasta, and Tehama Counties (USGS 2015). NZMS are established within the province in the Lower Smit River, Lake Earl, Redwood Creek, Stone and Big Lagoons, Lower Klamath, Tomales-Drake's Bay drainages, the Russian, Garcia, and Napa Rivers, and Putah Creek. Their establishment in important salmonid streams within the province equates to additional stress on the struggling populations by eliminating important food sources. Vinson and Baker (2008) showed that Green River trout (Utah) with NZMS in their guts had significantly poorer body conditions than those without. In feeding trials, rainbow trout fed an exclusive diet of unlimited NZMS passed 54 percent of mudsnails through the digestive tract alive, and subsequently lost up to 0.48 percent of their initial body weight each day (which is nearly equal to the impact of starvation). NZMS has no known natural predators, parasites, or pathogens in California. Because there are no feasible eradication technologies, the first line of defense against New Zealand mud snail is containment and education to limit spreading populations. It is likely that freshwater ecosystems within the North Coast Range and Northern California Interior Coast Range ecoregion will be adversely affected in the future as these snail populations continue to grow. Many local and regional agencies are taking proactive efforts to prevent spread of invasive aquatic organisms. For example, Humboldt Bay Municipal Water District is trying to prevent contamination of Ruth Lake in Trinity County by requiring all water craft be registered and inspected.

Non-native fish species like largemouth and smallmouth bass, yellow perch, sunfish, black and white crappie, yellow perch, brown and brook trout, catfish and bullhead are present in waters throughout this province. Yellow perch, brown and brook trout, and Sacramento pikeminnow are some of those that negatively affect SGCN within the province. Yellow perch compete with trout and are believed to prey upon juvenile salmonids, while brown and brook trout aggressively out compete native trout species. Brook trout are present in many of the coldwater streams and creeks within the region and CDFW has begun eradication programs to remove these fish from critical native fish habitat especially Davis and Pine Creeks (McAlexander, pers. comm., 2015). Present in the Eel River, Sacramento pikeminnow are predatory fish that eat juvenile fish and compete with adults for food (Cook-Fletcher, pers. comm., 2015). The spread of this species is especially threatening to protected northern and coastal populations of coho and Chinook salmon and steelhead. Clear Lake hitch, located in the southern part of the province, is threatened by non-native sportfish like largemouth bass (which prey upon them) and other fish like Mississippi silversides and threadfin shad (which directly compete with it for food). Finally, with the increase in water temperatures because of dams and climate change, more waters may see an increase in warmwater centrarchid fish populations such as sunfish and crappies and a decrease in coldwater native salmon and steelhead. As these warm-water fish increase, they compete for limited food and resources with native fish.

American bullfrogs are a major invasive predator on herpofauna and fish species throughout California except in colder areas such as high altitudes and the northern California coast (van Hattem, pers. comm., 2015). Eradicating bullfrog populations is a major component of conservation for many SGCN frogs and fish species. With the increase in water temperatures because of dams and climate change and the importation of bullfrogs for food production in California, this species has proliferated and radiated into inland waters throughout northern California. With climate change potentially warming up coastal areas in the future, bullfrog populations that are held at bay because of colder weather may proliferate in the future. In the North Coast and Klamath Province, bullfrogs are currently a threat to sensitive species of frogs such as California red-legged frog, and fish such as the endangered coho salmon. Bullfrogs have been implicated in the spread of chytrid fungus, which has decimated native amphibian populations and continues to do so throughout California and will likely spread through the province threatening already declining populations. To combat this threat, CDFW staff in the province are collaborating with the CDFW Invasive Species Program in a pilot program to map bullfrog presence data, and subsequent management and eradication efforts, success of efforts, and management costs (Cook-Fletcher, pers. comm. 2015).

Many of the conservation strategies identified in the following section address prevention and early eradication of new invasive plants to stop them from becoming widespread. Cal-IPC has worked with stakeholder groups in this province to identify important early eradications species, many which are widespread in other parts of the state but not yet in the north, and others (like nutria) that have the potential to move south from Oregon. Some of these species include *Sesbania punicea, Euphorbia oblongata, Fallopia japonica, F. sachalinensis, Salvia aethiopsi,* *Chondrilla juncea, and Geranium lucidum*. Contact Cal-IPC for more information, or refer to http://calweedmapper.cal-ipc.org/region-iles/20130326_northcentral_invasiveweedstrategy.doc.

Fire and Fire Suppression

Wildfire is an ecologically important natural disturbance in the North Coast and Klamath Province. In forest communities, fires promote a mix of habitat types and successional stages. Some vegetation species and communities are adapted to fire; ceanothus and some other montane shrubs, for example, need fire to germinate. Fires create important habitat features like downed wood and hollow logs and tree bases that serve as dens for bears and other mammals and as nesting cavities for birds. Fires also create and maintain open forest habitats and meadows.

Climate, fuels, and terrain determine the extent, frequency, and intensity of wildfires. Owing to the moist coastal climate, redwood forests are believed to have naturally infrequent fire events. Over the last century, forest management and land development activities have altered the role of fire in the province. Fire suppression has had important effects on the province’s forest ecosystems. Because fires have not been allowed to burn, many areas of today’s forests are denser than early 20th-century forests, and many meadow habitats have been succeeded by forest growth. In other places, however, human activities have contributed to an increased frequency or severity of fires. Roads and rural residential development that expand the wildland-urban interface can lead to an increased incidence of human-caused fire. Additionally, some tree plantations experience more frequent severe fires than multi-aged forests (Odion et al. 2004).

Fire suppression activities, such as creating firebreaks along ridgetops, application of fire retardant, water drafting (i.e., use of suction to move water from a lake or stream), and back burning, can also damage vegetation communities, aquatic environments, and sensitive wildlife habitats.

Climate is also a major factor in determining fire patterns. Climate scientists project warmer and drier conditions in the coming century (Hayhoe et al. 2004; Schneider et al. 2002). These changes will add another variable to efforts to develop management measures that can approximate the historical role of fire in maintaining the mosaic of habitats and multi-aged forests naturally found across this landscape.

Livestock, Farming, and Ranching

Livestock grazing on private lands is prevalent in many portions of the province, as well as on public lands through allotments within the national forests. The effects of grazing on wildlife vary from beneficial to detrimental, depending upon how grazing is managed, including the seasonality and duration of grazing and the type and number of livestock. These effects also depend on the relative sensitivities of individual wildlife species, because not all species respond the same way to grazing. Well-managed livestock grazing can benefit sensitive plant and animal species, particularly by controlling annual grasses and invasive plants where these have become established and clearing undergrowth vegetation to create a fire-resilient landscape. These working lands are an essential part of the solution to conserving the state's wildlife.

While recognizing the values of appropriate grazing practices, the following discussion describes those situations where excessive grazing practices results in stresses to the conservation targets. Excessive grazing, as used here, refers to livestock grazing at a frequency or intensity that causes degradation of native plant communities, reduces habitat values for native wildlife species, degrades aquatic or other ecosystems, or impairs ecosystem functions.

The effects of grazing depend on rangeland management practices, including the seasonality and duration of grazing and the type and number of livestock. Livestock grazing in riparian areas can be a cause for concern because cattle congregate in these habitats, because of the proximity to water sources. Livestock trampling of stream channels results in collapse of stream banks and erosion of soils. In heavily grazed areas, cattle trails and reduced plant cover also contribute to erosion. Increased sediment in waterways can shade out aquatic plants, fill important pool habitats, and scour away or smother stream-bottom sediments that are important spawning sites and invertebrate habitats. Livestock consume and trample riparian plants, which decreases shade and can increase water temperatures, reducing habitat for species that depend on cool water (CDFG 2004). In the coastal portion of the province, more than 40 percent of the river miles listed as impaired under the Federal Clean Water Act list grazing as one of the causes of pollution (FRAP 2003). The effects of grazing on the water quality and temperature of spring-fed seeps and waterways can also be of concern, because these spring-fed systems often support many snail and amphibian species that can be very sensitive to water quality conditions (Ricketts et al. 1999).

Excessive grazing also contributes to changes in plant communities. Annual forage grasses replace native perennial grasses, and livestock can aid the spread of invasive weeds. They also graze away emergent vegetation from ponds, removing the structure amphibians attach their eggs onto and trample eggs masses when bathing and drinking. In the province's coniferous forest lands, grazing reduces grasses and other understory plants, eliminating habitat for some wildlife species, including small mammals and birds like chipping sparrow and fox sparrow that require herbaceous cover (Robinson and Alexander 2002). Where forest understory plants are consumed by livestock, woody species may increase in density in the absence of competition. Dense woody growth limits habitat for species requiring more open-forest habitats, such as Nashville warbler and mountain bluebird (Robinson and Alexander 2002).

Logging and Wood Harvesting

Forestry is the most widespread land use in the North Coast and Klamath Province, which is one of the state's leading timber-producing areas (FRAP 2003). There are 1.9 million acres of privately owned timber production lands in the province, the majority located in the coastal portion of the province and owned by large private timber companies (U.S. Fish and Wildlife Service [USFWS] 2005). Inland, a large proportion of the province's forest lands are in public ownership. The province's five national forests (Six Rivers, Klamath, Shasta-Trinity, Mendocino, and a small portion of the Siskiyou) comprise 4.8 million acres (34 percent of the province) and are managed by U.S. Forest Service (USFS) and U.S. Bureau of Land Management (BLM). USFS is updating the Northwest Forest Plan, which is a coordinated management plan for national forests in the northwest.

Historical forest management practices resulted in significant impacts on the province's forest habitats and waterways. Regulations governing current logging practices and advances in technology have substantially improved timber-harvest practices. However, some ongoing management practices continue to adversely affect the vegetation communities and wildlife habitats of forest systems. Legacy impacts from past logging practices continue to reduce forest contributions that reduce over-story shade and cool microclimates along stream channels provided by mature, near stream forests.

Shaped by natural disturbances and variable ecological conditions, forests are characterized by a mosaic of different habitat types, including stands of trees of different ages, shrub-dominated habitats, and numerous open meadows containing grasses and forbs, and wet fens. In recently disturbed areas, saplings, shrubs, and herbaceous understory vegetation are abundant. Other forest areas are dominated by large trees several centuries old and support complex habitat features like large, standing dead trees and decaying, fallen trees.

Over the last century and a half, forest management practices have included cultivation of even-aged timber stands, clear cutting, fire suppression, clearing of dead trees and downed wood, and road building for forest access and timber transport. Herbicide use to reduce shrub growth and shorten harvest rotations has also been employed. The cumulative effects of these practices have resulted in substantial changes in the forest habitats of the North Coast and Klamath Province, often making these forests less suitable for some wildlife communities. There are fewer old forest areas, and second-growth forests are simplified, with reduced structural diversity and less varied habitats. Forests managed for timber harvest are often characterized by even-aged stands of trees dominated by a single species, while the early grass-, forb-, and shrub-dominated stages of forest growth are cut short to quickly establish tree crops. Fire suppression and lack of harvest or thinning in areas planted for timber production result in unnaturally dense growth. This dense, woody growth can displace open-forest habitats like meadows and prevent sunlight from reaching the forest floor to support herbaceous vegetation.

Poorly constructed or maintained roads and ground disturbance resulting from timber harvest can also result in soil and surface-water runoff. High rainfall levels, steep topography, and erodable soils make many parts of the province particularly vulnerable to increased erosion and landslides. Erosion and sedimentation can have substantial consequences for aquatic systems, leading to turbidity and fine-sediment deposition that smothers spawning gravels as well as amphibian and invertebrate habitats (CDFG 2004; USFWS 2002). Headwaters amphibians like southern torrent salamanders and coastal tailed frogs need cool, clear, fast running water, and so sedimentation is a significant threat to their persistence. The addition of coarse sand, gravel, and cobble to waterways can raise stream bed levels and alter channel shape, resulting in shallower waterways and elevated temperatures. Under standards established by the National Clean Water Act, many rivers in the province (e.g., Albion, Big, Gualala, Russian, Navarro, Mattole, Eel, Van Duzen, Elk, Mad, Scott, and Trinity rivers and Freshwater, Jacoby, and Redwood creeks) are considered impaired because of excessive sediment loads and elevated temperatures that are at least partially attributable to timber harvest (State Water Resources Control Board 2012).


Dave Feliz, CDFW

Timber harvest can fragment forest lands, with adverse effects on wildlife and ecosystems. Forest roads can introduce invasive plant and animal species (Lindenmayer and Franklin 2002), and some species, like the varied thrush, Northern spotted owl, Northern goshawk, and Pacific fisher can tolerate a mosaic of habitat types for foraging, but species such as the spotted owl, prefer nesting or resting sites that include a core area with unfragmented interior forest characteristics (Gonzales 2006).

However, natural and human-caused disturbances (including timber harvest) also can benefit forest communities by creating canopy gaps that allow for the growth of understory vegetation and edge-habitats that are important to some of the province's wildlife species. Some species, like Northern goshawk and Pacific fisher, depend on large, old trees for nesting or denning but forage in more open areas where herbaceous vegetation supports abundant prey species (DellaSala et al. 2004). Many songbird species nest in open-canopy mixed grass and shrub habitats, while cavity-nesting birds, like the pileated woodpecker and Vaux's swift, depend on dead trees hollowed by fire (Robinson and Alexander 2002).

Climate Change

The climatic changes presented below will likely affect all conservation targets identified in this province. Climate change has only been included as a pressure for a subset of targets that are considered more vulnerable to climate impacts, and/or in instances where it was determined that interactions between climate change and other pressures could be addressed in a meaningful way through a conservation strategy.

Temperature

Climatic changes along the Northern California Coastline, the Northern Coast Ranges, and Interior Coast Ranges are expected to include increased average temperatures of 1.7 to 1.9°C (3.0 to 3.4°F) by 2070, and 1.5 to 4.5°C (2.7 to 8.1°F) by 2099 (PRBO 2011; Cayan et al. 2008). Mean maximum and minimum temperatures are projected to increase by 2.5°C (4.5°F) and 2.3°C (4.1°F), respectively, and frequency of extremely hot days (exceeding long-term 95th percentile) is projected to increase by 27 days per year. Prolonged hot spells are projected to increase by 1.6 events per year and increase in duration by 3 days (Bell et al. 2004). Many of these changes will be slightly less pronounced in coastal regions and amplified in inland regions.

Precipitation and Snowpack

Within the North Coast counties, changes in annual precipitation are projected to vary by location with a subtle decrease throughout the century in most areas. Areas of heavy rainfall (203 cm [80 inches] or more per year) are projected to lose 13 to 18 cm (5 to 7 inches) by 2050 and 28 to 38 cm (11 to 15 inches) by the end of the century. Slightly drier places are projected to see a decrease of around 8 to 10 cm (3 to 4 inches) by 2050 and 15 cm (6 inches) of precipitation by 2100 (California Emergency Management Agency [CalEMA] 2012). In the Klamath Mountains, annual precipitation is projected to decline by approximately an inch by 2050 and 5 cm (2 inches) by 2100 (CalEMA 2012). March snow levels in the higher-elevation, mountainous portions of region could drop to almost zero by the 2090s, a decrease of 5 to 25 cm (2 to 10 inches) from 2010 levels. In areas with more snow, 8 to 13 cm (3 to 5 inches) of reduction will occur by 2050. In areas with currently little snow (<8 cm [<3 inches] per year), the snowpack is projected to be near zero by 2050 (CalEMA 2012).

Freshwater Hydrologic Regimes

Projected loss of snowpack in this region would suggest a potential decrease in duration and magnitude of flows. While hydrologic changes have not been modeled, observational data show non-snowmelt dominated streams in northwest California have been trending towards later stream flow timing. There could also be a shift in timing of heaviest runoff. Observational data from last 50 years shows that in non-snowmelt streams, the center of mass of annual flow has shifted from 5 to 25 days later in the season (PRBO 2011).

Wildfire Risk

Substantial increase in fire risk is projected throughout the region. Modest increases in area burned are projected for 2050. By 2100, the projected frequency increases dramatically, eight times greater in parts of Del Norte, Humboldt, and Mendocino counties. Lake County and Northern Mendocino County are projected to have up to 2.5 times greater wildfire frequency (CalEMA 2012).

Sea Level Rise

Projected sea levels along the state’s coastline south of Cape Mendocino are expected to increase from 12 to 61 cm (5 to 24 inches) by 2050 compared to 2000 levels, and 42 to 167 cm

(17 to 66 inches) by 2100 compared to 2000 levels. North of Cape Mendocino, geologic forces are causing much of the land to uplift, resulting in a slower projected rate of sea level rise than California's coastline to the south. Between 2000 and 2100, sea level north of Cape Mendocino is projected to rise approximately 10 to 143 cm (4 to 56 inches) (California Ocean Protection Council [OPC] 2013:2). The increase in acreage vulnerable to 100-year floods because of sea level rise in the region will be 18 percent in both Humboldt and Mendocino counties and 17 percent in Del Norte County (CalEMA 2012).

5.1.6 Conservation Strategies

Conservation strategies were developed for conservation targets in the North Coast and Klamath Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted pressures. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.1-5 through 5.1-15 show the relationships between the stresses and the pressures for each target. Table 5.1-16 summarizes conservation strategies for the province.

Target: North Coastal and Montane Riparian Forest and Woodland

Goals (Northern California Coast Ranges):

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Goals (Northern California Coast):

- By 2025, acres of habitat (riparian) are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired endemic plant diversity (ground cover, shrubs, understory) are increased at least 5 percent from 2015.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.

- By 2025, acres/miles with desired channel pattern (natural floodplain) are increased by at least 5 percent from 2015 acres/miles.
- By 2025, miles connected (to natural floodplain) are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime (through management of water operations in the Eel, Klamath, Trinity, Mad, and Russian Rivers) are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):
- Educate CDFW staff, local agencies, and the public on the value of riparian habitats and the impacts to the system, including invasive issues.
- Co-develop a comprehensive invasive eradication and control outreach plan.
- Coordinate with CDFW invasive program, Non-governmental Organizations (NGOs), local landowners, and local/federal agencies.
- Provide the public with information about the negative impacts on fish and wildlife and their habitats associated with illegal marijuana cultivation.

Targeted pressure(s): Invasive plants/animals; housing and urban areas.

Conservation Strategy 2 (Direct Management): Habitat restoration and enhancement.

Objective(s):
- Recover ecological function of keystone species; where appropriate allow beaver colonies to persist for benefit of riparian habitat.
- Remove or setback levees to facilitate habitat restoration.

Targeted pressure(s): Strategy acts directly on target.

Dave Feliz, CDFW

Conservation Strategy 3 (Direct Management): Develop buffers along major rivers and streams.

Objective(s):
- Create riparian buffers along major rivers and streams.

Targeted pressure(s): Housing and urban areas; annual and perennial non-timber crops; logging and wood harvesting.

Conservation action(s):

- Redesignate buffers as natural resource zones in county general plans.

Conservation Strategy 4 (Law and Policy): Develop CDFW Riparian Conservation Policy.

Objective(s):

- Conserve riparian habitats and create CDFW policy for their conservation.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops; logging and wood harvesting.

Conservation action(s):

- Change CDFW or state regulations to have harsher penalties for environmental impacts resulting from marijuana cultivation activities.
- Deter water diversions from streams and creeks that impact riparian vegetation.
- Deter peat collection from fens.
- Make importation of bullfrogs illegal in California.

Conservation Strategy 5 (Management Planning): Improve implementation of grazing best management practices (BMPs).

Objective(s):

- Improve the condition of riparian habitat by improving grazing management techniques and reducing the impact from improper grazing practice.
- Increase implementation of appropriate grazing BMPs on private lands.

Targeted pressure(s): Livestock, farming, and ranching; housing and urban areas.

Conservation action(s):

- Coordinate with National Resource Conservation Service (NRCS).
- Coordinate with California Cattlemans Association, the California Farm Bureau Federation, and federal lands permittees.

Conservation Strategy 6 (Partner Engagement): Develop Riparian and Wetlands Task Force.

Objective(s):

- Compile CDFW expertise to find solutions for statewide resource conservation issues.
- Improve the CDFW riparian conservation approaches so that they are more scientifically sound.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):

- petition CDFW's Science Institute.

Conservation Strategy 7 (Partner Engagement): Coordinate with Regional Conservation Districts (RCDs), flood control agencies, counties, cities, and watershed groups/councils.

Objective(s):

- Restore natural riverine floodplains, currently being used for grazing and farming, by reconnecting the river to the floodplain; pool resources, funding and expertise to ensure success of this process.
- Gather support for the process with multi-agency collaboration and partnerships.
- Streamline processes such as the Incidental Take Permitting, California Environmental Quality Act (CEQA) review, Coastal Development Permitting, and grant funding.
- Educate stakeholders.
- Consider funding for watershed coordinator positions through Fisheries Restoration Grant Program or other sources.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Work with NRCS and Fisheries Restoration Grant Program.

Conservation Strategy 8 (Land Acquisition/Easement/Lease): Implement Santa Rosa Plain Conservation Strategy and Draft Santa Rosa Plain Recovery Plan. Utilize potential and existing conservation lands, including banks, mitigation sites and other public and private lands to develop and implement conservation actions and management plans for SGCN that inhabit grassland habitats, vernal pools and associated habitats on the Santa Rosa Plain.

Objective(s):

- Implement Santa Rosa Plain Conservation Strategy and the Draft Santa Rosa Plain Recovery Plan.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas.

Conservation action(s):

- Develop and implement conservation actions, land acquisition and management plans as part of the Santa Rosa Plain Conservation Strategy and Draft Santa Rosa Plain Recovery Plan.

Table 5.1-5 Stresses and Pressures for North Coastal and Montane Riparian Forest and Woodland

Priority Pressures	Stresses											
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics					Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Sea level rise	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in water chemistry	Change in flood occurrence, frequency, intensity, and area flooded	Change in pollutants	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents		X			X		X	X		X		
Annual and perennial non-timber crops*		X	X	X		X		X	X	X	X	X
Climate change	X	X	X	X	X	X			X	X	X	X
Dams and water management/use		X	X	X		X	X		X	X	X	X
Household sewage and urban waste water		X			X		X	X		X		
Housing and urban areas		X	X			X		X	X			X
Invasive plants/animals									X	X	X	
Livestock, farming, and ranching		X	X	X	X	X			X	X		X
Roads and railroads		X	X									X

*This includes illegal marijuana cultivation.

Target: Freshwater Marsh

Goals:

- By 2025, acres of freshwater emergent wetland habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, population abundance of key species (SGCN) is increased by at least 5 percent from 2015 population.
- By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5 percent from 2015.
- By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, population of key species (beaver) is increased by at least 5 percent from 2015 population.
- By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5 percent from 2015 acres/miles.
- By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Outreach and Education): Provide outreach and education.

Objectives:

- Influence public awareness of proper land management for freshwater marshes by providing information to landowners regarding BMPs and proper wetland management.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Target Buckeye Conservancy and RCDs.
- Design and produce brochures with wetland conservation message.
- Employ web-based media for providing information to public.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Purchase land and conservation easements.

Objective(s):
- Improve land management by removing invasive species and creating better grazing practices.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Prioritize with Conceptual Area Protection Plan (CAPP) and Environmental Site Assessment.

Conservation Strategy 3 (Law and Policy): Advocate for laws and policies.

Objective(s):
- Strengthen regulatory authority over wetlands and integrate beaver ecology into wetland restoration activities.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Evaluate and update Wetlands Policy.
- Implement wetland and riparian technical memorandum.
- Review and modify CDFW policy on beaver depredation.
- Update wetlands implementation policy.

Conservation Strategy 4 (Management Planning): Develop management plans.

Objective(s):
- Develop BMPs for ecosystem and invasive species management on CDFW lands.
- BMPs would provide guidance on managing CDFW lands for multi-species use and benefit both recreation and conservation of native species.

Targeted pressure(s): Invasive plants/animals; livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Revise Land Management Plan (LMP) guidelines to include ecosystem management.
- Update LMPs to be consistent with new guidelines for managing at an ecosystem level.
- Develop policy on ecosystem management on public lands.

Conservation Strategy 5 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):

- Provide economic incentives through restoration grants.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Table 5.1-6 Stresses and Pressures for Freshwater Marsh

Priority Pressures	Stresses												
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics						Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Sea level rise	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in pollutants	Change in nutrients	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure and composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents							X	X			X		
Annual and perennial non-timber crops		X	X	X	X	X	X	X	X	X	X	X	X
Climate change	X	X	X	X	X				X	X	X	X	
Commercial and industrial areas		X	X	X	X	X	X		X	X	X	X	X
Dams and water management/use		X	X	X	X	X			X	X	X	X	X
Household sewage and urban waste water		X					X	X			X		
Housing and urban areas		X	X	X	X	X	X		X	X	X	X	X
Industrial and military effluents							X	X			X	X	
Invasive plants/animals		X		X	X				X		X	X	
Livestock, farming, and ranching		X	X		X			X		X	X	X	X
Mining and quarrying		X					X						
Roads and railroads		X	X		X					X	X	X	X

Target: Pacific Northwest Conifer Forests

Goals:

- By 2025, acres of redwood habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity (multi-story canopy) are increased from at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic (udic) regime are increased by at least 5 percent from acres/miles.
- By 2025, acres with suitable soil characteristics (in wet meadows) are increased by 5 percent from 2015 acres.
- By 2025, acres with desired (late) stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Conduct research (data management) on conifer forest ecosystems and response to fire.

Objective(s):

- Research efficacy of different techniques to manage forest and reduce catastrophic fire.
- Study and document the post-fire wildlife response and the response of wildlife to different logging systems.
- Document baseline conditions and monitor trends of the conifer forests ecosystem and trends of target SGCN using occupancy as a metric.
- Conduct post-fire monitoring and prevention of invasive species invasion.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education.

Objective(s):

- Provide information to the public on invasive species identification and management, grazing BMPs, and wildlife-friendly land use policies.
- Increase public awareness of the values of intact redwood habitats.
- Recruit public participation in monitoring invasive species and rapid response.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation Strategy 3 (Direct Management): Manage invasive species.

Objective(s):

- Reduce the spread of invasive species in redwood habitat by 20 percent. This reduction should include active management and control (i.e., treating disturbed soil to prevent establishment of invasive species).

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Coordinate with California Invasive Plant Council (CalIPC).
- Work with California Department of Forestry and Fire Protection (CAL FIRE) to monitor post-harvest sites.
- Identify acceptable herbicides.

Conservation Strategy 4 (Management Planning): Advocate for wildlife-friendly fire management.

Objective(s):

- Develop policies to reduce invasive species during post-fire treatment.
- Restore native vegetation to ensure fire resistance in target vegetation.

Targeted pressure(s): Invasive plants/animals; agricultural and forestry effluents.

Conservation action(s):

- Coordinate with fire agencies to develop BMPs for active and post-fire treatment.
- Develop comprehensive sage habitat map identifying quality and recommended action during fire.

Conservation Strategy 5 (Management Planning): Provide input on project planning and decision making process, by leading or participating in land use planning for rural, urban, or agricultural lands (e.g., provide input on local land use plans), developing county-wide zoning plans, and participating in workgroup regarding low impact development siting.

Objective(s):

- Participate in planning and decision making processes to ensure that redwood habitat is conserved.
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Parasites/pathogens/diseases; logging and wood harvesting; roads and railroads.

Conservation Strategy 6 (Management Planning): Develop management plans for the conservation of natural resources.

Objective(s):

- Improve existing fire management plans to include use of fire for habitat improvements and identify high value wildlife habitat.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):

- Engage USFWS about listed species and management indicator species.
- Identify high value forested wildlife habitats.

Conservation Strategy 7 (Partner Engagement): Partner with USFS, NRCS, The Nature Conservancy (TNC), Western Klamath Restoration Partnership, Mendocino Firescape, and others for joint advocacy.

Objective(s):

- Influence management of federal lands with partnerships.

Targeted pressure(s): Parasites/pathogens/diseases; logging and wood harvesting.

Conservation action(s):

- Coordinate with USFS on forest plan revisions and other landscape level planning efforts, when appropriate.
- Coordinate with partners to prevent intense wildfires to protect wildlife habitat, water quality, and recreation opportunities.
- Collaborate with Western Klamath Restoration Partnership and Mendocino Firescape on landscape level planning efforts that overlap with SWAP strategies,
- Advocate for appropriate grazing practices.
- Review existing ranching and grazing BMPs.
- Partner and advocate for reducing rodenticide use.
- Work with NRCS, BLM, USFS, California Cattleman's Association, California Farm Bureau Federation, and landowners to modify BMPs as needed.
- Incorporate use of BMPs into CEQA comment letters.
- Identify key private land owners to whom outreach is directed.
- Advocate prescribed burns.
- Advocate for post burn weed control.
- Coordinate with local Air Quality Management Districts to consider ways to allow for more prescriptive burn days.

Conservation Strategy 8 (Training and Technical Assistance): Provide training on invasive species management.

Objective(s):

- Train regional staff and managers on invasive species management and control techniques.
- Provide regular annual training for CDFW staff and make training available to other agencies, non-governmental organizations and consultants.

Targeted pressure(s): Introduced genetic material; invasive plants/animals.

Table 5.1-7 Stresses and Pressures for Pacific Northwest Conifer Forests

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes		Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents	X				X	
Fire and fire suppression		X	X	X	X	
Introduced genetic material				X		
Invasive plants/animals		X	X	X		
Livestock, farming, and ranching	X		X	X	X	X
Logging and wood harvesting	X	X	X	X	X	X
Parasites/pathogens/diseases		X	X	X		
Roads and railroads	X					X
Wood and pulp plantations			X			

Target: Pacific Northwest Subalpine Forest

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect more information on climate-related impacts to species and habitats in the red fir/subalpine zone, to better predict future distribution and viability and inform land acquisition and other strategies.

Objective(s):

- Identify clear management needs and outcomes with input from relevant data users.
- Conduct research that provides answers to relevant questions, allows appropriate audiences to access data, develops and provides recommendations for conservation actions, and uses data to inform conservation actions.

Targeted pressure(s): Fire and fire suppression; climate change.

Conservation Strategy 2 (Data Collection and Analysis): Collect data to evaluate effects of fuels treatments in the red fir zone, and whether treatments can partly offset climate-related increases in fire severity.

Objective(s):

- Identify clear management needs and outcomes with input from relevant data users.
- Conduct research that provides answers to relevant questions, allows appropriate audiences to access data, develops and provides recommendations for conservation actions, and uses data to inform conservation actions.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 3 (Economic Incentives): Develop economic incentives to reduce greenhouse gas emissions within California.

Objective(s):

- Develop and provide economic incentives to reduce greenhouse gas emissions in California and target 5 percent of the population using these incentives.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Land Use Planning): Provide input on local land use plans regarding the conservation of natural resources.

Objective(s):

- Within 3 months, CDFW provides input to local land use planners on land use plans.
- Within 1 year of providing input, the land use plan is approved and consistent with the input provided by CDFW.
- Within 1 year of the campaign, the plans are implemented in a manner that is consistent with the CDFW input.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 5 (Direct Management): Implement fuels treatments in red fir, if determined to be effective (see "Data Collection and Analysis").

Objective(s):

- Management actions are implemented by 2025.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 6 (Management Planning): Develop or update management plans to integrate the effects of climate change.

Objective(s):

- By 2025, the proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- By the end of the project/grant funding cycle, the management plans include appropriate strategies, action and monitoring plan for SGCN, habitats, and natural processes.
- Within 2 years of start of the management plan, appropriate audiences are accessing data.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 7 (Partner Engagement): Establish partnership to co-monitor target habitat on state and federal lands.

Objective(s):

- By 2025, a mutually agreed upon partnership and monitoring strategy is developed and monitoring is implemented.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 8 (Environmental Review): Review projects for potential increases in greenhouse gas emissions; require mitigation as needed.

Objective(s):

- By 2025, input on environmental review document is provided.
- By 2025, an environmental review document is approved that is consistent with the input provided.
- By 2025, the plan is implemented in a manner that is consistent with the input and the behavior of local entity is consistent with input.

Targeted pressure(s): Climate change.

Conservation Strategy 9 (Training and Technical Assistance): Provide science-based applications and tools for climate change and natural resources management.

Objective(s):

- By 2025, 90 percent of target audience (land managers) that were trained have knowledge consistent with the training.
- By 2025, 5 percent of target audience (land managers) have adopted or continued actions consistent with the training.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):

- Identify priority list of invasive species

Table 5.1-8 Stresses and Pressures for Pacific Northwest Subalpine Forest

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development
Climate change	X	X	X	X	X	X
Fire and fire suppression	X		X	X		X
Parasites/pathogens/diseases	X			X	X	
Recreational activities			X			

Target: California Foothill and Valley Forests and Woodlands

Goals:

- By 2025, acres with desired endemic plant diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity (oak recruitment) are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired inches of groundwater are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Provide economic incentives to landowners for managing grazing at appropriate residual dry matter (RDM).

Targeted pressure(s): Fire and fire suppression; livestock, farming, and ranching; invasive plants/animals.

Debra Hamilton, CDFW

Conservation Strategy 2 (Direct Management): Conduct ecologically sound controlled burns on CDFW lands.

Objective(s):
- Conduct ecologically sound controlled burns on the CDFW lands**.**

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 3 (Direct Management, Outreach and Education): Conduct demonstration management, including providing public demonstrations of successful BMPs and scientifically documenting environmental change from implementation of BMPs.

Objective(s):
- Provide public demonstrations of successful BMPs and scientifically document environmental change from BMP implementation.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 4 (Land Acquisition/Easement/Lease): Purchase and provide long-term conservation of land.

Objective(s):
- Provide long term conservation to land purchased.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 5 (Land Acquisition/Easement/Lease): Protect land through conservation easements.

Objective(s):
- Protect land through conservation easements.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 6 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):

- Work with landowners and allotment leasees to implement BMPs for grazing.
- Inform public of incentive programs available to them.
- Educate recreation-focused landowners on wildlife BMPs.
- Grazing fees will be used to provide funding for recreation use).
- Keep CDFW staff current on relevant science such as restoration techniques and science.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation Strategy 7 (Partner Engagement): Establish partnerships to enhance conservation opportunities.

Objective(s):

- Develop partnerships with agencies and organizations to enhance conservation opportunities. Current partnerships include BLM, Resource Conservation Districts, UC Davis, Audubon Society, Blue Ridge-Berryessa Partnership.

Targeted pressure(s): Recreational activities; invasive plants/animals; livestock, farming, and ranching.

Table 5.1-9 Stresses and Pressures for California Foothill and Valley Forest and Woodlands

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes		
	Change in natural fire regime	Change in soil moisture	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development
Fire and fire suppression	X		X	X	X
Invasive plants/animals	X	X	X	X	X
Livestock, farming, and ranching	X	X	X		
Recreational activities	X			X	

Target: Alpine Vegetation

Goals:

- By 2025, acres connected are maintained within the ecoregion from 2015 acres.
- By 2025, acres of macrogroup (target) are maintained within the ecoregion from 2015 acres.
- By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained within the ecoregion from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Gather more information on alpine habitat requirements and impacts of climate change on the plant community and its KEAs, specifically in the North Coast and Klamath Province.

Objective(s):

- Within 5 years of start of research, answers to relevant questions are provided.
- Information is obtained on macrogroup habitat requirements and impacts to climate change on the macrogroup and KEAs specifically in the Klamath/Cascade regions. Information on KEAs needed include: soil moisture and regime and area requirements of target alpine vegetation as a whole; snow pack levels and snow cover period requirements including minimal seasonality and weather regimes required to maintain target vegetation; changes in the above KEAs; and area and extent of macrogroup in relation to current weather changes from climate change.
- Within 10 years of start of research, appropriate audiences are accessing information and data are being used to inform conservation actions. Data is used to inform state and federal land managers; land managers develop conservation strategies to reduce any pressures to macrogroup habitat that may be cumulative to climate change (e.g., recreation, grazing).

Targeted pressure(s): Climate change.

Conservation action(s):

- Develop conservation strategies to reduce any pressures on alpine habitat that may be cumulative with adverse effects of climate change (e.g., recreation, grazing).

Conservation Strategy 2 (Outreach and Education): Engage urban citizens, educate grade school children on climate change, and expand conservation education programs to include climate change and solutions to reduce impacts such as reducing greenhouse gas emissions.

Objective(s):

- Within 10 years of campaign, at least 90 percent of target audience receives the message.
- Within 10 years of campaign, at least 90 percent of target audience has desired attitudes and values.
- Within 10 years of campaign, at least 90 percent of target audience continues the desired behavior.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Conservation Strategy 3 (Economic Incentives): Develop economic incentives to reduce greenhouse gas emissions within California.

Objective(s):

- Within 5 years of the start of the project, economic incentive is developed, provided and implemented in a manner that is consistent with design.
- Within 5 years of implementation, the desired pressure reduction is seen.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Direct Management): Restore subalpine and alpine meadows, including restoration or enhancement of degraded habitats, monitoring populations, fencing for protection and removing barriers to species movement.

Objective(s):

- Within 5 years of receiving funding, 100 percent of management actions are implemented.

Targeted pressure(s): Climate change; livestock, farming, and ranching; recreational activities; invasive plants/animals.

Conservation action(s):

- Prioritize restoration of subalpine and alpine meadows.
- Remove non-native or invasive species.
- Add fencing to restrict livestock and human access to sensitive areas.
- Consider retirement of grazing allotments on state controlled lands.
- Add BMPs for assisting vegetation shift from impending climate change.

Conservation Strategy 5 (Direct Management): Manage grazing and invasive species by removing trails, restricting grazing and pack animal use of subalpine and alpine meadows on public lands, removing campground use away from subalpine and alpine meadows, and removing invasive species.

Objective(s):

- Within 10 years, 5 percent of management actions are implemented.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):

- Add BMPs for assisting vegetation shift from impending climate change.
- Consider retirement of grazing allotments on state controlled lands.

Conservation Strategy 6 (Management Planning): Develop or update management plans to integrate the effects of climate change.

Objective(s):

- By 2025, more information is obtained on local climate change impacts to the target alpine vegetation. More information is obtained on local impacts of climate change and on the management actions that exacerbate climate change impacts to KEAs.
- By 2025, management plans include appropriate strategies, actions and monitoring plans for SGCN, habitats, and natural processes. Plan recommendations (management strategies, and action and monitoring plans) are developed for SGCN, habitats, and natural processes.
- By 2025, the plan recommendations are being used to inform conservation actions. Conservation strategies are implemented based on research into KEAs and climate change impacts to macrogroup habitat to reduce any pressures to macrogroup habitat that may be cumulative to climate change (e.g., recreation and grazing).

Targeted pressure(s): Climate change; recreational activities; livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 7 (Partner Engagement): Establish partnerships to co-monitor target on state and federally managed lands, to establish decision-making processes with other public and private entities to determine or implement strategies, convene an advisory committee to assist with implementation of strategies and engage university students in research.

Objective(s):

- Within 1 year of engaging with the partner, a mutually agreed upon partnership and monitoring strategy is developed.
- Within 3 years of engaging with the partner, monitoring is implemented.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Conservation Strategy 8 (Training and Technical Assistance): Provide training on science based applications and tools. Provide science-based applications and tools for climate change and natural resources management.

Objective(s):

- By 2025, 90 percent of the target audience (land managers) that were trained have knowledge consistent with the training.
- By 2025, 5 percent of the target audience (land managers) have adopted or continue actions consistent with the training.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Table 5.1-10 Stresses and Pressures for Alpine Vegetation

Priority Pressures	Stresses										
	Climate Related Factors							Soil and Sediment Characteristics	Ecosystem Conditions and Processes		
	Change in CO_2 levels	Change in spring average temperature	Change in summer average temperature	Change in temperature extremes	Change in snow pack	Change in snow cover period	Change in soil temperature	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Habitat fragmentation
Climate change	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas									X	X	X
Invasive plants/animals									X	X	
Livestock, farming, and ranching								X	X	X	X
Recreational activities								X		X	

Target: Wet Mountain Meadow; Fen (Wet Meadow); Mountain Riparian Scrub and Wet Meadow; Subalpine Aspen Forests and Pine Woodlands (Meadows); Western Upland Grasslands

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Conduct comprehensive ecological assessment (research) and evaluate climate effects on aspen meadows.

Objective(s):

- Study and understand the wildlife response in the aspen community to management and restoration of aspen meadows.
- Delineate aspen-meadows within the ecoregion.

Targeted pressure(s): Fire and fire suppression; climate change.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data regarding aspen meadows and wildlife.

Objective(s):

- Complete baseline inventory of aspen-meadows within ecoregion.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):

- Ensure forest professionals, students, and the public are more knowledgeable about forest practices that benefit wildlife.
- Provide best available science and strategies to landowners when opportunities present themselves.
- Develop and maintain CDFW website.
- CDFW staff should attend workshops, symposia, online meetings and trainings, and other forums to identify shortcomings and strategies.

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies that protect natural resources.

Objective(s):

- Standardize BMPs developed for management of aspen-wet meadows that build on current guidelines and include a monitoring component.
- Develop and implement policies that benefit forest maturation with the Board of Forestry.
- Approve and implement policies that benefit management of aspen-wet meadows.
- Policies eliminate barriers to management (i.e., Forest Practice Regulations [FPRs]).
- Develop timber-harvest cumulative-impact standards for each watershed or group of adjacent watersheds to protect aquatic ecosystems and conserve wildlife habitat.
- Policies adopt a "no net loss" policy for critical habitat.
- Devote CDFW staff to engaging the appropriate decision-making agencies and boards.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Change CDFG code regulations to have harsher penalties for environmental impacts resulting from marijuana cultivation activities.
- Work to develop cumulative impacts standards.
- Develop no-net-loss policy for meadow aspen.

Conservation Strategy 5 (Direct Management): Implement habitat restoration and enhancement of aspen meadows.

Objective(s):

- Restore 5,000 acres of aspen meadows through active management.
- Remove encroaching conifer trees greater than 18 inches diameter at breast height from aspen meadows.
- Use managed thinning or conduct controlled burns.

Targeted pressure(s): Fire and fire suppression; climate change.

Conservation action(s):

- Inventory aspen meadows, evaluate condition, establish baseline.
- Coordinate with USFS, CAL FIRE, NGOs and private landowners.

Conservation Strategy 6 (Environmental Review): Conduct environmental review, maintain devotion of staff to environmental review of CEQA projects, and enhance staffing levels to commit to environmental review of National Environmental Policy Act (NEPA) projects on federal lands.

Objective(s):

- Improve CDFW staffing capacity through redirected or new positions to allow participation in state and federal environmental review.

Targeted pressure(s): Logging and wood harvesting.

Conservation action(s):

- Develop statewide management and implementation strategy.

Conservation Strategy 7 (Partner Engagement): Partner for joint advocacy by establishing partnership for privately managed lands and decision-making processes with other public and private entities.

Objective(s):

- Form partnerships between agencies and landowners that benefit wildlife on timberlands.
- Agencies and landowners jointly implement ten projects that benefit wildlife.

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Table 5.1-11 Stresses and Pressures for Wet Mountain Meadow; Fen (Wet Meadow); Mountain Riparian Scrub and Wet Meadow; Subalpine Aspen Forests and Pine Woodlands; Western Upland Grasslands

Priority Pressures	Stresses							
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics		Ecosystem Conditions and Processes				
	Change in natural fire regime	Change in water levels and hydroperiod	Change in groundwater tables	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Climate change	X	X	X		X	X		
Fire and fire suppression	X				X		X	
Invasive plants/animals (non-native species)	X			X	X	X	X	X
Invasive plants/animals* (native species)	X	X		X	X	X	X	X
Livestock, farming, and ranching	X			X	X	X		X
Logging and wood harvesting	X	X	X					X

*This addresses native species encroachment.

Target: Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, acres connected are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Conduct comprehensive ecological assessment (research) on target, particularly aspen meadows.


Patricia Bratcher, CDFW

Objective(s):

- Delineate mature forests.
- Increase and understand wildlife use of restored mature forests.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data on subalpine aspen forests and pine woodlands (mature conifer forest).

Objective(s):

- Study the area and extent of baseline inventory of mature forests to inform fire management decisions.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education.

Objective(s):

- To increase the knowledge in forest professionals, students, and the public about forest practices that benefit wildlife.
- Provide best available science and strategies to landowners when opportunities present themselves.
- Develop and maintain CDFW website.
- CDFW attend workshops, symposia, online meetings and trainings, and other forums to identify shortcomings and strategies.
- Enlist professional foresters to conduct outreach at elementary and high schools, junior and undergraduate colleges, and other educational formats.)

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies that protect natural resources.

Objective(s):
- Develop and implement standardized BMPs for management of mature forests that built on current guidelines and include a monitoring component. Build on current guidelines and include monitoring component.
- Approve and implement policies that benefit management of mature forests.
- Policies eliminate barriers to management (i.e., FPRs).
- Develop timber-harvest cumulative-impact standards for each watershed or group of adjacent watersheds to protect aquatic ecosystems and conserve wildlife habitat.
- Policies will adopt a "no net loss" policy for critical habitat.
- Devote CDFW staff to engaging the appropriate decision-making agencies and boards.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Work to develop cumulative impacts standards.
- Develop no-net-loss policy for meadow aspen.

Conservation Strategy 5 (Direct Management): Implement habitat restoration and enhancement of aspen meadows.

Objective(s):
- Restore 5,000 acres of mature forests through active management.
- Remove encroaching conifer trees greater than 18 inches diameter at breast height from aspen meadows.
- Use managed thinning or conduct controlled burns.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Inventory aspen meadows, evaluate condition, establish baseline.
- Coordinate with USFS, CAL FIRE, NGOs, and private landowners.

Conservation Strategy 6 (Partner Engagement): Partner for joint advocacy with public and private sectors.

Objective(s):
- Form partnerships between agencies and landowners that benefit wildlife on timberlands.
- Participate in the Fire Learning Network, and develop partnerships with USFS, Native Tribes, Fire Safe councils, and others planning landscape level restoration activities.
- Agencies and landowners jointly implement projects that benefit wildlife.

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Conservation Strategy 7 (Environmental Review): Conduct environmental review, maintain devotion of staff to environmental review of CEQA projects, and enhance staffing levels to commit to environmental review of NEPA projects on federal lands.

Objective(s):
- Improve staffing capacity to participate in state and federal environmental review.

Targeted pressure(s): Logging and wood harvesting.

Conservation action(s):
- Statewide management and implementation strategy.

Table 5.1-12 Stresses and Pressures for Subalpine Aspen Forest and Pine Woodlands

Priority Pressures	Stresses			
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes		
	Change in natural fire regime	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X	X	X
Logging and wood harvesting	X	X	X	X
Parasites/pathogens/diseases		X		

Target: Montane Upland Deciduous Scrub

Goals:
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, connected montane shrubland and grassland acres are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Conduct comprehensive ecological assessment (research).

Objective(s):
- Delineate aspen meadows.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Evaluate climate effects to aspen meadows.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data about aspen meadows and wildlife.

Objective(s):
- Establish a baseline inventory of aspen stands.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):
- Increase knowledge of forest professionals, students, and the public about forest practices that benefit wildlife.
- Provide the best available science and strategies to landowners when opportunities present themselves.
- Develop and maintain CDFW website.
- Have CDFW staff attend workshops, symposia, online meetings and trainings, and other forums to identify shortcomings and strategies.
- Enlist professional foresters to conduct outreach at elementary and high schools, junior and undergraduate colleges, and other educational formats.

Targeted pressure(s): Logging and wood harvesting.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies that protect natural resources.

Objective(s):
- Policies with the Board of Forestry are developed that help conserve montane shrubland and grassland (early seral forest habitat).
- Develop and implement standardized BMPs for management of aspen wet meadows that built on current guidelines and include a monitoring component. Build on current guidelines and include monitoring component.
- Approve and implement policies that benefit management of aspen wet meadows.
- Policies eliminate barriers to management (i.e., FPRs).

- Develop timber-harvest cumulative-impact standards for each watershed or group of adjacent watersheds to protect aquatic ecosystems and conserve wildlife habitat.
- Policies will adopt a “no net loss” policy for critical habitat.
- Devote CDFW staff to engaging the appropriate decision-making agencies and boards.

Targeted pressure(s): Climate change.

Conservation action(s):

- Develop policy statement for Board of Forestry and Fish and Game Commission.
- Collaborate with USFS, BLM, and private landowners on development of BMPs.
- Work to develop cumulative impacts standards.
- Develop no-net-loss policy for meadow aspen.
- Increase wildlife use of restored aspen meadows from 2015 levels.
- By 2025, aspen community has positively responded to management actions.

Conservation Strategy 5 (Direct Management): Implement habitat restoration and enhancement for aspen meadows.

Objective(s):

- Restore 10 percent of aspen meadows through active management.
- Remove encroaching conifer trees greater than 18 inches diameter at breast height from 10 percent of aspen meadows through managed thinning and conducting controlled burns.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 6 (Partner Engagement): Partner for joint advocacy with public and private sectors. Establish partnership for privately managed lands. Establish decision making processes with other public and private entities to determine or implement strategies. Creating and maintaining partnerships will ensure the coordinated development of conservation strategies or actions to reduce climate-related stresses to species and habitats.

Objective(s):

- Form partnerships between agencies and landowners that benefit wildlife on timberlands.
- Agencies and landowners jointly implement projects that benefit wildlife.

Targeted pressure(s): Logging and wood harvesting.

Conservation Strategy 7 (Environmental Review): Conduct environmental review. Maintain devotion of staff to environmental review of CEQA projects. Enhance staffing levels to commit to environmental review of NEPA projects on federal lands.

Objective(s):

- Improve staffing capacity to participate in state and federal environmental review.

Targeted pressure(s): Logging and wood harvesting; housing and urban areas.

Conservation action(s):
- Develop statewide management and implementation strategy.

Table 5.1-13 Stresses and Pressures for Montane Upland Deciduous Scrub

Priority Pressures	Stresses						
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in groundwater tables	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X	X	X	X	X	X
Housing and urban areas	X	X	X	X	X	X	X
Logging and wood harvesting	X	X	X	X	X	X	X

Target: Coastal Dune and Bluff Scrub

Goals:
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres connected are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect priority habitats through fee title acquisition, permanent conservation easement, or other means; purchase land in a corridor connecting two protected areas to provide connectivity of habitat.

Objective(s):
- Ensure that funds are in place and priority sites are placed in easements; and, at each annual review, ensure that easements or leases are in compliance.

Targeted pressure(s): Tourism and recreation areas; annual and perennial non-timber crops; housing and urban areas; climate change; commercial and industrial areas.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Designate conservation areas with emphasis on sites or landscapes that have unique and important value to wildlife.

Objective(s):

- Designate 5,000 acres for conservation area status.

Targeted pressure(s): Roads and railroads; housing and urban areas; commercial and industrial areas.

Conservation Strategy 3 (Data Collection and Analysis): Collect biological and ecological data to address key information gaps on SGCN, habitats, and pressures.

Objective(s):

- Ensure that: the proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- Research provides answers to relevant questions.
- Appropriate audiences are accessing data.
- Research provides recommendations for conservation actions.
- Data are being used to inform conservation actions.
- Ensure that conservation strategies are implemented, based on research, to reduce any pressures to conservation targets that may be cumulative to climate change (e.g., recreation, grazing).
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; tourism and recreation areas; annual and perennial non-timber crops; fire and fire suppression; invasive plants/animals; airborne pollutants; climate change.

Conservation Strategy 4 (Law and Policy): Develop or influence law and policy that addresses vehicle emissions, timber harvest cumulative impacts, critical habitat, and marine species with ranges that overlap jurisdictional boundaries.

Objective(s):

- Adopt policies that address vehicle emissions, no net loss of critical habitat, timber harvest cumulative impact standards, and interstate enforcement for marine species with ranges that cross jurisdictional boundaries.

Targeted pressure(s): Airborne pollutants; climate change.

Conservation Strategy 5 (Land Use Planning): Provide input to land use planning decisions.

Objective(s):

- Ensure that: local land use planners receive input on land use plans; a land use plan is approved that is consistent with input provided; the plan is implemented in a manner consistent with the input; and, at each annual review, the behavior of local entities is consistent with input.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; roads and railroads; airborne pollutants.

Conservation action(s):

- Provide comments on documents such as City and County general plans, CEQA and NEPA documents, timber harvest plans, Integrated Natural Resource Management Plans (INRMPs) on military lands, etc.

Conservation Strategy 6 (Direct Management): Conduct direct resource management.

Objective(s):

- Desired management actions are implemented. Examples of applicable actions include: restore or enhance degraded habitats, monitor populations, and remove barriers to species movement; conduct controlled burns, wet burns, fire hazard abatement, and periodic burning in wildland areas; conduct managed thinning; enhance partnerships in private lands to increase direct management of natural resources; conduct managed grazing; manage invasive species; remove non-native species; conduct resource assessments to inform management decisions; and establish BMPs to implement across partnerships.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):

- Coordinate with CAL FIRE.
- Coordinate with Weed Management groups.
- Apply for funding.

Conservation Strategy 7 (Management Planning): Develop and implement needed management plans.

Objective(s):

- Develop management plans for target areas. Examples of applicable management planning actions include: work with partners on the development of large landscape conservation planning; develop or update management plans to integrate the effects of climate change; development of management plans for species, habitats and natural processes; develop a management plan for habitat of SGCN; reintroduction, relocation or stocking of native animals or plants or animals to an area where they can better adapt; translocate/breed in captivity SGCN to establish new populations in suitable habitat; and restore SGCN to historically occupied habitats.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Coordinate with weed management groups.

Conservation Strategy 8 (Partner Engagement): Establish and engage in partner relationships.

Objective(s):

- Engage state and federal agencies, tribal entities, the NGO community and other partners to achieve shared objectives and broader coordination across overlapping areas.
- Establish partnership to co-monitoring species/habitats on federally managed lands.
- Establish decision-making processes with other public and private entities to determine or implement strategies.
- Convene an advisory committee to assist with implementation of strategies.
- Establish BMPs to implement across partnerships.
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; tourism and recreation areas; fire and fire suppression; invasive plants/animals; climate change.

Conservation Strategy 9 (Environmental Review): Implement environmental review, with focus on the following: non-conservation oriented policies; projects and plans to help ensure impacts to wildlife are minimized and benefits maximized; infrastructure development projects to ensure they are designed and sited to avoid impacts on species and habitat; state highway plans; forest management plans; and plans for transmission corridor siting.

Objective(s):

- Review appropriate plans (i.e., EIRs, EISs, Negative Declarations, Biological Opinions, Land use changes, General Plans).

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; roads and railroads; dams and water management/use; renewable energy.

Table 5.1-14 Stresses and Pressures for Coastal Dune and Bluff Scrub

Priority Pressures	Stresses								
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes		Soil and Sediment Characteristics		Ecosystem Conditions and Processes			
	See level rise	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in nutrients	Change in sediment quality	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Airborne pollutants				X		X	X	X	X
Annual and perennial non-timber crops						X			X
Climate change	X	X				X	X	X	X
Commercial and industrial areas		X			X	X		X	X
Fire and fire suppression			X				X		X
Housing and urban areas		X	X		X	X		X	X
Invasive plants/animals		X	X	X	X	X	X	X	X
Roads and railroads		X		X	X	X	X		X
Tourism and recreation areas						X	X		X

Target: Native Aquatic Species Assemblages/Communities

Goals:

- By 2025, miles of streams with target amphibian population are increased by at least 5 percent from 2015 miles.
- By 2025, miles of streams with target fish population are increased by at least 5 percent from 2015 miles.
- By 2025, miles of streams with key species population are increased by at least 5 percent from 2015 population.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres/miles with total dissolved solids are decreased by at least 5 percent from 2015 acres.
- By 2025, miles with desired stream stage (flow) are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles with desired temperature are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire riparian areas. Protect stream ecosystems by riparian land purchase and conservation easements.

Objective(s):

- CDFW identifies and prioritizes Areas of Conservation Emphasis (ACE).

Targeted pressure(s): Housing and urban areas.

Conservation action(s):

- Establish in lieu fee program.
- Develop CAPP.
- Create areas of conservation emphasis database.
- Coordinate with Natural Community Conservation Plan (NCCP).

Conservation Strategy 2 (Outreach and Education): Provide outreach and education. Outreach includes both formal (classroom) and non-formal education efforts to: (1) landowners to implement land management practices to benefit species; and (2) decision makers about impacts on at-risk quality standards for key water bodies and aquatic species.

Objective(s):

- Increase public awareness of BMPs through the creation and distribution of manuals for road construction and maintenance.
- Road maintenance BMPs will be improved to decrease sedimentation in streams and creeks protecting aquatic species habitat.
- Increase the public awareness of the pressure and impact of invasive species.
- Increase public awareness of the negative impact to fish from excessive water use and how water conservation measures would benefit fish.
- Inform land owners on their responsibilities for water rights compliance.

Targeted pressure(s): Dams and water management/use; invasive plants/animals.

Conservation Strategy 3 (Economic Incentives): Provide economic incentives to private landowners to influence responsible stewardship of land/water and specific species and establish good stewardship recognition or payments to landowners practicing sound resource management that benefits stream ecosystems.

Objective(s):

- CDFW will support and contribute to efforts to provide restoration grants to manage invasive species.
- State and federal grants that incentivize landowners to conserve and restore habitat through the removal and/or control of the spread of invasive and non-native species will be targeted. Change farming practices to be more fish friendly by increasing buffers, reducing sediment, and reducing chemical use; target wineries, crops and livestock farms.
- CDFW will obtain monetary grants to upgrade and enhance critical road problems impacting anadromous fish streams through state and federal grant programs.

Targeted pressure(s): Roads and railroads; dams and water management/use; annual and perennial non-timber crops.

Conservation action(s):

- Prioritize critical road problems impacting anadromous fish streams.
- Link to Outreach and Education strategy.

Conservation Strategy 4 (Law and Policy): Support effective law enforcement by increasing funding for federal and state enforcement resources and increasing public awareness.

Objective(s):
- Achieve 100 percent compliance with water rights and FGC Section 1602 Lake and Streambed Alteration Agreements.
- Reduce illegal diversions by 100 percent and increase Law Enforcement Division (LED) staffing levels by 50 percent.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Include BMPs as enforceable condition of Section 1602 Lake and Streambed Alteration Agreements.
- Include BMPs as enforceable condition of water right permit/license.
- Coordinate with law enforcement officers.
- Provide law enforcement with maps of critical problem areas.
- Advocate for opportunities to improve prosecutions of environmental laws.
- Evaluate and increase law enforcement officers staffing levels.
- Provide funding for enforcement to enforce laws protecting riparian habitat.
- Identify laws and regulations governing riparian areas and work with governing agencies to apply effectively.
- Make recommendations to enhance enforcement of existing laws and regulations.

Conservation Strategy 5 (Law and Policy): Advocate for laws and policies. Develop, change, influence, and help implement formal legislation, regulations, and voluntary standards.

Objective(s):
- Create and implement policies to ensure that land owners and agencies protect lower order streams above fish-bearing reaches.
- Create and implement timber harvest rules by CAL FIRE and CDFW to increase protection of streams and creeks to benefits fish and wildlife.
- Develop timber-harvest cumulative-impact standards for each watershed or group of adjacent watersheds to protect aquatic ecosystems and conserve aquatic habitat.
- Adopt a "no net loss" policy for critical habitat.
- Ensure riparian function and processes are maintained to provide desired conditions and manage riparian buffers to achieve mature to late-seral stand conditions.

Targeted pressure(s): Logging and wood harvesting.

Conservation action(s):
- Change regulations to have harsher penalties for environmental impacts resulting from marijuana cultivation activities that deter water diversion from streams and creeks and impact riparian vegetation.

- Change regulations to have harsher penalties to deter peat collection from fens for marijuana cultivation.
- Make importation of bullfrogs illegal in California.
- Develop policy for protecting riparian and watercourse and lake protection zones.
- Participate in interagency working group to advocate for lower order stream protection.
- Advocate for compliance monitoring.

Conservation Strategy 6 (Direct Management): Develop buffers. Develop county stream buffer policy and guidelines in conjunction with ongoing regional efforts to develop riparian buffers. Adequate support and clear policy guideline are needed.

Objective(s):

- Landowners increase riparian buffers along rivers and streams.
- Manage riparian buffers to achieve mature to late-seral stand conditions. Properly functioning riparian buffers reduce erosion, reduce sediment input, and provide shade and micro-climate to help keep stream water cool, source of large woody debris, nutrient inputs.
- Ensure riparian function and processes are maintained to provide desired conditions. Improve water quality in streams and rivers by meeting Total Maximum Daily Loads (TMDL) standards.
- Improve agriculture practices by increasing efficiency of water diversions (i.e., plastic pipes, drip systems to reduce evaporation).
- Reduce the amount of land growing water intensive crops where water diversion has significant adverse impacts to stream ecology. Cultivate less water intensive crops.

Targeted pressure(s): Housing and urban areas.

Conservation action(s):

- Make recommendations to local agencies to establish minimum buffer width.
- Re-designate buffers as natural resource zones in county general plans.

Conservation Strategy 7 (Direct Management): Promote water conservation measures by reducing the amount of land growing water intensive crops, considering less water intensive crops, providing incentives for water conservation, and encouraging public participation in enforcement of wasteful use of water (peer pressure).

Objective(s):

- Increase the efficient use of domestic water by the agricultural community with improved agricultural practices. Achieve this through low water use on vegetation or in irrigation using locally adapted plants, implementing household conservation actions, and using low flow shower heads and toilets.
- Improve landscape practices by increasing efficiency of water diversions i.e., plastic pipes to reduce evaporation.

Targeted pressure(s): Dams and water management/use; livestock, farming, and ranching.

Conservation action(s):

- Evaluate the efficacy of existing conservation measures.
- Develop new or improve existing water conservation strategies.
- Implement water conservation strategies/programs.
- Develop partnerships for joint advocacy.
- Develop water banking/storage opportunities.

Conservation Strategy 8 (Direct Management): Manage dams and other barriers by reviewing potential cost/benefit of modifying or removing dams that block access to significant amounts of high quality salmonid spawning and rearing habitat and modifying or removing Cape Horn Dam and Scott Dam from the upper Eel River, Dwinnel dam on the Shasta River, and dams from upper Klamath River.

Objective(s):

- By 2025, water managers allow sufficient bypass flows in anadromous fish streams to support biological requirements and geomorphology.
- Gather and analysis data on water use and fish connectivity to identify the current conditions on amount of water use and water use efficiency, of fish passage including allocating the major barriers.
- Develop restoration objectives within management planning.
- Investigate the impact from water diversion; including stream flow modification and fish passage barriers.
- Investigate the potential to develop water conservation and fish passage barrier modification measures, and evaluate the effectiveness of the measures. Prioritize the conservation scope. Decide the timeframe, appropriate restoration tools and methodology. Find funding to contract for developing a plan for restoration and management implementation.

- Modify or remove all small diversion dams by landowners on anadromous fish streams. Diversions are regulated by CDFG code 1600 and subject to CEQA. Many diversions currently occurring are not permitted. Some may be linked to appropriated water rights and-should follow consistent and effective BMPs, such as timing of removal.
- Land owners modify or remove all large dams.
- Landowners remove all impairments to fish passage. CDFW should review diversions and investigate any need to improve fish passage. Many road crossings are/or have become barriers because of changes they have caused over time.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 9 (Direct Management): Reduce need for livestock access to streams and riparian corridors by providing and locating water supply to livestock in grazing areas away from streams (use wells and other off channel sources).

Objective(s):

- Livestock farmers will provide off-stream watering sources for their animals on anadromous fish streams.
- Land owners and ranchers will construct exclusionary fencing to protect anadromous fish streams from their use.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Coordinate with other agencies and private landowners on use of alternative watering locations and exclusionary fencing.
- Prioritize locations for reducing impact of livestock having access to watercourses.
- Identify watering alternative structures and water sources.
- Identify appropriate locations to develop off stream water sources and exclusionary fencing.

Table 5.1-15 Stresses and Pressures for Native Aquatic Species Assemblages/Communities

Priority Pressures	Stresses											
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Hydrology and Water Characteristics						Ecosystem Conditions and Processes			
	Changes in sediment erosion-deposition regime	Change in pollutants	Change in runoff and river flow	Change in water temperature	Change in water chemistry	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded	Change in nutrients	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents		X			X			X		X		
Annual and perennial non-timber crops	X	X	X	X		X			X	X	X	X
Dams and water management/use	X		X	X		X	X		X	X	X	X
Fire and fire suppression	X	X	X	X		X	X	X	X	X	X	X
Garbage and solid waste		X			X				X	X		
Household sewage and urban waste water		X			X			X		X		
Housing and urban areas	X	X	X	X			X	X	X	X	X	X
Industrial and military effluents		X			X			X		X		
Introduced genetic material										X		
Invasive plants/animals									X	X	X	
Livestock, farming, and ranching	X	X	X	X		X		X	X	X		X
Logging and wood harvesting	X		X	X		X	X	X	X	X	X	X
Marine and freshwater aquaculture								X		X		
Mining and quarrying	X								X	X		
Parasites/pathogens/ diseases										X		
Renewable energy	X		X			X			X	X	X	X
Roads and railroads	X	X							X		X	X

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Table 5.1-16 Conservation Targets and Strategies for the North Coast and Klamath Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
North Coastal and Montane Riparian Forest and Woodland	Northern California Coast Ranges: • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. Northern California Coast: • By 2025, acres of habitat (riparian) are increased at least 5% from 2015 acres. • By 2025, acres with desired endemic plant diversity (ground cover, shrubs, understory) are increased at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (natural floodplain) are increased by at least 5% from 2015 acres/miles. • By 2025, miles connected (to natural floodplain) are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime (through management of water operations in the Eel, Klamath, Trinity, Mad, and Russian Rivers) are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Connectivity among communities and ecosystems • Successional dynamics • Hydrological regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Connectivity among communities and ecosystems • Successional dynamics • Community structure and composition • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban wastewater • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Pacific Northwest Conifer Forests	• By 2025, acres of redwood habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity (multi-story canopy) are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic (udic) regime are increased by at least 5% from 2015 acres/miles. • By 2025, acres with suitable soil characteristics (in wet meadows) are increased by at least 5% from 2015 acres. • By 2025, acres with desired (late) stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Successional dynamics • Community structure and composition • Hydrological regime • Soil quality and sediment deposition regime	• Agricultural and forestry effluents • Climate change • Fire and fire suppression • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Parasites/pathogens/diseases • Roads and railroads • Wood and pulp plantations	• Data Collection and Analysis • Direct Management • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance

Table 5.1-16 Conservation Targets and Strategies for the North Coast and Klamath Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Pacific Northwest Subalpine Forest	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Fire regime • Successional dynamics • Community structure and composition	• Climate change • Fire and fire suppression • Parasites/pathogens/diseases • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Environmental Review • Land Use Planning • Management Planning • Partner Engagement • Training and Technical Assistance
California Foothill and Valley Forests and Woodlands	• By 2025, acres with desired endemic plant diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity (oak recruitment) are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired inches of groundwater are increased by at least 5% from 2015 acres/miles.	• Fire regime • Successional dynamics • Community structure and composition • Soil quality and sediment deposition regime	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Outreach and Education • Partner Engagement
Alpine Vegetation	• By 2025, acres connected are maintained within the ecoregion from 2015 acres. • By 2025, acres of macrogroup (target) are maintained within the ecoregion from 2015 acres. • By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained within the ecoregion from 2015 acres.	• Area and extent of community • Connectivity among communities and ecosystems • Community structure and composition	• Climate change • Commercial and industrial areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Wet Mountain Meadow Fen (Wet Meadow) Mountain Riparian Scrub and Wet Meadow Subalpine Aspen Forests and Pine Woodlands (Meadows) Western Upland Grasslands	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Fire regime • Successional dynamics • Community structure and composition • Hydrological regime	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting	• Data Collection and Analysis • Direct Management • Environmental Review • Law and Policy • Outreach and Education • Partner Engagement
Subalpine Aspen Forests and Pine Woodlands (Mature Conifer Forest)	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Fire regime • Connectivity among communities and ecosystems • Successional dynamics • Community structure and composition • Soil quality and sediment deposition regime	• Climate change • Fire and fire suppression • Logging and wood harvesting • Parasites/pathogens/diseases	• Data Collection and Analysis • Direct Management • Environmental Review • Law and Policy • Outreach and Education • Partner Engagement

Table 5.1-16 Conservation Targets and Strategies for the North Coast and Klamath Province (continued)				
Target	**Goals**[1]	**Key Ecological Attributes (KEAs)**	**Pressures**[2]	**Strategy Categories**
Montane Upland Deciduous Scrub	• By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, connected montane shrubland and grassland acres are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Fire regime • Connectivity among communities and ecosystems • Successional dynamics • Community structure and composition • Hydrological regime	• Climate change • Fire and fire suppression • Housing and urban areas • Logging and wood harvesting	• Data Collection and Analysis • Direct Management • Environmental Review • Law and Policy • Outreach and Education • Partner Engagement
Coastal Dune and Bluff Scrub	• By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres.	• Area and extent of community • Fire regime • Connectivity among communities and ecosystems • Community structure and composition • Soil quality and sediment deposition regime	• Airborne pollutants • Climate change • Commercial and industrial areas • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Environmental Review • Land Acquisition/Easement/ Lease • Land Use Planning • Law and Policy • Management Planning • Partner Engagement
Native Aquatic Species Assemblages/Communities	• By 2025, miles of streams with target amphibian population are increased by at least 5% from 2015 miles. • By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. • By 2025, miles of streams with key species population are increased by at least 5% from 2015 population. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles. • By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage (flow) are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired temperature are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Soil quality and sediment deposition regime • Surface water flow regime • Water temperatures and chemistry • Pollutant concentrations and dynamics	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Garbage and solid waste • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Marine and freshwater aquaculture • Mining and quarrying • Parasites/pathogens/diseases • Renewable energy • Roads and railroads	• Direct Management • Economic Incentives • Land Acquisition/ Easement/ Lease • Law and Policy • Outreach and Education

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2]Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Cascades and Modoc Plateau Province

5.2 Cascades and Modoc Plateau Province

5.2.1 Geophysical and Ecological Description of the Province

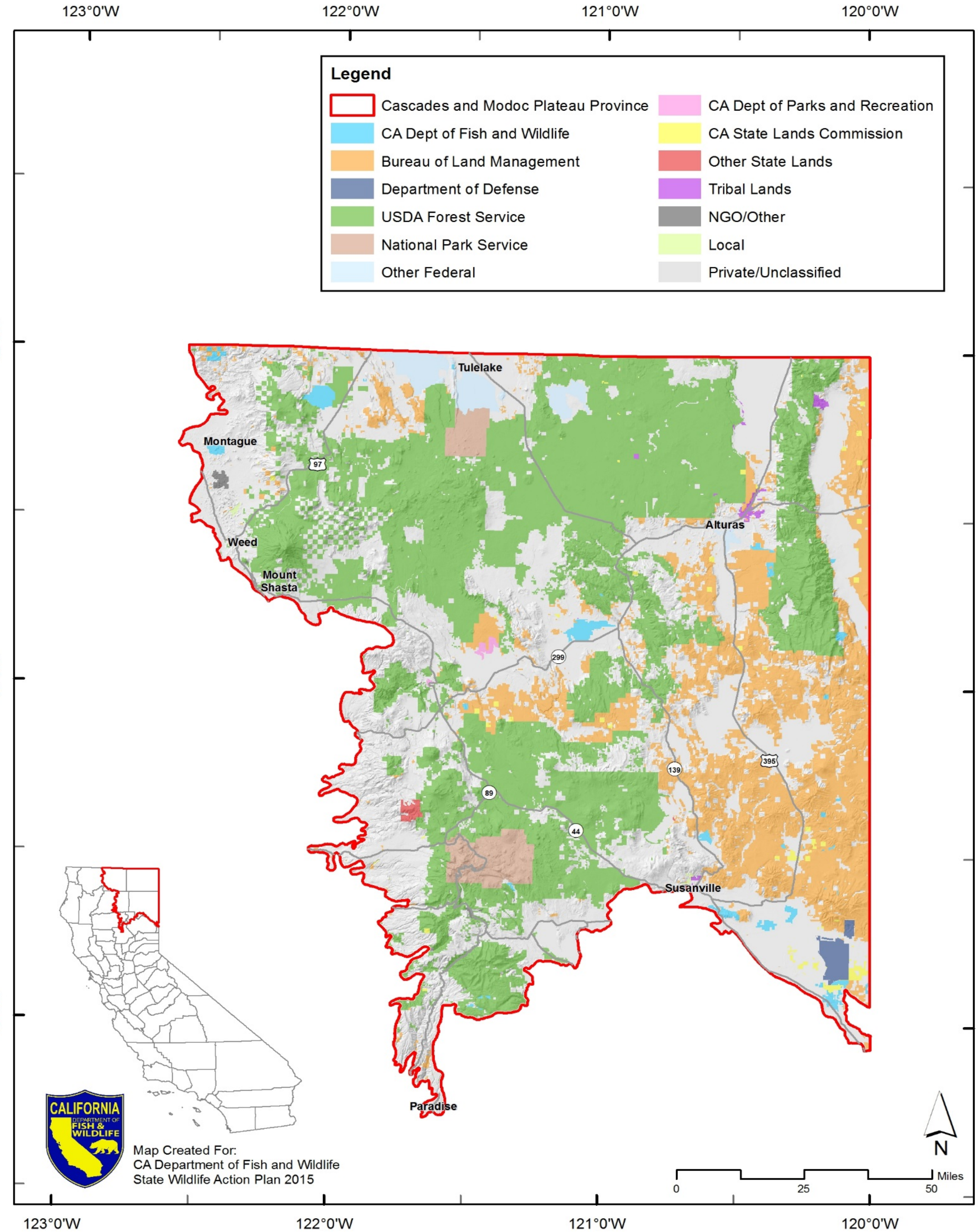
The Cascades and Modoc Plateau Province encompasses over 7 million acres in the far northeastern corner of California (Exhibit 5.2-1). This province is composed of two distinct geographic and ecological areas, the Modoc Plateau and the Southern Cascades. Elevations in the province average higher than other provinces, ranging from 3,000 feet throughout the Modoc Plateau to over 14,000 feet on mountain peaks of the Southern Cascades. Northeastern California is an outstanding region for wildlife, providing habitat for mountain lion, black-tailed deer, mule deer, pronghorn, elk, yellow-bellied marmot, porcupine, greater sage-grouse, and the colorful waterfowl of the Pacific Flyway that funnel through the area during their annual migrations. Golden eagle, prairie falcon, cascade frog, southern long-toed salamander, Northern goshawk, Northern spotted owl, sooty grouse, greater sandhill crane, and American white pelican nest and hunt or forage in varied habitats in the province. Sharp-tailed grouse historically occurred in this province but have been extirpated. The varied aquatic habitats and natural barriers along the Pit River and Klamath River and their tributaries have allowed the evolution of several unique aquatic communities that include endemic fish and invertebrates in the Cascades and Modoc Plateau Province.

<u>Modoc Plateau</u>

The Modoc Plateau is located in the northeastern corner of the state, framed by and including the Warner Mountains and Surprise Valley along the Nevada border to the east and west to the edge of the southern Cascades Range. The area extends north to the Oregon border and south to include the Skedaddle Mountains and the Honey Lake Basin.

A million years ago, layered lava flows formed the 4,000–5,000-foot elevation Modoc Plateau, separating the watersheds of the area from the Klamath drainage to the northwest. The waters of the western slope of the Warner Mountains and the Modoc Plateau carved a new course, the Pit River, flowing to the southwest through the Cascades and joining the Sacramento River at Lake Shasta. Many of the springs and creeks of northeastern California drain via the Pit River.

Situated on the western edge of the Great Basin, the Modoc Plateau historically has supported high desert plant communities and ecosystems similar to that region—shrub-steppe, perennial grasslands, sagebrush, antelope bitterbrush, mountain mahogany, and juniper woodlands. Sagebrush plant communities are characteristic of the area, providing important habitat for sagebrush-dependent wildlife such as greater sage-grouse and pygmy rabbit. Conifer forests



Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands

Figure 5.2-1 Land Ownership of the Cascades and Modoc Plateau Province

dominate the higher elevations of the Warner Mountains and the smaller volcanic mountain ranges and hills that shape the area. Wetland, spring, meadow, vernal pool, riparian, and aspen communities scattered across the rugged and otherwise dry desert landscape support diverse wildlife. The area has varied aquatic habitats, from high mountain streams to the alkaline waters of Goose Lake and Eagle Lake to clear spring waters of Fall River and Ash Creek.


Jimmy Emerson, DVM

The 3-million-acre Pit River watershed is the major drainage of the Modoc Plateau and spans the border of northern California and Oregon as well as the Modoc Plateau and Southern Cascades ecoregions. It is of major importance to California water supply and fish populations as it provides 20 percent of the water to the Sacramento River. The upper reaches of the watershed include the Warner Mountains that drain into Goose Lake. Goose Lake occupies about 144 square miles between California and Oregon with the majority of the water on the California side. The major portion of the water comes from Dry, Mill, Drews, Antelope, Cottonwood, Thomas, Crane, Cogswell, Tandy, and Kelley creeks. The north fork of the Pit River flows from Goose Lake southwest and merges with the south fork of the Pit River, which drains the southern Warner Mountains. The Pit River meanders across the plateau and farmlands, receiving the drainage of Ash Creek and the flows of Fall River and Hat Creek before weaving west across the southern Cascades Range. The river is checked and held by several dams and reservoirs but eventually drains into Lake Shasta. Unique fish and invertebrates have evolved in isolated springs and segments of the Pit River watershed and over 24 endemic species depend on the lower Pit River for their survival (Nature Conservancy 2015). Fourteen native fish species are found in various associated fish communities in segments of the watershed's rivers and creeks. Endemic species include the Modoc sucker, the Goose Lake redband trout, Goose Lake tui chub, Goose Lake lamprey, and Shasta crayfish (Ellis and Cook 2001; Moyle 2002). Management issues within the Pit River watershed include threatened wild trout production, degraded forest health because of heavy fuels, degraded aquatic and riparian habitat, degraded water quality, unsustainable water supply, increased erosion and natural stream function, and invasive plant and animal species (SRWP 2015).

Another important watershed within the province that also spans two states (California and Nevada) is the Eagle Lake watershed. One of the few alkaline lakes in California, it is also the second largest lake in California at 15 miles long and more than 2 miles wide. Tributaries of

Eagle Lake are Cleghorn Creek, Papoose Creek, Merrill Creek, and Pine Creek. Pine Creek, main tributary of Eagle Lake, is about 39 miles long and considered an intermittent stream. Pine and cedar forests surround the south shore of Eagle Lake, while juniper and sage dominate the north side. The endemic Eagle Lake rainbow trout, as well as the Lahontan redside, Tahoe sucker, and tui chub attract thrive in the waters of Eagle Lake and its Basin. Western grebes, eared grebes, buffleheads, many diving ducks and cormorants, terns, ospreys, and bald eagles fish along its productive waters. Marshy areas near the shoreline provide available forage for American white pelicans, cinnamon teal, and other waterfowl, in addition to egrets and muskrats.

Creeks of the northern Modoc Plateau, or Lost River watershed, drain to Clear Lake in Modoc County from the Lost River Diversion located in southern Oregon. The outlet of Clear Lake is the Lost River, which circles north into Oregon farmland and then joins the Klamath River system. The Lost River watershed encompasses an area of approximately 3,000 square miles in Klamath and Lake Counties in Oregon, and Modoc and Siskiyou counties in California. Sixty-miles-long, the Lost River winds through forests, meadows, and fields providing important habitat for aquatic and terrestrial species, including 22 endemic species (Nature Conservancy 2015). Endemic aquatic fish and invertebrates include the federally endangered Lost River sucker, shortnose sucker, and Klamath pebblesnail.

Sixty percent of the Modoc Plateau is federally managed; U.S. Forest Service (USFS) manages 30 percent, U.S. Bureau of Land Management (BLM) manages 26 percent, and U.S. Fish and Wildlife Service (USFWS) and the U.S. Department of Defense (DOD) each manage about 2 percent of the lands. CDFW manages 1 percent of the Modoc Plateau as wildlife areas. About 37 percent of the lands are privately owned or belong to municipalities.

Southern Cascades

The Cascade Mountain Range starts in southern British Columbia and runs south through Washington and Oregon into northern California, merging just south of Mount Lassen with the northern reaches of the predominantly granitic Sierra Nevada. The most recent volcanic eruptions in conterminous United States have occurred in the Cascades, with eruptions of Mount Lassen in 1914-1915 and eruptions of Mount St. Helens in Washington in the 1980s and continuing. Within Northern California, the mostly volcanic southern Cascades contain two of the most active volcanoes in the state, Mount Shasta and Mount Lassen, both of which are considered active. The southern Cascades are bordered by the Klamath Mountains on the west side, bounded by the foothills of the Tuscan Formation to the southwest, by the Sierra Nevada Mountains to the south and finally to the east, they grade into the Modoc Plateau. Elevations range from about 2,000 feet in the adjacent foothills to 14,179 feet, the peak of Mt. Shasta which is the second highest peak in the Cascade Range. (The highest peak in the Cascade Range is Mount Rainer in Washington.) The mountain elevations then drop off gradually to the east.

In the Cascades, hundreds of creeks and streams of the western slope drain via a dozen major river basins to merge with the Klamath, Pit, McCloud, and Sacramento rivers. On the eastern slope, creeks and rivers drain east onto the Modoc Plateau and Great Basin region. Battle Creek, which empties into the Sacramento River, has headwaters in the Mount Lassen area and its flows are primarily derived from the Southern Cascades. Battle Creek has been the focus of major anadromous fish restoration projects because it has very cold, clean waters and excellent fish habitat. Springs and creeks of the southern Cascades support unique species or subspecies of fish such as the Modoc red-band trout, and invertebrates such as Shasta crayfish and endemic springsnails. These mountains receive substantial rainfall and snowfall, with Mount Lassen having the highest known winter snowfall amounts in California. The endangered willow flycatcher finds breeding and nesting habitat in the wet meadow valleys and broad meadow floodplains of mountain creeks. Because 40 percent of the state's surface water runoff flows from the Sierra Nevada and the Cascades, maintaining and restoring the ecological health of the Cascade watersheds and aquatic systems is important to ensure clean water for California.

Bold topography, the large elevation gradient, and varied climatic conditions of the Cascades support diverse plant communities. North of Mount Shasta, the Klamath Mountains absorb precipitation coming from the west, resulting in dry west slopes in the Cascades. Soils, like the Modoc Plateau, are generally volcanic in origin. These varied conditions, and floristically and structurally diverse plant communities, provide a large array of habitats important for maintaining California's wildlife diversity and abundance. Communities common to the Cascade area are conifer habitats dominated by ponderosa pine, white fir, red fir, and lodgepole pine. In general, mixed ponderosa pine, Douglas fir, and white fir forests occur on the western slopes at elevations below approximately 5,600 feet. Canyon live oak stands favor large, rocky canyons at mid to low elevations. On the xeric, east slopes of the Cascades, ponderosa pine and Jeffrey pine form open stands on flats and mild slopes. At the highest elevations, lodgepole pine, white fir, and red fir are dominant. Big sagebrush and western juniper dominated habitats are more common on the eastern slopes and valleys of the ecoregion.

Common large mammalian inhabitants of the ecoregion include the black bear, mountain lion, Rocky Mountain and Roosevelt elk, pronghorn antelope, and mule deer. Species of Greatest Conservation Need (SGCN) include the Northern spotted owl, Sierra Nevada red fox, pacific fisher, American marten, American badger, and coastal tailed frog.

D.A. Buehler, NPS

Fifty-two percent of the Southern Cascades ecoregion in California are federally owned and managed with principal management by the USFS, BLM, and National

Park Service (NPS). One percent is owned and managed by other governmental (state, tribal, and county) entities. Forty-seven percent is privately owned and managed with the majority of private ownership being among several large timber companies.

5.2.2 Conservation Units and Targets

The conservation units associated with the Cascades and Modoc Plateau Province include the Southern Cascades, Modoc Plateau, and Northern Basin and Range ecoregions (Figure 5.2-2), as well as portions of the North Lahontan hydrologic unit (HUC 1808) and the Sacramento hydrologic unit (HUC 1802) (Figure 5.2-3).

Patricia Bratcher, CDFW

Eight conservation targets were selected in this province as priorities for conservation planning within the conservation units (Table 5.2-1). These communities include: north coastal mixed evergreen and montane coniferous forests, western upland grasslands, big sagebrush scrub, great basin dwarf sagebrush scrub, great basin upland scrub, great basin pinyon-juniper woodland, eagle lake native fish assemblage, and goose lake native fish assemblage.

Although numerous potential conservation targets were identified within the province, conservation strategies were only developed for the targets that contained the greatest number of SCGN and that are considered most immediately under threat. Other potential targets, such as conifer forests, riparian, grasslands, and vernal pool, were not among those targets selected, because these habitat types have much smaller distributions within the province. Pinyon-juniper and sage habitats are a high priority habitat for conservation by many agencies, organizations, and private landowners. It is expected that additional key targets will be addressed through future conservation planning efforts. Information about the methods used to prioritize conservation targets is presented in Appendix D.

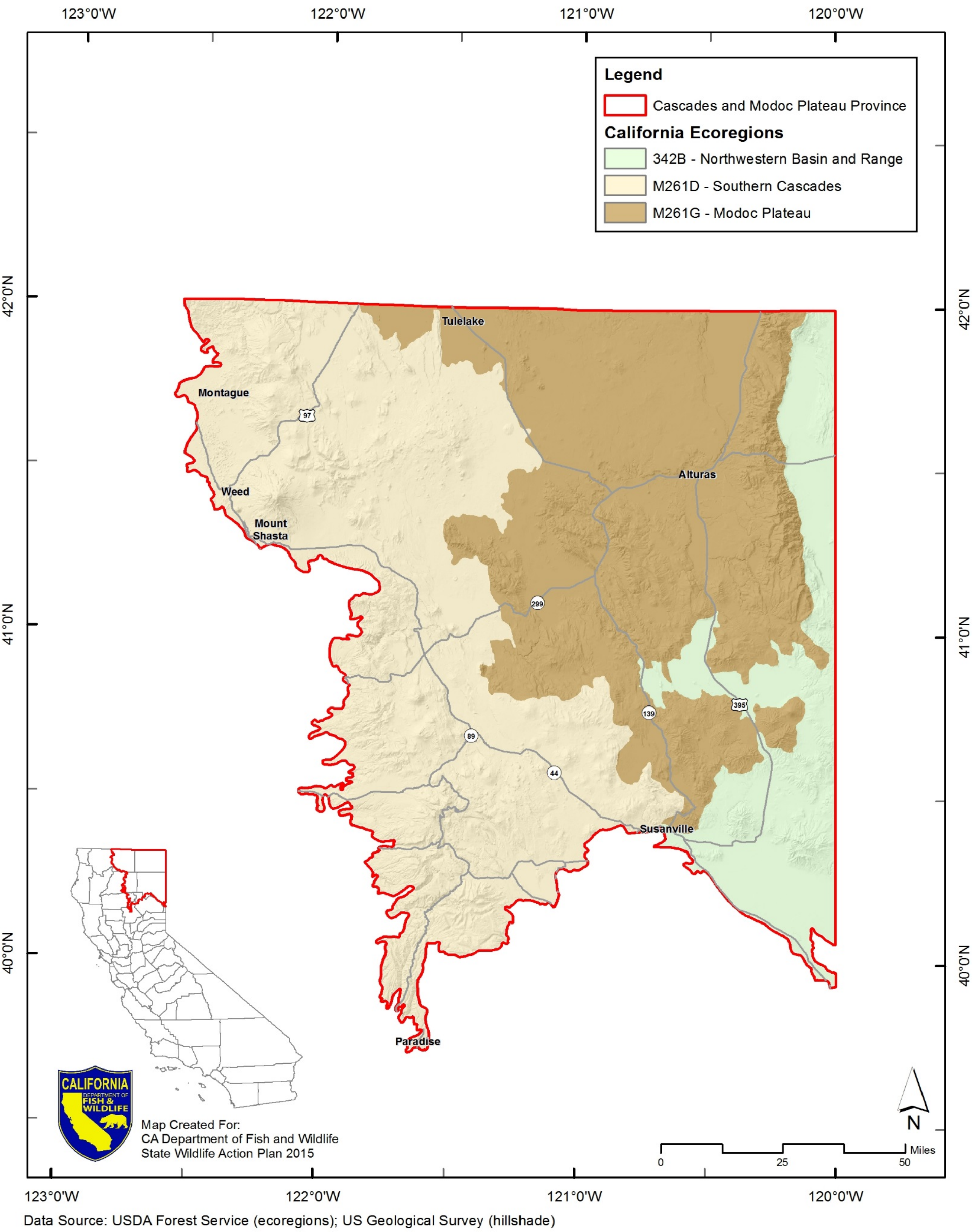
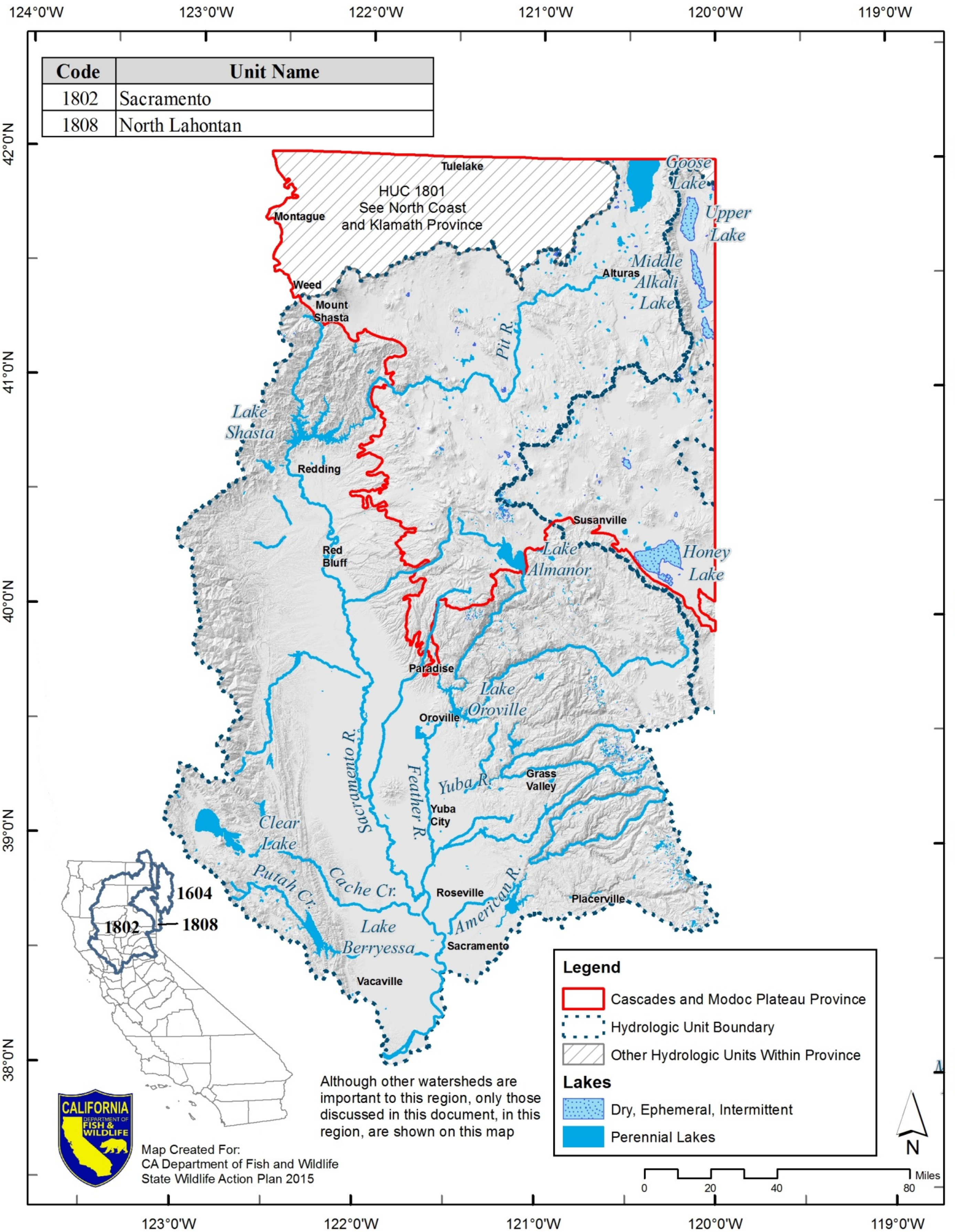


Figure 5.2-2 Ecoregions of the Cascades and Modoc Plateau Province



Data Source: National Hydrologic Dataset (NHD); US Geological Survey (hillshade)

Figure 5.2-3 Hydrologic Units of the Cascades and Modoc Plateau Province

Table 5.2-1	Conservation Units and Targets – Cascades and Modoc Plateau Province*			
Conservation Unit	**Geographic and Ecological Summary**	**Conservation Target**	**Target Summary**	**Focal CWHR Types Associated with Target**
Southern Cascades Ecoregion	Consists of scattered mountains of low to high elevations. While there is no distinct range, the crest of the mountain chain is aligned toward the north-northwest between the Sierra Nevada and Mt. Shasta and toward the north from Mt. Shasta northward. Slow and moderately rapid rivers and streams are common throughout the ecoregion. Major rivers and lakes include the Klamath and Pit Rivers, Lake Almanor and Meiss Lake. Predominant vegetation communities in this section include ponderosa pine, big sagebrush, Idaho fescue, western juniper, mixed conifer, white fir, red fir, and lodgepole pine. Elevation range: 2,000 to 14,000 feet.	North Coastal Mixed Evergreen and Montane Conifer Forests	Representative of cool-temperate forests of northern California. These range inland from the immediate coast and experience warm, relatively dry summers and cool rainy to cool snowy winters. The interior mixed evergreen forests contain madrone, tan oak, Oregon oak and drier Douglas-fir with canyon-live oak mixes. At higher elevations, ponderosa pine mixes with incense-cedar. Further up in elevation are mixed white fir, sugar pine, and Jeffrey pine communities. The eastern slopes have open ponderosa and Jeffrey pine stands.	Douglas-Fir; Montane Hardwood-Conifer; Montane Hardwood; Klamath Mixed Conifer; Eastside Pine; Sierran Mixed Conifer; White Fir; Jeffrey Pine; Ponderosa Pine
		Western Upland Grasslands	Dominated by perennial grasses that are found in moist, lightly grazed, or relic prairie areas. Can be up to 100 percent cover. Includes native grasslands of Idaho fescue, blue wild rye, Great Basin wild rye, ashy ryegrass, Sandberg blue grass, big and bottlebrush squirreltail, one-sided bluegrass. Also includes the non-native grasslands such as creeping bentgrass, velvetgrass, Kentucky bluegrass, Harding grass, and cheat-grass.	Perennial Grassland; Annual Grassland
Modoc Plateau Ecoregion	Fault-block mountains and ridges with non-marine sedimentary rocks and other formations of materials of volcanic origin. Rivers and streams follow alluvial and bedrock controlled channels to the Sacramento and Klamath Rivers or to basins within the Modoc Plateau. Predominant vegetation communities include big sagebrush, western juniper, Idaho fescue, bluebunch wheatgrass, ponderosa pine, white fir, low sagebrush, Jeffrey pine, lodgepole pine, aspen, and sedge meadow communities. Climate is generally dry and cold in the winter with annual precipitation from 8-30 inches. Summers are hot and dry. Elevation range: 3,000 to 9,900 feet.	Big Sagebrush Scrub	Emblematic of the valleys and lower slopes of the Great Basin Desert. It enters the province in the Modoc Plateau and continues south and east of the Cascades. Occupies dry slopes and flat areas within the ecoregion where annual precipitation is usually 16 inches or less. Dominated by shrubs. Most stands are dominated by big sagebrush and mountain sagebrush. Where the soil remains saturated through the spring, silver sagebrush dominates. On low flats with shallow soils and restricted drainage low sagebrush is dominant. Black sagebrush dominates sites with soils high in gravel and carbonates.	Sagebrush
		Great Basin Dwarf Sagebrush Scrub	Low subshrub sagebrush species. These species form stands on poor soils, or exposed slopes and ridges where larger sagebrush species are unable to grow. The main species in this macrogroup include low sage, (Lahontan sagebrush, and black sagebrush). Each of these species has different ecological requirements from calcarious shallow soils, deep clay-rich soils, and shallow rocky upland soils.	Low Sage
		Great Basin Upland Scrub	Shrublands with cool desert affinities but has been segregated from sagebrush species. Predominant species include fire-sensitive, long-lived species such as blackbrush and mountain mahogany; species which recover well from disturbance include spiny hop-sage, winter-fat, Mormon-tea, and some species of bitterbrush. Shorter fire intervals are conducive to emphasizing perennial grass cover such as desert needlegrass, or Indian rice grass (in sandy areas).	Bitterbrush; Low Sage; Sagebrush

Table 5.2-1 Conservation Units and Targets – Cascades and Modoc Plateau Province*

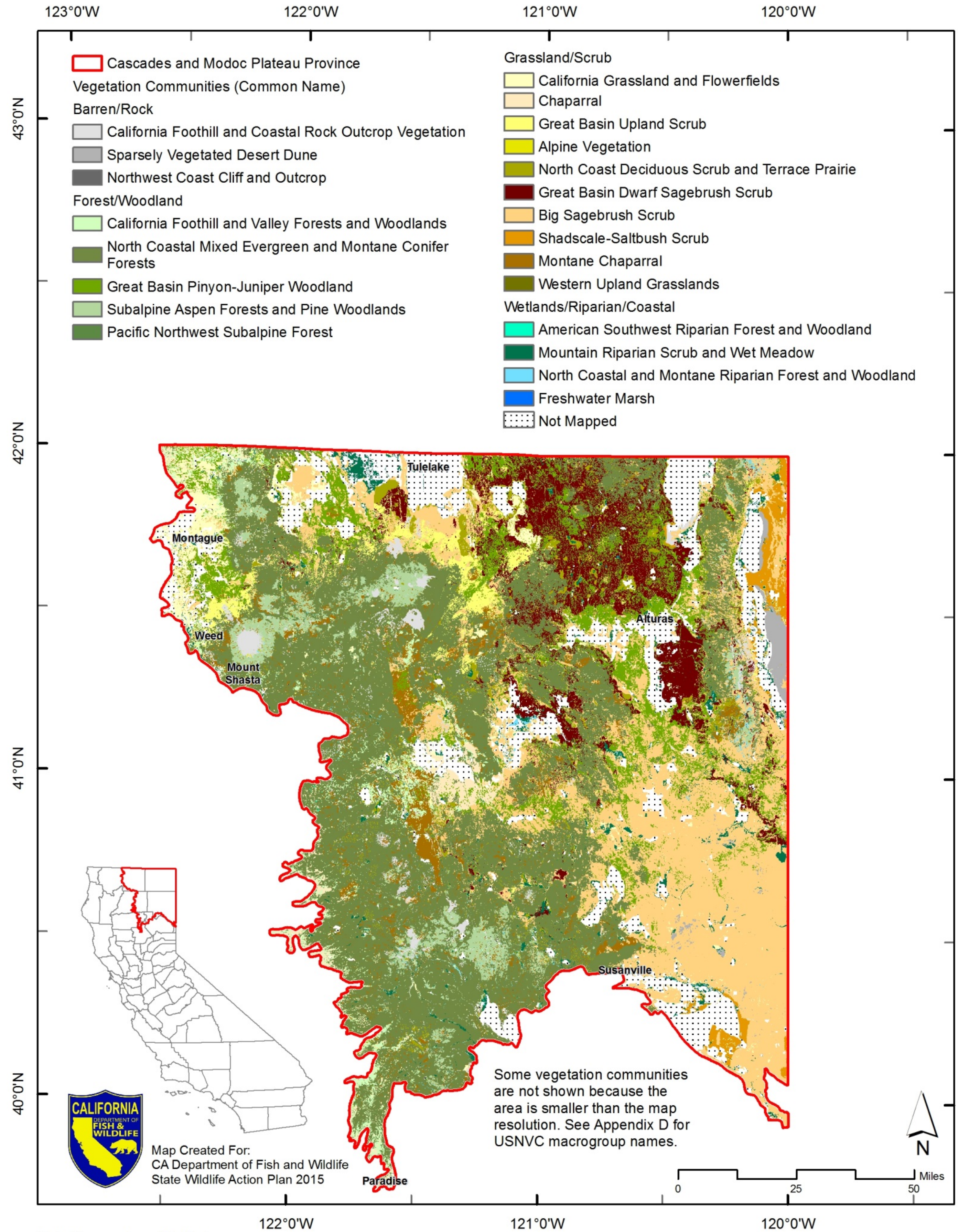
Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Northwestern Basin and Range Ecoregion	Nearly level basins and valleys bordered by long, gently sloping alluvial fans with linear mountain ranges. Soils are formed mostly from rocks of volcanic origin. Moderately slow rivers and streams flow through deeply incised canyons with bedrock controlled channels (higher elevations) to alluvial channels (lower elevations). A few large lakes, such as Honey Lake, occur here. Vegetation consists of sagebrush and desert shrub cover types. Climate is dry with cold winters and annual precipitation from 4 to 20 inches. Summers are hot and dry. Elevation range: 4,000 to 8,000 feet.	Great Basin Pinyon-Juniper Woodland	Found on virtually all exposures and slopes but is common on level to gently rolling topography. Dominated by Utah or western juniper stands. Very little, if any single-leaf pinyon or California juniper, are present. Shrub species include sagebrush, mountain mahogany, bitterbrush and other cool-desert shrubs and grasses. Denser stands are associated with a grassier understory while more open stands have shrubs.	Pinyon-Juniper; Juniper
North Lahontan Hydrologic Unit (HUC 1808)	Includes the eastern slopes of the Warner Mountains and the Sierra Nevada. Major watersheds in the North Lahontan Basin include the Eagle Lake and Susan River/Honey Lake watersheds. Dominant vegetation ranges from sagebrush to pinyon-juniper and mixed conifer forest at higher elevations. Wetland and riparian plant communities, including marshes, meadows, bogs, riparian deciduous forest, and desert washes. Elevation range: 4,000 to 7,600 feet	Eagle Lake Native Fish Assemblage	Lake habitats consist of closed basins with large, shallow alkaline water of high pH and warm summer water temperatures. Stream habitats are composed of low gradient, intermittent, streams that cross pine forest and sagebrush flats. The Eagle Lake Native Fish Assemblage consists of five species: • Eagle Lake rainbow trout • Eagle Lake tui chub • Tahoe sucker • Lahontan speckled dace • Lahontan redside	N/A

Table 5.2-1 Conservation Units and Targets – Cascades and Modoc Plateau Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Sacramento Hydrologic Unit (HUC 1802)	The Sacramento River Basin covers much of northern California at 27,210 square miles and includes the entire area drained by the Sacramento River. All tributaries to the Sacramento River that are north of the Cosumnes River watershed are included in this watershed. The major lakes and streams of this watershed included in the Cascade-Modoc Plateau Province are Goose Lake, Lake Almanor, and the Pit River. The geology, climate, and associated vegetation are similar to those described for the North Lahontan watershed. Elevation range: 0 to 9,000 feet	Goose Lake Native Fish Assemblage	Lake habitats consist of semi-closed basins with large, shallow alkaline water of high pH and warm summer water temperatures. Stream habitats consist of high gradient mountain streams that enter low gradient meadows and grasslands or agricultural lands. Eight fish species are included in the Goose Lake Native Fish Assemblage. Four of these are endemic species unique to the Goose Lake Watershed: - Goose Lake redband trout - Goose Lake sucker - Goose Lake tui chub - Goose Lake lamprey These species are highly dependent upon stream habitat as refugia during drought and resilient to adverse water conditions. Tributary streams also provide important refuge habitat for these species during drought and low lake levels. The other four species are primarily stream-dwelling: - Pit-Klamath brook lamprey - Speckled dace - Northern roach - Pit sculpin	Lacustrine; Riverine

*Description referenced from CDFG 1988, USDA 1994, and USDA 2007.

Figure 5.2-4 shows the distribution of the plant communities within the province. Some of the plant communities identified as conservation targets occur in areas smaller than the mapping unit and do not appear on the figure.



Data Source: fveg (Calfire)

Figure 5.2-4 Plant Communities of the Cascades and Modoc Plateau Province

5.2.3 Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the Cascade and Modoc Plateau Province are listed in Table 5.2-2. The most commonly identified attributes for the Cascade and Modoc Plateau Province are:

- area and extent of community;
- fire regime;
- successional dynamics;
- community structure and composition; and
- soil quality and sediment deposition regime.

Table 5.2-2 Key Ecological Attributes – Cascades and Modoc Plateau Province

Key Ecological Attributes	Conservation Units and Targets							
	Southern Cascades		Modoc Plateau			Northwestern Basin and Range	North Lahontan HUC 1808	Sacramento HUC 1802
	North Coastal Mixed Evergreen and Montane Conifer Forests	Western Upland Grasslands	Big Sagebrush Scrub	Great Basin Dwarf Sagebrush Scrub	Great Basin Upland Scrub	Great Basin Pinyon-Juniper Woodland	Eagle Lake Native Fish Assemblage	Goose Lake Native Fish Assemblage
Area and extent of community		X	X	X	X		X	X
Fire regime	X	X	X	X	X	X		
Community structure and composition	X	X	X	X	X	X	X	X
Connectivity among communities and ecosystems							X	X
Hydrological regime	X						X	X
Nutrient concentration and dynamics								X
Soil quality and sediment deposition regime			X	X	X		X	X
Successional dynamics	X	X	X	X	X	X		
Surface water flow regime							X	X
Water level fluctuations							X	X
Water temperatures and chemistry								X

5.2.4 Species of Greatest Conservation Need in the Cascades and Modoc Plateau Province

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.2-3). Not all of the focal species meet the criteria to be considered SGCN. SGCN are indicated with an asterisk. SGCN associated with the Cascades and Modoc Plateau Province are shown by ecoregion in Tables C-12 through C-14 in Appendix C.

Table 5.2-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the Cascades and Modoc Plateau Province

Common Name	Scientific Name	Conservation Units and Targets[1]							
		Southern Cascades		Modoc Plateau			Northwestern Basin and Range	North Lahontan HUC 1808	Sacramento HUC 1802
		North Coastal Mixed Evergreen and Montane Conifer Forests	Western Upland Grasslands	Big Sagebrush Scrub	Great Basin Dwarf Sagebrush Scrub	Great Basin Upland Scrub	Great Basin Pinyon-Juniper Woodland	Eagle Lake Native Fish Assemblage	Goose Lake Native Fish Assemblage
Fishes									
Goose Lake lamprey*	*Entosphenus sp.*								X
Pit-Klamath brook lamprey*	*Lampetra lethophaga*								X
Eagle Lake rainbow trout*	*Oncorhynchus mykiss aquilarum*							X	
Northern Pit roach*	*Lavinia mitrulus*								X
Lahontan speckled dace	*Rhinichthys robustus*							X	
Lahontan redside	*Richardsonius egregius*							X	
Eagle Lake tui chub*	*Siphateles bicolor ssp.*							X	
Goose Lake tui chub*	*Siphateles bicolor thalassinus)*								X
Goose Lake sucker*	*Catostomus occidentalis lacusanserinus*								X
Tahoe sucker	*Catostomus tahoensis*							X	
Pit sculpin	*Cottus pitensis*								X
Amphibians									
Coastal tailed frog*	*Ascaphus truei*	X							
Northern leopard frog*	*Lithobates pipiens*		X						
Foothill yellow-legged frog*	*Rana boylii*	X							
Cascades frog*	*Rana cascadae*	X	X						
Oregon spotted frog*	*Rana pretiosa*		X						
Reptiles									
Northwesterm western pond turtle*	*Actinemys marmorata*	X	X	X					
Rubber boa	*Charina bottae*	X							

Table 5.2-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the Cascades and Modoc Plateau Province

Common Name	Scientific Name	Conservation Units and Targets[1]							
		Southern Cascades		Modoc Plateau			Northwestern Basin and Range	North Lahontan HUC 1808	Sacramento HUC 1802
		North Coastal Mixed Evergreen and Montane Conifer Forests	Western Upland Grasslands	Big Sagebrush Scrub	Great Basin Dwarf Sagebrush Scrub	Great Basin Upland Scrub	Great Basin Pinyon-Juniper Woodland	Eagle Lake Native Fish Assemblage	Goose Lake Native Fish Assemblage
California mountain kingsnake	*Lampropeltis zonata*		X						
Gopher snake	*Pituophis catenifer*		X	X	X	X			
Birds									
Greater white-fronted goose	*Anser albifrons*		X						
Greater sage-grouse*	*Centrocercus urophasianus*			X	X	X	X		
Sooty grouse	*Dendragapus fuliginosus*	X							
Great egret	*Adea alba*		X						
Osprey	*Pandion haliaetus*	X							
Northern goshawk*	*Accipiter gentilis*	X							
Golden eagle	*Aquila chrysaetos*	X	X	X	X	X	X		
Ferruginous hawk	*Buteo regalis*		X				X		
Northern harrier*	*Circus cyaneus*		X						
White-tailed kite*	*Elanus leucurus*		X						
Bald eagle*	*Haliaeetus leucocephalus*	X							
Sandhill crane	*Grus canadensis*		X						
Short-eared owl*	*Asio flammeus*		X						
Long-eared owl*	*Asio otus*		X	X	X	X			
Burrowing owl*	*Athene cunicularia*		X	X	X	X	X		
Spotted owl	*Strix occidentalis*	X							
Vaux's swift*	*Chaetura vauxi*	X							
Black swift*	*Cypseloides niger*	X							
American peregrine falcon*	*Falco peregrinus anatum*			X	X	X	X		
Olive-sided flycatcher*	*Contopus cooperi*	X							
Gray flycatcher	*Empidonax wrightii*			X	X	X			
Loggerhead shrike*	*Lanius ludovicianus*		X	X	X	X	X		
Purple martin*	*Progne subis*	X	X						
Common yellowthroat	*Geothlypis trichas*		X						
Yellow warbler*	*Setophaga petechia*	X							
Rufous-crowned sparrow	*Aimophila ruficeps*		X						
Sage sparrow	*Artemisiospiza belli*			X	X	X			
Lark sparrow	*Chondestes grammacus*			X	X	X			
Savannah sparrow	*Passerculus sandwichensis*		X						
Green-tailed towhee	*Pipilo chlorurus*			X	X	X			
Brewer's sparrow	*Spizella breweri*			X	X	X			

Table 5.2-3 Focal Species of Conservation Strategies Developed for Conservation Targets in the Cascades and Modoc Plateau Province

Common Name	Scientific Name	Conservation Units and Targets[1]							
		Southern Cascades		Modoc Plateau			Northwestern Basin and Range	North Lahontan HUC 1808	Sacramento HUC 1802
		North Coastal Mixed Evergreen and Montane Conifer Forests	Western Upland Grasslands	Big Sagebrush Scrub	Great Basin Dwarf Sagebrush Scrub	Great Basin Upland Scrub	Great Basin Pinyon-Juniper Woodland	Eagle Lake Native Fish Assemblage	Goose Lake Native Fish Assemblage
Western meadowlark	*Sturnella neglecta*			X	X	X			
Yellow-headed blackbird*	*Xanthocephalus xanthocephalus*		X						
Mammals									
Vagrant shrew	*Sorex vagrans*		X						
Long-eared myotis*	*Myotis evotis*	X					X		
Fringed myotis*	*Myotis thysanodes*						X		
Western mastiff bat	*Eumops perotis californicus*		X						
American pika*[1]	*Ochotona princeps*		X				X		
Pygmy rabbit*	*Brachylagus idahoensis*			X	X	X			
Snowshoe hare	*Lepus americanus*	X							
Black-tailed jackrabbit	*Lepus californicus*		X	X	X	X			
Western white-tailed jackrabbit	*Lepus townsendii ownsendii*			X	X	X			
Mountain beaver	*Aplodontia rufa*	X							
Northern flying squirrel	*Glaucomys sabrinus*	X							
Little pocket mouse	*Perognathus longimembris*			X	X	X			
Desert woodrat	*Neotoma lepida*			X	X	X	X		
Dusky-footed woodrat	*Neotoma fuscipes*	X							
Mountain lion	*Puma concolor*	X							
Gray wolf*	*Canis lupus*	X	X						
Sierra Nevada red fox*	*Vulpes vulpes necator*		X						
Ringtail*	*Bassariscus astutus*	X							
California wolverine*	*Gulo gulo*	X	X						
Pacific marten*	*Martes caurina (=Americana)*	X	X						
Pacific fisher - West Coast DPS*	*Pekania [=Martes] pennanti*	X	X						
American badger*	*Taxidea taxus*	X	X	X	X	X	X		
Western spotted skunk	*Spilogale gracilis*	X					X		
Pronghorn antelope*	*Antilocapra americana*			X	X	X			
Roosevelt elk	*Cervus canadensis roosevelti*		X						
Rocky Mountain elk*	*Cervus elaphus*	X							

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion, see Appendix C.
* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.2.5 Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have strong influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified for conservation targets in the Cascades and Modoc Plateau Province are summarized in Table 5.2-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures for the province. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.2.6. Some of the major pressures for the province are discussed in more detail below.

Table 5.2-4 Key Pressures on Conservation Targets – Cascades and Modoc Plateau Province

Pressure	Conservation Units and Targets							
	Southern Cascades		Modoc Plateau			Northwestern Basin and Range	North Lahontan HUC 1808	Sacramento HUC 1808
	North Coastal Mixed Evergreen and Montane Conifer Forests	Western Upland Grasslands	Big Sagebrush Scrub	Great Basin Dwarf Sagebrush Scrub	Great Basin Upland Scrub	Great Basin Pinyon-Juniper Woodland	Eagle Lake Native Fish Assemblage	Goose Lake Native Fish Assemblage
Annual and perennial non-timber crops		X	X	X	X			X
Climate change	X	X	X	X	X	X	X	X
Dams and water management/use			X	X	X		X	X
Fire and fire suppression	X	X	X	X	X	X		
Housing and urban areas			X	X	X			
Introduced genetic material							X	X
Invasive plants/animals		X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X		X	X
Logging and wood harvesting	X	X					X	X
Other ecosystem modifications						X		
Recreational activities			X	X	X			
Renewable energy	X		X	X	X			
Roads and railroads							X	X
Utility and service lines	X		X	X	X			

Annual and Perennial Non-Timber Crops

Farming within the province is limited because of the rugged terrain and thin rocky soils. In the Shasta Valley, there are some 500 square miles of wheat, barley (dry farming), and other crops on irrigated land. Dairies have existed in the province since the 1920s to bring milk to local markets in the Pit River and Goose Lake watersheds. Habitat in valleys and watersheds that was once meadows, shrublands, grasslands, and foothill woodlands has been converted to farmland. The local extinction of sharp-tailed grouse is attributed to the conversion of lands to farming and ranching and the subsequent loss of riparian habitat (Shilling et al. 2002; Williams 1986).

Nutrient runoff from farms has degraded creeks and rivers, negatively affecting ecosystems that support aquatic and riparian species. Grazing and farm waste runoff have increased water temperature and polluted the Fall and Pit River drainages and the Bear Creek drainage with excessive nutrients, lowering dissolved oxygen. Many Pit River tributaries suffered similar degradation from land-use practices. Agricultural water use has resulted in low flows and has dried up river segments within the province. Even pesticide drift has been speculated to have contributed to declines in Cascades frogs in the Modoc Plateau (Davidson 2004).

National Park Service

Marijuana cultivation is also having deleterious effects on habitat for fish and wildlife. Many illegal and legal sites for growing marijuana include illegal water diversions which are reducing tributary streams to levels inhospitable to fish and other aquatic organisms (Bauer et al. 2015). The use of concentrated fertilizers that leach into streams can be toxic to amphibians, fish, or invertebrates at high concentrations or promote excessive algal growth leading to reduced oxygen levels. The excessive use of herbicides and their surfactants used on these farms can also be toxic to these organisms. Use of pesticides and rodenticides kill target and non-target animals indiscriminately and even bio-accumulate in predators in which the concentration of toxins can lead to illness or death. Please see the description of marijuana cultivation in the North Coast and Klamath Province section for more detail.

Dams and Water Management/Use

Dams and diversions for hydroelectric power and agricultural diversions have disrupted normal flow patterns, increased water temperatures, and blocked spawning migrations within the province waterways. Large and small dams have fragmented creeks and rivers, permanently isolating subpopulations of aquatic species such as the Shasta crayfish, Eagle Lake rainbow trout, and Lost River sucker. The seasonal fluctuation in river water levels caused by hydropower operations affects fish, reptiles, amphibians, invertebrates, and plants. Rapid reductions in water flows strand spawning salmon and trap young salmon in pools on their journey to the sea. Rapid releases also have detrimental effects on herptofaunal by scouring away amphibian egg masses and tadpoles and inundating turtle nests. Thousands of miles of rivers and streams no longer support salmon and steelhead because migration is blocked by hydropower dams. Radical stream flow fluctuations and higher-than-normal flows from peaking hydropower projects can drown deer and other animals if high-flow releases are improperly timed with migratory or reproductive seasons. Hydropower project operations have major consequences for rivers and riverine ecosystems of the Cascades, contributing to the decline of endangered salmon, steelhead, and other fish populations. Similar to the barriers mentioned above, hydropower operations affect water from rivers and streams, changing natural flow regimes of rivers, altering water temperature, and blocking fish passage and migration. Many of locally endemic fish within this province are now either listed as threatened or as species of special concern, such as the Eagle Lake and Goose Lake rainbow trout and tui chubs.

Major dams in the province include those within the Pit River and Lost River watersheds. The lower Pit River is one of California's most significant hydroelectric rivers because of its perennial flow and steep elevation drop near Shasta Lake. It generates 13 percent of California's hydropower through a series of dams. Hat Creek and Fall River further up the watershed also have powerhouse dams along them. Fall River emerges as spring water in the southern Cascades, receives the Bear Creek drainage, and then joins the Pit River. Fall River is known for its premiere wild trout fishery; however, sediment runoff from past land-use practices in the Bear Creek watershed has polluted Fall River (State Water Resources Control Board [SWRCB] 2003). Large sediment loads, erosion, and declining water quality have degraded habitat essential to the Shasta crayfish and has led to its extremely reduced current range. The several dams and reservoirs within the watershed have degraded the main stem and tributaries of the Pit River. SWRCB listed the Pit River and Fall River as impaired in 2002 for failing to meet state water quality standards (SWRCB 2003).

Clear Lake Dam on the Lost River provides storage for irrigation and reduces flow into the reclaimed portion of Tule Lake and the restricted Tule Lake Sumps in Tule Lake National Wildlife Refuge. Surface waters in the Lower Lost River and its tributaries are listed as impaired for nutrients and impaired for high pH levels (more acidic) as per the 2008-2010 Section 303(d) List (North Coast Regional Water Quality Control Board [NCRWQCB] 2015). The combined effects of damming of rivers, instream flow diversions, draining of marshes, dredging of Upper Klamath Lake, and other water manipulations have threatened both the endangered Lost River and shortnose sucker species with extinction (California Department of Pesticide Regulation [CDPR] 2015). Additionally, water quality degradation in the Klamath Basin watershed through inappropriate grazing and logging techniques, dams, levees, channelization, roads, and other activities has led to large-scale fish kills related to algal bloom cycles.

Watershed Fragmentation and Fish Barriers

Aquatic species depend upon the ability to move within watersheds as a way to survive temperature changes and catastrophic events and to access different habitats at different stages in their lives. Upstream tributary habitats offer breeding and rearing grounds, and downstream habitats usually provide expanded nurseries with an abundance of nutrients. This annual mixing and migration allows recolonization of tributary or downstream habitats following catastrophic events such as floods or fires. Aquatic connectivity is an important part of overall watershed function, one that has been disrupted by many activities. Present populations of numerous fish species are confined below or above dams or separated by other fish barriers such as poorly designed culverts. These artificial barriers prevent genetic mixing between populations and block recolonization of areas within the watershed. Within these fragmented watersheds, native minnows and other fish and amphibian populations are listed either as threatened or endangered or as species of special concern. Improving fish passage is of particular concern in the Eagle and Goose Lake watersheds within this province.

The Goose Lake watershed is home to four endemic species of fish: the Goose Lake redband trout, sucker, tui chub, and lamprey. Goose Lake tributaries are important refugia for these species during extensive dry periods when the lake dries up, and the removal of water diversions and fish passage barriers from roads, diversions for livestock and agriculture, levee and other human activities are critical for maintaining these fish populations without human intervention (e.g., trapping and hatchery production). Because of apparent declines in these native fish populations and the concern over federal and state endangered species listings, the Goose Lake Watershed Council was formed to protect habitat and fish species in the basin. The Goose Lake Fishes Conservation Strategy was prepared in 1996, which continues to guide management priorities for this watershed that include protecting and restoring aquatic and terrestrial habitat and native fish populations. Since its formation, a large number of habitat improvement projects, riparian fencing, grazing management projects, diversion replacements, fish passage improvements, and installations of fish screens have occurred throughout the watershed basin (Lake County Watershed Councils 2015).

Small-Scale Diversions and Groundwater Use

The cumulative effects of small-scale surface water diversions have substantial consequences for some of the province’s river systems including Goose Lake, Eagle Lake, and Lost River watersheds. Agricultural and domestic water use has resulted in low flows and has dried up river segments. Small-scale diversions to provide livestock water sources have depleted instream flows in some waterways, such as the Eagle Lake and Goose Lake watersheds. These changes will be compounded by longer, drier summers brought on by the effects of climate change.

Major water management issues within the Eagle Lake watershed include the management of Eagle Lake rainbow trout which requires the removal of water diversions and impoundments along Pine Creek, one of their major spawning areas. The Eagle Lake rainbow trout is uniquely adapted to tolerate the high levels of alkalinity and only occurs naturally in Eagle Lake. Current and ongoing water management pressures to the species include a hatchery weir that blocks access to Pine Creek, water diversions for livestock grazing, and other uses along Pine Creek that dewater the lower reaches. Local wells may also reduce groundwater, drawing water from the aquifer and lower Eagle Lake during extensive dry years and increase the salinity of the water. These pressures threaten the survival of the native trout and other fish species in the lake.

Fire and Fire Suppression

Fire is an ecologically important disturbance that shapes and maintains native plant communities and wildlife habitats. Fire frequency and intensity are determined by the pattern and density of vegetation (fuel loading), landscape topography, fuel moisture, and long-term weather trends. In turn, fire affects ecological processes, the vegetative mosaic of the landscape, the structural diversity of habitats, and the accumulation of organic material. Specific plant communities or habitats have evolved within ranges of fire-return intervals. At higher elevations, natural wildlife habitats of northeastern California are adapted to specific fire return intervals of between 12 and 30 years. At lower elevations and drier sites dominated by shrubs, with less dense fuel, natural fire return intervals may be 30 to 100 years (Brooks and Pyke 2001; Chang 1996; Young et al. 1988); however, for the past 150 years, land-use activities, native and non-native plant invasions, and fire suppression have increased or decreased fire frequencies, upsetting fire regimes and degrading habitat for native species (Arno and Fiedler 2005). Coupled with selective harvest of large trees, road building, and intensive grazing, suppression of fire over the last 100 years has affected fire frequency and intensity and thus dramatically reshaped forest structure and altered ecosystems throughout the region.

For example, in native shrub-grass communities, overgrazing in the years between the 1860s and the 1930s reduced native perennial grasses, providing conditions more beneficial to invasive annual grasses and to shrub expansion. The proliferation of flammable annual grasses such as cheatgrass and medusahead have led to increased fire frequency in many areas, reducing less fire-tolerant shrubs, such as big sagebrush, mountain mahogany, and lower-elevation bitterbrush. More-frequent fire disturbance has facilitated additional invasions of non-native plants, further transforming the plant community to a monoculture of invasive grasses less suitable for native wildlife (Brooks and Pyke 2001; McAdoo et al. 2002). Additionally, with the absence of fire on the landscape, native juniper has encroached into the once treeless sagebrush shrublands. As the trees proliferate and their density increases, the intensity of fire as it moves through the landscape increases proportionally, causing higher-intensity fire than previously observed and enhancing the power of invasive annual grasses to succeed post-fire.

One of the major management challenges for this province is sustaining ecosystem functionality, including those provided from the fire regime (timing, frequency, intensity, and extent), while ensuring safety and avoiding catastrophic events. Strategies needed to address this issue include coordination with partner stakeholders to search for mutual solutions by revisiting and updating the current fire management protocols so that the future Best Management Practices (BMPs) of forests would also embrace measures that benefit fish and wildlife. To restore native communities in the Cascades and on the Modoc Plateau, forest ecologists generally agree that fire needs to return to forests and shrublands at intervals consistent with historical fire regimes. Returning fire to the forests presents the greatest of challenges. The fire threat to people and expanding residential communities in the forests, excessive fuel loads created by fire suppression and past forest management practices, effects on air quality and conflicts with clean-air laws, and liability all impose difficult constraints on the increased use of prescribed fire and allowing natural fires to burn. Even with the best efforts to reduce fire conflicts and risks, in many areas, reintroducing fire will not be practical or politically possible, at least as a first treatment. Certainly in some locations, selective timber harvest may have to serve as the surrogate for natural fire to begin the process of restoring ecological diversity to forests. Mechanical thinning, however, will not provide all of fire's ecological benefits.

Housing and Urban Areas

Pressures with growth and development have particularly occurred in the lower elevations of the province within the Southern Cascades ecoregion with subdivisions of one to twenty acres as part of rural development on the margins of larger urban and suburban zones around cities outside the ecoregion. The greatest growth and development have occurred in the mostly privately owned western foothills, such as those east of Redding. Development pressure is strong in the foothills adjacent to the metropolitan centers such as Redding, particularly along the foothill river corridors near these cities.

Ranchette and residential communities are expanding from metropolitan area of Redding within the Cascades region. New development along highway corridors is displacing wildlife habitat and creating barriers in important wildlife migration areas. Key wildlife corridors in the region are crossed by highways. Major highways, such as State Routes 44, 89, 97, and 299, traverse the Southern Cascades and are seeing increased levels of vehicle traffic each year. As development expands on the private lands adjacent to these highways, and traffic increases, migrating mule deer, elk, and antelope will be less able to move between seasonal ranges. Increased traffic loads also increase the frequency of bird, small mammal, reptile, and amphibian mortalities as they attempt to cross the highways. Without conservation planning, future development along these corridors will likely have a significant impact on the region's wildlife.

In the Southern Cascades Ecoregion, development is also expanding into the forest. New golf courses, single-family homes, commercial properties, ski resorts, industrial sites, and new roads are replacing and fragmenting wildlife habitat. Where development occurs, fire is suppressed, preventing regeneration of fire-dependent vegetation and altering plant communities. Development also requires new water diversions and creates new sources of pollution. Mountain meadows, oak woodlands, and riparian streams are places of high wildlife diversity, and they are also preferred sites for development. As seasons change, the survival of many mammal, bird, amphibians, reptiles, and fish species depends on their ability to migrate between higher and lower elevations. Because of development and even roads, these species are cut off from necessary uplands or aquatic habitats. For instance, turtles and garter snakes inhabiting streams leave to nest and overwinter in the uplands, and pond-breeding amphibians migrate en masse from the uplands to aquatic habitat when winter rains commence. Opportunities to migrate successfully have been compromised by dams, reservoirs, highways, altered stream flows, residential community development, and predation by free-roaming domestic pets.

Invasive Plants/Animals

Invasive Plants

Numerous invasive plants, like perennial pepper weed, cheatgrass, medusahead, red brome, and various non-native thistles and aquatic weeds, such as Eurasian watermilfoil, have displaced native plants and altered local plant communities. Northeastern California has the highest number of species listed by the California Department of Food and Agriculture (CDFA) as noxious weeds in the state. Many weeds come into California from the Great Basin, so management strategies need to consider the regional landscape. Preventing the spread of invasive species through education and early detection are important to maintaining healthy ecosystems. Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

One species, cheatgrass, has had a particularly dramatic impact on native shrub and grassland communities on the Modoc Plateau. Native to southern Europe, North Africa, and southwestern Asia, cheatgrass was first dispersed in northeastern California sometime in the early 1900s, probably via contaminated grain seeds. Cheatgrass displaces native grasses and forbs by more effectively tapping soil moisture and hinders seedling establishment of native shrubs by reducing moisture and nutrients in surface soils (Norton et al. 2004). Once established and abundant, cheatgrass facilitates frequent fires by providing a carpet of fine fuels, which carries fire more efficiently than well-spaced native perennial grasses and native shrubs (Pellent 1996). Plant species slow to recolonize following fire, like bitterbrush and sagebrush, decline with increased fire frequencies. Cheatgrass has converted native vegetation to fire-prone grasslands, destroying sagebrush, bitterbrush, and mountain mahogany plant communities. The invasion of cheatgrass, medusahead, and other invasive plants has contributed to the wholesale conversion of thousands of acres of sagebrush, bitterbrush, and mountain mahogany plant communities to annual grasslands less supportive of native wildlife (Henstrom et al. 2002; Miller et al. 1994; Schaefer et al. 2003; Young 2000).

In the Modoc Plateau ecoregion, the annual grass medusahead is also invading dry shrublands, causing changes in vegetation diversity and fire frequency. Medusahead competes and replaces other annual invasives, such as cheatgrass, leading to monocultural stands of medusahead that are avoided by most native species of terrestrial animals. Medusahead plants are palatable to livestock when the plants are young, but become unpalatable as they mature and silica concentrates in their inflorescence. The high silica content causes the dead plants to resist decay, leading to build up of dense thatch that is composed primarily of medusahead plants. Other plant species cannot germinate beneath this thatch, proliferating the cycle of an ever expanding monoculture of medusahead. This dense thatch and monoculture is very susceptible to fire and increases fire risk and frequency within these lands. Once burned, the seed bank is composed primarily of medusahead seeds which resprout vigorously and repeat the cycle. Native animal and plant diversity is reduced and threatened in these areas.

Introduced Non-Native Fish

The introduction of non-native fish to lakes and streams has dramatically affected the aquatic life in the province. Specifically, non-native brown and brook trout that prey upon or compete with the native species such as Goose Lake redband trout, have reduced populations of native fishes. Brook trout and brown trout in Davis and Pine creeks have been particularly problematic to the native aquatic assemblages. Brook trout are problematic in Pine Creek in the Eagle Lake Watershed and brown trout within Davis and Pine Creeks in the Goose Lake Watershed. In Pine Creek with the Eagle Lake Watershed specifically, brook trout limit populations of Eagle Lake rainbow trout through competition and predation. Brook and brown trout are present in many of the cold water streams and creeks within the region and CDFW has begun an eradication program within this province to remove these fish from critical native fish spawning and rearing habitat (McAlexander, pers. comm., 2015). Other species, both native and non-native, such as largemouth bass, blue chub, yellow perch, fathead minnows, and rainbow trout may reduce recruitment of other SGCN such as the Lost River and shortnose suckers. These and other non-native aquatic species may reduce or extirpate populations of sensitive endemic crayfish, amphibians and fish within the province.

Problematic Native Species – Western Juniper Expansion

Jeannie Stafford, USFWS

Livestock grazing between 1880 and 1930 likely facilitated the expansion of native western juniper. Grazing consumed fine fuels, decreasing fire frequency and reducing competition from herbaceous species. (This process began 30 to 50 years before invasive grasses increased fire frequencies in the early 1900s.) The reduced fire frequency allowed western juniper to expand its coverage into sagebrush, bitterbrush, mountain mahogany, riparian, and aspen plant communities (BLM 2004; Miller and Rose 1999). Juniper has flourished by outcompeting other vegetation for water and nutrients and altering ecosystems to such an extent that other once-abundant native plants and wildlife are now scarce in these areas. In the last 130 years, juniper has increased its coverage in the plant communities tenfold and now covers more than 2.5 million acres of northeastern California (Eastern Oregon Agricultural Research Center 2004; USFS 2004; OSU 2005). The expansion and increased density of this tree reduces shrubs, herbaceous cover, and plant diversity, decreasing habitat for shrub-affiliated native wildlife (Miller et al. 2000; Miller 2001). As juniper crowds out shrubs and forbs, ground- and shrub-nesting birds are absent or in low numbers. With the increase in juniper dominance and the decline of sagebrush communities on the Modoc Plateau, greater sage-grouse populations have plummeted.

There have been limited efforts to reduce western juniper to encourage the growth of shrubs and grass for forage. The Big Sage Fire Management Unit, which overlies portions of the Devil's Garden and Doublehead Forest Districts of the Modoc National Forest, has a fire plan that allows lightning caused fires to burn with minimum suppression effort. This practice has reduced juniper on several hundred acres. Since 1980, the Doublehead Ranger District has removed about 150 acres per year of western juniper through firewood sales (USFS 1991a). The Cooperative Sagebrush Steppe Restoration Initiative, launched by a coordinated effort of BLM and USFS, is preparing plans for landscape treatments to reestablish the shrub communities that are more important for wildlife. Reestablishing native shrubs and grasses where juniper now dominates is not as simple as cutting down or burning acres of juniper. Invasive annual grasses, rather than native plant communities, are likely to replace the juniper unless conditions are appropriate to benefit the native plants. Conversion of juniper to alternate native plant communities will require careful field testing and analysis of results, followed up with adaptive management (Belsky 1996; Miller 2011).

Livestock, Farming, and Ranching

Livestock Grazing

Livestock production is a major economic activity of northeastern California. The Modoc Plateau and the adjacent forested lands have been grazed since the late 1800s. While livestock grazing practices have improved over the last few decades, excessive grazing continues to degrade shrublands, riparian plant communities, and aquatic ecosystems in the province (USFS 1991b; USFS 2000b; USFS 2001b). Today, there are very few areas in the province that are not grazed. Grazing allotments cover nearly all public forest and rangelands that can support large herbivores. For example, the Warner Mountain Range is currently managed as rangeland for cattle and sheep, with 28 grazing allotments covering nearly the entire landscape, including much of the South Warner Wilderness Area (USFS 2000b). According to the U.S. Department of Agriculture (USDA) 2013 agricultural statistics, approximately 146,600 cattle are produced within Lake, Lassen, Modoc, Plumas, and Shasta counties; this includes rangeland cattle and feed cattle (USDA 2014). Approximately 50,000 cattle graze in Lassen County on the grasses in the sagebrush areas and on irrigated pasture (DWR 2013). Livestock in the region are typically grazed on private lands in the winter and moved to BLM and USFS lands in the spring and summer. Grazing continues to occur throughout USFS and BLM lands throughout the region.

Livestock grazing can be positive or negative depending on the timing, duration and intensity of occurrence. There are numerous examples of the importance of private grazing lands to wildlife. For example over 60 percent of threatened greater sandhill cranes breed on private lands in this region (Ivey and Herziger 2001). Private lands support relatively high densities of breeding and migrating waterfowl and many other wildlife and the efforts by the Intermountain West Joint Venture to focus on habitat conservation on private lands in the Southern Oregon Northeastern California region (http://iwjv.org/sonec-southern-oregon-northeastern-california) to maintain high migratory bird values (Intermountain West Joint Venture 2013). In addition, many livestock producers have been working in the province to improve habitat for sage grouse.

Excessive livestock grazing has both short-term and long-term impacts. Seasonally, grazing reduces available herbaceous vegetation required by native herbivores, and it reduces nesting and escape cover for birds and other wildlife. As upland grasses and forbs dry in the summer, livestock grazing intensifies around riparian and meadow habitats, and browsing shifts to other higher-protein sources such as bitterbrush, mountain mahogany, and aspen; annual bitterbrush leaders and willow and aspen shoots are consumed (Loft et al. 1998; Menke et al. 1996; USFS 1991b; Young and Clements 2002). Excessive grazing removes vegetation and causes erosion along springs, creeks, meadows, and riparian corridors of the Modoc Plateau Ecoregion (Moyle 2002).

Decades of excessive livestock grazing have also contributed to long-term ecosystem and habitat changes in the region. Since the late 1800s, overgrazing has triggered change in composition and abundance of grasses, herbs, shrubs, and tree species. Livestock carried seeds of invasive species such as cheatgrass into the region. Grazing pressure created conditions for invasive grasses to outcompete native species and facilitated shrub growth over perennial grasses. Invasive annual grasses, particularly cheatgrass, carpet the landscape with fine fuels conducive to more frequent fires in shrub-grass plant communities (Pellent 1996; Pellent2002). Intentional clearing of sagebrush stands to improve range conditions for livestock also contributed to the transformation of shrub habitats. This combination of grazing-associated pressures has caused landscape-level changes, resulting in steep declines in the sagebrush, bitterbrush, and mountain mahogany plant communities that once supported abundant populations of greater sage-grouse and other shrub-dependent species. Grazing has also degraded wildlife habitat in areas like the sagebrush steppe on the Devil's Garden, the forestlands of the Warner Mountains, and the forest meadows throughout the region, reducing habitat values for native species (Menke et al. 1996; Miller et al. 1994; Young and Clements 2002).

Reduced fire frequency and incompatible livestock grazing throughout the growing season have contributed to the decline of aspen communities in the region. Livestock, along with deer and elk, consume aspen suckers and shoots and compact soft soils, preventing the successful regeneration of aspen stands. Like riparian habitats, aspen stands represent a small area of the landscape, but they are very important for supporting wildlife diversity. The multilayered vegetative structure found in the understory of aspen stands consists of herbs, shrubs, and woody debris which provides abundant food and shelter for wildlife. Cottontail rabbit, snowshoe hare, porcupine, beaver, mule deer, blue grouse, quail, flycatchers, bluebirds, and Northern goshawk are among the animals that utilize and rely on aspen communities (FRAP 2003; Loft et al. 1987).

Riparian and aquatic ecosystems are particularly affected by livestock grazing today (USFS 1991b; USFS 2001b). Sedimentation caused by over-grazing on stream or erosion from trampling has caused water quality issues in many of the watersheds within the province including Eagle and Goose Lake watersheds. Water diversions to allow livestock access to fresh water have also caused dewatering of streams of creeks important to critical aquatic species such as those in the Eagle and Goose Lake fish assemblages. Various public and private efforts are under way in the region to restore stream habitats or to prevent further damage from livestock. The Central Modoc Resource Conservation District and the Pit River Watershed Alliance are working with land owners on stream restoration projects. USFS has fenced some streams to protect the endangered Modoc sucker and other species. Rotational grazing systems that provide periodic cessation of grazing pressure on a regular basis have been implemented to restore riparian habitats on many grazing allotments on the Modoc National Forest. The Goose Lake Watershed Council has worked on many habitat improvement projects toward this goal of reducing livestock impacts such as riparian fencing, grazing management projects, and diversion replacements (Lake County Watershed Councils 2015).

Excessive Feral Horse Grazing

While grazing by wild horses is very limited compared to cattle and sheep grazing in the region, it adds to the total impact of livestock and wildlife grazing. Since the arrival of settlers in the late 1800s, horses have escaped or been released, and today horses roam as wild herds throughout the Modoc Plateau Region. More than 2,300 wild horses graze year-round in northeastern California and border areas of Nevada on BLM and USFS land in eight Herd Management Areas. Wild horses graze riparian and aquatic plant communities in late season, when these habitats are most vulnerable to damage (Beever 2003). One of the largest herds in the region is on the Modoc National Forest's 236,000-acre Devil's Garden Wild Horse Territory, overlapping 10 livestock-grazing allotments. Many of the Devil's Garden horses are descendants of draft horses, large animals with big hooves. The heavier animals consume more forage and likely cause more trampling damage to delicate soils and creek beds than smaller horses.

For the past 30 years, USFS, with the help of BLM, has tried to maintain horse numbers in the Wild Horse Territory within appropriate management levels. Excessive horse numbers contribute to overgrazing in the region, leaving less forage for wildlife, degrading range condition, and adding to grazing impacts on seeps, springs, riparian habitat, and aspen stands. The lack of resources to maintain limited horse herd sizes means horses contribute to overgrazing of the region; thus, the combined grazing of livestock and horses far exceeds grazing levels that are compatible with maintaining wildlife diversity and abundance.

Logging and Wood Harvesting

Forest management practices, including even-aged tree production, road building, and fire suppression, significantly affect forest ecosystems and wildlife in the Modoc Plateau and Cascade Province, as they do in the Sierra Nevada.

For the last century, forest management practices have adversely affected wildlife and plant communities of the Sierra Nevada, Cascades, and the Modoc Plateau regions. The cumulative effects of even-aged timber-harvest practices, elimination of older trees, snags and brush, logging-road construction, and fire suppression have changed forest plant communities and ecosystem processes. Old-forest conditions (old-growth and late-seral forest) has been drastically reduced throughout the Sierra, Cascades, and Modoc regions (USFS 2001). Fire suppression has allowed denser forests to persist with more shade tolerant trees in the understory causing heightened fire risk and risk of larger, catastrophic fires. While some of these pressures have been reduced in recent years, they all continue to affect the forests' ecosystems and wildlife.

Maintaining diverse wildlife requires forests that contain, in adequate distribution, all sizes and ages of trees, areas of open and closed canopies, and a varied landscape shaped by natural disturbance. Much of the Sierra Nevada, Cascades, and Modoc mixed-conifer forests need to be thinned to restore complex forest structure, improve conditions for wildlife, and reduce the risk of catastrophic fires (Smith 2001).

In addition to treatments of forest stands, regeneration practices following timber harvests or fire are very important in shaping the future forest structure. While timber harvest strategies on public lands are beginning to incorporate wildlife and habitat needs, regeneration practices have generally not made similar changes. In some national forests, regeneration treatments clear shrubs and herbaceous vegetation to promote growth of tree species. Yet shrubs and herbaceous vegetation are particularly important for wildlife. These kinds of post-harvest treatments are more common on private forest lands. The National Forest Management Act and federal regulations prescribe the method and speed of reestablishing the next generation of trees on federal lands (Tappeiner and McDonald 1996). State Forest Practice Rules have similar prescriptions for private forest lands. These regeneration prescriptions are generally designed to enhance timber production and do not generally support regeneration practices specifically to benefit wildlife and restore diverse native plant communities. For example, if a land owner wishes to restore aspen stands following the removal of conifers, the State Forest Practice rules on regeneration may conflict with this activity.

Climate Change

The climatic changes presented below will likely affect all conservation targets identified in this province. Climate change has only been included as a pressure for a subset of targets that are considered more vulnerable to climate impacts, and/or in instances where it was determined that interactions between climate change and other pressures could be addressed in a meaningful way through a conservation strategy.

Temperature

Annual average temperatures are expected to increase by 1.8 to 2.2°C (3.2 to 4.0 °F) by 2070 in the Southern Cascades, and 1.7 to 2.4°C (3.0 to 4.3°F) by 2070 in the Modoc Plateau (PRBO 2011). January average temperatures throughout the province are projected to increase 0.3 to 2.2°C (0.5 to 3.2°F) by 2050 and 1.7 to 3.3°C (3.0 to 5.9°F) by 2100, while July average temperatures are projected to increase 1.7 to 3.1°C (3.0 to 5.6°F) by 2050 and 4.4 to 5.6°C (7.9 to

10.0°F) by 2100, with larger temperature increases in the mountainous areas in the northeastern portion of the region (CalEMA 2012). Mean maximum and minimum temperatures are projected to increase by 2.7 and 2.5°C (4.9 and 4.5°F), respectively (Bell et al. 2004).

The projected impacts of climate change on thermal conditions in this region will be warmer winter temperatures, earlier warming in the spring, later cooling in the fall, and increased summer temperatures (PRBO 2011).

Precipitation and Snowpack

Annual precipitation is projected to decline approximately 2.5 cm (1 inch) by 2050 and 5 cm (2 inches) by 2100 for most of the province. Warmer temperatures are projected to result in earlier snowmelt, and March snowpack is projected to disappear by 2090 for most of the province, with the exception of higher elevation areas near Mt. Shasta (DWR 2008; CalEMA 2012).

Change in Freshwater Hydrologic Regimes

Loss of snowpack in this region would suggest a potential decrease in duration and magnitude of flows (PRBO 2011). Shifts in timing of runoff are projected to occur in the Cascades, with more occurring in winter/early spring, less in spring/summer. As runoff timing changes, lower base stream flows are projected in summer and seasonally higher water temperatures are projected to occur in the fall (CNRA 2009; DWR 2008). Changes in temperature and precipitation, coupled with shifts in hydrologic regimes, may degrade aquatic habitat for some species. Remaining cold-water ecosystems will likely become areas of refugia as climate change impacts unfold on the landscape.

Wildfire Risk

Substantial increases in the likelihood of wildfires are projected in most of the region, especially in Shasta and Siskiyou counties where risks may be multiplied 6 to 14 times by the end of the century (CalEMA 2012). Areas burned could increase up to 50 percent in the northern portion the Southern Cascades (PRBO 2011).

5.2.6 Conservation Strategies

Conservation strategies were developed for conservation targets in the Cascades and Modoc Plateau Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted pressures. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.2-5 through 5.2-10 show the relationships between the stresses and the pressures for each target. Table 5.2-11 summarizes conservation strategies for the province.

Target: North Coastal Mixed Evergreen and Montane Conifer Forests

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of water yield are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition and conservation easements.

Objective(s):

- Increase the amount of key conifer areas protected through purchase or conservation easement. Key conifer areas are old-growth forest, watercourse zones, and nest sites.

Targeted pressure(s): Logging and wood harvesting.

Conservation action(s):

- Identify potential key conifer areas for purchase or conservation easement.
- Develop a habitat conservation plan.
- Develop database to track acquisition.
- Develop protection criteria for conservation easement language: standardize, complete, doable, executable, legally enforceable, protection criteria.
- Develop Conceptual Area Protection Plan (CAPP) or Land Acquisition Evaluation (LAE).

Conservation Strategy 2 (Data Collection and Analysis): Conduct research (data management) to identify areas with restoration potential to allow prioritization for protection and restoration. Work with other agencies doing restoration in sagebrush steppe habitat throughout the region. Map vegetation following standard protocol and fill information gaps into what has already been mapped. Prioritize for restoration areas of encroachment that have not crossed over to juniper woodland.

Objective(s):

- Research efficacy of different techniques to manage forest and reduce catastrophic fire.
- Document the response of wildlife post-fire and to different types of logging techniques.
- Document baseline conditions and monitor trends of SGCN using occupancy as a metric.
- Document baseline conditions and monitor trends of the conifer forest ecosystem.

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Conservation action(s):

- Work with federal agencies and add wildlife component to ongoing/funded research.
- Document the response of wildlife post-fire.
- Document response of wildlife to different types of logging.
- Document baseline conditions and monitor trends of SGCN using occupancy as a metric.
- Document baseline conditions and monitor trends of the conifer forests ecosystem.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):

- Educate public on the ecological effects of fire and on recent landscape changes within the province.
- Relate fire management to beneficial uses of wildlife.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Conduct field trips and workshops.
- Develop brochures and web content.
- Encourage small landowners to do proper thinning.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies that protect and enhance natural resources.

Objective(s):

- Coordinate with agencies to allow fires to burn when possible.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Prioritize areas that can be allowed to burn.

Conservation Strategy 5 (Law and Policy; Partner Engagement): Engage in decision-making process, through cooperation with federal agencies and private landowners on where controlled burns and forest thinning would be most beneficial to wildlife. Coordinate with state and federal agencies, tribal entities, the non-governmental organization community and other partners to establish a decision-making process to achieve shared objectives and broader coordination across overlapping areas.

Objective(s):

- Cooperate with federal agencies and private landowners on where controlled burns and forest thinning would be most beneficial to wildlife.
- Coordinate with partners to prevent intense wildfires to protect wildlife habitat, water quality, and recreation opportunities.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Coordinate with Fire Science Centers.
- Engage in forest treatment priorities and elevate wildlife to a higher priority.
- Work with USFS to identify possible treatment areas.
- Establish ways to identify and prioritize high value wildlife habitat.

Conservation Strategy 6 (Management Planning; Partner Engagement): Develop management plans to improve existing fire management plans and identify high value wildlife habitat.

Objective(s):

- Improve existing fire management plans by identifying high value wildlife habitat.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Coordinate with state and federal agencies.
- Engage USFWS with respect to listed species and management indicator species.
- Identify high value forested wildlife habitats.

Table 5.2-5 Stresses and Pressures for North Coastal Mixed Evergreen and Montane Conifer Forests

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X	X	X	X
Livestock, farming, and ranching		X	X	X	X
Logging and wood harvesting	X	X		X	X
Renewable energy					X
Utility and service lines		X	X	X	X

Target: Western Upland Grasslands

Goals

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity (remove in-growth trees from within grassland habitats) are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect and restore land through acquisitions or conservation easements.

Objective(s):
- Within 10 years restore 5,000 acres perennial grasslands.

Targeted pressure(s): Annual and perennial non-timber crops.

Conservation action(s):
- Conduct assessment of parcels for potential restoration of perennial grasslands.
- Develop LAE or CAPP.
- Complete management and restoration plan.

Conservation Strategy 2 (Data Collection and Analysis): Baseline data collection and analysis on effect of natural fire on grasslands.

Objective(s):
- Collect and analyze data to understand the optimal fire return interval to promote perennials, control invasive species using fire (timing, intensity), and understand dynamic of fire disturbance regime.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Collaborate with USFS Fire Laboratory.
- Develop study design for fire response in grassland habitat.
- Coordinate with CAL FIRE and USFS to conduct study.

Conservation Strategy 3 (Economic Incentives): Provide economic incentives by providing restoration grants, collaborating with federal agencies to identify opportunities to implement joint conservation actions, develop a habitat conservation plan or voluntary local program, or implement candidate conservation agreement to protect candidate species that are vulnerable.

Objective(s):
- Provide restoration grants to incentivize landowners to conserve and restore habitat.
- Collaborate with federal agencies and identify opportunities to implement joint conservation actions.
- Develop a Habitat Conservation Plan (HCP) or voluntary local program such as a Candidate Conservation Agreement. The Candidate Conservation Agreement would focus on protecting candidate species that are vulnerable.

Targeted pressure(s): Annual and perennial non-timber crops; livestock, farming, and ranching.

Conservation action(s):
- Coordinate development of Private Land Management Plans with CDFW and private landowners.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies by influencing land use policies and coordinating with federal agencies to reduce grassland conversion.

Objective(s):
- Coordinate with federal agencies to influence land use policies to reduce grassland conversion.

Targeted pressure(s): Livestock, farming, and ranching; fire and fire suppression.

Conservation action(s):
- Partner with California Rangeland Conservation Coalition.
- Provide input on federal regulation governing grazing allotments.
- Engage USFS in review of current BMPs.
- Identify laws and regulations governing perennial grasslands and work with governing agencies to apply.
- Evaluate the efficacy of creating new policies and regulations protecting grasslands.
- Make recommendations to enhance enforcement of existing laws and regulations.

Conservation Strategy 5 (Land Use Planning): Provide input on local planning regarding the conservation of natural resources.

Objective(s):
- Influence local planning by commenting on general plan updates.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):
- Engage county planning staff on local land use policy.

Conservation Strategy 6 (Direct Management): Manage invasive species.

Objective(s):
- Control or eradicate invasive species.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Conduct assessment of number and species of invasive species.
- Develop plan to control invasive species.
- Implement management plan to control invasive species.

Conservation Strategy 7 (Direct Management): Manage grazing.

Objective(s):
- Improve community composition of perennial grasslands.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):
- Conduct pilot project for implementation of grazing BMPs.

Table 5.2-6 Stresses and Pressures for Western Upland Grasslands

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes		
	Change in natural fire regime	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development
Annual and perennial non-timber crops	X		X	X	
Fire and fire suppression	X		X	X	X
Invasive plants/animals	X		X	X	X
Livestock, farming, and ranching	X	X	X	X	X
Logging and wood harvesting	X			X	X

Target: Big Sagebrush Scrub; Great Basin Dwarf Sagebrush Scrub; Great Basin Upland Scrub

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with suitable soil characteristics are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Conduct research (data management) on restoration to inform prioritization of potential restoration areas.

Objective(s):

- By 2025, the restoration potential of sagebrush habitat is known.
- By 2025, coordinate data management efforts between agencies.
- By 2025, utilize mapping by CDFW and federal agencies to inform prioritization for restoration activities.

Targeted pressure(s): Invasive plants/animals (native species encroachment)

Conservation action(s):

- Fill gaps in current mapping to inform prioritization for restoration activities.

Conservation Strategy 2 (Outreach and Education): Advocate for wildlife-friendly fire management.

Objective(s):
- Develop management practices with USFS that include measures to reduce invasive species by including post-fire treatments.
- USFS post-fire treatments prioritize restoring native vegetation to increase fire resistance.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals (native species encroachment).

Conservation action(s):
- Coordinate with fire agencies to develop BMPs for active and post-fire treatment.
- Review and provide input on firefighting practices.
- Develop comprehensive sage habitat map identifying quality and recommended action during fire.

Conservation Strategy 3 (Outreach and Education): Provide education and outreach for the ranching public and CDFW staff; educate staff on rangeland science; and educate ranching public on the availability of existing BMPs, and the need and status of implementing those BMPs.

Objective(s):
- Provide education and outreach for the ranching public and CDFW staff.
- Educate CDFW staff on rangeland science.
- Work with the ranching public on the availability of BMPs and the need to properly implement those BMPs.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):
- Coordinate with Natural Resource Conservation Service (NRCS) and the California Rangeland Conservation Coalition.

Conservation Strategy 4 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Provide incentives for implementing grazing BMPs on private and public lands.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation Strategy 5 (Economic Incentives): Obtain funding for resource management.

Objective(s):

- Obtain funding for restoration on public and private lands for NRCS sage-grouse initiative.

Targeted pressure(s): Invasive plants/animals (native species encroachment).

Conservation Strategy 6 (Law and Policy): Develop BMPs for improved resource conservation.

Objective(s):

- Co-developed BMPs with land management agencies, California Cattleman's Association, California Farm Bureau, and landowners.
- Put policies in place that benefit wildlife and sustain sage habitats.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s) include:

- Create a sagebrush steppe working group.
- Identify and review existing grazing management policies.
- Develop Memorandum of Understanding (MOU)/Memorandum of Agreement (MOA) between partners.
- Provide input to land management agencies on grazing policies.

Conservation Strategy 7 (Direct Management): Conduct controlled burns for fire/fuel reduction and habitat management in conifer/sagebrush areas (like those encroached by pinyon-juniper).

Objective(s):

- By 2025, 1,000 acres of higher elevation mountain big sage habitat are treated for cheatgrass and medusahead.

Targeted pressure(s): Invasive plants/animals (non-native).

Conservation action(s):

- Coordinate with land management agencies and CAL FIRE to remove cheatgrass and medusahead.
- Identify and prioritize candidate treatment areas.

Conservation Strategy 8 (Direct Management): Implement habitat restoration and enhancement.

Objective(s):

- By 2025, 1,000 acres of sagebrush steppe habitat is restored and functional.

Targeted pressure(s): Strategy acts directly on the target.

Conservation action(s):

- Protect "wet spots" in the high desert (e.g., springs, seeps, riparian zones, meadows) through fencing or other means.
- Select appropriate methodology for priority restoration sites.
- Coordinate with local Resource Conservation District, BLM, and USFS.

Conservation Strategy 9 (Direct Management): Manage invasive species.

Objective(s):

- Agencies and landowners remove pockets of invasive grasses from otherwise intact sagebrush steppe habitat.

Targeted pressure(s): Invasive plants/animals (non-native); fire and fire suppression.

Conservation action(s):

- Coordinate with land management agencies to reduce spread of invasive grasses such as cheatgrass and medusahead.
- Use tools to guide restoration and enhancement efforts.
- Set priorities for treatment of invasive species.

Conservation Strategy 10 (Management Planning): Provide input on grazing management plans, including review and comment on California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documents for grazing management plans to help slow or reverse habitat degradation because of the negative impacts of certain grazing practices.

Objective(s):

- By 2025, USFS management plans address how to reduce negative impacts from allotment grazing practices.
- By 2025, USFS grazing allotments are issued with requirements for sustainable grazing practices.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Build capacity within CDFW in range sciences.
- Identify rangeland experts.
- Coordinate with federal agencies.
- Conduct review of proposed allotment leases.
- Coordinate with development of Total Maximum Daily Loads (TMDL).

Conservation Strategy 11 (Partner Engagement): Implement management partnership/coordination.

Objective(s):
- By 2025, 50 percent of highest priority sagebrush habitat areas are restored.
- By 2025, funding and management is pooled across agencies for habitat restoration and sage-grouse management.

Targeted pressure(s): Invasive plants/animals (native species encroachment).

Conservation action(s):
- Coordinate with potential partners to agree on objective and priorities for habitat restoration and sage-grouse management.
- Identify areas needing restoration from annual grasses or invasive juniper.

Table 5.2-7 Stresses and Pressures for Big Sagebrush Scrub; Great Basin Dwarf Sagebrush Scrub; Great Basin Upland Scrub

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X		X
Dams and water management/use					X
Fire and fire suppression	X	X	X	X	X
Housing and urban areas	X		X		X
Invasive plants/animals (non-native species)	X	X	X	X	
Invasive plants/animals* (native species)		X	X	X	
Livestock, farming, and ranching	X	X	X	X	X
Renewable energy					X
Utility and service lines					X

*This row addresses native species encroachment.

Target: Great Basin Pinyon-Juniper Woodland

Goals:

- By 2025, acres where desired native species are dominant and desired structural diversity are increased by 5 percent within the presettlement range of pinyon-juniper and juniper habitats in the ecoregion.
- By 2025, acres of desired successional stage are increased by 5 percent from presettlement habitat acreage.
- By 2025, acres with desired fire return interval are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Conduct research on climate change.

Objective(s):

- Conduct research on climate change impacts to Great Basin pinyon-juniper woodland within the ecoregion and increase CDFW knowledge on climate change/greenhouse gas emissions.
- Within three years of the start of research, land management agencies, NGOs, and research scientists are able to access the data.
- Within five years of the start of research, areas have been prioritized for restoration, protection or fuels treatments.
- By the end of research, data are being used to prioritize areas of restoration, rehabilitation and protection.
- Within 10 years of research, findings are used to design management action.

Targeted pressure(s): Climate change.

Conservation action(s):

- Develop or collect additional information needed on climate change projections for target habitat health and distribution within the Northwestern Basin and Range ecoregion.
- Collect data to answer relevant questions on climate change impacts on the conservation target within the Northwestern Basin and Range ecoregion.
- Prepare white papers on research of underlying mechanisms and climate change impacts.

Conservation Strategy 2 (Direct Management): Identify highest priority areas for restoration and rehabilitation to protect from annual grass or weed invasion.

Objective(s):

- By 2025, restoration is implemented on 5,000 acres of burn areas.
- By 2025, invasive species are treated on 5,000 acres.

Targeted pressure(s): Climate change; invasive plants/animals.

Conservation action(s):

- Restore areas of burned presettlement habitats by planting native shrub, forbs and grasses to restrict invasion by annual invasive species.
- Treat and control invasive species.

Conservation Strategy 3 (Direct Management): Identify highest priority areas for restoration and rehabilitation to lower or eliminate fire risk; conduct controlled burns and managed thinning in areas of post-settlement (1860) pinyon-juniper and juniper expansion or old growth stands with high canopy cover and fire risk; protect old growth juniper and pinyon-juniper; and continue implementation of Bi-state Action Plan.

Objective(s):
- By 2025, the following management actions are implemented:
    - identify and remove priority areas of post-settlement habitat that threaten other macrogroup habitats;
    - identify and thin presettlement habitat and old growth that require thinning to protect them from high intensity fire; and
    - identify areas of old growth pinyon-juniper and juniper stands.
- By 2025, place fuels treatments around identified old growth stands for protection from fire.
- By 2025, the highest areas for fire risk of the pinyon-juniper are prioritized for management.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Identify and remove 10 percent of target vegetation in post-settlement sagebrush and scrub target habitat that threaten other sagebrush and scrub target habitats.
- Identify and thin 10 percent of target vegetation that was sagebrush and scrub target habitat presettlement and areas of old growth pinyon-juniper and juniper that require thinning to protect them from high intensity fire.
- Identify areas of old growth pinyon-juniper and juniper and place fuels treatments around 10 percent of them for protection.

Conservation Strategy 4 (Partner Engagement): Maintain partnerships through the Bi-state Action Plan, BLM, USFS, NPS, and U.S. Geological Service (USGS) to help coordinate data collection and implement a management plan.

Objective(s):
- By 2025, current partnerships such as the Bi-State Action plan are maintained, a management plan is being implemented and data is being collected for the plan.
- By 2025, areas of removal, restoration or protection of pinyon-juniper vegetation are prioritized and implemented with data collected.

Targeted pressure(s): Climate change; invasive plants/animals; fire and fire suppression.

Conservation action(s):
- Prioritize and implement areas of removal, restoration or protection of sagebrush and scrub target habitat.
- Collect data and coordinate with partnership groups.

Table 5.2-8 Stresses and Pressures for Great Basin Pinyon-Juniper Woodland

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development
Fire and fire suppression	X	X		X	X
Invasive plants/animals	X		X	X	X
Other ecosystem modifications		X			

Target: Eagle Lake Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish population (Eagle Lake rainbow trout [ELRT]) are increased by at least 5 percent from 2015 miles.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, population of key species (ELRT) is increased by at least 5 percent from the 2015 population size.
- By 2025, acres with desired genetic connectivity between lower Pine Creek and lake populations during spawning and migration period, are increased by at least 5 percent from 2015 acres.
- By 2025, miles connected are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Prepare groundwater assessment.

Objective(s):

- Identify location, direction of movement, and quantity of ground-water.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with USFS, DWR, Regional Water Quality Control Board, and private landowners.
- Conduct groundwater assessment.

Conservation Strategy 2 (Outreach and Education): Provide education and outreach by educating the public on the development, status, and need for BMPs and about invasive species.

Objective(s):

- Educate public on the need for BMPs and keep them informed on development and status of BMPs.
- Educate public about invasive species.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):

- Coordinate with NRCS.
- Coordinate with USFS and Pine Creek Coordinated Resource Management Process.

Conservation Strategy 3 (Economic Incentives): Provide economic incentives for grazing on public lands to follow BMPs.

Objective(s):

- Grazing on private and public lands is incentivized to follow BMPs.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Design or support existing incentive programs.

Conservation Strategy 4 (Law and Policy): Develop or update grazing BMPs for managed grazing, including barriers to sensitive areas, fencing timing, and grazing rotations.

Objective(s):

- Co-develop BMPs with land management agencies, California Cattleman's Association, California Farm Bureau Federation, and landowners.
- Have policies that benefit wildlife and sustain habitats.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Develop MOU/MOA between partners.
- Develop or update BMPs including adding an enforcement policy.
- Provide input to land management agencies on grazing policies.

Conservation Strategy 5 (Direct Management): Improve road maintenance to reduce sediment from roads entering streams.

Objective(s):

- Reduce sediment from roads entering streams. (Sediment degrades stream habitat by filling interstitial spaces in gravel affecting fish spawning habitat and invertebrate production, and filling pools.)
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Roads and railroads.

Conservation action(s):

- Coordinate with USFS.
- Conduct road inventory and evaluation.

Conservation Strategy 6 (Direct Management): Manage dams and other barriers by installing control structures (gate or gate valve) to allow more bypass flows and fish passage.

Objective(s):

- Allow more bypass flows to improve in-stream flows.
- Allow fish passage on CDFW lands.
- Have management plan with BMPs.
- Remove Pine Creek Weir and old USGS gauging station.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with USFS.
- Identify dams or other barriers to modify or remove to improve fish passage.
- Coordinate with USFS to remove USGS gauging weir.

Conservation Strategy 7 (Direct Management): Manage invasive species.

Objective(s):

- Remove brook trout from Pine Creek.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Update data on extent of brook trout in Pine Creek.
- Develop strategy for removal of brook trout from Pine Creek.
- Coordinate with USFS and private landowners.

Conservation Strategy 8 (Direct Management): Manage grazing.

Objective(s):

- Reduce grazing impacts to stream(s)/corridor.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Construct exclusionary fencing in highly impacted areas to reduce grazing impacts to streams or their corridors.
- Coordinate with USFS and private landowners.
- Consult with University of California, Extension.
- Identify ways to achieve better compliance of BMPs.

Conservation Strategy 9 (Direct Management): Encourage use of alternative water sources (wells if sufficient ground water is present), water conservation practices, and reduce the impacts of water loss at water treatment sites.

Objective(s):

- Identify best locations to locate wells and develop 10-20 wells to replace stream diversions.
- Large diversions can be switched from direct use of stream water to wells, improving in-stream flow.
- Stock water ponds using stream-flow could be switched to wells.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with local districts and USFS on the use of alternative water source (wells).
- Identify problematic sites and candidate alternate water sources.

Conservation Strategy 10 (Management Planning): Develop BMPs for water management and conservation in the Pine Creek watershed. Coordinate with USFS to create enhanced wetlands and multi-use management (wildlife, livestock, and fish) policy. Managed water could better be used for fish as there are alternative water sources for wildlife and livestock in the Pine Creek watershed.

Objective(s):

- Co-develop BMPs with USFS for enhanced wetland management and agree to the best use of the water.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Engage Pine Creek Coordinated Resource Management Process working group.
- Identify and review existing enhanced wetland management policies.
- Develop or update and implement BMPs.
- Develop MOU/MOA between partners.

Conservation Strategy 11 (Management Planning): Promote domestic water efficiency and conservation through reducing water use by increased efficiency from residence and businesses.

Objective(s):

- Reduced water use by increased efficiency from residences and businesses.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with local and state water management agencies and stakeholders.
- Review available information on potential water savings for the North Lahontan watershed.
- Develop water conservation campaign.

Conservation Strategy 12 (Partner Engagement): Engage in decision-making process.

Objective(s):

- Reduce grazing pressure by animal numbers and duration.
- Influence grazing allotment and management plans to reduce livestock impacts on streams.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Coordinate with USFS on allotment management plans to reduce grazing impacts on streams and reduce grazing pressure within the watershed.

Conservation Strategy 13 (Direct Management): Implement the Eagle Lake Rainbow Trout Conservation Strategy (ELRTCS), which was developed amongst the USFWS, USFS, and CDFW.

Objective(s):

- Conserve and enhance the sustainability of the Eagle Lake Fish Assemblage.

Targeted pressure(s): Livestock, farming, and ranching; dams and water management/use; invasive plants/animals; climate change.

Conservation action(s):

- Improve passage into and through Pine Creek for migration and spawning of Eagle Lake rainbow trout.
- Remove or control of the brook trout population in the headwater reaches of Pine Creek and the subsequent establishment and management of a stream based population of Eagle Lake rainbow trout.
- Provide improved passage through the trap/weir structure at the mouth of Pine Creek as well as effective coordination with hatchery operations.
- Implement artificial spawning program and monitor genetic integrity to ensure retention of adequate genetic diversity to maintain lake and creek populations.
- Implement effective habitat restoration projects and management strategies to improve watershed function and riparian and aquatic habitat conditions. Adaptive management and monitoring of land use activities in coordination with ELRT conservation objectives.
- Develop and support research projects to inform adaptive management and success criteria of conservation actions outlined in the plan.
- Expand outreach and education programs relating to Eagle Lake rainbow trout and the conservation of its habitats.

Table 5.2-9 Stresses and Pressures for Eagle Lake Native Fish Assemblage

Priority Pressures	Stresses												
	Climate Related Factor			Geophysical and Disturbance Regimes		Hydrology and Water Characteristics				Ecosystem Conditions and Processes			
	Change in annual average temperatures	Change in annual average precipitation	Change in snow pack	Change in sediment erosion-deposition regime	Change in extreme events	Change in runoff and river flow	Change in water levels and hydroperiod	Change in water temperature	Change in water chemistry	Change in spatial distribution of habitat types	Change in community structure and composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Climate change	X	X	X	X	X	X	X	X	X	X	X		X
Dams and water management/use						X							X
Introduced genetic material											X	X	
Invasive plants/animals											X	X	
Livestock, farming, and ranching				X		X	X	X		X	X		X
Logging and wood harvesting				X		X				X			X
Roads and railroads				X		X				X			X

Target: Goose Lake Native Fish Assemblage

Goals:
- By 2025, acres connected are increased by at least 5 percent from 2015 acres by improving access to habitat in all lake tributaries and enhancing fish passage.
- By 2025, populations of key species are increased by at least 5 percent from 2015 population.
- By 2025, miles of river in Pine and Davis Creeks where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles connected between stream and lake populations during spawning and migration period are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Design and implement inventory and assessment of fish populations and fish habitat.

Objective(s):
- Collect baseline information on fish populations and fish habitat for the Goose Lake Native Fish Assemblage.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):
- Coordinate with Oregon Department of Fish and Wildlife, USFS, and the Goose Lake Fishes Working Group.

Conservation Strategy 2 (Outreach and Education): Education and outreach; inform public of restoration plans and why treatment is necessary.

Objective(s):
- Raise public awareness and support by starting education and outreach before the restoration project is implemented.
- Continue education and outreach after restoration.
- Target land owners, anglers, and agencies for outreach.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Coordinate with USFS, Goose Lake Fishes Working Group and with agricultural organizations in the area.

Conservation Strategy 3 (Law and Policy): Develop or update grazing BMPs and conduct managed grazing.

Objective(s):
- Reduce grazing impacts to streams, stream corridors, and assemblage habitat.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):
- Coordinate with USFS, NRCS, California Cattleman's Association, California Farm Bureau Federation, and private landowners to develop or update BMPs that reduce grazing impacts to stream(s)/corridors and impacts on habitat.
- Consult with University of California, Extension.

Conservation Strategy 4 (Direct Management): Reduce livestock access to natural water features with wells and alternative water sources.

Objective(s):
- Provide off-stream watering sources and construct exclusionary fencing (to exclude livestock).

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):
- Coordinate with Oregon Department of Fish and Wildlife.
- Coordinate with USFS and private landowners on use of alternative watering locations and exclusionary fencing.
- Quantify impact of livestock having access to watercourses.
- Identify alternative watering structures and water sources.
- Identify locations to develop off-stream water sources and exclusionary fencing.
- Update Goose Lake Conservation Strategy.
- Obtain permits and conduct environmental reviews.
- Implement contract for construction.
- Develop budget, identify grant sources, and apply for funding.

Conservation Strategy 5 (Direct Management): Manage invasive species.

Objective(s):

- Remove brown trout from Davis and Pine Creek.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Update data on extent and distribution of native and non-native species in Davis and Pine Creeks.
- Initiate long-term monitoring and management plan.

Conservation Strategy 6 (Direct Management): Manage dams and other barriers.

Objective(s):

- Allow more bypass flows through water conservation to improve flows in streams.
- Gather and analyze data on water use and fish connectivity; gather baseline information on the current conditions of water use, water use efficiency, and fish passage, including allocating the major barriers.
- Develop restoration and management plans to investigate the impact to stream flow from water diversion, including stream flow modification and fish passage barriers.
- Investigate the potential to develop water conservation and fish passage barrier modification measures, and evaluate the effectiveness of these measures.
- Prioritize the conservation scope by deciding the timeframe of restoration and the appropriate restoration tools and methodology. Find funding to contract the plan development and implementation of restoration and management.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with private landowners.
- Inventory barriers and assess flow and water condition.
- Obtain permits and conduct environmental review.
- Implement water conservation flow.

Table 5.2-10 Stresses and Pressures for Goose Lake Native Fish Assemblage

Priority Pressures	Stresses												
	Climate Related Factors		Geophysical and Disturbance Regimes		Hydrology and Water Characteristics					Ecosystem Conditions and Processes			
	Change in annual average temperatures	Change in average winter precipitation	Change in sediment erosion-deposition regime	Change in extreme events	Change in runoff and river flow	Change in water chemistry	Change in water levels and hydroperiod	Change in groundwater tables	Change in water temperature	Change in spatial distribution of habitat types	Change in community structure and composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Annual and perennial non-timber crops			X		X	X	X	X	X	X			X
Climate change	X	X	X	X	X	X	X	X	X	X			X
Dams and water management/use			X		X		X		X	X			X
Introduced genetic material										X		X	
Invasive plants/animals										X	X	X	
Livestock, farming, and ranching			X		X	X	X	X	X	X	X		X
Logging and wood harvesting			X		X					X	X		X
Roads and railroads			X		X					X			X

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Table 5.2-11 Conservation Targets and Strategies for the Cascades and Modoc Plateau Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
North Coastal Mixed Evergreen and Montane Forests	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of water yield are increased by at least 5 % from 2015 miles.	• Fire regime • Successional dynamics • Community structure and composition • Hydrological regime	• Climate change • Fire and fire suppression • Livestock, farming, and ranching • Logging and wood harvesting • Renewable energy • Utility and service lines	• Data Collection and Analysis • Land Acquisition/Easement/Lease • Law and Policy • Management Planning • Outreach and Education
Western Upland Grasslands	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity (remove in-growth trees from within grassland habitats) are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Fire regime • Successional dynamics • Community structure and composition	• Annual and perennial non-timber crops • Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting	• Data Collection and Analysis • Direct Management • Economic Incentives • Land Acquisition/Easement/Lease • Land Use Planning • Law and Policy
Big Sagebrush Scrub Great Basin Dwarf Sagebrush Scrub Great Basin Upland Scrub	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Fire regime • Successional dynamics • Community structure and composition • Soil quality and sediment deposition regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Housing and urban areas • Invasive plants/animals (non-native species) • Invasive plants/animals (native species) • Livestock, farming, and ranching • Recreational activities • Renewable energy • Utility and service lines	• Data Collection and Analysis • Direct Management • Economic Incentives • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Great Basin Pinyon-Juniper Woodland	• By 2025, acres where desired native species are dominant and desired structural diversity are increased by at least 5% within the presettlement range of pinyon-juniper and juniper habitats in the ecoregion. • By 2025, acres of desired successional stage are increased by at least 5% from presettlement habitat acreage. • By 2025, acres with desired fire return interval are increased by at least 5% from 2015 levels.	• Fire regime • Successional dynamics • Structural diversity • Community structure and composition	• Climate change • Fire and fire suppression • Invasive plants/animals • Other ecosystem modifications	• Data Collection and Analysis • Partner Engagement • Direct Management
Eagle Lake Native Fish Assemblage	• By 2025, miles of streams with target fish population (Eagle Lake Rainbow Trout - ELRT) are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population of key species (ELRT) is increased by at least 5% from the 2015 population size. • By 2025, acres with desired genetic connectivity between lower Pine Creek and lake populations during spawning and migration period are increased by at least 5% from 2015 acres. • By 2025, miles connected are increased by at least 5% from 2015 miles.	• Area and extent of community • Connectivity among communities and ecosystems • Community structure and composition • Hydrological regime • Soil quality and sediment deposition regime • Surface water flow regime • Water level fluctuations	• Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock farming and ranching • Logging and wood harvesting • Roads and railroads	• Data Collection and Analysis • Partner Engagement • Management Planning • Direct Management • Economic Incentives • Law and Policy • Outreach and Education
Goose Lake Native Fish Assemblage	• By 2025, acres connected are increased by at least 5% from 2015 acres by improving access to habitat in all lake tributaries and enhancing fish passage. • By 2025, populations of key species are increased by at least 5% from 2015 population size. • By 2025, miles of river in Pine and Davis Creeks where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles connected between stream and lake populations during spawning and migration period are increased by at least 5% from 2015 miles.	• Area and extent of community • Connectivity among communities and ecosystems • Community structure and composition • Hydrological regime • Soil quality and sediment deposition regime • Surface water flow regime • Water temperatures and chemistry • Water level fluctuations • Nutrient concentration and dynamics	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock farming and ranching • Logging and wood harvesting • Roads and railroads	• Data Collection and Analysis • Direct Management • Law and Policy • Outreach and Education

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Bay Delta and Central Coast Province

5.3 Bay Delta and Central Coast Province

5.3.1 Geophysical and Ecological Description of the Province

The Bay Delta and Central Coast Province contains the important geophysical and ecological complex of estuaries, coastal valleys, and coast range mountains, comprising over 300 miles of central California coast, between the Southern California Bight and the North Coast, and extending approximately 75 miles inland from the Pacific Ocean (Figure 5.3-1). While the Bay Delta region plays many important ecological roles on its own and is affected by most of the state's ecosystems north of the Tehachapi Mountains, incorporating it with the Central Coast as one province associates it with several other critical estuarine habitat and coastal areas. Geophysically, the province is defined primarily by the Southern Coast Ranges, with many peaks in between 3,000 to over 4,000 feet elevation, up to the tallest at 5,862 feet, which is Junipero Serra Peak in the Santa Lucia Range. Between mountain ranges are broad coastal valleys, such as the Santa Clara Valley and Salinas Valley. Ecologically, the province contains extensive areas of some of the most important and sensitive salt, brackish, and fresh water habitats in the state, including the San Francisco Bay system; Sacramento-San Joaquin Delta; and the Elkhorn Slough, Carmel River, and Morro Bay estuaries. Overall, the habitats of the province are highly varied, including tidal marsh, broad areas of cultivated lands in valleys, valley and mountain riparian corridors, coastal grasslands, chaparral and other scrub plant communities, and large areas of forest and woodland habitats.

<u>Bay Delta</u>

Encompassing 1,600 square miles of waterways, the San Francisco Bay and Delta together form the West Coast's largest estuary and the second-largest estuary in the nation. Much of the region, combined with the Central Valley, is part of a vast hydrological system that drains 40 percent of the state's fresh water. This water, falling as either rain or snow over much of the northern and central parts of the state, drains along the Sacramento, Mokelume, and San Joaquin rivers into the Delta. In the Delta, fresh water from these rivers mixes with salt water from San Francisco Bay, creating a rich and diverse aquatic ecosystem.


California Department of Water Resources (DWR)

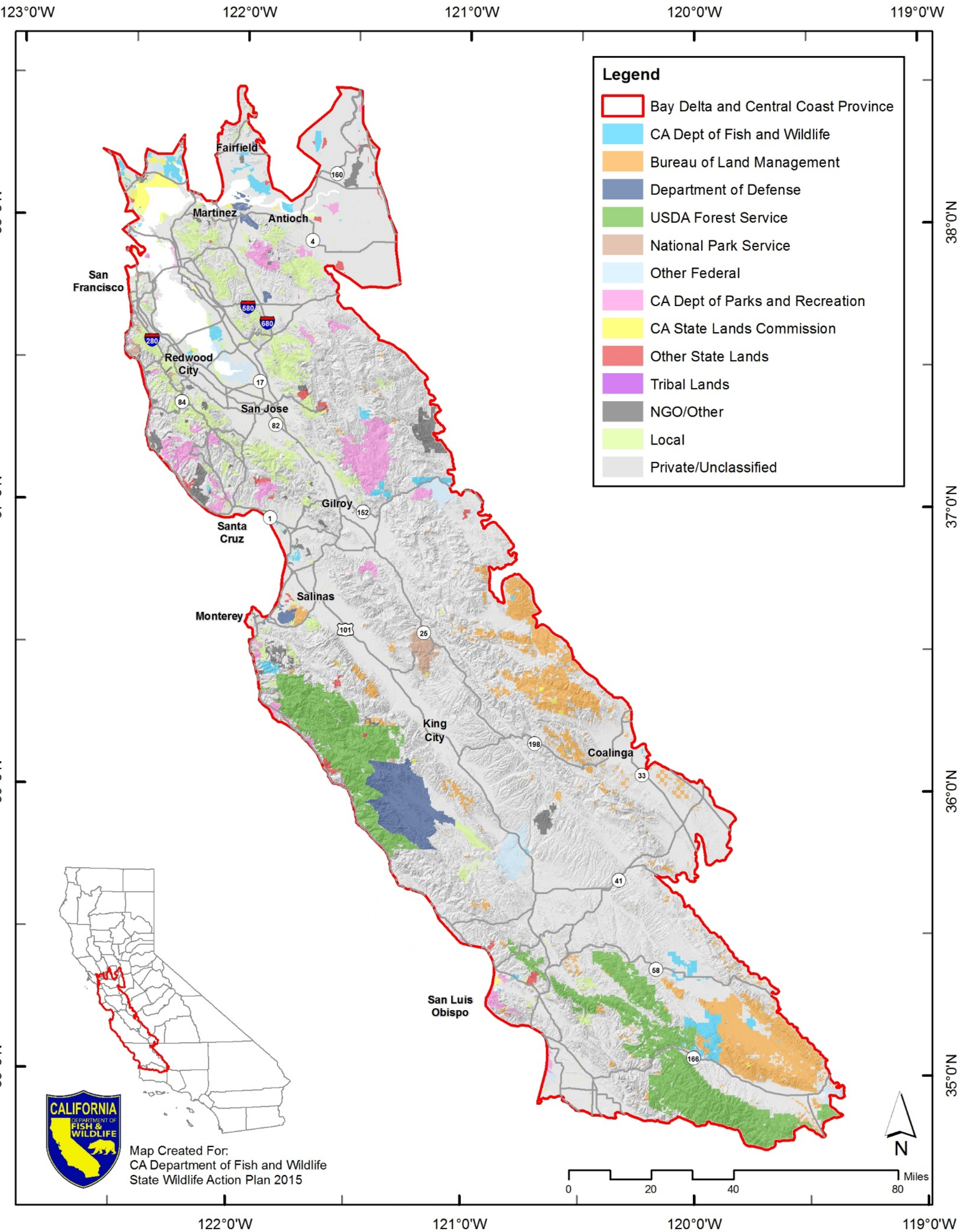
The Bay Delta has two subregions: the San Francisco Bay Area and the Delta. The San Francisco Bay Area subregion is the most densely populated area of the state outside of the Southern California metropolitan region. It consists of the low-lying baylands, aquatic environments, and watersheds that drain into San Francisco Bay. Low coastal mountains surround San Francisco Bay, with several peaks rising above 3,000 feet. The region receives 90 percent of its surface water from the Sierra Nevada via major Central Valley creeks and rivers that feed the Delta. Other rivers draining into the Bay include the Napa, Petaluma, and Guadalupe rivers and Sonoma, Petaluma, Alameda, and Coyote creeks. The Bay Area has relatively cool, often foggy summers and cool winters, strongly influenced by marine air masses. Rain falls almost exclusively during the winter season (October to April) and averages 15 to 25 inches annually, with occasional snowfall at higher elevations. Rainwater runs off rapidly, and most of the smaller streams are dry by the end of the summer.

The topography allows for a variety of different habitats. The Bay itself has both deep and shallow estuarine (mixed fresh water and salt water) environments. In addition to estuarine species, the Bay also supports many marine species, including fish, invertebrates, sharks, seals, and even, on occasion, whales. Along the shoreline are coastal salt marsh, coastal scrub, tidal mudflats, and salt ponds. Freshwater creeks and marshes, especially those that still have patches of riparian vegetation, are home to aquatic invertebrates and freshwater fish. Upland areas support a mixture of grasslands, chamise chaparral, and live oak and blue oak woodlands. Small stands of redwood, Douglas fir, and tanoak grow in moister areas.

The Delta is a low-lying area that contains the tidally influenced portions of the Sacramento, San Joaquin, Mokelumne, and Cosumnes rivers. The Delta was once a huge marsh formed by the confluence of the Sacramento and San Joaquin rivers. Once described as a “terraqueous labyrinth of such intricacy that unskillful navigators have been lost for days in it” (Bryant 1848), it has been extensively drained and diked for flood protection and agriculture. Exposure of the rich, organic soils behind these levees has increased oxidation rates to such an extent that the land is breaking down and much of the surface has now subsided below sea level. Because of its natural patterns of flooding, the Delta is relatively less populated than the other subregions.

“The Sacramento-San Joaquin River Delta is the grand confluence of California’s waters, the place where the state’s largest rivers merge in a web of channels—and in a maze of controversy. The Delta is a zone where the wants of a modern society come into collision with each other and with the stubborn limitations of a natural system. In 2009, seeking an end to decades of conflict over water, the Legislature established the Delta Stewardship Council with a mandate to resolve long-standing issues.”

-The Delta Plan, 2013



Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands

Figure 5.3-1 Land Ownership of the Bay Delta and Central Coast Province

The wildlife of this region is affected by a wide variety of pressures, described below. The major problem has been the loss, degradation, and fragmentation of habitats, both terrestrial and aquatic, because of the development of agriculture and urban areas. Since the Gold Rush, significant loss of wetlands has occurred as a result of diked agricultural lands, commercial salt ponds, ports, airports, transportation, and other development. Virtually all of the streams and rivers that enter the Delta have been dammed, blocking fish migration, or have been so severely degraded that they are no longer usable by salmon and other anadromous and resident fish. Flood control structures, such as dikes, levees, and hardened embankments (riprap), have altered floodplain habitats, such as riparian forests and wetlands, throughout the region. Additionally, the biomass of the San Francisco Bay and Delta is dominated by non-native species, which has shifted the food-base and reduced the aquatic biological diversity. Invasive cordgrass (*Spartina)* has become established in coastal areas, including mud flats, salt marshes and beaches, out-competing native plants. This region is primarily in private ownership, and the role of private landowners is very important for conservation. Additionally, water diversions for agricultural, industrial, and municipal uses, export of water to users south of the Delta (and shifts of flow patterns from west-east to north-south), and salinity control have dramatically altered water availability and ecosystem functions.

The Sacramento-San Joaquin Delta has been stressed intensively by human pressures. Its ecosystem functions have been in steep decline (e.g., pelagic organism declines), which jeopardizes the Delta's ability to support essential habitat for its fish and wildlife species and to provide water supplies to the state. In many parts of the Bay, there have been shifts in the locations of the baylands and adjacent habitats. These shifts have resulted from a combination of urbanization of moist grasslands and vernal pool complexes, reclamation of tidal habitats, and sediment deposition in subtidal habitats. Reclamation has converted some tidal habitats into seasonal wetlands, while urbanization destroyed similar habitats in the adjacent uplands. Sedimentation has converted some subtidal areas to more shallow tidal habitats. The combined effect of these changes has been to shift seasonal wetlands and the baylands bayward. The desired landscape elements sought within tidal marsh restoration projects are open water areas within the tidal marsh of both shallow (for shorebirds) and deeper (for waterfowl) depths (Goals Project 1999).

The nontidal freshwater marsh natural community is composed of perennially saturated wetlands, including meadows, dominated by emergent plant species that do not tolerate perennial saline or brackish conditions. Nontidal freshwater perennial marsh communities occur in small fragments along the edges of the nontidal perennial aquatic and valley/foothill riparian natural communities. Soils are predominantly silt and clay, although coarser sediments and organic material may be intermixed. In some areas, organic soils (peat) may constitute the primary growth medium. The extent of nontidal freshwater perennial emergent wetland in California, including the Delta, has declined dramatically over the past century due to reclamation and conversion of the habitat to other uses, primarily agriculture (Gilmer et al. 1982; The Bay Institute 1998). The extent of this natural community in the Delta has been dramatically reduced in the past century, with a corresponding reduction in habitat function for associated fish and wildlife species (The Bay Institute 1998).

Bay-Delta Live

Bay-Delta Live (BDL; http://www.baydeltalive.com/) is a data hub of information needed in understanding the dynamic ecosystem known as the Sacramento-San Joaquin Rivers Delta. BDL's purpose is to expand access to data for the Delta. Members of the BDL community can view data from multiple sources with a set suite of tools such as visualizations and time series analyses to expand knowledge and reach of information to the public. BDL is supported through contributions from federal and state agencies, as well as community and agency information. Data providers include CDFW, California Department of Water Resources, U.S. Geological Survey, U.S. Fish and Wildlife Service, and U.S. Bureau of Reclamation.

Because of the conservation and management complexities and challenges facing the Bay Delta, the SWAP team implemented a focused approach to identifying pressures, conservation targets, and conservation strategies for the region. An interdisciplinary team representing CDFW (from Marine Region, Bay Delta Region, Water Branch, and Fisheries Branch), Sacramento-San Joaquin Delta Conservancy, and U.S. Fish and Wildlife Service (USFWS) worked with experts from the San Francisco Bay Joint Venture and the Central Valley Joint Venture to develop conservation strategies for the SWAP update. This SWAP regional team recognized that this task required a unique melding of regional boundaries and general habitat types, designated as the *Bay Delta Conservation Unit,* for the SWAP update (see Figure 1.5-4). The boundary for this conservation unit consists of the entire San Francisco Bay and portions of the San Francisco Bay (HUC 1805), Sacramento River (HUC 1802), and San Joaquin River (HUC 1804). The boundary includes areas of tidal influence, areas of salt marsh vegetation, and lowland elevations behind dikes/levees. In addition, the area was increased to roughly incorporate a 1-meter sea-level rise to take climate change into account.

In addition, the SWAP regional team recognized that a critical step for developing conservation strategies for an area as broad, complex, and diverse as the Bay Delta was to first gather existing peer reviewed published literature on the San Francisco Bay and Delta. Due to broad user group interests, complex biological interactions, and diverse habitats of the Bay Delta, several organizations and agencies have published studies, reports, and restoration plans for the region. The SWAP regional team assembled a list of the most relevant environmental planning documents for review and synthesis. These documents are called "reference documents" in the discussion below.

The SWAP regional team developed targets and conservation strategies based on their discussion within the reference documents. The SWAP team also developed conservation strategies that they identified as being underrepresented in the reference documents but warranted specific attention. For example, a climate change strategy was identified as important by the SWAP regional team, but it did not appear frequently in the reference documents. Furthermore, the interdisciplinary and iterative approach allowed the SWAP regional team to evaluate baseline concepts in concert with outside representatives from the scientific community, fill in areas where concepts appeared to be lacking, and develop conservation strategies for a target that provides broad ecosystem benefits. The following reference documents were reviewed and synthesized by the SWAP regional team to develop targets and conservation strategies presented in this chapter.

- Restoring the Estuary: Implementation Strategy of the San Francisco Bay Joint Venture — A Strategic Plan for the Restoration of Wetlands and Wildlife in the San Francisco Bay Area (San Francisco Bay Joint Venture 2001).
- San Francisco Bay Subtidal Habitat Goals Report: Conservation Planning for the Submerged Areas of the Bay (California State Coastal Conservancy 2010).
- Bay Delta Conservation Plan (Working Draft; DWR et al. 2013).
- Central Valley Joint Venture Implementation Plan – Conserving Bird Habitat (USFWS 2006).
- The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value (Delta Stewardship Council 2013).
- Sacramento-San Joaquin Delta Native Fishes Recovery Plan (USFWS 1995).
- Suisun Marsh Habitat Management, Preservation, and Restoration Plan (U.S. Bureau of Reclamation [USBR] et al. 2013).
- Baylands Ecosystem Habitat Goals: A Report of Habitat Recommendations Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project (1999).
- The Riparian Bird Conservation Plan: A Strategy for Reversing the Decline of Riparian Associated Birds in California (Riparian Habitat Joint Venture [RHJV] 2004).
- Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta, Sacramento Valley, and San Joaquin Valley Regions (CDFW et al. 2014).
- California Marine Life Protection Act Initiative. San Francisco Bay Options Report: Considering MPA Planning (CDFW 2011).
- 2012 Central Valley Flood Protection Plan (DWR 2012).
- State of the State's Wetlands: 10 Years of Challenges and Progress (California Natural Resources Agency [CNRA] 2010).
- The Baylands and Climate Change: What We Can Do. The 2014 Science Update to the Baylands Ecosystem Habitat Goals (San Francisco Bay Area Wetlands Ecosystem Goals Project 2014).

Central Coast


Dick Daniels

California's Central Coast region encompasses approximately 8 million acres and extends from the southern boundary of the Los Padres National Forest north to the San Francisco Bay lowlands. Inland, the region is bounded east of the Diablo and Temblor mountain ranges. The Central Coast landscape is characterized by a rugged coastline, small mountain ranges that roughly parallel the coast, river valleys with rich alluvial soils, and arid interior valleys and hills. Across the region, differences in climate, geography, and soils result in widely varying ecological conditions, supporting diverse coastal, montane, and desert-like natural communities.

Sand dunes and wetlands occur along the coast. Rivermouth estuaries, lagoons, sloughs, tidal mudflats, and marshes make up coastal wetland communities, a unique environment where marine, freshwater, and terrestrial systems meet. Coastal habitats support numerous shorebirds, including the western snowy plover, willet, whimbrel, long-billed curlew, marbled godwit, and American avocet. Coastal estuaries provide important nursery habitats for anadromous and marine fish, especially in watersheds where small or seasonally dry upper tributaries provide limited rearing capacity (California Department of Fish and Game [CDFG] 1996). Elkhorn Slough and Morro Bay are the region's two largest estuaries, with other significant wetlands found at the Pajaro, Salinas, Carmel, and Santa Maria river mouths, Devereux Slough, and Goleta Slough (Page and Shuford 2000), and Pescadero Marsh. During the last 20 year years, the salt marsh of Elkhorn Slough has been recolonized by large numbers of sea otters and it may be their preferred habitat.

Other coastal habitats include native coastal prairie grasslands, coastal scrub, and maritime chaparral. Coastal scrub and grasslands also extend inland along river valleys, like the lower Salinas Valley, where the moist maritime climate reaches through gaps in the coastal ranges. Maritime chaparral, characterized by manzanita and California lilac species adapted to the foggy coastal climate, once dominated sandy hills along Monterey Bay, Nipomo Mesa, Burton Mesa, and Morro Bay. Maritime chaparral is now one of the region's most pressured community types, with its extent severely reduced by development. These scrub and chaparral communities provide important habitat for Morro Bay, Santa Cruz, and Pacific kangaroo rat species and the San Diego desert woodrat, as well as shrubland bird species, including California quail, sage sparrow, rufous-crowned sparrow, and the sensitive California thrasher and Costa's hummingbird. Additionally, several species of rare plants occur in maritime chaparral habitats.


Patricia Bratcher, CDFW

The outer coastal ranges, including the Santa Cruz and Santa Lucia mountains, run parallel to the coastline. Well-watered by the moist ocean air, these slopes are drained by streams that run all year. The Santa Lucia Mountains provide most of the water supply to the Salinas River. These ranges support mixed coniferous forests and oak woodlands. The dominant coniferous species include ponderosa pine, Douglas fir, red alder, and, in the north, redwoods. The oak woodlands are dominated by coast live oak and valley oak. Rarer, endemic tree species include Monterey pine and Santa Lucia fir. Wildlife inhabitants of the outer coastal mountains include wide-ranging species such as mountain lion and bobcat, and sensitive species that include California spotted owl, American badger, peregrine falcon, and golden eagle.

Moving inland across the Gabilan, Diablo, Temblor, and Sierra Madre mountain ranges, the climate becomes progressively drier, and the vegetation shifts to oak woodlands, grasslands, interior chaparral, and desert-like interior scrub. Interior streams are often intermittent, drying in the summer and fall, except at the higher elevations of the Sierra Madre ranges, where streams run year round. Additionally, many streams in San Luis Obispo and Monterey counties run year round in their upper reaches. Biologically diverse oak woodland communities support more than 200 species of plants, 300 vertebrates, and 5,000 invertebrates (Thorne et al. 2002; The Nature Conservancy 1997). Inhabitants of oak woodlands include western gray squirrel, dusky-footed woodrat, Monterey dusky-footed woodrat, pallid bat, and Townsend's big-eared bat. Large expanses of annual grasslands, now dominated by non-native grasses, are inhabited by California ground squirrel and black-tailed jackrabbit, along with sensitive species that include giant kangaroo rat, burrowing owl, San Joaquin kit fox, American badger, tule elk, and, in the southern portion of the region, reintroduced pronghorn. Interior chaparral habitats support drought-resistant woody shrubs, including manzanita, California lilac, and chamise.

The Central Coast's largest drainages include the Salinas, Carmel, Santa Maria, Pajaro, and Santa Ynez watersheds. Riverine and riparian habitats are important to amphibian and reptile species, including California red-legged frog, foothill yellow-legged frog, and western pond turtle, and birds such as bank swallow, Lawrence's goldfinch, and least Bell's vireo. Steelhead and coho salmon are still present, in reduced numbers, in most of the streams where they historically occurred. Mammals that use riparian habitats include gray fox, striped skunk, mole and shrew species, and ringtail.

Higher-elevation riparian vegetation in moist coastal climates includes willow, alder, bay, maple, Douglas fir, and sometimes redwood. Valley-bottom riparian communities are dominated by sycamore, willow, alder, and cottonwood. Steep coastal streams in the forested Santa Cruz and northern Santa Lucia mountains are some of the region's most intact systems and host relatively healthy anadromous fish populations (CDFG 1996). In contrast, the majority of the region's large river-valley floodplain and riparian forests have been replaced by agriculture, and lowland fish assemblages have been severely compromised.

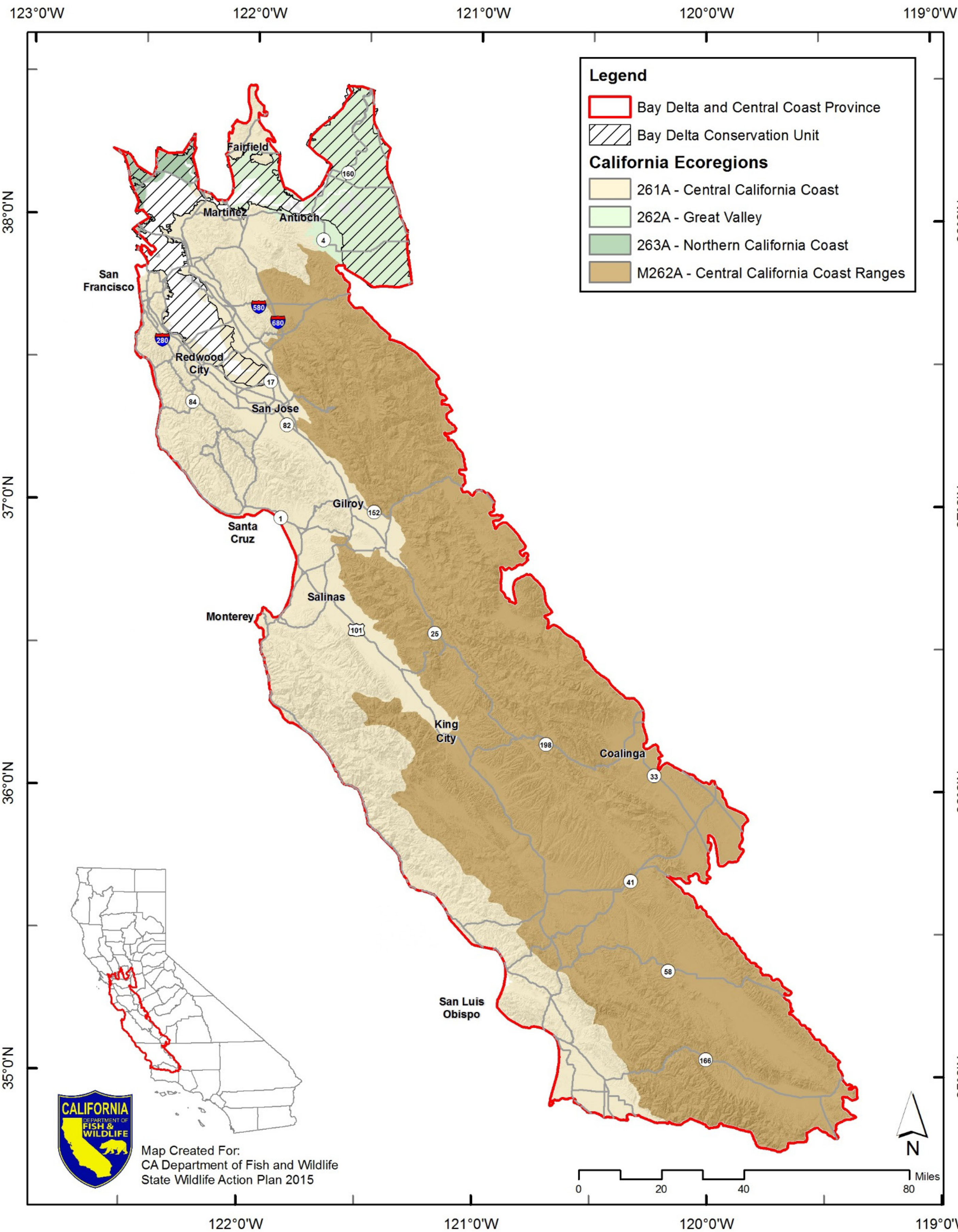
Seasonal vernal-pool wetland complexes are found in many parts of the region, including the Salinas River drainage and coastal dune terraces and mesas of Santa Barbara County, and seasonal sag ponds are found along the San Andreas Fault Zone, particularly in the eastern portion of San Luis Obispo County. California tiger salamanders, western spadefoot, fairy shrimp species, and many endemic plant species depend on these unique seasonal pool habitats.

The San Andreas Fault runs the length of the region and shapes much of the region's geography. Most of the north-south running mountain ranges and valley depressions have been formed as a result of pressure between the two continental plates meeting at this fault zone. Compression, chemical interaction, and surfacing of ancient seabed sediments have produced serpentine soils that are rich in heavy metals such as chromium, nickel, and cobalt, but poor in nutrients, and have poor water-holding capacity. A number of plants have adapted to these harsh, near-toxic conditions, resulting in unique, island-like ecological communities largely restricted to serpentine areas.

Historically, urban centers have been located along the region's coastal lowlands, with crop production concentrated in valley-floor areas and grazing and natural lands occupying the surrounding foothills and mountainous areas. In recent years, however, population pressures have increased, and growth and development have expanded from urban centers to adjacent farmlands and rural areas both on the coast and in the interior portions of the region. Along with population growth, the greatest pressures to regional wildlife diversity are expansion of intensive types of agriculture, invasions by nonnative species, and overuse of regional water resources. In spite of these significant regional pressures, large blocks of undeveloped natural lands remain, and the region presents many opportunities to accomplish conservation on a landscape-scale.

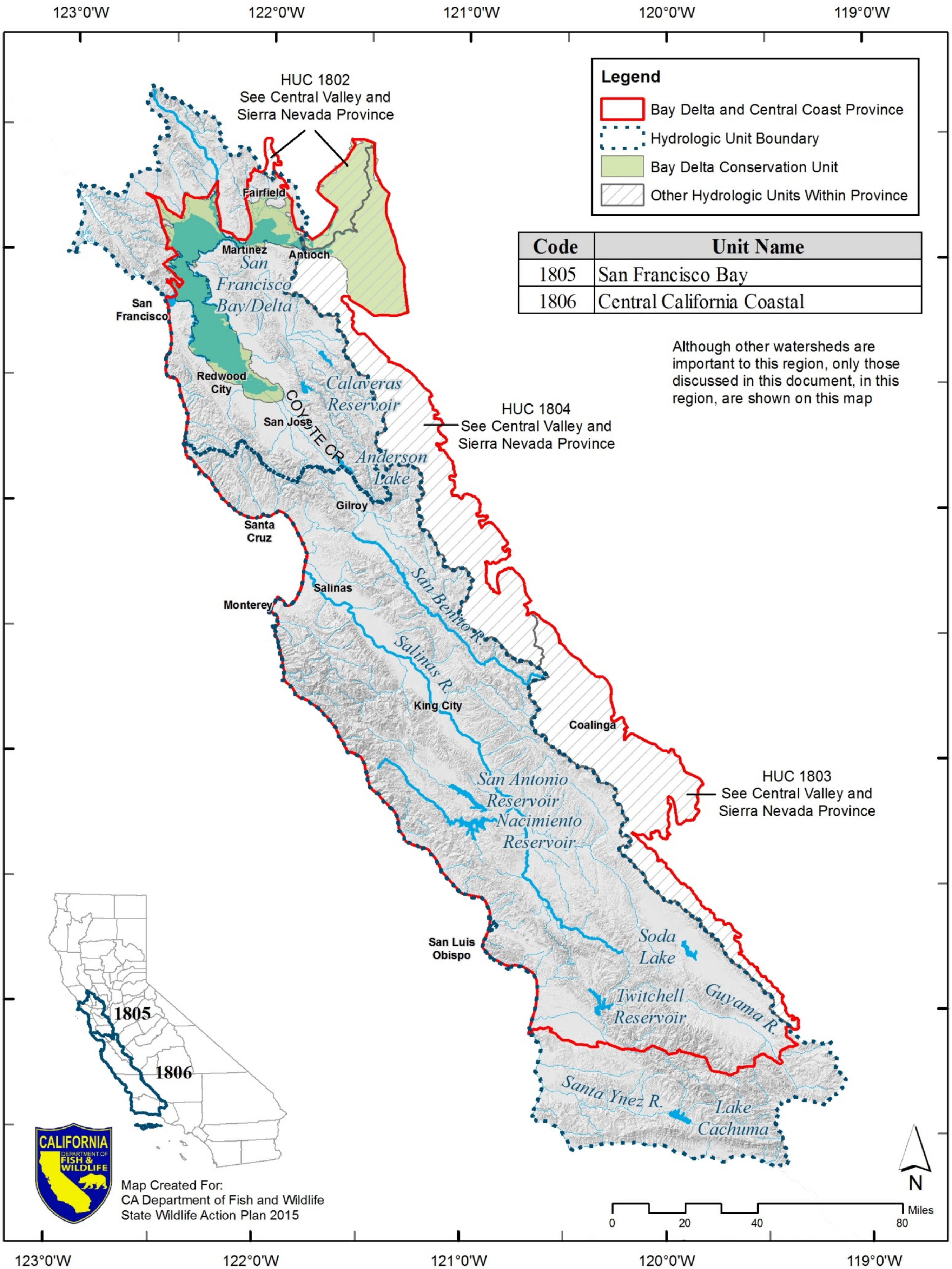
5.3.2 Conservation Units and Targets

The conservation units associated with the Bay Delta and Central Coast Province are the Central California Coast and Central California Coast Ranges ecoregions (Figure 5.3-2), Bay Delta conservation unit, which includes portions of HUC 1805, HUC 1802, and HUC 1804 (see Figure 1.5-4), and Central California Coastal (HUC 1806) hydrologic unit (Figure 5.3-3). The selected targets for each of these conservation units are summarized in Table 5.3-1. Information about the methods used to prioritize conservation targets is presented in Appendix D. Figure 5.3-4 shows the distribution of the plant communities within the province.



Data Source: USDA Forest Service (ecoregions); US Geological Survey (hillshade)

Figure 5.3-2 Ecoregions of the Bay Delta and Central Coast Province



Data Source: National Hydrologic Dataset (NHD); US Geological Survey (hillshade)

Figure 5.3-3 Hydrologic Units of the Bay Delta and Central Coast Province

Table 5.3-1 Conservation Units and Targets – Bay Delta and Central Coast Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Central California Coast Ecoregion	This ecoregion consists of mountains, hills, valleys, and plains in the southern Coast Ranges of California. Elevation range: 0 to 3,800 feet	California Grassland, Vernal Pools, and Flowerfields	Includes all annual forb/grass vegetation native and non-native, as well as native perennial grasslands growing within the California Mediterranean climate. This does not include the cool-moist north coastal terrace prairies, the montane meadow/upland grasslands, and non-native perennial pasture grasses. Native perennial grasslands include needle grass species, melicgrass and giant wild rye. Annual native forb and wildflower fields including species of poppy, goldfields, popcorn flowers, fiddleneck, and others. Target also includes vernal pools within grasslands. Non-native annual grasslands such as wild oat, brome, annual fescue, star-thistle, mustards, fennel, and others are also present in grassland habitats and affect the habitat function of this target.	Annual Grassland; Perennial Grassland
		Coastal Sage Scrub	Along with chaparral, coastal sage scrub is the main community type of California shrublands. It differs from chaparral by being composed of drought-deciduous shrubs, which typically are smaller with less extensive root systems and shorter life spans. California sagebrush, true sage species, shrubby buckwheats, deer-weed, and several other shrubs are characteristic. These scrubs are typical of relatively hot and dry slopes, and occupy finer textured soils than most chaparrals. Some members of this target are disturbance specialists, colonizing burns or clearings, and giving-way to longer lived chaparral and other vegetation a few years after disturbance. Non-native invasive broom species are also present in coastal sage scrub.	Coastal Scrub
		American Southwest Riparian Forest and Woodland	Diagnostic species include Fremont cottonwood, black and red willow, California sycamore, California wild grape, arroyo willow, narrow-leaf willow, button-bush, spice bush. Most stands are found in permanently moist settings or riparian settings where sub-surface water is available year-round. Suitable conditions to support native fish assemblages include presence of surface water year-round, interconnected by surface flow or pools maintained by intergravel flow.	Valley Foothill Riparian
		Northwest Coast Cliff and Outcrop	Includes the barren coastal cliffs on headlands and islands of the north coast. This target has not been well-described.	Barren
		Coastal Dune and Bluff Scrub	Stands of coastal dune and bluff vegetation are limited to salty, rocky or sandy settings immediately adjacent to the open coast. Adaptations to salt spray, wind and shifting sands, result in several lifeforms including succulent or hairy leaves, long underground roots and stolons (adaptation to shifting sands), and good colonization of relatively unstable and sterile substrates.	Coastal Scrub
		North Coast Deciduous Scrub and Terrace Prairie	This target includes a combination of grasses and shrubs, which tend to intermix in stands. Cool foggy summers and rainy winters, coupled with salty winds tend to preclude forest development along the immediate coast, but inland these stands only persist through regular disturbance such as clearing, grazing/browsing. Stands also commonly occur adjacent to upland coastal dune and bluff scrub; however, that community is characterized by more evergreen shrubs, which occur in well-drained exposed settings (exposed bluffs and dunes), dominated by mostly winter-deciduous shrubs in association with perennial cool-season grasses. Shrub indicators include: California blackberry, thimbleberry, salmonberry, hazel, and poison-oak. Grasses include Pacific reedgrass, California oat-grass, red fescue, and tufted hair-grass. In most stands there is a combination of grasses and shrubs, but more regularly disturbed (grazed, salt-spray-blasted, etc.) tend to have grass dominance.	Perennial Grassland; Coastal Scrub

Table 5.3-1 Conservation Units and Targets – Bay Delta and Central Coast Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Central California Coast Ranges Ecoregion	This ecoregion is the interior part of the southern Coast Ranges of California, south of the Carquinez Strait. It is inland from the coast far enough that the climate is modified only slightly by marine influence. It is bounded on the northeast by the alluvial plain of the San Joaquin Valley and on the southwest by the coastal part of the southern Coast Ranges. It extends south to the Transverse Ranges. Elevation range: 100 to 5,200	California Grassland/Vernal Pool and Flowerfields	See description under Central California Coast Ecoregion.	Annual Grassland; Perennial Grassland
		American Southwest Riparian Forest and Woodland	See description under Central California Coast Ecoregion.	Valley Foothill Riparian
Bay Delta Conservation Unit	Includes the drainage into the Pacific Ocean from the Stemple Creek Basin boundary in Sonoma and Marin counties south to and including the Pescadero Creek Basin in San Mateo County, excluding the Sacramento and San Joaquin River Basins in California. Covers an area of 4,470 square miles. Elevation range: 0 to 3,380	Freshwater Marsh	This vegetation type consists of freshwater emergent marshes and coastal/tidal marshes and meadows. It can be found surrounding streams, rivers, lakes and wet meadows. These habitats occur on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. Dominant species are generally perennial monocots including graminoids such as rushes, reeds, grasses and sedges. Dominant species include: common reeds, hardstem bulrush, small-fruited bulrush, water parsley, slough sedge, soft rush, salt rush, and pacific silverweed.	Fresh Emergent Wetland
		Salt Marsh	Salt marshes are generally tied to coastal tidally influenced wetlands in California. They have salinities similar to ocean water and do not develop the higher concentrations of salts characteristic of the salt marsh meadow community. Many salt marsh species are widespread and species diversity is relatively low. Individual vegetation alliances within the macrogroup tend to sort out based on inundation frequencies and maximum water depths.	Saline Emergent Wetland; Tidal Freshwater Wetland (in the Delta)
		American Southwest Riparian Forest and Woodland	See description under Central California Coast Ecoregion.	Valley Foothill Riparian
Central California Coastal HUC 1806	Includes the drainage into the Pacific Ocean from the Pescadero Creek Basin boundary in San Mateo County south to and including the Rincon Creek Basin along the border of Ventura and Santa Barbara counties in California. Covers an area of 11,400 square miles. Elevation range: 0 to 5,900	Coastal Lagoons	Coastal lagoons are bodies of water that are permanently or seasonally separated from the ocean by sand bars, and are also known as “bar-built estuaries.” Lagoons are characterized by estuarine species when open to the ocean periodically, and may be characterized by freshwater species when permanently separated from the ocean. Lagoons are surrounded by riparian vegetation providing habitat for amphibians, reptiles, birds, and mammals.	Estuarine

* Description referenced from CDFG 1988, USDA 1994, USDA 2007 and Keeler-Wolf 2010.

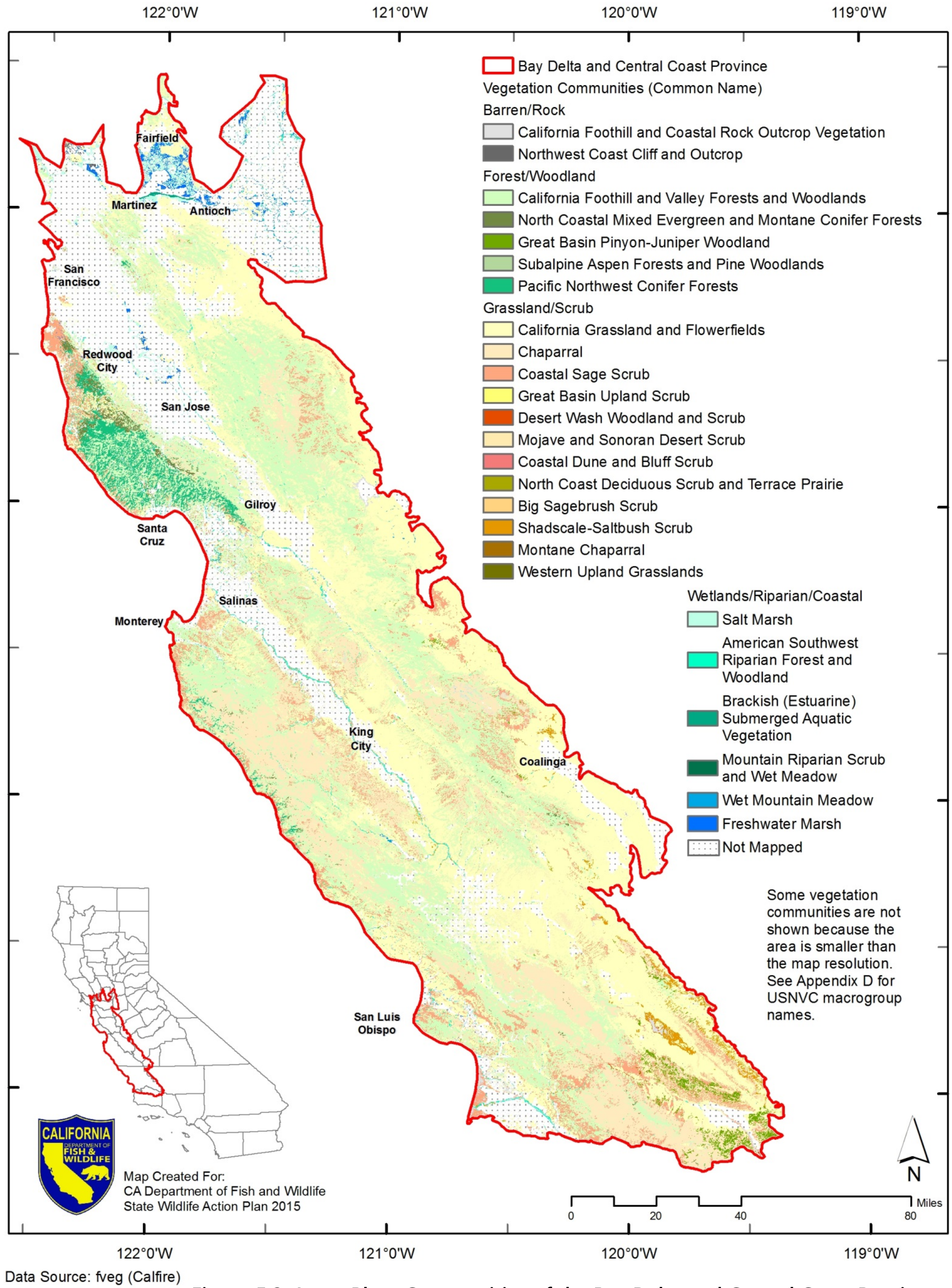


Figure 5.3-4 Plant Communities of the Bay Delta and Central Coast Province

5.3.3 Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the Bay Delta and Central Coast Province are listed in Table 5.3-2. The most commonly identified attributes for the Bay Delta and Central Coast Province are:

- area and extent of community;
- connectivity among communities and ecosystems;
- community structure and composition; and
- soil quality and sediment deposition regime.

Table 5.3-2 Key Ecological Attributes– Bay Delta and Central Coast Province

Key Ecological Attributes	Conservation Units and Targets											
	Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Central Coastal HUC 1806
	California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Area and extent of community	X	X	X	X	X	X	X	X	X	X	X	X
Community structure and composition	X	X	X	X	X	X	X	X	X	X	X	X
Connectivity among communities and ecosystems		X	X	X	X	X		X	X		X	X
Fire regime		X		X	X	X						
Nutrient concentrations and dynamics												X
Pollutant concentrations and dynamics										X		
Soil quality and sediment deposition regime		X		X	X	X				X		
Successional dynamics	X						X		X	X		
Surface water flow regime	X						X		X			X
Water level fluctuations			X					X		X	X	

5.3.4 Species of Greatest Conservation Need in the Bay Delta and Central Coast Province

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.3-3). Not all of the focal species meet the criteria to be considered Species of Greatest Conservation Need (SGCN). SGCN are indicated with an asterisk. SGCN associated with the Bay Delta and Central Coast Province are shown by ecoregion in Tables C-15 and C-16 in Appendix C.

Table 5.3-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Bay Delta and Central Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]											
		Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Coast HUC 1806
		California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Invertebrates													
Zayante band-winged grasshopper*	*Trimerotropis infantilis*		X		X	X	X						
Santa Cruz rain beetle	*Pleocoma conjugens conjugens*		X		X	X	X						
Smith's blue butterfly*	*Euphilotes enoptes smithi*		X		X	X	X						
Fishes													
Pacific lamprey*	*Entosphenus tridentatus*			X					X		X	X	
River lamprey*	*Lampetra eyresii*			X					X			X	
White sturgeon*	*Acipenser transmontanus*			X					X			X	X
North American green sturgeon Southern DPS*	*Acipenser medirostris*			X					X		X	X	
Coho salmon - central California coast ESU*	*Oncorhynchus kisutch*			X					X			X	X
Steelhead - central California coast DPS*	*Oncorhynchus mykiss irideus*			X					X			X	X
Steelhead – Central Valley DPS*	*Oncorhynchus mykiss irideus*			X					X		X	X	

Table 5.3-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Bay Delta and Central Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]											
		Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Coast HUC 1806
		California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Steelhead - south/central California coast DPS*	*Oncorhynchus mykiss irideus*			X					X			X	X
Sacramento River winter-run Chinook salmon ESU*	*Oncorhynchus tshawytscha*			X					X		X	X	
Central Valley spring-run Chinook salmon*	*Oncorhynchus tshawytscha*			X					X		X	X	
Central Valley fall- and late fall-run Chinook salmon*	*Oncorhynchus tshawytscha*			X					X		X	X	
Longfin smelt*	*Spirinchus thaleichthys*										X		
Delta smelt*	*Hypomesus transpacificus*										X		
Monterey roach*	*Lavinia symmetricus subditus*			X					X			X	
Sacramento splittail*	*Pogonichthys macrolepidotus*										X		
Unarmored threespine stickleback*	*Gasterosteus aculeatus williamsoni*								X				X
Tule perch	*Hysterocarpus traski*										X		
Tidewater goby*	*Eucyclogobius newberryi*										X		X
Coastrange sculpin	Cottus aleuticus												X
Prickly sculpin	*Cottus asper*												X
Pacific staghorn sculpin	*Leptocottus armatus*										X		X
Amphibians													
California tiger salamander*	*Ambystoma californiense*	X		X				X	X			X	
Santa Cruz long-toed salamander*	*Ambystoma macrodactylum croceum*	X	X	X			X					X	X
Red-bellied newt*	*Taricha rivularis*			X								X	
California newt (Monterey County and South)*	*Taricha torosa*	X	X	X			X	X	X			X	X
California giant salamander*	*Dicamptodon ensatus*		X	X			X		X	X		X	

Table 5.3-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Bay Delta and Central Coast Province

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		Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Coast HUC 1806
		California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Santa Cruz black salamander*	*Aneides flavipunctatus niger*	X		X								X	
San Simeon slender salamander*	*Batrachoseps incognitus*	X		X			X					X	
Santa Lucia Mountains slender salamander*	*Batrachoseps luciae*	X		X			X	X	X			X	
Lesser slender salamander*	*Batrachoseps minor*	X		X			X	X	X			X	
Western spadefoot*	*Spea hammondii*	X	X			X	X	X					
Arroyo toad*	*Anaxyrus californicus*							X	X				
Foothill yellow-legged frog*	*Rana boylii*	X	X	X			X	X	X			X	
California red-legged frog*	*Rana draytonii*	X	X	X			X	X	X	X		X	X
Reptiles													
Northwestern western pond turtle*	*Actinemys marmorata*	X	X	X			X	X	X	X		X	X
Southern western pond turtle*	*Actinemys pallida*	X	X	X			X	X	X			X	
Blunt-nosed leopard lizard*	*Gambelia sila*							X					
Blainville's horned lizard*	*Phrynosoma blainvillii*	X	X	X		X	X	X	X			X	
Bakersfield legless lizard*	*Anniella grinnelli*							X					
California legless lizard*	*Anniella pulchra*	X	X	X		X	X	X				X	
California glossy snake*	*Arizona elegans occidentalis*							X	X				
Forest sharp-tailed snake*	*Contia longicauda*			X								X	
San Joaquin coachwhip*	*Coluber flagellum ruddocki*							X					
Alameda whipsnake*/Alameda striped racer*	*Masticophis lateralis euryxanthus*	X	X	X			X	X	X			X	
Coast patch-nosed snake*	*Salvadora hexalepis virgultea*							X	X				
San Francisco garter snake*	*Thamnophis sirtalis tetrataenia*	X		X						X		X	X
Giant garter snake*	*Thamnophis gigas*								X	X			
Two-striped garter snake*	*Thamnophis hammondii*	X	X	X		X	X	X	X			X	

Table 5.3-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Bay Delta and Central Coast Province

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		California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Birds													
Tule greater white-fronted goose*	*Anser albifrons elgasi*									X	X		
Brant*	*Branta bernicla*										X		X
American white pelican*	*Pelecanus erythrorhynchos*										X		
Least bittern*	*Ixobrychus exilis*									X	X		
Great egret	*Ardea alba*									X			
Great blue heron	*Ardea herodias*									X			X
California condor*	*Gymnogyps californianus*	X		X				X	X			X	
Osprey	Pandion haliaetus									X			X
Golden eagle*	*Aquila chrysaetos*	X						X		X			
Swainson's hawk*	*Buteo swainsoni*	X						X					
Northern harrier*	*Circus cyaneus*	X						X		X	X		X
White-tailed kite*	*Elanus leucurus*		X		X	X	X			X	X		
Bald eagle*	*Haliaeetus leucocephalus*			X					X			X	
California black rail*	*Laterallus jamaicensis coturniculus*									X	X		
Ridgway's rail*	*Rallus obsoletus*										X		
Sandhill crane*	Grus canadensis	X						X		X			
Snowy plover (coastal population)*	*Charadrius nivosus*		X		X	X	X				X		
Mountain plover*	*Charadrius montanus*	X						X					
Long-billed curlew	*Numenius americanus*	X						X					
Black skimmer*	*Rynchops niger*										X		
California least tern*	*Sternula antillarum browni*										X		
Tufted puffin*	*Fratercula cirrhata*		X		X	X	X						X
Short-eared owl*	*Asio flammeus*	X						X		X	X		

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Long-eared owl*	*Asio otus*			X					X		X	X	
Burrowing owl*	*Athene cunicularia*	X						X					
Spotted owl	*Strix occidentalis*			X					X			X	
American peregrine falcon*	*Falco peregrinus anatum*		X		X	X	X			X			
Loggerhead shrike*	*Lanius ludovicianus*	X						X			X		X
Least Bell's vireo	*Vireo bellii pusillus*			X					X			X	
Purple martin*	*Progne subis*	X		X				X	X			X	
Bank swallow*	*Riparia riparia*			X					X	X		X	
Swainson's thrush	*Catharus ustulatus*			X					X			X	
Saltmarsh common yellowthroat/San Francisco common yellowthroat*	*Geothlypis trichas sinuosa*			X					X	X	X	X	
Yellow-breasted chat*	*Icteria virens*			X					X			X	
Yellow warbler*	*Setophaga petechia*			X					X			X	
Rufous-crowned sparrow	*Aimophila ruficeps*		X		X	X	X						
Grasshopper sparrow*	*Ammodramus savannarum*	X						X					
Sage sparrow	*Artemisiospiza belli*		X		X	X	X						
Suisun song sparrow*	*Melospiza melodia maxillaris*										X		
Alameda song sparrow*	*Melospiza melodia pusillula*										X		
San Pablo (= Samuels) song sparrow*	*Melospiza melodia samuelis*										X		
Savannah sparrow*	*Passerculus sandwichensis*		X		X	X	X				X		
Oregon vesper sparrow*	*Pooecetes gramineus affinis*	X						X					
Tricolored blackbird*	*Agelaius tricolor*	X		X				X	X	X	X	X	
Yellow-headed blackbird*	*Xanthocephalus xanthocephalus*									X	X		

Table 5.3-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Bay Delta and Central Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]											
		Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Coast HUC 1806
		California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Mammals													
Monterey shrew, Salinas ornate shrew*	*Sorex ornatus salarius*			X					X			X	
Suisun shrew*	*Sorex ornatus sinuosus*										X		
Salt marsh wandering shrew*	*Sorex vagrans halicoetes*									X	X		
Pallid bat*	*Antrozous pallidus*	X	X		X	X	X	X					
Western red bat	*Lasiurus blossevillii*			X					X			X	
Long-legged myotis*	*Myotis volans*			X					X			X	
Yuma myotis	*Myotis yumanensis*		X		X	X	X						
Western mastiff bat*	*Eumops perotis californicus*	X	X		X	X	X	X		X			
Nelson's antelope squirrel*	*Ammospermophilus nelsoni*							X					
American beaver	*Castor canadensis*			X					X	X		X	
Agile (=Pacific) kangaroo rat*	*Dipodomys agilis agilis*	X						X					
Giant kangaroo rat*	*Dipodomys ingens*	X						X					
Short-nosed kangaroo rat*	*Dipodomys nitratoides brevinasus*							X					
Narrow-faced kangaroo rat *	*Dipodomys venustus*	X						X					
Morro Bay kangaroo rat*	*Dipodomys heermanni morroensis*					X							
Santa Cruz kangaroo rat*	*Dipodomys venustus venustus*		X		X	X	X						
Salinas pocket mouse*	*Perognathus inornatus psammophilus*	X						X					
San Pablo vole*	*Microtus californicus sanpabloensis*									X	X		
San Francisco dusky-footed woodrat*	*Neotoma fuscipes annectens*			X					X			X	
Tulare grasshopper mouse*	*Onychomys torridus tularensis*							X					

Table 5.3-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Bay Delta and Central Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]											
		Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Coast HUC 1806
		California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Salt-marsh harvest mouse*	*Reithrodontomys raviventris*										X		
San Joaquin kit fox*	*Vulpes macrotis mutica*	X						X					
Ringtail	Bassariscus astutus		X		X	X	X		X				
American badger*	*Taxidea taxus*	X						X					
Western spotted skunk	*Spilogale gracilis*		X		X	X	X						
Pronghorn*	*Antilocapra americana*	X						X					
Tule elk	*Cervus elaphus nannodes*	X						X					

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion, see Appendix C.
* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.3.5 Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have strong influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified for conservation targets in the Bay Delta and Central Coast Province are summarized in Table 5.3-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures for the province. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.3.6. Some of the major pressures for the province are discussed in more detail below.

Table 5.3-4 Key Pressures on Conservation Targets – Bay Delta and Central Coast Province

Pressure	Conservation Units and Targets											
	Central California Coast						Central California Coast Ranges		Bay Delta Conservation Unit			Central California Central Coastal HUC 1806
	California Grassland, Vernal Pools, and Flowerfields	Coastal Sage Scrub	American Southwest Riparian Forest and Woodland	Northwest Coast Cliff and Outcrop	Coastal Dune and Bluff Scrub	North Coast Deciduous Scrub and Terrace Prairie	California Grassland, Vernal Pools, and Flowerfields	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Salt Marsh	American Southwest Riparian Forest and Woodland	Coastal Lagoons
Agricultural and forestry effluents			X					X	X	X		X
Airborne pollutants		X		X	X	X						
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X	X
Climate change	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X	X	X	X	X	X	X	X		X
Dams and water management/use			X					X	X	X	X	X
Fire and fire suppression	X	X		X	X	X	X					
Garbage and solid waste												X
Household sewage and urban waste water			X					X	X	X		X
Housing and urban areas	X	X	X	X	X	X	X	X	X	X		X
Industrial and military effluents									X	X		
Invasive plants/animals	X	X	X	X	X	X	X	X	X	X	X	
Livestock, farming, and ranching	X	X	X	X	X	X	X	X	X	X	X	X
Mining and quarrying									X	X		
Other ecosystem modifications										X		X
Recreational activities												X
Renewable energy	X						X					
Roads and railroads	X	X	X	X	X	X	X	X	X	X	X	X
Shipping lanes										X		
Tourism and recreation areas		X		X	X	X						X
Utility and service lines			X					X				
Wood and pulp plantations												X

Housing and Urban Areas; Commercial and Industrial Areas; Roads and Railroads; Dams and Water Management/Use

The main underlying cause of habitat loss and degradation in the Bay Delta and Central Coast Province is the increasing human population and its high demand for a limited supply of land, water, and other natural resources. Natural habitats of this region have been converted to a variety of different land uses, including weedy pastureland, dryland farming, irrigated cropland, relatively permanent orchards and vineyards, rural residential, and high-density urban. Wildlife species have different tolerances for each of these conversions, with many of them unable to adapt to the more-developed land uses. Beyond direct habitat loss, converting land to more intensive human-related uses brings additional stressors, including invasive species, human disturbance, fire suppression, and insect control, that further degrade ecosystem health and wildlife viability.

Growth and development fragment habitats into small patches, which cannot support as many species as larger patches can. These smaller fragments often become dominated by species more tolerant of habitat disturbance, while less-tolerant species decline. Populations of less-mobile species often decline in smaller habitat patches because of reductions in habitat quality, extreme weather events, or normal population fluctuations. Natural recovery following such declines is difficult for mobility-limited species. Such fragmentation also disrupts or alters important ecosystem functions, such as predator-prey relationships, competitive interactions, seed dispersal, plant pollination, and nutrient cycling (Bennett 1999; Environmental Law Institute [ELI] 2003).

Growth and development, along with associated linear structures like roads, canals, and power lines, impede or prevent movement of a variety of animals. As growth patterns include residential projects located far from existing urban centers, there is a greater need for supporting infrastructure. This is generally less significant than habitat loss but makes it more difficult for those species that need to move large distances in search of food, shelter, and breeding or rearing habitat and to escape competitors and predators. Animals restricted to the ground, like mammals, reptiles, and amphibians, face such obstacles as roads, canals, and new gaps in habitats. Attempts to cross these obstacles can be deadly, depending on the species and the nature of the gap (four-lane highways with concrete median barriers compared to narrow, rural two-lane roads, for example). Fish and other water-bound aquatic species attempting to move either upstream or downstream are blocked by lack of water resulting from diversions, physical barriers like dams, and by entrainment in diverted water. Even the movement of highly mobile species like birds and bats can be impeded by such features as transmission lines and wind energy farms, particularly in focused flight corridors like Altamont Pass, and 50 new wind energy sites are currently proposed throughout the state on land managed by BLM (CDFG 2005). Such species either cannot see or do not avoid these structures, and many die as a result. Even outside the portions of the region undergoing rapid growth, unused oil-lease lands and large cattle ranches that are no longer profitable are being acquired by land investors and sold as 40-acre to 160-acre residential parcels. This rural residential development also requires additional road infrastructure and fragments the natural landscape.

Population numbers in the Bay Delta and Central Coast have continued to grow over the last few years. The province's population grew by approximately 4.4 percent (281,778 people) between 2010 and 2014 (California Department of Finance [CDOF] 2014). Urban acreage makes up approximately 7.3 percent of the Bay Delta and Central Coast Province. A majority of growth within the San Francisco Bay Area is expected to be in San Francisco, the East Bay (including eastern Contra Costa County), and the South Bay (in both San Mateo and Santa Clara counties) (Association of Bay Area Governments [ABAG] 2015). Growth pressure in the Central Coast region has shifted inland from the coast, with urban and rural residential development centered along the Highway 101 corridor. In the northern portion of the region, affordable housing draws commuters from San Jose to rapidly expanding towns like Morgan Hill (which grew by 8.75 percent to a population of 47,197 between 2010 and 2014), Gilroy (7.36 percent, to 52,413), Hollister (5 percent, to 36,676) and Watsonville (2.56 percent, to 52,508) (CDOF 2014). Incorporated cities in the Salinas Valley have also seen growth in recent years. In the northern portion of the valley, Salinas grew by 3.17 percent, to 155,205, between 2010 and 2014 (CDOF 2014).

Invasive Plants/Animals

Invasive plant and animal species are an important pressure on wildlife in this province, just as they are in other regions throughout the state. Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

Invasive plants can be found in many different habitats in this region and tend to dominate brackish aquatic habitats. In grasslands, some of the more challenging plant invaders include eucalyptus, fountain grass, gorse, medusahead, tree of heaven, and yellow starthistle. In riparian and wetland areas, invading plants include edible fig, giant reed (or arundo), Himalayan blackberry, pampas grass, Russian olive, tamarisk (or saltcedar), pennyroyal, peppergrass, and tree of heaven. Invasive spartina and perennial pepperweed is a major concern in salt marshes, and opposite leaf Russian thistle appears to be increasing in some areas. Oak woodlands are invaded by plants such as Scotch broom and French broom. Coastal habitats face alien species such as gorse, ice plant, and pampas grass. Introduced plants also invade aquatic habitats. These aquatic invaders include Brazilian waterweed, egeria, Eurasian water milfoil, hydrilla, water hyacinth, water pennywort, and parrot feather.

Numerous invasive plant species are also established in the region's beaches, dunes, sandy coastal soils, and lowland areas. Outcompeting and displacing native plant communities, these invasive species often provide inferior habitat for wildlife. Veldt grass, associated with sandy soils, can shift native shrub communities toward grasslands and is of particular concern in the southern part of the province. On beaches and dunes, ice plant species, European beach grass, and Veldt grass form monocultures and dense mats of vegetation displacing native plants that provide important habitat for invertebrates like Smith's blue butterfly. Dense growth of non-native vegetation also causes unnatural stabilization of beach and dune systems. Jubata and Pampas grass are most invasive near Big Sur, Elkhorn Slough, and around the lower slopes of the Santa Cruz mountains. In timbered areas, these grasses can form dense stands that inhibit the germination of such coastal forest species as redwoods. Cape ivy chokes out native vegetation with densely growing vines. Found most commonly in shady coastal lowlands, cape ivy also invades oak woodlands, riparian forests, coastal scrub, and Monterey pine forests (CDFG 2005).

Introduced animals have invaded both terrestrial and aquatic environments. Non-native terrestrial animal species have invaded California wildlands, including brown-headed cowbirds, European starlings, domestic dogs and cats, introduced red foxes, Norway rats, and wild pigs. Cowbirds can lower the reproductive success of other native birds by laying their eggs in other birds' nests, causing the targeted host birds to raise the cowbird nestlings at the expense of their own. Native raccoons, whose populations appear to have greatly increased near housing developments and recreation facilities, pressure some native reptile species—notably western pond turtles—because of egg predation. Not all introduced vertebrates are invasive, and they have varying effects on wildlife; however, the species of most concern in the region parasitize songbird nests, dominate limited nesting habitat, prey on native species, or otherwise damage wildlife habitats. Introduced feral pigs are a major problem in many habitat types across the region. Wild pigs root in the soil, creating excessive soil disturbance and destroying native plant communities. In oak woodlands, feral pigs can inhibit the germination and growth of young oaks by eating acorns and oak seedlings and removing leaf litter, causing soils to dry out (CDFG 2005). In beach, dune habitats, and salt marsh, the introduced red fox increases predation rates for sensitive coastal shorebirds such as Ridgway's rail. Populations of native avian predators, such as California gulls and corvids (i.e., raven, crows, and jays) have increased and are now having negative consequences in salt marshes in San Francisco Bay.

Many non-native fish species have become established in California, dominating many of the rivers and streams in this province. These include species such as striped bass, white catfish, channel catfish, American shad, black crappie, largemouth bass, bluegill, and pikeminnow (found in the Chorro Creek Watershed). Many fish were historically introduced (via stocking) by federal and state resource agencies to provide sport fishing or forage fish to feed sport fish. Many introduced non-native fish and amphibians out-compete native fish for food or space, prey on native fish (especially in early life stages), change the structure of aquatic habitats (increasing turbidity, for example, by their behaviors), and may spread diseases (Moyle 2002). However, not all non-native species are considered invasive, which typically refers to species whose introduction causes or is likely to cause economic or environmental harm.

In addition to introduced fish, native aquatic species are stressed by introduced bullfrogs, non-native tiger salamanders, red-eared sliders (a turtle), and invertebrates. Many of the province's aquatic habitats, including ephemeral streams and seasonal ponds, naturally go dry in the rainless summer months; but, water management practices that create permanent water sources, including the creation of impoundments and some agricultural practices, favor these invasive species. Introduced invertebrates, such as Asian clam, overbite clam, zebra mussel, and mysid shrimp, are causing significant problems for native species in rivers, streams, sloughs, and the San Francisco estuary. Although prohibited by state and federal regulation, the introduction of species via discharge of ship ballast water in San Francisco Bay has created one of the most invaded estuaries in the world. There are at least 212 introduced species in the San Francisco Bay alone (Defenders of Wildlife 2015). Most of the clams, worms, and other bottom-dwelling invertebrates presently inhabiting the Bay-Delta have been introduced from other estuaries. This biological invasion continues, with a new species introduced roughly every 14 weeks (DWR et al. 2013). While not all of the introduced aquatic species are invasive or have significant consequences for native species, biologists are concerned about the sheer dominance of these new species and their current and potential effects on the structure and function of the estuarine ecosystem. Domestic cats also pose a threat to species dependent on coastal, riparian, and salt marsh habitats.

Annual and Perennial Non-Timber Crops

Approximately 763,590 acres, or 8 percent of the province’s land area, are planted in irrigated row crops, vineyards, and orchards (California Department of Forestry and Fire Protection [CAL FIRE], Fire and Resource Assessment Program 2006). The most extensive agricultural areas are fertile river valleys and coastal terrace lands. Major crops include grapes, lettuce, artichokes, asparagus, and strawberries, with some areas also supporting orchard-grown fruits and nuts and dry-land, unirrigated winter grains, such as barley. While these agricultural lands provide important crops for California’s food supply and for export, many of the intensive agricultural practices that have enabled such large-scale production also result in ecological problems. Agricultural consequences for the region’s wildlife and ecosystems include runoff of agricultural chemicals and sediment, consumption of over-subscribed water resources, and conversion and fragmentation of habitat. Private landowners and local conservation districts are working on numerous projects to mitigate these consequences, to improve water quality, and to enhance conditions for wildlife on the agricultural working landscapes of the region.

Many of the region’s crops receive substantial applications of fertilizers, herbicides, and pesticides. In 2012, Monterey County—which encompasses two major agricultural regions, the Salinas Valley and lower Pajaro Valley—ranked sixth in the state for the total pounds of pesticide applied (California Department of Pesticide Regulation 2012). In Monterey County, the high nitrate levels in Elkhorn Slough cause large blooms of sea lettuce (*Ulva lactuca*), which smothers mudflats and salt marsh vegetation. Exposed soils and irrigation practices make croplands susceptible to erosion. Rain and irrigation runoff carry silt and agricultural chemicals, degrading surface water quality and reaching groundwater. For example, significant amounts of nitrogen fertilizer applied through agricultural practices have contaminated groundwater supplies in agricultural communities throughout the State (Viers et al. 2012). Herbicides and pesticides can have toxic effects on aquatic plants and animals, and chemical contaminants can upset the ecological balance of aquatic systems. For example, nutrients increase aquatic plant and algal growth, resulting in lowered oxygen levels when the excessive plant matter decomposes. Elevated nutrient levels have also been implicated in amphibian deformities, because nutrient-rich environments favor the parasitic flatworm that causes deformities in many frog species (Johnson and Chase 2004). Also, pesticide drift has been shown to favor hybrid tiger salamanders over native California tiger salamanders (Ryan et al. 2012). Silt and sediment also degrade aquatic environments, increasing turbidity and shading out aquatic vegetation, along with scouring away or smothering stream-bottom sediments that are important spawning sites and invertebrate habitats. Runoff problems are particularly severe on steeply sloping, erosion-prone soils, where strawberries, artichokes, and vineyard grapes are commonly grown. Planting practices that result in large amounts of soil disturbance, such as the establishment of vineyards and strawberry and artichoke mounds, also contribute substantially to sediment runoff.

Agricultural water consumption also pressures aquatic and riparian habitats. Irrigated agriculture accounts for about 66 percent of the Central Coast's water use and 8 percent for the Bay Area (DWR 2013). Over the last century, the increased production of water-intensive crops like strawberries, lettuce, and grapes has increased the need for water. Water is supplied to agriculture by diversion of surface water, by groundwater pumping, and through import from other regions via the State Water Project. As groundwater levels are depleted, saltwater intrusion increases and flows are also reduced in streams and rivers. Diminished flows reduce aquatic systems' capacity to discharge incoming contaminants and sediment and can inhibit migration by anadromous fish. Additionally, groundwater depletion and drought have increased salinity in inland lakes and freshwater/brackish lagoons in the province, which affects habitat conditions for pond turtles and other species.

The growth of agriculture over the last century, particularly along valley-bottom floodplains and coastal terraces, has resulted in both the loss of important habitat areas and the fragmentation of larger natural landscapes. In recent decades, intensively cultivated crops (such as vineyards) have been expanding into areas formerly used for grazing and dry-land grain production. Intensive agricultural crops almost entirely eliminate wildlife habitat values and tax water resources.

Although agriculture can have adverse effects on ecosystem, some types of agricultural practices provide important habitat to many wildlife species. For example, fallow grain fields with the Sacramento-San Joaquin Delta are essential wintering habitat for greater and lesser sandhill cranes, waterfowl, shorebirds, and other waterbirds. Other avian species, including tricolored blackbird and Swainson's hawk are strongly associated with agricultural fields where certain crops and management practices are implemented.

Fire and Fire Suppression

Wildfire is a natural and important ecological process in the Central Coast. Widespread fire management practices, as well as increases in human-caused wildfires, have altered fire regimes, in some cases causing dramatic changes in regional habitats. Efforts to establish fire regimes that approximate historical fire patterns and frequencies while also minimizing loss of property and life are important to maintain and restore wildlife habitats, such as chaparral shrublands, coastal sage scrub, grasslands, and woodlands.

Dry conditions and annual high summer temperatures make the region prone to fires. The causes and ecological consequences of wildfires differ among the region's ecological communities. In sage scrub, chaparral, and grassland systems, lightning-induced fires are fairly infrequent. Human-caused fires, however, have resulted in unnaturally high fire frequencies, especially along roads and near the urban-wildland interface, with some locations experiencing multiple fires within a period of 15 to 20 years (CDFG 2005). Increased fire frequencies favor the Mediterranean grasses that were introduced to the region with the arrival of European settlers and livestock. Once established, the non-native grasses grow in a dense-thatch pattern that chokes out native vegetation and lowers habitat quality for wildlife. The dense grass also provides ample fuel for the cycle of frequent burning (Keeley 2004).

Although frequent fires can promote the spread of non-native grasses, fire's effects on grassland and shrubland ecosystems depend on the time of year the fire occurs. Prescribed burning can be an effective management tool, with spring and early summer fires being most effective to control most invasive annual plants if they occur before invasive plants set seed (DiTomaso et al. 2006); however, spring fires can also be extremely damaging to nesting birds and young mammals and must be used with caution.

Climate is also a primary determinant of fire patterns. In light of this, climate change will add a significant variable to efforts to understand historical fire regimes and to find management measures that can maintain the region's mosaic of habitats. Additionally, the expansion of residential communities into fire-dependent ecosystems creates a conflict between maintaining ecological integrity and protecting property (CDFG 2005).

Climate Change

Although climate change is already affecting wildlife throughout the state, and its effects will continue to increase, it has particular significance for this province's coastal and estuarine systems. In California winters will likely become warmer and wetter during the next century. Instead of deep winter snowpacks that nourish rivers through the long, dry summer, most of the precipitation will be winter rain that runs off quickly. For the Bay Delta, this means more intense winter flooding, greater erosion of riparian habitats, and increased sedimentation in wetland habitats (Field et al. 1999; Hayhoe et al. 2004).

Hotter, drier summers, combined with lower river flows, will dramatically increase the water demands of both people and wildlife. This is likely to translate into less water for wildlife, especially fish and wetland species. Lower river flows will allow saltwater intrusion into the rivers, the Bay, and the Delta, increasing salinity and disrupting the complex food web of the estuary. Water contaminants may accumulate during the summer as the natural flushing action decreases.

Ongoing and future climate change is expected to alter the nontidal freshwater marsh natural community. Sea level rise will affect the location, extent, and composition of this community in places where it exists at or below current sea level because of increased water elevation, increased saltwater intrusion, and the tidal hydrologic regime. Nontidal freshwater perennial emergent wetland locations that exist at the water's edge will become more deeply immersed, or in the case of overtopped levees, deeply flooded. Where this community exists in flooded depressions in upland areas, which presumably already support the nontidal freshwater perennial emergent wetland natural community, it is not likely that natural processes could replace the area that will be lost.

The climatic changes presented below will likely affect all conservation targets identified in this province. Climate change has only been included as a pressure for a subset of targets that are considered more vulnerable to climate impacts, and/or in instances where it was determined that interactions between climate change and other pressures could be addressed in a meaningful way through a conservation strategy.

Temperature

In the San Francisco Bay Area, average annual temperatures are expected to increase 1.7 to 1.9°C (3.0 to 3.4°F) by 2070; and 1.5 to 4.5°C (2.7 to 8.1°F) by 2099 (Cayan et al. 2011). January average temperatures are projected to increase 2.2 to 2.8°C (4 to 5°F), while July averages temperatures are projected to increase 2.8 to 3.3°C (5 to 6°F) by 2100 (CalEMA 2012).

Inland areas within the Bay-Delta region (i.e., portions of Contra Costa, Sacramento, San Joaquin, Solano and Yolo counties) are expected to experience similar or greater increases in average temperatures. January average temperatures are expected to increase 1.7 to 2.8°C (3 to 4°F) by 2050 and 3.3 to 3.9°C (6 to 7°F) by 2100. July increase in average temperatures: 1.7 to 2.8°C (3 to 5°F) by 2050 and 3.9 to 5°C (7 to 9°F) by 2100 (CalEMA 2012).

In the Central Coast Ranges and Central Coast regions, average annual temperatures are expected to increase 1.6 to 1.9°C (2.9 to 3.4°F) by 2070 (PRBO Conservation Science 2011). January average temperatures are expected to increase 0.6 to 1.1°C (1°F to 2°F) by 2050 and 2.2 to 2.8°C (4 to 5°F) by 2100. July average temperatures could increase 1.1 to 1.7°C (2 to 3°F) by 2050 and 2.8 to 3.9°C (4 to 7°F) by 2100, with larger increases in the eastern portions of the Coast Ranges (CalEMA 2012).

Precipitation

A moderate decline in annual rainfall is expected in the San Francisco Bay region, with a decline of 2.5 to 7.6 cm (1 to 3 inches) by 2050 and 10.2 to 12.7 cm (4 to 5 inches) by 2090. Inland areas within the Bay Delta are projected to experience similar decreases in rainfall from 7.6 to 12.7 cm (3 to 5 inches) by 2100 (CalEMA 2012).

Within the Central Coast Ranges and Central Coast regions, lower elevation areas are projected to experience declines in annual precipitation of approximately 5 cm (2 inches) by 2050 and 7.6 to 10.2 cm (3 to 4 inches) by 2100, while more elevated areas are projected to experiences losses of approximately 25 cm (10 inches) (CalEMA 2012).

Change in Freshwater Hydrologic Regimes

Sea-level rise and changes in timing and volume of flow are projected to increase salinity intrusion into freshwater aquifers and the Bay Delta region. Similarly, changes in runoff and flows could result in increases in stream temperatures throughout the province (PRBO 2011).

Estuarine inflows are projected to increase an average of about 20 percent from October through February and decrease by about 20 percent from March through September. Higher winter inflows could result in higher watershed runoff present in estuaries in winter, but reduced inflows in the spring and summer have the largest projected impact on estuarine waters reducing the amount of watershed runoff by a maximum of 8 percent by late June (PRBO 2011).

Wildfire Risk

Wildfire frequency, size, and intensity are expected to increase throughout the western portions of the province, particularly within the Coast Ranges near the San Francisco Bay Area and Central Coast Range.

In the Central Coast Ranges and Central Coast regions, particularly the eastern portion of the Central Coast Ranges, wildfire risk is projected to increase 4 to 6 times current conditions. The number of escaped fires is projected to increase by 51 percent, while total area burned by contained fires is projected to increase 41 percent despite enhancement of fire suppression efforts. The probability of large fires (>200 ha) is expected to increase by the end of the 21st century, and area burned is projected to increase from 10 to 50 percent by the 2070-2099 time period (PRBO 2011).

Inland areas of the Bay Delta, including portions of western and northern Yolo County, northwestern Solano County, southern Contra Costa County, and San Joaquin and Sacramento counties are projected to experience limited increases in potential area burned by wildfire (CalEMA 2012).

Sea-Level Rise

Projected sea levels along the state’s coastline south of Cape Mendocino are expected to increase from 12 to 61 cm (5 to 24 inches) by 2050 compared to 2000 levels, and 42 to 167 cm (17 to 66 inches) by 2100 compared to 2000 levels (OPC 2013).

The number of acres vulnerable to flooding is expected to increase 20 to 30 percent in most parts of the San Francisco Bay Area, with some areas projected for increases over 40 percent. Coastal areas in the Bay Area are estimated to experience an increase of approximately 15 percent in the acreage vulnerable to flooding (CalEMA 2012).

In the Bay Delta region, portions of the region closer to San Francisco Bay are projected to be increasingly susceptible to sea-level rise of around 1.4 m (55 inches) or higher. Solano County is anticipated to experience a 13 percent increase in estimated acreage of land vulnerable to a 100-year flood event. This indicator rises to 40 percent in Contra Costa County and 59 percent in Sacramento County. Most flooding is projected to occur in areas around Suisun City, Pittsburg, Benicia, Richmond, and Vallejo (CalEMA 2012).

This is especially significant in the San Francisco Bay Area and the Delta, where much of the land has subsided to below sea level and is currently protected from flooding by levees. Continuation of current farming practices will worsen this subsidence throughout much of the Delta. This increased subsidence, combined with higher sea level, increased winter river flooding, and more intense winter storms, will significantly increase the hydraulic forces on the levees. Given their current state, a powerful earthquake in the region could collapse levees, leading to major seawater intrusion and flooding throughout the Delta (Mount and Twiss 2005).

Marshes around San Francisco Bay are particularly vulnerable to the anticipated increase in sea-level rise and reductions in sediment availability. Ultimately, the concern is that future change will cause marshes and mudflats to drown, leaving only narrow, fragmented habitat patches along the shoreline. Such patches would be squeezed up against levees and seawalls with development behind them, exacerbating flooding and creating deleterious edge effects. These impacts would be additive or synergistic with other stressors that may also increase over time, like invasive species, contaminants, and reductions in freshwater inputs.

The ecological functioning of upland habitats is likely to be disrupted as individual species respond differently to climatic changes. Some species will likely adapt in place, others will probably move to better climates, and the rest will experience different rates of population or health declines.

5.3.6 Conservation Strategies

Conservation strategies were developed for conservation targets in the Bay Delta and Central Coast Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted pressures. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.3-5 through 5.3-10 show the relationships between the stresses and the pressures for each target. Table 5.3-11 summarizes conservation strategies for the province.

Target: American Southwest Riparian Forest and Woodland

Goals:
- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres of riparian habitat.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, miles connected are increased by at least 5 percent from 2015 miles of riparian habitat.
- By 2025, miles with desired level of discharge are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres of riparian habitat.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire, conserve and manage habitat for SGCN that inhabit riparian forest and woodland habitats by finalizing draft conservation plans and implementing completed NCCPs, HCPs, and Conservation Strategies and other opportunities.

Objective(s):
- By 2020, establish conservation and management plans for SGCN that inhabit riparian forest and woodland habitats.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas.

Conservation action(s):
- Develop, fund and implement conservation actions, land acquisition and management plans as part of the East Contra Costa NCCP, Santa Clara Valley NCCP, East Alameda County Conservation Strategy, draft Solano HCP, Suisun March Habitat Plan, and other relevant conservation management plans.
- Obtain funding for conservation actions, land acquisition and management plans implementation and staff.
- Survey the interests from willing sellers of title fee or conservation easements.
- Identify partners for funding and management.
- Coordinate with partners though Joint Ventures.
- Identify willing landowners to participate in habitat enhancement programs.

Conservation Strategy 2 (Outreach and Education): Implement education and outreach to the public and local agencies regarding the value of riparian habitat, development of riparian buffers along major rivers and streams, and reducing encroachment of crops into riparian buffers.

Objective(s):
- Increase the knowledge of all local agencies on the value of riparian habitat.
- Gain support by all local agencies for the development of riparian buffers along major rivers and streams.
- Reduce encroachment of annual and perennial non-timber crops into riparian buffers.

Targeted pressure(s): Annual and perennial non-timber crops.

Conservation action(s):

- Fund and implement riparian habitat education and conservation actions in draft and final NCCPs, HCPs, Conservation Strategies, and Recovery Plans.

Conservation Strategy 3 (Direct Management): Develop grazing best management practices (BMPs).

Objective(s):

- Co-develop BMPs with land management agencies.
- Implement state and local policies that benefit wildlife and sustain habitats.
- Reduce inappropriate livestock farming and ranching.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Fund and implement vegetation management actions, including grazing management practices, in draft and final NCCPs, HCPs, Conservation Strategies, and Recovery Plans.

Conservation Strategy 4 (Direct Management): Manage invasive species.

Objective(s):

- Eradicate or control invasive species on 1,000 acres of public lands by watershed.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Fund and implement invasive species management actions in draft and final NCCPs, HCPs, Conservation Strategies, and Recovery Plans.
- Conduct assessment and map invasive species occurrence by watershed.
- Develop partnerships with agencies and non-governmental organizations (NGOs).
- Identify and apply for funding grant to fund control of invasive species.
- Develop plan to prioritize and control invasive species.
- Implement management plan to control invasive species.

Conservation Strategy 5 (Direct Management): Manage dams and other barriers to allow for fish passage.

Objective(s):

- Remove barriers to allow for fish passage.
- Increase bypass flows through water conservation.
- Achieve agreement among water management agencies on dam management and barrier removal. This objective additionally includes the following:
    - improve in-stream flows;

- gather baseline data to identify the current conditions of amount of water use and water use efficiency, fish passage conditions, and the major barriers to fish passage;
- establish a baseline of candidate barriers that can be removed;
- develop restoration/management plans;
- investigate the impact from water diversion including stream flow modification and fish passage barriers; and
- investigate the potential to develop water conservation and fish passage barrier modification measures, and evaluate the effectiveness of the measures.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 6 (Direct Management): Develop riparian buffers along major rivers and streams.

Objective(s):
- Establish riparian buffers along major rivers and streams.
- Reduce encroachment of annual and perennial non-timber crops into buffer areas.

Targeted pressure(s): Annual and perennial non-timber crops.

Conservation action(s):
- Fund and implement riparian buffer management actions in draft and final NCCPs, HCPs, Conservation Strategies, and Recovery Plans.
- Identify existing land use policies on riparian buffers in agricultural landscapes.
- Link to Outreach and Education strategy.
- Seek to redesignate buffers as natural resource zones in county general plans.
- Identify incentives for landowners.
- Coordinate and provide input to cities and counties regarding buffer zones.
- Review local agencies ordinances to determine whether buffers zones are adequate.

Conservation Strategy 7 (Direct Management): Improve road maintenance on county and state roads to reduce sediment impacts to stream habitats.

Objective(s):
- Improve maintenance of county and state roads to reduce sediment impacts to stream habitat (particularly fish spawning and invertebrate production habitat within gravels, and pool habitat).
- Reduce road maintenance impacts.
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Roads and railroads.

Table 5.3-5 Stresses and Pressures for American Southwest Riparian Forest and Woodland

Priority Pressures	Stresses													
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics							Ecosystem Conditions and Processes				
	Sea level rise	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in water levels and hydroperiod	Change in water temperature	Change in groundwater tables	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents					X			X	X		X			
Annual and perennial non-timber crops		X	X	X	X	X	X	X	X	X	X	X	X	X
Climate change	X	X	X	X	X	X	X			X	X	X	X	X
Commercial and industrial areas		X	X	X	X		X		X	X	X		X	X
Dams and water management/use		X	X	X	X	X	X			X	X		X	X
Household sewage and urban waste water		X			X			X	X		X			
Housing and urban areas		X	X	X	X		X		X	X	X	X	X	X
Invasive plants/animals					X						X	X	X	
Livestock, farming, and ranching		X		X		X		X		X	X	X		X
Roads and railroads		X	X								X		X	X
Utility and service lines											X			X

Target: California Grassland, Vernal Pools, and Flowerfields

Goals:

- By 2025, acres of grassland habitat restored are increased by at least 5 percent from 2015 acres.
- By 2025, acres of vernal pool habitat restored are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres, by treatment with managed grazing.
- By 2025, population of key species (spadefoot toad) is increased by at least 5 percent from 2015 population levels.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres by reducing encroachment of coyote bush/coastal scrub into grassland.
- By 2025, miles with desired stream stage are increased by at least 5 percent from 2015 miles through length of hydroperiod.
- By 2025, miles with desired level water quality are increased by at least 5 percent from 2015 miles by meeting standards of Basin Plan.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire, conserve, and manage habitat for SGCN that inhabit grassland habitats by finalizing draft conservation plans and implementing completed NCCPs, HCPs, and Conservation Strategies and other opportunities.

Objective(s):

- Establish conservation and management plans for SGCN that inhabit grassland habitats.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas.

Conservation action(s):

- Develop, fund and implement conservation actions, land acquisition and management plans as part of the East Contra Costa NCCP, Santa Clara Valley NCCP, East Alameda County Conservation Strategy, draft Solano HCP, and other relevant conservation management plans.
- Obtain funding for conservation actions, land acquisition and management plans implementation and staff.
- Survey the interests from willing sellers.
- Identify partners for funding and management.
- Identify willing landowners.

Conservation Strategy 2 (Data Collection and Analysis): Identify and conduct research on high-priority study questions for grassland habitat/conservation areas; conduct research to inform coordination with Caltrans and county transportation agencies on wildlife-friendly transportation corridors; implement and fund monitoring and research components of completed and draft NCCPs, HCPs, and Conservation Strategies.

Objective(s):

- Reflect the research and data analysis needs of the province.
- Identify high priority research/study questions regarding grassland habitat/conservation areas.
- Use research to inform coordination with Caltrans and County Transportation Agency on wildlife-friendly transportation corridors.
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops; roads and railroads.

Conservation action(s):

- Conduct surveys and monitoring as part of the East Contra Costa NCCP, Santa Clara Valley NCCP, East Alameda County Conservation Strategy, and draft Solano HCP.
- Obtain funding for research, surveys and monitoring for developing and existing conservation plans and recovery plans.
- Gather and/or review existing information.
- Utilize existing conservation plans and recovery plans to establish prioritization
- Identify inventory protocol.
- Coordinate with landowners.
- Utilize existing conservation plan partnerships and identify new partners.
- Obtain funding for program implementation.
- Analyze spatial distribution using Geographic Information Systems (GIS).
- Coordinate with Caltrans on siting of roads, and design and siting of wildlife crossings.

Conservation Strategy 3 (Land Use Planning): Develop statewide strategies on renewable energy development location siting; identify renewable energy development zones and obtain their approval by the Renewable Energy Action Team (REAT).

Objective(s):

- Identify and approve renewable energy development zones by REAT.

Targeted pressure(s): Renewable energy.

Conservation Strategy 4 (Land Use Planning): Provide input on project planning and decision-making processes; ensure that city and county planning departments consider the conservation of grassland and vernal pool habitat.

Objective(s):

- City and county planning departments take into account the conservation of grassland and vernal pool habitat.

Targeted pressure(s): Renewable energy; housing and urban areas.

Conservation Strategy 5 (Direct Management): Manage invasive species, with focus on controlling or eradicating them in grassland habitats in the Central California Coast Ecoregion.

Objective(s):

- Eradicate or control invasive species in grassland habitats in the Central California Coast Ecoregion.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Fund and implement invasive species management actions in draft and final NCCPs, HCPs, conservation Strategies, and Recovery Plans.
- Coordinate with the California Invasive Plant Council.
- Identify sites for eradication of non-native tiger salamanders and bullfrogs.
- Obtain funding for management actions.

Conservation Strategy 6 (Partner Engagement): Coordinate with Caltrans and county transportation agencies to use information on high-priority wildlife corridors in the design of wildlife-friendly transportation corridors.

Objective(s):

- Transportation agencies use information on high priority wildlife corridors to design wildlife-friendly transportation corridors.

Targeted pressure(s): Roads and railroads; invasive plants/animals.

Conservation Strategy 7 (Partner Engagement): Coordinate with fire agencies and local landowners to develop and implement fire management BMPs in grassland habitats.

Objective(s):

- Fire management BMPs to improve grassland habitat are co-developed with fire agencies and local landowners.

Targeted pressure(s): Fire and fire suppression.

Table 5.3-6 Stresses and Pressures for California Grassland, Vernal Pools, and Flowerfields

Priority Pressures	Stresses									
	Geophysical and Disturbance Regime	Hydrology and Water Characteristics		Soil and Sediment Characteristics			Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in runoff and river flow*	Change in water levels and hydroperiod	Change in soil chemistry	Change in soil moisture**	Change in sediment quality***	Change in spatial distribution of habitat types	Change in community structure or composition position	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X		X		X	X	X	X
Fire and fire suppression	X							X	X	
Housing and urban areas	X	X	X		X	X	X	X	X	X
Invasive plants/animals	X	X	X		X			X	X	
Livestock, farming, and ranching	X	X	X	X	X	X	X	X	X	X
Renewable energy	X							X	X	X
Roads and railroads		X	X	X	X			X	X	X

*This addresses surface flow.
**This addresses subsurface water and flow
***This addresses soil structure.

Target: Coastal Sage Scrub; Northwest Coast Cliff and Outcrop; Coastal Dune and Bluff Scrub; and North Coast Deciduous Scrub and Terrace Prairie

Goals:

- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres connected are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect priority habitats through fee title acquisition, permanent conservation easement, or other means; purchase land in a corridor connecting two protected areas to provide connectivity of habitat.

Objective(s):

- Ensure that funds are in place and priority sites are placed in easements; and, at each annual review, ensure that easements or leases are in compliance.

Targeted pressure(s): Tourism and recreation areas; annual and perennial non-timber crops; housing and urban areas; commercial and industrial areas.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Designate conservation areas with emphasis on sites or landscapes that have unique and important value to wildlife.

Objective(s):

- Designate 5,000 acres for conservation area status.

Targeted pressure(s): Roads and railroads; housing and urban areas; commercial and industrial areas.

Conservation Strategy 3 (Data Collection and Analysis): Collect biological and ecological data to address key information gaps on SGCN, habitats, and pressures.

Objective(s):

- Ensure that: the proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- Research provides answers to relevant questions.
- Appropriate audiences are accessing data.
- Research provides recommendations for conservation actions.
- Data are being used to inform conservation actions.
- Ensure that conservation strategies are implemented, based on research, to reduce any pressures to conservation targets that may be cumulative to climate change (e.g., recreation, grazing).

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; tourism and recreation areas; annual and perennial non-timber crops; fire and fire suppression; invasive plants/animals; airborne pollutants; climate change.

Conservation Strategy 4 (Law and Policy): Develop or influence law and policy that addresses vehicle emissions, timber harvest cumulative impacts, critical habitat, and marine species with ranges that overlap jurisdictional boundaries.

Objective(s):

- Adopt policies that address vehicle emissions, no net loss of critical habitat, timber harvest cumulative impact standards, and interstate enforcement for marine species with ranges that cross jurisdictional boundaries.

Targeted pressure(s): Airborne pollutants; climate change.

Conservation Strategy 5 (Land Use Planning): Provide input to land use planning decisions.

Objective(s):

- Ensure that: local land use planners receive input on land use plans; a land use plan is approved that is consistent with input provided; the plan is implemented in a manner consistent with the input; and, at each annual review, the behavior of local entities is consistent with input.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; roads and railroads; airborne pollutants.

Conservation action(s):

- Provide comments on documents such as City and County general plans, California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documents, timber harvest plans, Integrated Natural Resource Management Plans (INRMPs) on military lands, etc.

Conservation Strategy 6 (Direct Management): Conduct direct resource management.

Objective(s):

- Management actions are implemented. Examples of applicable actions include: restore or enhance degraded habitats, monitor populations, and remove barriers to species movement; conduct controlled burns, wet burns, fire hazard abatement, and periodic burning in wildland areas; conduct managed thinning; enhance partnerships in private lands to increase direct management of natural resources; conduct managed grazing; manage invasive species; remove non-native species; conduct resource assessments to inform management decisions; and establish BMPs to implement across partnerships.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):

- Coordinate with CAL FIRE.
- Coordinate with Weed Management Areas (WMAs).
- Apply for funding.

Conservation Strategy 7 (Management Planning): Develop and implement management plans.

Objective(s):

- Develop management plans for target areas. Examples of applicable management planning actions include: work with partners on the development of large landscape conservation planning; develop or update management plans to integrate the effects of climate change; development of management plans for species, habitats and natural processes; develop a management plan for habitat of SGCN; reintroduction, relocation or stocking of native animals or plants or animals to an area where they can better adapt; translocate/breed in captivity SGCN to establish new populations in suitable habitat; and restore SGCN to historically occupied habitats.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s) include:

- Coordinate with WMAs.

Conservation Strategy 8 (Partner Engagement): Establish and engage in partner relationships.

Objective(s):

- Engage state and federal agencies, tribal entities, the NGO community and other partners to achieve shared objectives and broader coordination across overlapping areas.
- Establish partnership to co-monitoring species/habitats on federally managed lands.
- Establish decision-making processes with other public and private entities to determine or implement strategies.
- Convene an advisory committee to assist with implementation of strategies.
- Implement and expand existing BMPs.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; tourism and recreation areas; fire and fire suppression; invasive plants/animals; climate change.

Conservation Strategy 9 (Environmental Review): Implement environmental review, with focus on the following: non-conservation oriented policies; projects and plans to help ensure impacts to wildlife are minimized and benefits maximized; infrastructure development projects to ensure they are designed and sited to avoid impacts on species and habitat; state highway plans; forest management plans; and plans for transmission corridor siting.

Objective(s):

- Review appropriate plans (i.e., EIRs, EISs, Negative Declarations, Biological Opinions, Land use changes, General Plans).

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; roads and railroads; dams and water management/use; renewable energy.

Table 5.3-7 Stresses and Pressures for Coastal Sage Scrub; Northwest Coast Cliff and Outcrop; Coastal Dune and Bluff Scrub; North Coast Deciduous Scrub and Terrace Prairie

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes		
	Change in natural fire regime	Change in nutrients	Change in spatial distribution of habitat types	Change in community structure or composition	Habitat fragmentation
Airborne pollutants		X		X	
Annual and perennial non-timber crops	X	X	X	X	X
Climate change	X	X	X	X	X
Commercial and industrial areas	X		X	X	X
Fire and fire suppression	X		X	X	X
Housing and urban areas	X		X	X	X
Invasive plants/animals	X		X	X	
Livestock, farming, and ranching	X	X	X	X	X
Roads and railroads		X	X	X	X
Tourism and recreation areas				X	X

Target: Coastal Lagoons

Goals:

- By 2025, area (miles/acres) with desired nutrient load (TMDL) are increased by at least 5 percent from 2015 area (miles/acres).
- By 2025, acres of lagoon habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres of connected lagoon habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of discharge (water level) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect riparian areas by acquiring land adjacent to lagoons, and reduce water diversion from the critical lagoons and tributary streams during late spring to summer.

Objective(s):
- Protect riparian areas by acquiring land adjacent to lagoons, and reduce water diversion from the critical lagoons and tributary streams during late spring to summer.

Targeted pressure(s): Livestock, farming, and ranching; wood and pulp plantations; dams and water management/use; commercial and industrial areas; housing and urban areas; tourism and recreation areas.

Conservation action(s):
- Develop Conceptual Area Protection Plan (CAPP).
- Obtain funding for implementation and staff.
- Survey the interests from willing sellers.
- Identify partners for funding and management.
- Identify willing landowners.

Conservation Strategy 2 (Data Collection and Analysis): Conduct baseline surveys for SCGN/habitat and pressures in at least 50 percent of coastal lagoons within the ecoregion.

Objective(s):
- Conduct baseline surveys for SCGN/habitat and pressures in coastal lagoons within the ecoregion.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; tourism and recreation areas; annual and perennial non-timber crops; livestock, farming, and ranching; wood and pulp plantations.

Conservation Strategy 3 (Law and Policy): Influence the drafting of laws and policies that promote conservation of lagoon habitat.

Objective(s):
- Influence the drafting of laws and policies that promote conservation of lagoon habitat.
- Ensure that riparian function and processes are maintained to provide desired conditions, and manage riparian buffers.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; tourism and recreation areas; annual and perennial non-timber crops; livestock, farming, and ranching; wood and pulp plantations.

Conservation action(s):
- Develop CDFW policy for protecting riparian and watercourse zones tributary to lagoons.
- Participate in interagency working group to advocate for lower order stream protection.
- Advocate for compliance monitoring.

Conservation Strategy 4 (Direct Management): Manage dams and other barriers to improve fish passage and stream ecosystem function.

Objective(s):

- Using the Passage Assessment Database, Fish Passage Forum Barrier Optimization Model, and CDFW's internal prioritization team, establish a candidate list of small diversion dams that can be modified or removed to improve fish passage.
- Quantify needed bypass flows to support biological requirements and geomorphology.

Targeted pressure(s): Dams and water management/use; other ecosystem modifications.

Conservation action(s):

- Coordinate with private landowners.
- Inventory barriers and assess flow and water condition.
- Develop plan for prioritization and construction or retrofits.
- Identify funding sources-apply.
- Permits, environmental review.
- Perform conservation-oriented construction or retrofits.
- Implement water conservation strategies.
- Identify location of barriers.

Conservation Strategy 5 (Direct Management): Develop an interagency direct management plan for coastal lagoons.

Objective(s):

- Develop an interagency direct management plan for coastal lagoons.

Targeted pressure(s): Annual and perennial non-timber crops; livestock, farming, and ranching; wood and pulp plantations.

Conservation action(s):

- Coordinate with private and public landowners.
- Inventory lagoons to assess flow and water condition and other important parameters for SGCN.
- Identify groups/organizations to participate in interagency working group to establish priorities for restoration.
- Develop plan for management prioritization, including restoration needs.
- Identify funding sources.
- Secure permits and complete environmental review.
- Perform conservation-oriented management and restoration actions.
- Implement strategies to enhance functions for SGCN critical life history needs.
- Conduct or acquire existing assessments of parcels to determine restoration potential and biological value.

Conservation Strategy 6 (Training and Technical Assistance): Provide training and technical assistance, including training interagency staff in fish identification and invasive species management/control techniques.

Objective(s):

- Train interagency staff on fish identification (native and non-native) and invasive species management/control techniques.

Targeted pressure(s): Invasive plants/animals; annual and perennial non-timber crops; livestock, farming, and ranching; wood and pulp plantations; household sewage and urban waste water; agricultural and forestry effluents; garbage and solid waste; climate change.

Table 5.3-8 Stresses and Pressures for Coastal Lagoons

Priority Pressures	Stresses							
	Coastal and Oceanic Characteristics		Geophysical and Disturbance Regimes	Hydrology and Water Characteristics			Ecosystem Conditions and Processes	
	Sea level rise	Change in oceanic hydrodynamics	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water chemistry	Change in groundwater tables	Change in spatial distribution of habitat types	Habitat fragmentation
Agricultural and forestry effluents					X			
Annual and perennial non-timber crops			X	X	X	X	X	X
Climate change	X	X	X	X	X	X	X	X
Commercial and industrial areas			X	X	X	X	X	X
Dams and water management/use		X	X	X				
Garbage and solid waste					X			
Household sewage and urban waste water					X			
Housing and urban areas			X	X	X	X	X	X
Livestock, farming, and ranching			X	X	X	X	X	X
Other ecosystem modifications		X	X	X				
Recreational activities				X	X			
Roads and railroads			X	X			X	X
Tourism and recreation areas			X	X			X	X
Wood and pulp plantations			X	X				X

Target: Salt Marsh

Goals:

- By 2025, miles with desired level water quality are increased by at least 5 percent from 2015 miles.
- By 2025, acres of habitat (salt-marsh habitat) are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired genetic connectivity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres connected are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat (salt-marsh habitat by providing high-tide refugia for native species) are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of water yield (consistent with the Bay-Delta Water Quality Control Plan requirements) are increased by at least 5 percent from 2015 miles.
- By 2025, improve water quality in the San Francisco Bay Delta by meeting Total Maximum Daily Load (TMDL) requirements for organic and inorganic pollutants.
- By 2025, miles with desired level water quality are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect and restore land acquired through fee title or conservation easement, with focus on the following: acquire, protect, enhance, or restore salt marsh habitat; support the Delta Conservancy to establish restoration priorities; and increase connectivity among salt marsh habitats.

Objective(s):

- Restore 60,000 acres of salt-marsh habitat; acquire, protect, enhance, or restore salt-marsh habitat in the Bay Delta.
- Support the Delta Conservancy to establish priorities for restoration in the Bay Delta.
- Support for the Coastal Conservancy and others to implement established priorities and conservation goals in San Francisco Bay.
- Increase connectivity among salt-marsh habitats in the Bay Delta.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; livestock, farming, and ranching; climate change.

Conservation action(s):

- Develop, fund, and implement conservation actions, land acquisition, and management plans as part of the East Contra Costa NCCP, Santa Clara Valley NCCP, East Alameda County Conservation Strategy, draft Solano HCP, other relevant conservation management plans, the South San Francisco Bay Salt Pond Restoration Project, the Invasive Spartina Project, the San Francisco Baylands Ecosystem Habitat Goals Update, and the San Francisco Bay Subtidal Habitat Goals Project.

- Update conservation targets based on upcoming bay-wide strategies addressing ecosystem needs, challenges and restoration opportunities such as the Baylands Ecosystem Habitat Goals Update due for completion in late 2015.
- Conduct or acquire existing assessments of parcels to determine restoration potential and biological value, as well as gain information on transition zones and connectivity with upland habitats.
- Write Land Acquisition Evaluation (LAE) or CAPP for high priority parcels. Acquire lands or easements to allow for future marsh migration.
- Identify groups/organizations, such as the San Francisco Bay Joint Venture, to participate in interagency working group to establish priorities for restoration of salt-marsh habitat.
- Establish priorities for restoration of salt-marsh habitat in San Francisco Bay Delta.
- Link to strategy that advocates for legislation that supports acquisition and restoration of degraded habitat.
- Identify and summarize available grant funding for acquisition and restoration.
- Coordinate with private landowners.
- Restore CDFW lands.
- Develop or support conservation strategies that focus on subtidal and open water habitats.

Conservation Strategy 2 (Data Collection and Analysis): Conduct research regarding effective salt marsh management and restoration.

Objective(s):
- Coordinate with the Delta-Science Program, Delta Conservancy, and the Coastal Conservancy in the coordination of research efforts and data sharing.
- Continue ongoing long-term studies (baseline and monitoring).
- Identify and prioritize data gaps for future investigation/research.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; livestock, farming, and ranching.

Conservation action(s):
- Obtain funding and implement research and monitoring described in the UFWS Tidal Marsh Recovery Plan and Suisun Marsh Plan.
- Obtain funding for plan implementation.
- Coordinate with state, federal, and local agencies, universities, and NGOs.
- Identify existing/ongoing research/data-gathering efforts.
- Create central repository for data, research tracking, and coordination.
- Participate in science tracking database.
- Develop data needs database/conceptual model.
- Evaluate and prioritize existing long-term baseline data gathering efforts.

Conservation Strategy 3 (Outreach and Education): Implement education and outreach focused on educating local agencies and the public on the biological values of Bay Delta habitats and existing pressures that affect fish and wildlife, and promote effective and coordinated conservation strategies for the Bay Delta.

Objective(s):
- Educate local agencies and the public on the biological values of the Bay Delta habitats and the existing pressures affecting fish and wildlife.
- Promote effective and coordinated conservation strategies for the Bay Delta.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):
- Identify existing outreach and education strategies for the Bay Delta.
- Participate in existing partnerships for developing an outreach and education strategy for the Bay Delta.
- Coordinate with stakeholders.
- Develop outreach messages.
- Identify target audience.
- Obtain funding for strategy implementation and staffing.
- Develop and implement outreach plan.

Conservation Strategy 4 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Support Resource Conservation Districts on existing incentive programs (e.g., incentivize landowners to conserve and restore habitat).
- Collaborate with state, federal, and local agencies to identify opportunities to implement joint conservation actions.
- Provide landowner assistance with cost share requirements to receive incentives.
- Work with agencies providing incentives to lengthen enrollment limits.

Targeted pressure(s): Housing and urban areas; commercial and industrial areas; annual and perennial non-timber crops; livestock, farming, and ranching.

Conservation action(s):
- Identify willing landowners to participate in incentive programs.
- Identify priorities based on conservation potential.
- Obtain funding for strategy implementation.
- Identify partnership opportunities.

- Make recommendations based on program criteria.
- Coordinate with federal agencies.
- Develop pilot projects and case studies to demonstrate success.
- Promote good-neighbor policies.

Conservation Strategy 5 (Law and Policy): Advocate for laws and policies, with a focus on the following: influence land use policies to reduce impacts on salt marsh habitat; streamline permitting process for restoration; enhance law enforcement capacity for protection of restoration sites; develop programmatic permits; and prepare for climate change.

Objective(s):
- Influence land use policies to reduce impacts on salt-marsh habitat.
- Improve the effectiveness of the local, state, and federal permitting processes for restoration.
- Enhance law enforcement capacity for protection of restoration sites
- Reduce vandalism (e.g., pumps) and dumping.
- Develop programmatic permits.

Targeted pressure(s): Recreational activities.

Conservation action(s):
- Identify conservation partners.
- Coordinate with state, federal, and local agencies.
- Evaluate the efficacy of creating new policies and regulations protecting salt-marsh habitat.
- Make recommendations to enhance enforcement of existing laws and regulations.
- Advocate for changes in regulations to allow streamlining.
- Develop legislative and regulatory proposals for streamlining permitting process.
- Develop advocacy message for habitat restoration.
- Link to outreach and education strategy to inform decision makers.
- Obtain funding for strategy implementation.

Conservation Strategy 6 (Direct Management): Control invasive species.

Objective(s):
- Comprehensively assess and map plant and animal invasive species distributions.
- Develop an integrated control plan for each.
- Coordinate update and implementation of landscape level invasive species monitor and control plan.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Collaborate with existing agencies or groups involved with invasive species monitoring and treatment.
- Identify and compile existing invasive species strategies.

- Conduct additional mapping as necessary to fill gaps.
- Develop control plans for priority species.
- Implement priority species control plans, such as the Invasive Spartina Project.
- Implement top priority controls plans, i.e. spartina.
- Monitor invasive species and continue removal efforts as needed to keep populations in check.
- Link to outreach and education plan.

Conservation Strategy 7 (Management Planning): Implement integrated resource management.

Objective(s):
- Coordinate and integrate ongoing management activities (e.g., grazing BMPs, invasive species, water management, land use).
- Enhance working landscapes to benefit fish and wildlife.
- Participate and contribute to working committees, management boards, and projects of each of the California Joint Ventures, such as the San Francisco Bay Joint Venture.

Targeted pressure(s): Dams and water management/use; shipping lanes; roads and railroads; recreational activities.

Conservation action(s):
- Fund and implement water and habitat management strategies on existing large-area habitat lands to enhance fish and wildlife population and increase water conservation for multi-benefits and uses.
- Fund and implement salt marsh resource management actions as described in draft and final NCCPs, HCPs, Conservation Strategies, and Recovery Plans, including the Suisun Marsh Habitat Plan, and USFWS Tidal Marsh Recovery Plan.
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.
- Coordinate with state, federal, local agencies, and private landowners, including the California Water Fix process.
- Participate in California Biodiversity Council integration process.
- Participate in Dredged Material Management Office, incorporate Delta.
- Implement invasive species strategy.
- Create common set of biological/ecological indicators.
- Develop common methods/priorities for habitat restoration and management.
- Coordinate cross-jurisdictional activities.

Conservation Strategy 8 (Partner Engagement): Partner for joint advocacy.

Objective(s):

- Create high-level multi-agency/NGO partnerships to coordinate conservation actions.
- Through partnerships, leverage political awareness of need to conserve salt marsh habitat in the Bay Delta.
- Solicit additional funding through grants or political advocacy.

Targeted pressure(s): Dams and water management/use; shipping lanes; roads and railroads; recreational activities.

Conservation action(s):

- Coordinate with local agencies and NGOs with large-area draft and completed conservation plans.
- Coordinate with entities involved in Bay-Delta conservation.
- Develop MOU/Charter for partnership.
- Review and synthesize existing conservation strategies.
- Establish process for prioritizing conservation actions.
- Advocate science based decisions and process.
- Develop coordinated/unified conservation plan.
- Pool or leverage funding for conservation.

Table 5.3-9 Stresses and Pressures for Salt Marsh

Priority Pressures	Stresses												
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics					Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Sea level rise	Change in oceanic hydrodynamics	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in pollutants	Change in nutrients	Change in sediment quality	Change in spatial distribution of habitat types	Change in community structure and composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents					X		X	X			X		
Annual and perennial non-timber crops			X	X	X	X	X	X	X	X	X	X	X
Climate change	X	X	X	X	X	X			X	X	X	X	
Commercial and industrial areas			X	X	X	X	X		X	X	X	X	X
Dams and water management/ use		X	X	X	X	X			X	X	X	X	X
Household sewage and urban waste water			X		X		X	X			X		
Housing and urban areas			X	X	X	X	X		X	X	X	X	X
Industrial and military effluents			X				X	X			X	X	
Invasive plants/animals			X		X	X			X		X	X	
Livestock, farming, and ranching			X	X		X		X		X	X	X	X
Mining and quarrying			X			X	X						
Other ecosystem modifications		X	X		X	X	X		X	X	X	X	X
Roads and railroads			X	X		X			X	X	X	X	X
Shipping lanes		X	X				X		X	X	X	X	X

Target: Freshwater Marsh

Goals:

- By 2025, acres of freshwater emergent wetland habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, population abundance of key species (SGCN) is increased by at least 5 percent from 2015 population.
- By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5 percent from 2015.
- By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, populations of key species (beaver, tricolored blackbird, giant garter snake, and western pond turtle) are increased by at least 5 percent from 2015 population.
- By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5 percent from 2015 acres/miles.
- By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Outreach and Education): Provide outreach and education.

Objective(s):

- Influence public awareness of proper land management for freshwater marshes by providing information to landowners regarding BMPs and proper wetland management. Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Target Buckeye Conservancy and RCDs.
- Design and produce brochures with wetland conservation message.
- Employ web-based media for providing information to public.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Purchase land and conservation easements.

Objective(s):
- Improve land management by removing invasive species and creating better grazing practices.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Prioritize with Conceptual Area Protection Plan (CAPP) and Environmental Site Assessment.

Conservation Strategy 3 (Law and Policy): Advocate for laws and policies.

Objective(s):
- Strengthen regulatory authority over wetlands and integrate beaver ecology into wetland restoration activities.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Evaluate and update Wetlands Policy.
- Implement wetland and riparian technical memorandum.
- Review and modify CDFW policy on beaver depredation.
- Update wetlands implementation policy.

Conservation Strategy 4 (Management Planning): Develop management plans.

Objective(s):
- Develop BMPs for ecosystem management on CDFW lands.
- BMPs would provide guidance on managing CDFW lands for multi-species use and benefit both recreation and conservation of native species.

Targeted pressure(s): Invasive plants/animals; livestock, farming, and ranching; annual and perennial non-timber crops; climate change.

Conservation action(s):
- Revise Land Management Plan (LMP) guidelines to include ecosystem management.
- Update LMPs to be consistent with new guidelines for managing at an ecosystem level.
- Develop policy on ecosystem management on public lands.

Conservation Strategy 5 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Provide economic incentives through restoration grants.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Table 5.3-10 Stresses and Pressures for Freshwater Marsh

Priority Pressures	Stresses												
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics						Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Sea level rise	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in pollutants	Change in nutrients	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure and composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents		X					X	X			X		
Annual and perennial non-timber crops		X	X	X	X	X	X	X	X	X	X	X	X
Climate change	X	X	X	X	X				X	X	X	X	
Commercial and industrial areas		X	X	X	X	X	X		X	X	X	X	X
Dams and water management/ use		X	X	X	X	X			X	X	X	X	X
Household sewage and urban waste water		X					X	X			X		
Housing and urban areas		X	X	X	X	X	X		X	X	X	X	X
Industrial and military effluents		X					X	X			X	X	
Invasive plants/animals		X		X	X				X		X	X	
Livestock, farming, and ranching		X	X		X			X		X	X	X	X
Mining and quarrying		X					X						
Roads and railroads		X	X		X					X	X	X	X

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Table 5.3-11 Conservation Targets and Strategies for the Bay Delta and Central Coast Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
American Southwest Riparian Forest and Woodland	• By 2025, acres of habitat are increased by at least 5% from 2015 acres of riparian habitat in the Central Coast Ecoregion. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, miles connected are increased by at least 5% from 2015 miles of riparian habitat. • By 2025, miles with desired level of discharge are increased by at least 5% from 2015 miles. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres of riparian habitat.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Water level fluctuations	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads • Utility and service lines	• Direct Management • Land Acquisition/Easement/ Lease • Outreach and Education
California Grassland, Vernal Pools, and Flowerfields	• By 2025, acres of grassland habitat restored are increased by at least 5% from 2015 acres. • By 2025, acres of vernal pool habitat restored are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres by treatment with managed grazing. • By 2025, population of key species (spadefoot toad) is increased by at least 5% from 2015 population levels. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres by reducing encroachment of coyote bush/coastal scrub into grassland. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles through length of hydroperiod. • By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles by meeting standards of Basin Plan.	• Area and extent of community • Community structure and composition • Successional dynamics • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Renewable energy • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Land Use Planning • Partner Engagement
Coastal Sage Scrub Northwest Coast Cliff and Outcrop Coastal Dune and Bluff Scrub North Coast Deciduous Scrub and Terrace Prairie	• By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Soil quality and sediment deposition regime	• Airborne pollutants • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads • Tourism and recreation areas	• Data Collection and Analysis • Direct Management • Environmental Review • Land Acquisition/Easement/ Lease • Land Use Planning • Law and Policy • Management Planning • Partner Engagement
Coastal Lagoons	• By 2025, area (miles/acres) with desired nutrient load (TMDL) are increased by at least 5% from 2015 area (miles/acres). • By 2025, acres of lagoon habitat are increased by at least 5% from 2015 acres. • By 2025, acres of connected lagoon habitat are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of discharge (water level) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Nutrient concentrations and dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Garbage and solid waste • Housing sewage and urban waste water • Housing and urban areas • Livestock, farming, and ranching • Other ecosystem modifications • Recreational activities • Roads and railroads • Tourism and recreation areas • Wood and pulp plantations	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Training and Technical Assistance

Table 5.3-11 Conservation Targets and Strategies for the Bay Delta and Central Coast Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat acre increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, populations of key species (beaver, tricolored blackbird, giant garter snake, and western pond turtle) are increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Salt Marsh	• By 2025, miles with desired level of water quality are increased by at least 5% from 2015 miles. • By 2025, acres of habitat (salt-marsh habitat) are increased by at least 5% from 2015 acres. • By 2025, acres with desired genetic connectivity are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres of habitat (salt-marsh habitat by providing high-tide refugia for native species) are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of water yield (consistent with the Bay-Delta Water Quality Control Plan requirements) are increased by at least 5% from 2015 miles. • By 2025, improve water quality in the San Francisco Bay Delta by meeting Total Maximum Daily Load (TMDL) requirements for organic and inorganic pollutants. • By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Pollutant concentrations and dynamics • Soil quality and sediment deposition regime • Successional dynamics • Water level fluctuations	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Other ecosystem modifications • Roads and railroads • Shipping lanes	• Data Collection and Analysis • Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education • Partner Engagement

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Central Valley and Sierra Nevada Province

5.4 Central Valley and Sierra Nevada Province

5.4.1 Geophysical and Ecological Description of the Province

The Central Valley and Sierra Nevada Province is the largest within the state (Figure 5.4-1), composed of two of California's major geographic and ecological regions. Although the Central Valley and the Sierra Nevada range are very distinct physically and ecologically, together they contain most of the state's major watersheds and form an important elevation and ecological gradient that drives much of California's biodiversity patterns. Elevations in the province range from less than 300 feet throughout most of the Central Valley to over 14,500 feet in the Sierra Nevada. The types, distribution, and functions of vegetation and wildlife resources in the province are strongly influenced by variations in geology, climate, topography, and hydrology along this gradient, as well as development and land use patterns. These physical and ecological conditions support a diverse mix of vegetation communities, wildlife habitats, and conservation challenges.

Central Valley

The Central Valley comprises most of the low-lying lands of central California. Much of the region is part of a vast hydrological system that drains much of the state's water. This water, falling as either rain or snow over much of the northern and central parts of the state, culminates in the Sacramento and San Joaquin rivers into the Delta.

The Central Valley has two distinct subregions: the Sacramento Valley and the San Joaquin Valley. Each subregion has unique combinations of climate, topography, ecology, and land use patterns. Together, they form a vast, flat valley, approximately 450 miles long and averaging 50 miles wide, with elevations almost entirely under 300 feet. The Sutter Buttes, a circle of 2,000-foot-high hills left over from the eroded remains of a volcano, rise from the middle of the Sacramento Valley (promoted locally as the "Smallest Mountain Range in the World") and is the only topographic feature that exceeds the valley floor elevation. The Central Valley is surrounded by the Sierra Nevada on the east, the coastal ranges on the west, the Tehachapi Mountains on the south, and the Klamath and Cascade mountains on the north. Less influenced by marine air than San Francisco Bay, the valley's climate has hot, dry summers and foggy, rainy winters. Annual rainfall averages from 5 to 25 inches, with the least rainfall occurring in the southern portions and along the west side (in the rainshadow of the coastal mountains).

Agriculture dominates land uses in the Central Valley, with very few remnants of natural habitat remaining. The major natural upland habitats are annual grassland, valley oaks on floodplains, and vernal pools on raised terraces. The more arid lands of the southern San Joaquin Valley contain desert habitats which include alkali sink and saltbush shrublands. Slow-moving rivers along the valley floor provide habitat for fish and invertebrates and help maintain adjacent riparian, freshwater wetland, and floodplain habitats.

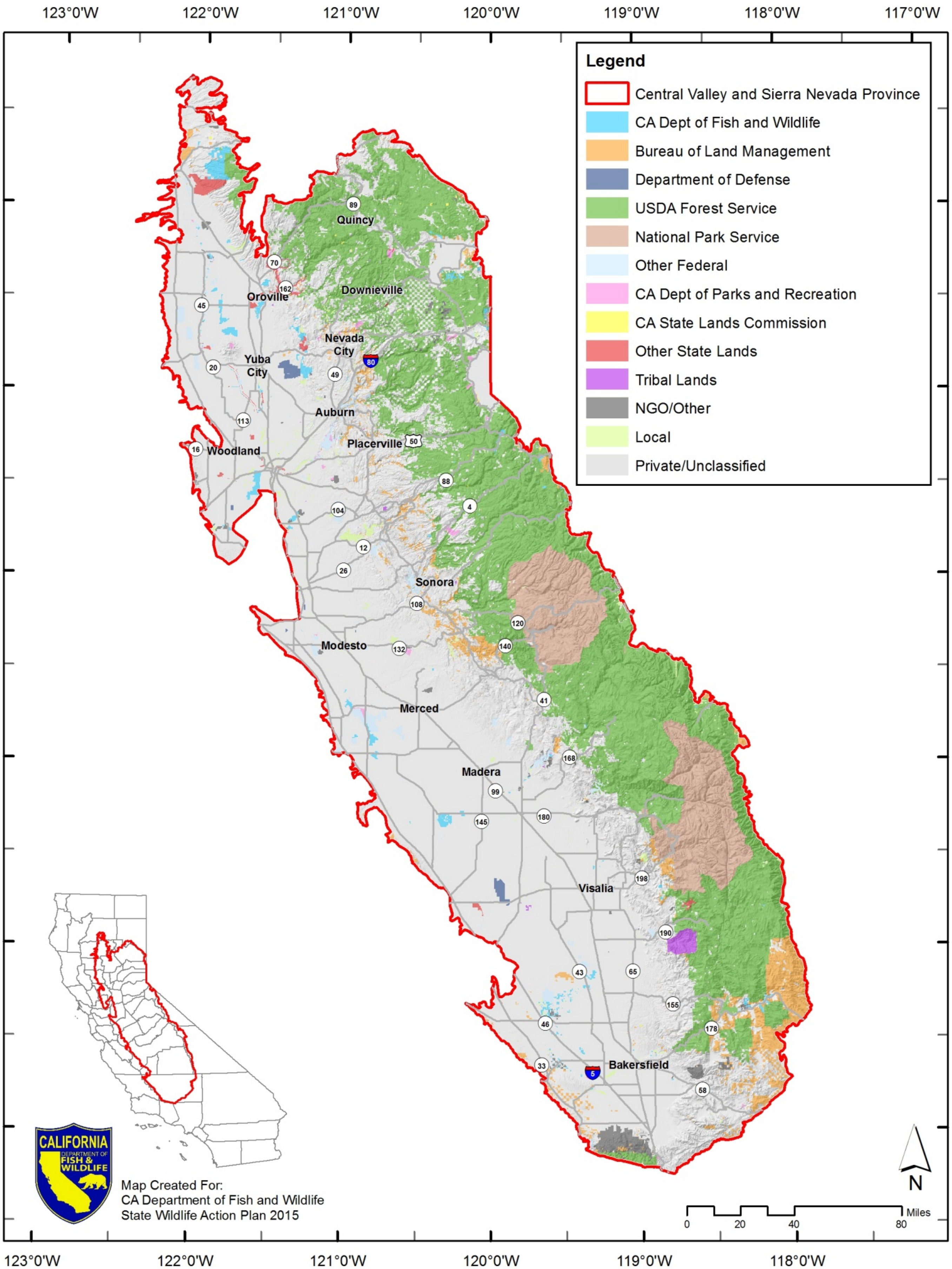
Hydrology is the main difference between the two Central Valley subregions. The Sacramento Valley contains the Sacramento River, the largest river in the state. This river historically overflowed into several low-lying areas, particularly in its lower reaches. The lower 180 miles of the river, below Chico Landing, are now constrained by levees, and excess floodwaters are diverted into large bypasses to reduce risks to human populations. The San Joaquin Valley has two separate drainages. In the northern portion, the San Joaquin River flows north toward the Delta. It captures water via several major rivers that drain the central Sierra Nevada. The southern portion of the valley is isolated from the ocean and drains into the closed Tulare Basin, which includes the beds of the former Tulare, Buena Vista, and Kern lakes. These lakes and vast wetlands historically were fed by the rivers that drain the southern Sierra Nevada (the Kings, Kaweah, Tule, and Kern). These lakes are now dry most of the time because water has been diverted to upland agriculture. Runoff during the wettest years will occasionally flood out of river channels and temporarily refill some of these lakebeds. The California Aqueduct extends along the entire western edge of the valley, delivering water from the Delta to farmers in the Tulare basin and over the Tehachapi Mountains to Southern California.

Central Valley Flood Management Planning and Flood System Conservation Strategy

A cornerstone of efforts by the California Department of Water Resources (DWR) to improve integrated flood management in California's Central Valley, the Central Valley Flood Management Planning (CVFMP) Program was launched in 2008 and is managed by the Division of Flood Management's Central Valley Flood Planning Office. The Central Valley Flood Protection Plan (CVFPP) sets forth a plan for sustainable flood management and investment to improve flood risk management in the Central Valley through use of the State Plan of Flood Control (SPFC) facilities. Following adoption of the CVFPP in 2012, DWR began refinement of the CVFPP recommendations via the three significant planning efforts—Basin-Wide Feasibility Studies, Regional Flood Management Planning, and Central Valley Flood System Conservation Strategy.

The Conservation Strategy is an informational document that identifies specific tools and approaches to restore natural areas to benefit fish and wildlife as part of a sustainable flood management plan. The Conservation Strategy and CVFPP as a whole support two of the key actions identified in the California Water Action Plan, in particular increasing flood protection and protecting and restoring important ecosystems.

There has been an unprecedented amount of data collection, modeling, and the development of Central Valley-wide restoration targets and numerical objectives developed through this effort. They are focused on the riparian systems within the SPFC facilities. It has been a collaborative development process with input from CDFW, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), local Flood Agencies, and many conservation organizations including The Nature Conservancy, Point Blue, and Audubon Society.



Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands.

Figure 5.4-1 Land Ownership of the Central Valley and Sierra Nevada Province

The wildlife of this region is affected by a variety of pressures, described below. The major problem has been the loss, degradation, and fragmentation of habitats, both terrestrial and aquatic, because of the development of agriculture, construction of moderate and large dams and reservoirs, and urban areas. Many of the streams have been dammed, blocking fish migration, or have been so severely degraded that they are no longer usable by many native fishes. Flood control structures, such as dikes, levees, and hardened embankments (riprap), have altered floodplain habitats like riparian forests, river processes (meanders and associated functions), and wetlands throughout the region. This loss of habitat has led to population reduction for waterfowl, wading birds, and tricolored blackbird, as well as other wetland dependent species. Some species that persist on the remaining habitat fragments are at risk of local extirpation or rangewide extinction (e.g., Clear Lake hitch, winter-run Chinook salmon). A large percentage of the historic Central Valley salmon habitat has been lost; the estimate is between 75-95 percent (California Department of Fish and Game [CDFG] 1993; Clemmins et al. 2008; National Marine Fisheries Service [NMFS] 2014).

The Central Valley is primarily in private ownership, and the role of private landowners in conservation is very important. More than 75 percent of the known California locations of 32 special-status animal species occur predominately on private lands. Examples of these species include Swainson's hawk, burrowing owl, California tiger salamander, and Buena Vista Lake shrew.

Central Valley agricultural habitat is very important to species such as greater and lesser sandhill cranes, waterfowl, shorebirds, and other waterbirds; as well as many other avian species, including tricolored blackbird and Swainson's hawk. Therefore, it is important to focus on maintenance of wildlife-friendly agriculture (e.g., discouraging habitat loss from urbanization and orchard and vineyard encroachment into important wintering areas and encouraging wildlife friendly crops and cropland management [Ivey et al. 2014]). The Central Valley Joint Venture Implementation Plan (2006), currently being updated, provides recommendations for wildlife management and conservation on private lands in the Central Valley.

Managed wetlands in the Central Valley are broadly categorized as seasonal, semi-permanent or permanent. Seasonal wetlands are typically flooded in the fall, with drawdown occurring between March and May. Semi-permanent wetlands are usually flooded from early fall through early July, while permanent wetlands are flooded year round. Since the majority of these non-seasonal wetland habitats are semi-permanent, for planning purposes, semi-permanent and permanent wetlands are combined. About two thirds of all managed wetlands in the Central Valley are privately owned, while nearly 90 percent of all wetlands are managed on a seasonal basis. Seventy-seven percent of all wetlands are located in four basins: Butte, Colusa, Suisun, and San Joaquin (CVJV 2006).

Sierra Nevada

Extending approximately 400 miles from north to south, the Sierra Nevada forms the spine of the California landscape. The predominantly granitic Sierra Nevada ranges from the Susan River and Fredonyer Pass in the north to Tehachapi Pass in the south. To the south, the Sierra Nevada range embraces the Mojave Desert to the east and curves south to link with the Tehachapi Mountains. The region includes the oak woodland foothills on the western slopes and, on the east, the Owens Valley and edges of the Great Basin.

On the west side, the slope of the Sierra Nevada rises gradually from near sea level at the floor of the Central Valley to ridges ranging from 6,000 feet in the north to over 14,000 feet in the south, then drops off sharply to the east. As the elevation increases from west to east, life zones transition from chaparral and oak woodlands to lower montane forests of ponderosa and sugar pine to upper montane forests of firs, Jeffrey and lodgepole pine and, above timberline, to alpine plant communities.

Sierra Nevada Foothills Fine-Scale Habitat Connectivity Model

A connected landscape is crucial for maintaining ecological processes and healthy wildlife populations. Habitat connectivity supports the movement of wildlife across the landscape to find food, cover and mates; to seasonally migrate; and to move in adaptation to climate change. Wildlife movement patterns can be disrupted by barriers such as roads, urban development, and habitat conversion. There are many factors that influence wildlife movement including physical and ecological attributes of the landscape, and species behavior. Wildlife connectivity models help us to better understand potential species movement patterns and how barriers may impact wildlife movement.

In 2014 the Conservation Analysis Unit in the Biogeographic Data Branch completed a fine-scale connectivity analysis of the northern Sierra Nevada foothills ecoregion. This ecoregion contains intermediate elevation oak woodland, grassland, and chaparral habitats and represents an important movement corridor between the low elevations of the Central Valley and the mountains of the Sierra Nevada. The ecoregion is bisected by several major highways and is experiencing rapid growth, underscoring the need for a regional connectivity analysis to support conservation and transportation planning.

The purpose of this project was to build onto the statewide California Essential Habitat Connectivity work using a regional approach based on species-specific wildlife movement needs, as recommended in the CEHC report. The project used state-of-the-art methods to develop habitat suitability models for 30 focal species representative of the ecoregion. The models, together with species-specific information on patch size and dispersal ability, were used to identify core habitat areas and wildlife corridors across the landscape. In addition, riparian and land facets corridors were identified. Riparian corridors offer an important tool for conservation planning, representing areas that are important for wildlife and serve multiple ecological functions. Land facet corridors are areas of land with uniform topographic and geologic features that will interact with future climate to support species and species movement under future climate conditions.

The maps of core habitat patches and wildlife linkages, supplemented by maps of riparian corridors and land facets, can be used to address species-specific conservation needs as well as overall habitat connectivity in conservation planning. The analysis also helps us better understand what barriers to species movement are present in the landscape. Scientists in the CDFW Region 2 office are conducting a field-based analysis to evaluate corridor use through the deployment of camera traps throughout the ecoregion.

Federal agencies manage about 75 percent of the Sierra Nevada: 57 percent by the U.S. Forest Service (USFS), 13 percent by the National Park Service (NPS), and 5 percent by the Bureau of Land Management (BLM). About 2 million acres are wilderness areas, mostly in the southern Sierra, managed by USFS. Lands managed by the NPS include Sequoia, Kings Canyon, and Yosemite National Parks and Devils Postpile National Monument. State parks and wildlife areas account for

0.6 percent of the region, and the remaining, approximately 24 percent of the Sierra Nevada, is privately owned. Most of the higher elevations and the eastern Sierra are public lands, whereas most of the oak woodlands and lower mixed conifer forests and rangelands below 3,000 feet on the western slope are in private ownership. There is a checkerboard ownership pattern of private and public lands in areas of the northern half of the Sierra Nevada that lie near historical railway routes (California Resources Agency [CRA] 2004; Sierra Nevada Ecosystem Project [SNEP] 1996).

Much of the state's surface-water runoff flows to the Central Valley from the Sierra Nevada and adjacent Cascades. These flows are critical to meet California's hydropower demands and agricultural and drinking water needs. Much of the water is stored in reservoirs and is conveyed by aqueducts to irrigate agriculture from Redding to Bakersfield and to provide drinking water for most of urbanized California, including the San Francisco Bay Area and Southern California (California Department of Water Resources [DWR] 1998).

The hundreds of creeks and streams of the western slopes of the Sierra Nevada drain via a dozen major river basins to merge with the Sacramento River in the north and the San Joaquin River in the south, which eventually join at the San Francisco Bay Delta. The southern forks of the Kings River and streams farther south drain into the Tulare basin. The streams east of the Sierra crest flow into the Great Basin through the Lahontan, Mono, and Owens drainages. Maintaining and restoring the ecological health of these watersheds and aquatic systems is important to ensure clean water.

Variable topography, the large elevation gradient, and varied climatic conditions of the Sierra Nevada support diverse plant communities. The Sierra Nevada supports at least 1,300 vascular plant species, along with numerous bryophytes and lichens, and more than 450 species of vertebrate animals (USFS 2004a). The varied conditions and floristically and structurally diverse plant communities provide a large array of habitats important for maintaining California's wildlife diversity and abundance.

Several major pressures have altered aquatic ecosystems and transformed forest structure and habitats on both public and private lands. Dramatic human population growth and development in the western Sierra foothills, forest management practices, fire suppression, and livestock grazing have altered ecosystems and continue to affect wildlife habitats. Hydropower facilities and agricultural and municipal water diversions have disrupted natural river flow regimes. Eroding access roads in forested and other habitats and excessive livestock grazing have resulted in the conversion of wet meadows to drier lands and have degraded streams and aquatic habitat. The introduction of trout has caused declines in native species. In the central Sierra, historical mining severely altered watersheds and water courses, and those effects persist. Importantly, effects of climate change are already evident; the Sierra Nevada has experienced increased minimum temperatures, earlier snowpack melting, changes in stream hydrology, and increased frequency of large, severe wildfires (Safford et al. 2012). Fire suppression and inadequate forest management have led to uncharacteristic fires, which drastically change landscapes and habitat for decades and start self-perpetuating cycles of uncharacteristic fire.

The altered forest ecosystems of the Sierra Nevada largely lack the qualities of old-growth or late seral stage forests (forests that are in the later stages of development with large-diameter trees, snags, and logs) that are important for diverse and abundant wildlife (Franklin and Fites-Kaufman 1996; USFS 2001). Species that depend on old-growth or late-seral stage forest habitat, like the Pacific fisher, have been negatively affected. The degradation of mountain meadows and loss of quaking aspen, willow, and other riparian woody plants have affected the endangered willow flycatcher and other species that have similar habitat requirements.

New conservation challenges and opportunities will affect the Sierra Nevada in the next few decades. How new development is managed will determine the extent of wildlife habitat fragmentation. Changing global climate will alter depth and seasonality of snowpack, further modifying river flow regimes, fire behavior, and ecosystems. The relicensing of hydropower projects provides an opportunity to change hydropower operations to reduce their effects on fish and wildlife.

Concerned about the decline of old forests and associated wildlife species of the region, Congress funded, in 1993, the Sierra Nevada Ecosystem Project (SNEP), based at UC Davis, for the "scientific review of the remaining old growth in the national forests of the Sierra Nevada in California, and for the study of the entire Sierra Nevada ecosystem by an independent panel of scientists, with expertise in diverse areas related to this issue." The forests of the Sierra, Cascades, and the Modoc Plateau were evaluated by a multidisciplinary team of scientists from many organizations. SNEP completed its work and published a three-volume report in 1996. Based on the work of dozens of scientists, the report analyzed the status of conifer forests, rangelands, meadow and riparian plant communities, and aquatic ecosystems, and suggested alternatives to restore ecosystems.

Aquatic and riparian systems are believed to be two of the most altered and impaired habitats of the Sierra Nevada. Among other critical findings, SNEP found that key causes of the decline of mammals, birds, and other vertebrates in the Sierra, Cascades, and Modoc regions include the loss and degradation of riparian areas, foothill woodlands, and diverse old forest habitats (including large trees, snags, fallen logs, and layered vegetative structure).

A 1992 technical report by USFS Pacific Southwest Research Station highlighting at-risk California spotted owl populations triggered debate about habitat conservation and forest uses. That debate prompted USFS to initiate a multiyear planning process that resulted in the Sierra Nevada Framework for Conservation and Collaboration (Sierra Framework), which evolved into the Sierra Nevada Forest Plan Amendment (SNFPA) Final Environmental Impact Statement covering the national forests of the Sierra, Cascades, and Modoc regions. In January 2001, USFS announced the SNFPA Record of Decision, describing chosen management options. In January 2004, the SNFPA was amended, reducing livestock-grazing and timber-harvest restrictions and giving USFS greater management discretion. USFS Forest Plans are currently being updated to align with the new National Forest System planning rule adopted in 2012.

Numerous watershed groups, private landowners, local conservancies, resource conservation districts, and state and federal programs are engaged in habitat conservation and restoration work on public and private lands throughout the region. The legislatively created Sierra Nevada Conservancy, established in January 2004, is a key collaborator and a potential source of funding for conservation and restoration of habitats for species at risk in the Sierra Nevada.

5.4.2 Conservation Units and Targets

The conservation units associated with the Central Valley and Sierra Nevada Province are the Great Valley, Sierra Nevada Foothills, and Sierra Nevada ecoregions (Figure 5.4-2), and the Sacramento, Central Lahontan, San Joaquin, and Tulare-Buena Vista Lakes hydrologic units (Figure 5.4-3). The selected targets for each of these conservation units are summarized in Table 5.4-1.

Although numerous potential conservation targets were identified within the province, conservation strategies were only developed for the targets that contain the greatest number of SCGN and that are under immediate threat. Forests and woodlands, shrubland, and grassland were not among those targets selected, because these habitat types are under less threat or are being conserved through other programs. Additional key targets will be addressed through future conservation planning efforts. Information about the methods used to prioritize conservation targets is presented in Appendix D.

Figure 5.4-4 shows the distribution of the plant communities within the province. Some of the plant communities identified as conservation targets occur in areas smaller than the mapping unit and do not appear on the figure.

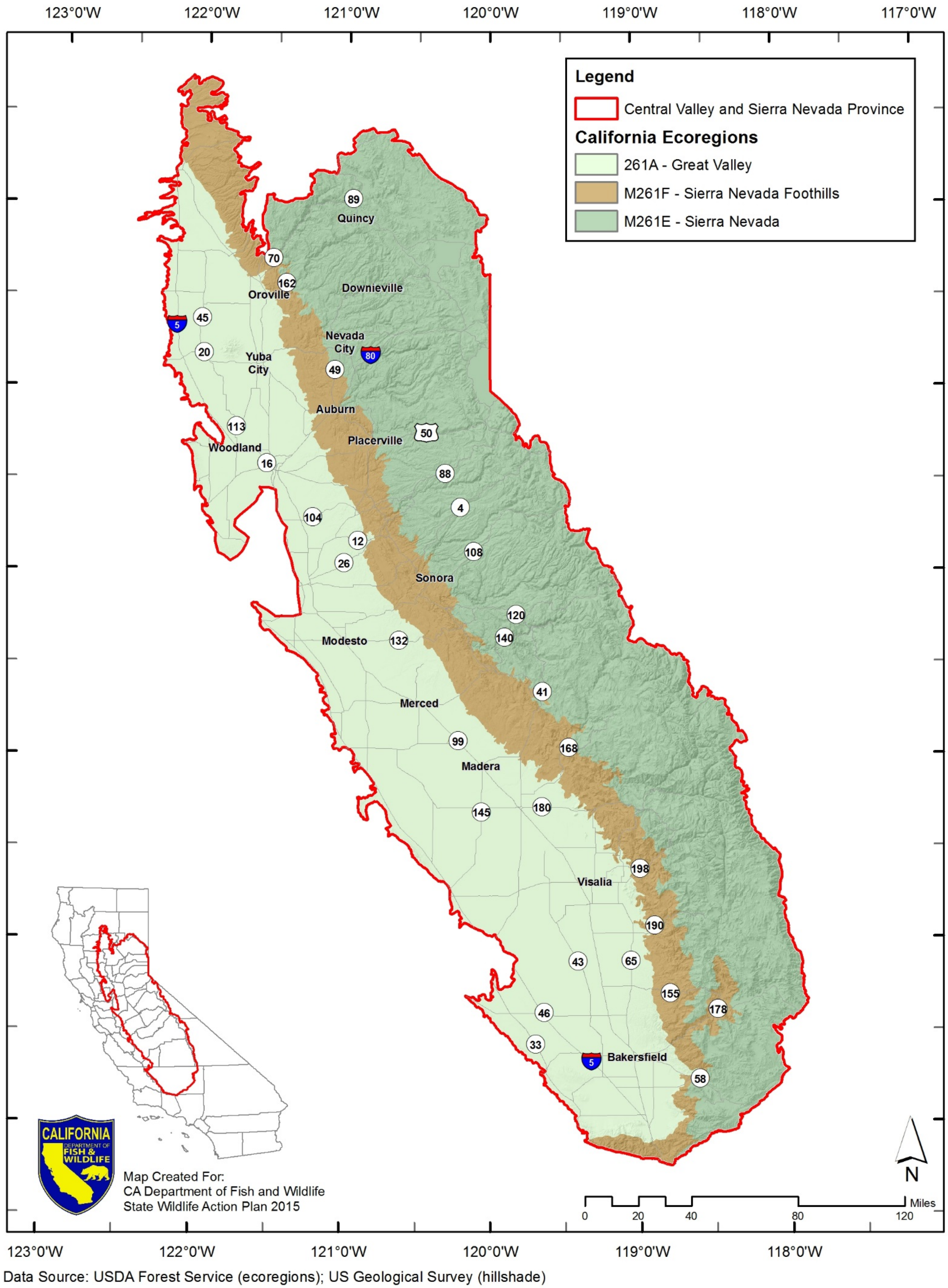


Figure 5.4-2 Ecoregions of the Central Valley and Sierra Nevada Province

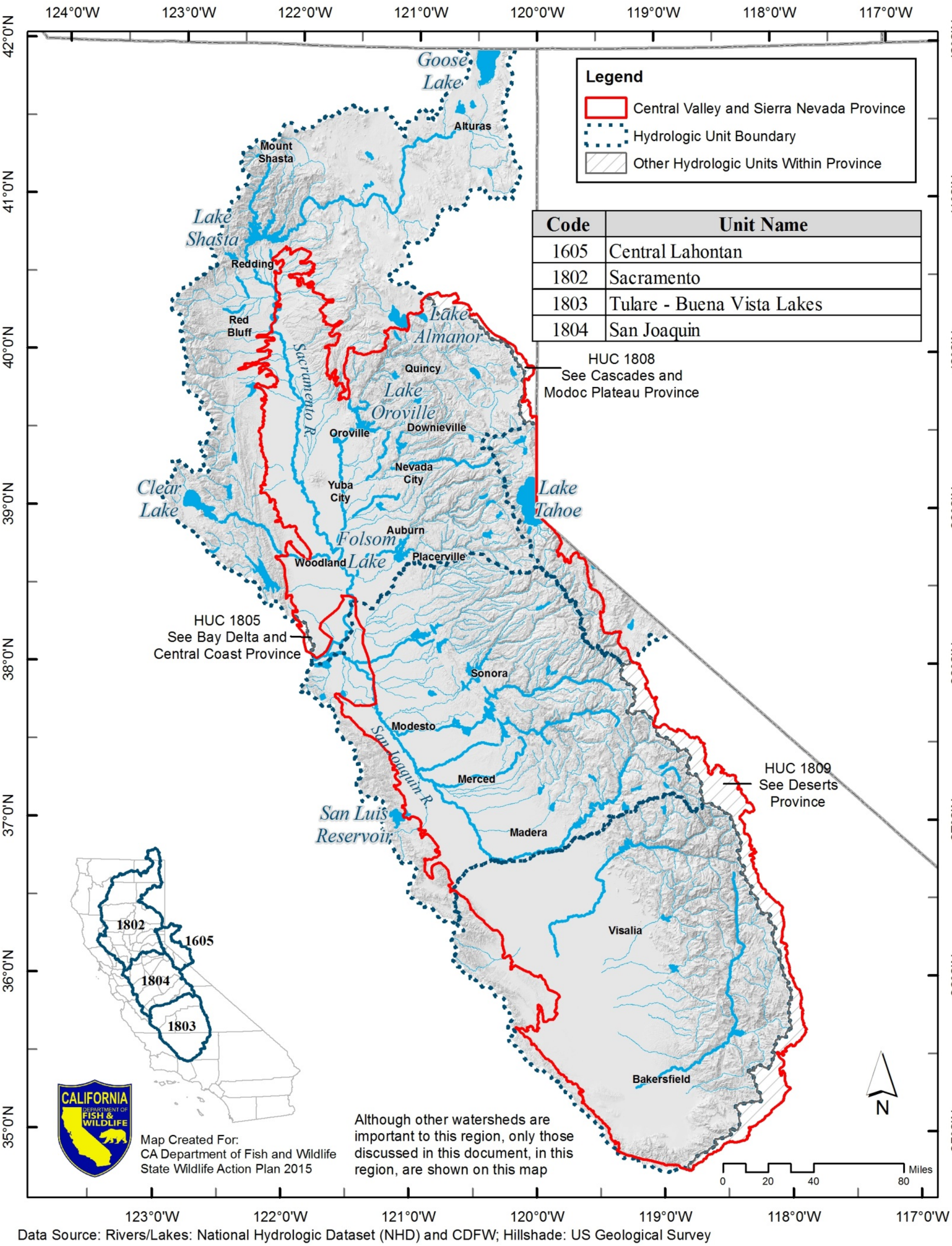
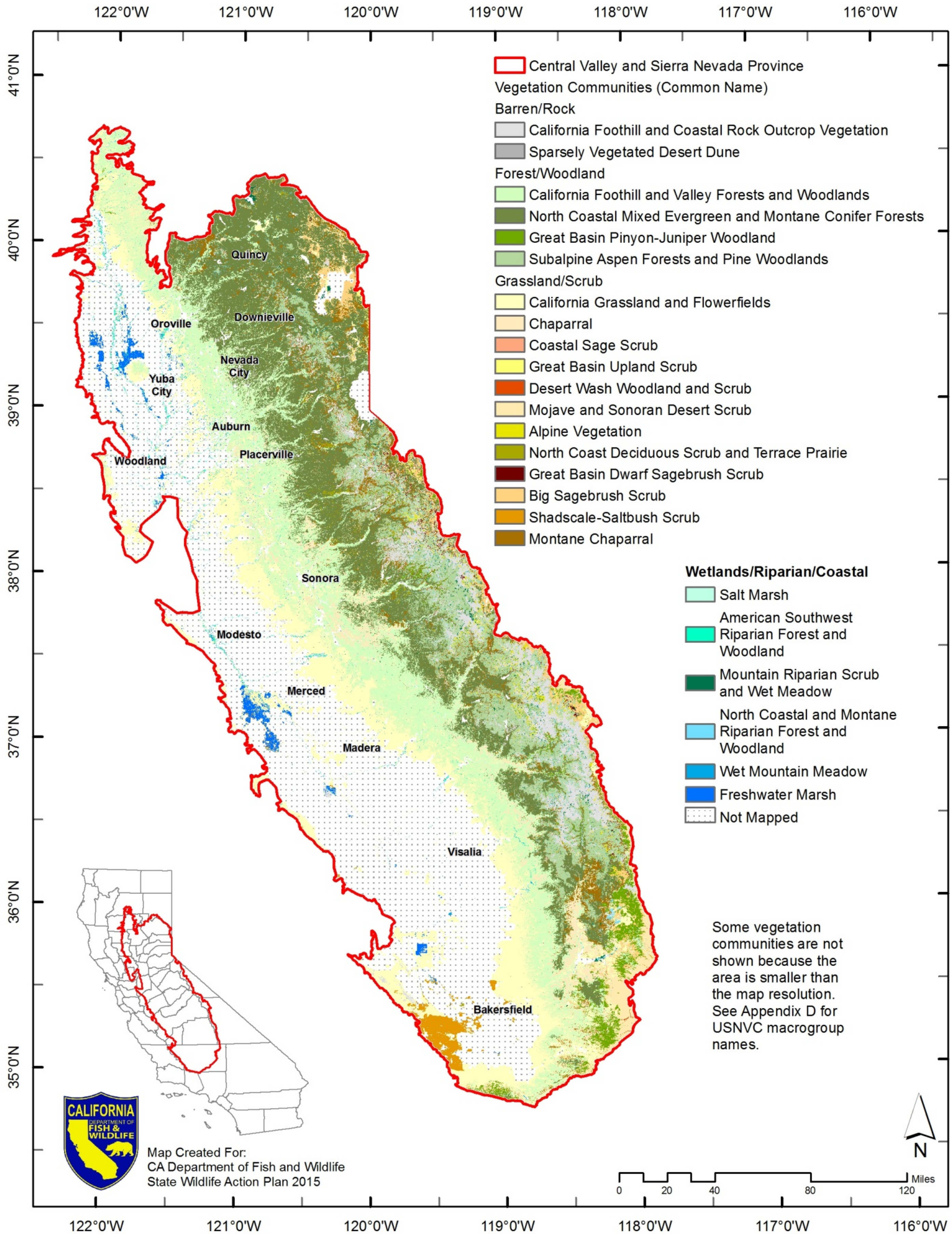


Figure 5.4-3 Hydrologic Units of the Central Valley and Sierra Nevada Province



Data Source: fveg(Calfire)

Figure 5.4-4 Plant Communities of the Central Valley and Sierra Nevada Province

Table 5.4-1 Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Great Valley Ecoregion	Contains the alluvial plains of the Sacramento and San Joaquin Valleys. Summers are hot and dry and winters are mild. Oceanic influence on climate is slight in the middle of the Great Valley, which receives some marine air through the Carquinez Strait, but becomes negligible at the north and south ends of the Valley. Predominant vegetation includes annual grassland, cheatgrass, valley oak, vernal pools and wetland communities, blue oak, allscale and saltgrass. Elevation range: 0 to 2,000	American Southwest Riparian Forest and Woodland	Diagnostic species include Fremont cottonwood, black and red willow, California sycamore, California wild grape, arroyo willow, narrow-leaf willow, button-bush, and spice bush. Most stands are found in permanently moist settings or riparian settings where sub-surface water is available year-round.	Valley Foothill Riparian
		Freshwater Marsh	This vegetation type consists of freshwater emergent marshes and coastal/tidal marshes and meadows. It can be found surrounding streams, rivers, lakes and wet meadows. These habitats occur on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. Dominant species are generally perennial monocots including graminoids such as rushes, reeds, grasses and sedges. Dominant species include: common reeds, hardstem bulrush, small-fruited bulrush, water parsley, slough sedge, soft rush, salt rush, and pacific silverweed.	Fresh Emergent Wetland
Sierra Nevada Foothills Ecoregion	Includes the hot foothills of the Sierra Nevada, and the southwestern end of the Cascade Ranges, adjacent to the Great Valley. Predominant vegetation communities include blue oak, broom, cheatgrass, chamise, mixed chaparral, foothill pine, and valley oak. Elevation range: 200 to 5,000	Chaparral	Represented by a wide variety of floristic alliances, but in general can be grouped into coastal (maritime), xeric (dry, sunny slopes), mesic (cooler, shady slopes), and lower montane (somewhat frost sensitive) types. All of these groupings have different characteristic species and fire regimes. The core diagnostic species are shrubs with evergreen thickened leaves including many species of manzanita, *Ceanothus*, scrub oaks, and other characteristic shrubs: toyon, chamise, flannel-bush, silk-tassel bush, and many others. Many shrubs tend to break down into their fire responses, including obligate-seeding and resprouting strategies.	Mixed Chaparral; Chamise-Redshanks Chaparral
		California Foothill and Coastal Rock Outcrop Vegetation	Vegetative cover is generally < 2%. Cliffs and outcrops west of the deserts and inland from the immediate coast, south of central California. Rock surfaces or rapidly eroding unstable slopes are characteristic. Stands do not include alpine or subalpine sparse, rocky vegetation, and also do not include the sparsely vegetated portions of the warm and cold deserts. Target is poorly understood floristically; includes coastal succulents (e.g., *Dudleya* and *Coreopsis gigantea*).	Barren

Table 5.4-1 Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Sierra Nevada Foothills Ecoregion (continued)		Desert Transition Chaparral	These chaparral stands occur in the "rain shadow" of the mountains. Compared to the target "Chaparral," the stands are less dense, contain a mix of other non-chaparral shrubs with desert affinities, and tend to have less frequent and less intense fires. This target contains the desert margin scrub oaks *Quercus john-tuckeri, Q. turbinella*, and *Q cornelius mulleri*, also sugar-bush, red-shank, Silk-tassel bush, and cup-leaf ceanothus. Understory short shrubs include golden-bush, California buckwheat, and matchweed. Prickly-pear, cholla, jojoba, nolina, and other desert perennials and annuals are also common associates in many of the stands.	Mixed Chaparral; Chamise-Redshanks Chaparral
		Montane Chaparral	These are cold-adapted and occupy successional relationships to various coniferous forests on productive sites, or persist in rocky or other poor soil sites. Contains the *Ceanothus cordulatus, C. velutinus, Arctostaphylos patula, A. nevadensis, Chrysolepis sempervirens*, and *Q. vaccinifolia*-dominated montane chaparrals. Does not include bittercherry, ocean spray or other taller winter deciduous shrub stands, which may occur near or adjacent to these evergreen stands.	Montane Chaparral
		California Foothill and Valley Forests and Woodlands	These forests may be open woodlands to denser forests, and may be dominated by broadleaf evergreen or deciduous hardwoods, co-dominated by hardwoods and conifers, or dominated entirely by conifers. Understories can be grassy, shrubby, or mixed with both. This target contains two groups, one dominated by broad leaf trees and the other dominated by conifers. Fire ecology is varied depending on the spacing of trees and the herbaceous or woody understory characteristics.	Coastal Oak Woodland; Blue Oak Woodland; Blue Oak-Foothill Pine; Montane Hardwood; Valley Foothill Riparian; Valley Oak Woodland; Closed-Cone Pine-Cypress; Juniper

Table 5.4-1 Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Sierra Nevada Ecoregion	The temperate to very cold parts of the Sierra Nevada, which is a north-northwest aligned mountain range that is much steeper on the east than on the west side. Predominant vegetation communities include mixed conifer, ponderosa pine, Jeffrey pine, white fir, red fir, lodgepole pine, huckleberry oak, western juniper, aspen, big sagebrush, mixed subalpine forest, mountain hemlock, whitebark pine, and giant sequoia. Elevation range: 1,000 to 14,495	North Coastal Mixed Evergreen and Montane Conifer Forests	All of these forests average cooler and wetter conditions than California Foothill and Valley Forests and Woodlands. There is relatively broad overlap between the three groups composing this target. The moist coastal mixed evergreen has (or had) tanoak, madrone, giant chinquapin mixed frequently with Douglas-fir, but also mixes with bigleaf maple and red alder in upland settings. The more interior mixed evergreen forests have cooler winters and warmer summers than the moist coastal group above, and contain Oregon oak and drier Douglas-fir with canyon oak mixes.	Montane Hardwood; Montane Hardwood-Conifer; Douglas-Fir; Klamath Mixed Conifer; Sierran Mixed Conifer; White Fir; Eastside Pine; Jeffrey Pine; Ponderosa Pine
		Alpine Vegetation	This target is representative of the state's alpine zone in the Sierra Nevada, Cascades, White, Sweetwater, and Klamath Mountains. It either occurs above timberline or is found localized within subalpine areas in cold air drainages (e.g., North-facing slopes, often near long persisting snow banks). The characteristic species are either herbaceous (many are cushion plants, some tufted or rhizomatous graminoids) or low prostrate or dwarf shrubs. Different groups segregate based on substrate type (e.g., scree, talus, felfield) and moisture regime (e.g., snowbank, felfield). Snowbank indicator species include white heather, several species of saxifrage, and sedge. Felfield indicators include alpine reedgrass, Congdon sedge, alpine goldenbush, and Phlox species, among others. Alpine turf indicators include dwarf willows, dwarf huckleberry, Muir's hairgrass, and several sedges.	Alpine Dwarf-Shrub
		Pacific Northwest Subalpine Forest	Includes montane conifer forests and woodlands adapted to very high winter snowfall, from montane to subalpine elevations. Snow loads are the greatest anywhere in North America and persist well into the summer. Tree germination is also limited in some cases by the short period the ground is not covered by snow. Characteristic trees include red fir, mountain hemlock, and western white pine.	Red Fir; Subalpine Conifer

Table 5.4-1 Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Sierra Nevada Ecoregion (continued)		Wet Mountain Meadow	Typical of low lying sites in the mountains and in some lower elevation valleys and depressions. Widespread throughout the state wherever freshwater meadows and seeps occur. Saturated soil or standing water through the growing season are key characteristics. Wet mountain meadows are generally characterized by herbaceous plants with shrubs or trees absent or sparse (<20 percent cover), or along the edges. Most species are perennial and canopy cover is generally dense (60-100 percent).	Wet Meadow
		Western Upland Grasslands	Dominated by grasses, which are typically not restricted to moisture surrounding landscape (not seeps, riparian, or wet meadows). Dominant vegetation generally includes native grasslands of Idaho fescue, Great Basin wild rye, blue wild rye, one-sided bluegrass. It also includes the non-native grasslands that are from cool temperate settings in Eurasia such as creeping bentgrass, velvetgrass, Kentucky bluegrass, and Harding grass and cheat-grass.	Perennial Grassland; Annual Grassland
Sacramento HUC 1802	Encompasses much of northern California. Includes the Sacramento River Basin, including Shasta Lake and the isolated Clear Lake drainage basin, in California; and drainage into Goose Lake in Oregon. Covers an area of 27,600 square miles. Traverses the Coastal, Cascade, Warner, and Sierra Nevada mountain ranges and Modoc Plateau.	Clear Lake Native Fish Assemblage	Species of Greatest Conservation Need (SGCN) associated with target are Clear Lake hitch, Sacramento perch, Clear Lake tule perch, Pacific brook lamprey, prickly sculpin, Sacramento blackfish, Sacramento pikeminnow, California roach, Sacramento sucker, three-spine stickleback, and rainbow trout.	N/A
Central Lahontan HUC 1605	Includes the Central Lahontan Basin, consisting of the Carson, Truckee, and Walker River Basins in California and Nevada. Covers an area of 12,500 square miles. This unit is characterized by a diverse topography and climate. It includes high points along the eastern slopes of the Sierra Nevada and adjacent valley bottoms. The unit experiences very high to very low levels of precipitation associated with heavy snowfall in the mountainous regions and rainshadow effects in the valleys to the east and a similarly wide variation in temperature extremes. Varied topography and climate provides for a correspondingly diverse array of habitats, including abundant high quality waters and wetlands that support many distinct and unique plants and communities in this unit. Particularly notable are	Carson River Native Fish Assemblage	Includes 10 species of native fish. SGCN associated with target are Paiute cutthroat trout, Lahontan cutthroat trout, mountain sucker, and mountain whitefish. Other species in native fish assemblage are Paiute sculpin, Lahontan creek tui chub, Lahontan redside, Lahontan speckled dace, and Tahoe sucker.	N/A
		Walker River Native Fish Assemblage	SGCN associated with target are Lahontan cutthroat trout, mountain sucker, mountain whitefish, and freshwater mussels.	N/A

Table 5.4-1 Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Central Lahontan HUC 1605 (continued)	endemic fish species such as Paiute cutthroat trout and several species of desert pupfish. Numerous beneficial uses related to biological resources have been identified in this unit; as well as numerous CDFW-designated Significant Natural Areas. Elevation range: 4,200 to 11,400			
San Joaquin HUC 1804	Includes the entire San Joaquin River basin and its tributaries, including the Chowchilla, Merced, Stanislaus, Calaveras, Cosumnes, Mokolumne, Fresno, and Tuolumne rivers, Panoche Creek, and Mormon Slough. Also includes the San Luis reservoir and the San Joaquin Delta. Covers an area of 15,600 square miles. This unit, together with the Sacramento unit (1802), covers about one fourth of the total area of the state and furnishes roughly 51% of the State's water supply. The upper portions of this unit are characterized by high gradient mountain streams entering low gradient meadows and grasslands/agricultural lands and in areas terminating into large warm water lakes with unique native fish assemblages. Surface water from this unit in combination with the Sacramento unit meet and form the Delta, which ultimately drains into the San Francisco Bay. Two major water projects, the CVP and SWP, deliver water from the Delta to Southern California, the San Joaquin Valley, Tulare Lake Basin, the San Francisco Bay area, as well as within the Delta boundaries. The Delta is a maze of river channels and diked islands. Historic and ongoing point and nonpoint source discharges impact surface waters in this unit. Significant portions of major rivers and the Delta within this unit are impaired, to some degree, by discharges from agriculture, mines, urban areas and industries. The wetlands of this unit form important waterfowl habitat for migratory waterfowl using the Pacific Flyway. The alluvial fans within portions of this unit contain salts and selenium, which can be mobilized through irrigation practices and can pose potential threat to condition of surface waters and wetlands supporting important wildlife. Elevation range: 0 to 12,800	San Joaquin Native Aquatic Species	SGCN associated with target are hardhead, California roach, Red Hills roach, Sacramento sucker, Sacramento pikeminnow, Sacramento blackfish, Sacramento spittail, hitch, western pearlshell mussel, California floater mussel, Paiute cutthroat trout, Lahontan cutthroat trout, rainbow trout, California red-legged frog, foothill yellow-legged frog, and mountain yellow-legged frog.	N/A

Table 5.4-1 Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Tulare-Buena Vista Lakes HUC 1803	Includes drainage into the closed basins of Tulare and Buena Vista Lake in portions of Fresno, Kern, Kings, and Tulare counties of the southern San Joaquin Valley, California. Covers an area of 16,200 square miles. This unit is situated in the topographic horseshoe formed by the Diablo and Temblor Ranges on the west, by the San Emigdio and Tehachapi Mountains on the south, and by the Sierra Nevada Mountains on the east and southeast. It receives flood water from the major rivers during times of heavy runoff and surface water only drains from this unit north into the San Joaquin River in years of extreme rainfall. This unit once supported vast tule marshes, riparian corridors, abundant wetlands, and one of the most diverse, productive grasslands in temperate North America. However, the Tulare and Buena Vista lakes basin has been developed for farming due to its fertile soils, relatively cloudless summers, and high quality runoff from the adjacent mountains; it is now one of the most important agricultural centers of the world. Surface water supplies are inadequate to support the present level of agricultural and other development; ground water resources supply additional demands. Of primary concern in this unit is the accumulation of salts due to importation and evaporative use of the water. Evaporation ponds are being used for disposal of these saline waters, but the ponds are known to detrimentally impact wildlife. Additionally, historically poor sanitation associated with recreational uses and erosion from construction, logging, grazing, and irrigated agriculture are threats to stream environments in this unit. Elevation range: 160 to 13,200	Upper Kern Native Fish Assemblage	SGCN associated with target are California golden trout, hardhead, Kern River rainbow trout, and Little Kern golden trout. Other native fish in the assemblage is Sacramento sucker	N/A

* Description referenced from CDFG 1988, USDA 1994, USDA 2007 and Keeler-Wolf 2010.

5.4.3 Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the Central Valley and Sierra Nevada Province are listed in Table 5.4-2. The most commonly identified attributes for the Central Valley and Sierra Nevada Province are:

- area and extent of community;
- fire regime;
- connectivity among communities and ecosystems;
- successional dynamics;
- community structure and composition; and
- soil quality and sediment deposition regime.

Table 5.4-2 Key Ecological Attributes – Central Valley and Sierra Nevada Province

Key Ecological Attributes	Conservation Units and Targets: Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista Lakes HUC 1803
	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Area and extent of community	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X
Community structure and composition		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Connectivity among communities and ecosystems	X	X	X	X		X	X		X		X	X	X		X	X	
Fire regime			X	X	X	X	X	X		X	X	X		X			X
Hydrological regime	X							X								X	
Nutrient concentration and dynamics													X				
Pollutant concentrations and dynamics													X	X			
Soil quality and sediment deposition regime	X				X						X	X	X	X			X
Successional dynamics	X	X	X		X	X	X	X		X							
Surface water flow regime	X	X											X	X	X	X	X
Water level fluctuations											X	X				X	
Water quality															X	X	
Water temperatures and chemistry																X	

5.4.4 Species of Greatest Conservation Need in the Central Valley and Sierra Nevada Province

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.4-3). Not all of the focal species meet the criteria to be considered Species of Greatest Conservation Need (SGCN). SGCN are indicated with an asterisk. SGCN associated with the Central Valley and Sierra Nevada Province are shown by ecoregion in Tables C-17 through C-19 in Appendix C.

Table 5.4-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	Conservation Units and Targets[1]																
		Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Invertebrates																		
California floater mussel	*Anodonta californiensis*															X	X	
Western pearlshell mussel	*Margaritifera falcata*														X	X	X	X
Valley elderberry longhorn beetle*	*Desmocerus californicus dimporphus*	X																
Fishes																		
Pacific lamprey*	*Entosphenus tridentatus*																X	
Goose Lake lamprey*	*Entosphenus tridentatus* ssp.[1]																	
Pit-Klamath brook lamprey	*Lampetra lethophaga*																	
Green sturgeon*	*Acipenser medirostris*																X	
Lahontan cutthroat trout*	*Oncorhynchus clarkii henshawi*														X	X	X	
Paiute cutthroat trout*	*Oncorhynchus clarkii seleniris*														X		X	
Rainbow trout	*Oncorhynchus mykiss*													X			X	
California golden trout*	*Oncorhynchus mykiss aguabonita*																	X
Kern River rainbow trout*	*Oncorhynchus mykiss gilberti*																	X
Goose Lake redband trout*	*Oncorhynchus mykiss* ssp.[1]																	
Little Kern golden trout*	*Oncorhynchus mykiss whitei*																	X
Mountain whitefish	*Prosopium williamsoni*														X	X		
Hitch	*Lavinia exilicauda chi*																X	
Clear Lake hitch	*Lavinia exilicauda chi*													X				
California roach	*Lavinia symmetricus*													X			X	
Pit roach*	*Lavinia symmetricus mitrulus*																	
Hardhead*	*Mylopharodon conocephalus*																X	X
Sacramento blackfish	*Orthodon microlepidotus*													X			X	
Sacramento pickeminnow	*Ptychocheilus grandis*													X			X	
Lahontan redside	*Richardsonius egregius*														X	X		
Speckled dace	*Rhinichthys osculus*														X	X		
Lahontan Lake tui chub*	*Siphateles bicolor pectinifer*														X			
Lahontan Creek tui chub	*Siphateles bicolor obesa*														X	X		
Goose Lake tui chub*	*Siphateles bicolor thalassina*																	
Sacramento sucker	*Catostomus occidentalis lacusanserinus*													X			X	X
Goose Lake sucker*	*Catostomus occidentalis lacusanserinus*																	
Mountain sucker*	*Catostomus platyrhynchus*														X	X		
Tahoe sucker	*Catostomus tahoensis*														X	X		
Unarmored threespine	*Gasterosteus aculeatus*													X				

Table 5.4-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	Conservation Units and Targets[1]																
		Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
stickleback*	*williamsoni*																	
Sacramento perch	*Archoplites interruptus*													X				
Clear Lake tule perch	*Hysterocarpus traski lagunae*													X				
Prickly sculpin	*Cottus asper*													X				
Paiute sculpin*	*Cottus beldingi**														X	X		
Pit sculpin	*Cottus pitensis*																	
Amphibians																		
California tiger salamander*	*Ambystoma californiense*	X		X		X	X	X										
Southern long-toed salamander*	*Ambystoma macrodactylum*								X	X	X	X	X					
Limestone salamander*	*Hydromantes brunus*			X	X		X	X										
Mount Lyell salamander*	*Hydromantes platycephalus*									X	X							
Red-bellied newt	*Taricha torosa*		X															
Western spadefoot*	*Spea hammondii*			X	X		X	X										
Kern Canyon slender salamander	*Batrachoseps simatus*					X												
Tehachapi slender salamander	*Batrachoseps stebbinsi*					X			X									
Relictual slender salamander	*Batrachoseps relictus*								X									
Yosemite toad	*Anaxyrus canorus*														X	X		
Northern leopard frog	*Lithobates pipiens*											X	X					
Foothill yellow-legged frog*	*Rana boylii*	X																
California red-legged frog*	*Rana draytonii*	X	X			X												
Southern mountain yellow-legged frog	*Rana muscosa*								X	X	X	X	X					
Sierra Nevada yellow-legged frog	*Rana sierra*														X	X		
Reptiles																		
Northwestern western pond turtle*	*Actinemys marmorata*	X	X			X												
Blunt-nosed leopard lizard*	*Gambelia sila*			X	X		X	X										
Blainville's horned lizard (coast horned lizard) *	*Phrynosoma blainvillii*			X	X		X	X										
Sagebrush lizard	*Sceloporus graciosus*								X		X							
Western skink	*Plestiodon skiltonianus*	X				X												
California legless lizard*	*Anniella pulchra*			X	X		X	X										
Southern rubber boa*	*Charina umbratica*								X									
Ring-necked snake	*Diadophis punctatus*	X		X	X	X	X	X										
California mountain kingsnake	*Lampropeltis zonata*											X	X					
San Joaquin whipsnake	*Masticophis flagellum ruddocki*			X	X		X	X										

Table 5.4-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	Conservation Units and Targets[1]: Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Gopher snake	*Pituophis catenifer*	X		X	X		X	X				X	X					
Coast patch-nosed snake*	*Salvadora hexalepis virgultea*			X	X		X	X										
Giant garter snake*	*Thamnophis gigas*	X	X	X	X		X	X										
Birds																		
Greater white-fronted goose	*Anser albifrons*	X	X	X	X		X	X									X	
Sooty grouse	*Dendragapus fuliginosus*								X		X							
California quail	*Callipepla californica*	X		X	X	X	X	X										
Great egret	*Adea alba*	X	X	X	X		X	X										
Great blue heron	*Ardea herodias*	X	X	X	X		X	X										
Black-crowned night heron	*Nycticorax nycticorax*	X	X															
Least bittern*	*Ixobrychus exilis*	X	X															
American white pelican*	*Pelecanus erythrorhynchos*		X														X	
California condor*	*Gymnogyps californianus*			X	X		X	X			X							
Osprey	*Pandion haliaetus*	X	X			X			X		X						X	
Northern goshawk*	*Accipiter gentilis*	X				X			X	X	X							
Golden eagle*	*Aquila chrysaetos*	X		X	X	X	X	X	X	X	X	X	X					
Rough-legged hawk	*Buteo lagopus*			X	X		X	X										
Ferruginous hawk	*Buteo regalis*			X	X		X	X										
Swainson's hawk*	*Buteo swainsoni*	X		X	X	X	X	X										
Northern harrier*	*Circus cyaneus*		X	X	X		X	X										
White-tailed kite*	*Elanus leucurus*			X	X	X	X	X										
Bald eagle*	*Haliaeetus leucocephalus*	X				X			X								X	
Snowy plover (interior population)*	*Charadrius nivosus*																X	
Western yellow-billed cuckoo*	*Coccyzus americanus occidentalis*	X																
Short-eared owl*	*Asio flammeus*		X	X	X		X	X				X	X					
Long-eared owl*	*Asio otus*	X		X	X	X	X	X				X	X					
Burrowing owl*	*Athene cunicularia*	X		X	X	X	X	X										
Great gray owl*	*Strix nebulosa*										X							
Spotted owl*	*Strix occidentalis*								X		X							
Vaux's swift*	*Chaetura vauxi*								X			X	X					
Black swift*	*Cypseloides niger*			X	X		X	X	X		X							
American peregrine falcon*	*Falco peregrinus anatum*		X	X	X	X	X	X			X							
Prairie falcon	*Falco mexicanus*			X	X		X	X										
Olive-sided flycatcher*	*Contopus cooperi*								X		X							
Loggerhead shrike*	*Lanius ludovicianus*			X	X		X	X										
Hutton's vireo	*Vireo huttoni*	X				X												

Table 5.4-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

		Conservation Units and Targets[1]																
		Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
Common Name	Scientific Name	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Clark's nutcracker	*Nucifraga columbiana*										X							
Purple martin*	*Progne subis*	X	X	X	X	X	X	X	X									
Bank swallow*	*Riparia riparia*	X	X	X	X		X	X				X	X					
Common yellowthroat*	*Geothlypis trichas**	X	X	X	X		X	X										
Marsh wren	*Cistothorus palustris*		X															
Yellow-breasted chat*	*Icteria virens*	X																
Yellow warbler*	*Setophaga petechia*	X		X	X	X	X	X	X									
Rufous-crowned sparrow	*Aimophila ruficeps*			X	X		X	X										
Grasshopper sparrow*	*Ammodramus savannarum*			X	X		X	X										
Song sparrow	*Melospiza melodia*	X	X															
California towhee	*Melozone crissalis*			X	X		X	X										
Savannah sparrow*	*Passerculus sandwichensis*			X	X	X	X	X										
Tricolored blackbird*	*Agelaius tricolor*	X	X	X	X	X	X	X										
Gray-crowned rosy-finch*	*Leucosticte tephrocotis*									X								
Mammals																		
Vagrant shrew	*Sorex vagrans*											X	X					
Pallid bat*	*Antrozous pallidus*	X		X	X	X	X	X										
Townsend's big-eared bat*	*Corynorhinus townsendii*			X	X		X	X										
Spotted bat	*Euderma maculatum*			X	X		X	X										
Western small-footed bat	*Myotis ciliolabrum*	X		X	X		X	X										
Long-eared bat*	*Myotis evotis*								X									
Fringed myotis*	*Myotis thysanodes*	X		X	X		X	X										
Yuma myotis	*Myotis yumanensis*	X																
Western pipistrelle	*Parastrellus hesperus*			X	X		X	X										
Western mastiff bat	*Eumops perotis californicus*	X	X	X	X		X	X										
American pika*	*Ochotona princeps*									X	X							
Snowshoe hare	*Lepus americanus*								X									
Black-tailed jackrabbit	*Lepus californicus*			X	X		X	X				X	X					
Riparian brush rabbit*	*Sylvilagus bachmani riparius*	X																
Mountain beaver	*Aplodontia rufa*								X		X							
Nelson's antelope squirrel*	*Ammospermophilus nelsoni*	X																
Northern flying squirrel	*Glaucomys sabrinus*								X		X							
California pocket mouse	*Chaetodipus californicus*			X	X		X	X										
North American beaver	*Castor canadensis*		X															
Heermann's kangaroo rat*	*Dipodomys heermanni heermanni*			X	X		X	X										
Giant kangaroo rat*	*Dipodomys ingens*	X																
San Joaquin kangaroo rat*	*Dipodomys nitratoides*			X	X		X	X										

Table 5.4-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	Conservation Units and Targets[1]																
		Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Fresno kangaroo rat*	*Dipodomys nitratoides exilis*			X	X		X	X										
San Joaquin pocket mouse*	*Perognathus inornatus inornatus*	X		X	X	X	X	X										
Dusky-footed woodrat	*Neotoma fuscipes*			X	X		X	X	X			X	X					
Riparian (=San Joaquin Valley) woodrat*	*Neotoma fuscipes riparia*	X																
Large-eared woodrat	*Neotoma macrotis*			X	X		X	X										
Deer mouse	*Peromyscus spp.*	X		X	X		X	X	X									
Porcupine*	*Erethizon dorsatum*					X			X		X							
Gray wolf*	*Canis lupus*								X									
Sierra Nevada red fox*	*Vulpes vulpes necator*									X								
Ringtail*	Bassariscus astutus	X		X	X	X	X	X	X			X	X					
California wolverine*	*Gulo gulo*								X	X	X							
Northern river otter	*Lontra canadensis*	X	X			X												
Pacific marten*	*Martes caurina [=americana]*								X	X	X							
Fisher - West Coast DPS*	*Pekania [=Martes] pennanti*								X		X							
American badger*	*Taxidea taxus*	X		X	X	X	X	X	X			X	X					
Western spotted skunk	*Spilogale gracilis*	X		X	X	X	X	X	X									
Tule elk*	*Cervus elaphus nannodes*	X																
Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*									X	X							

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion, see Appendix C.
* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.4.5 Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have string influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified for conservation targets in the Central Valley and Sierra Nevada Province are summarized in Table 5.4-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures for the province. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.4.6. Some of the major pressures for the province are discussed in more detail below.

Table 5.4-4 Key Pressures on Conservation Targets – Central Valley and Sierra Nevada Province

Pressure	Conservation Units and Targets: Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista Lakes HUC 1803
	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Agricultural and forestry effluents	X	X												X			
Annual and perennial non-timber crops	X	X									X	X	X	X		X	
Climate change	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X															
Dams and water management/use	X	X									X	X	X	X	X	X	
Fire and fire suppression			X	X	X	X	X	X		X	X	X		X			
Household sewage and urban waste water	X	X												X		X	
Housing and urban areas	X	X	X	X	X	X	X				X	X		X			
Industrial and military effluents																	
Introduced genetic material														X	X		X
Invasive plants/animals	X	X			X				X		X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X	X	X	X	X		X	X		X	X		X
Logging and wood harvesting	X							X			X	X					
Marine and freshwater aquaculture																X	
Mining and quarrying		X											X	X			
Parasites/pathogens/diseases										X							
Recreational activities					X				X	X	X	X	X			X	
Renewable energy			X	X		X	X	X									
Roads and railroads	X	X			X						X	X		X	X		
Tourism and recreation areas																	
Utility and service lines	X							X									

Dams and Water Management/Use

Central Valley

Water management pressures in the Central Valley include water diversions, dams, flood control structures (e.g., levees and bank protection), groundwater pumping, stream and river crossings (e.g., culverts, bridges), and dredging. Because of the important hydrologic connections, water management interrelationships, and other linkages between the Central Valley and the Bay Delta watersheds, the following includes some discussion of Central Valley water management influences on the Bay Delta.

Water diversions are found throughout the Central Valley's rivers and tributaries. Water is diverted for agriculture, municipal and industrial uses, and managed wetlands. Up to 70 percent of the freshwater flow that would naturally enter San Francisco Bay is now diverted (Steere and Schaefer 2001). Dams are located on all of the major rivers in the Central Valley and on many of their tributaries.

Dams and diversions have dramatically affected the aquatic ecosystems of the Central Valley, altering historical flooding regimes, erosion, and deposition of sediments that maintain floodplains. They also decrease riparian habitats and coarse gravel supplies needed for salmon and other native fish reproduction. Dam operations create rapid changes in flow rates that have led to the stranding of fish and exposure of fish spawning areas (CDFG 2005).

Dams reduce the amount of water remaining in the river that is needed by fish at critical times, and they alter the flow regimes in ways that are detrimental to aquatic life. Less water in the rivers also means less water for managed wetlands. Reduced river flows down- stream also allow saltwater intrusion into the Delta, increasing the salinity levels in the San Francisco estuary and bay beyond the tolerance levels of many species (Steere and Schaefer 2001).

Agricultural diversions usually get the highest quality water, discharging salty water that is then used in wildlife areas. By the time it is discharged from some wildlife areas, its salinity triggers concerns about water quality by regulatory agencies, particularly in the San Joaquin Valley. Efforts to correct this problem are complicated, owing to a poor understanding of the historic elements of salinity and the naturally saline wetlands of the San Joaquin drainage (CDFG 2005).

Dams and diversions also block fish movement to upstream habitat, remove fish and wildlife habitat, alter water quality (i.e., temperature and flow), and kill fish through entrainment and entrapment. Dams have cut off salmon access to 70-95 percent of their historical range (State Lands Commission 1993; Trust for Public Land [TPL] 2001; Clemmins et al. 2008; NMFS 2014). The diversion of water through powerful pumps from the Delta to the canals heading to Southern California reverses Delta flows and confuses migrating fish trying to find their way to the ocean. At times, the young fish swim with the flowing waters toward the pumps rather than toward the open ocean.

Levee, bridge, and bank-protection structures are present along more than 2,600 miles of rivers in the Central Valley and in the Delta (DWR 2005). These structures prevent flood flows from entering historic floodplains and eliminate or alter the character of floodplain habitats, such as shaded riverine habitat, and floodplain ecosystem processes. Constrained flood-level flows increase scouring and incision of river channels and reduce or halt the formation of riparian habitat, channel meanders, and river oxbow channels.

These changes in water supply also stress many upland species. Most of the resident terrestrial animals need to find adequate water during California's long, dry summer months. As human demand for water increases, there is less water available for resident wildlife species, so they experience greater physiological stress. In some cases, water management has also led to sustained year-round flows in streams that historically dried up in the summer. Central Valley habitats rely on a large and complex drainage, involving snowmelt and land uses up to 300 miles away and water imports from and exports to other river basins.

Current water management practices exemplify interactions between pressures and resulting stresses. As urban development expands, it creates more impermeable surfaces like concrete, asphalt, and the roofs of buildings. Subsequent rainfall is then less able to soak into the ground and runs off quickly. Rapid runoff reduces the recharge of groundwater reservoirs and reduces later summer stream flows. Combined with water diversions, this reduction in groundwater causes streams to dry up more quickly, thus reducing the availability of water to wildlife during summer months. Increased urban runoff also is a major source of water pollution. Urban runoff washes various pollutants out of urban areas, depositing them into creeks, rivers, and other water bodies, adding to wildlife stress.

Central Valley Project Improvement Act

The Central Valley Project (CVP) is a federal water management project under the supervision of the U.S. Bureau of Reclamation (USBR). It was authorized in 1935 in order to provide irrigation and municipal water to much of the Central Valley—by regulating and storing water in reservoirs in the northern half of the state, and transporting it to the San Joaquin Valley and its surroundings by means of a series of canals, aqueducts and pump plants, some shared with the California State Water Project (SWP).

In addition to water storage and regulation, the system provides recreation and promotes flood control with its dams and reservoirs. Over time CVP operations have resulted in environmental impacts, such as salmon population decline in four major California rivers, and many natural river environments, such as riparian zones, meanders and sandbars no longer exist.

The Central Valley Project Improvement Act (CVPIA) was enacted in 1992 and mandated changes in management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife. Its purposes are:

- Protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California
- Address impacts of the Central Valley Project on fish, wildlife and associated habitats, and improve the operational flexibility of the Central Valley Project
- Increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation
- Contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
- Achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors

Changes in management of the CVP under the CVPIA include: 800,000 acre-feet of water dedicated to fish and wildlife annually; tiered water pricing applicable to new and renewed contracts; water transfers provision, including sale of water to users outside the CVP service area; special efforts to restore anadromous fish population by 2002; restoration fund financed by water and power users for habitat restoration and enhancement and water and land acquisitions; no new water contracts until fish and wildlife goals achieve; no contract renewals until completion of a Programmatic Environmental Impact Statement; terms of contracts reduced from 40 to 25 years with renewal at the discretion of the Secretary of the Interior; installation of the temperature control device at Shasta Dam; implementation of fish passage measures at Red Bluff Diversion Dam; firm water supplies for Central Valley wildlife refuges; and development of a plan to increase CVP yield.

Sierra Nevada

Among the major rivers of the Sierra Nevada, all but a few have multiple dams or diversions. Flows are managed for hydropower generation, for water for irrigation and domestic uses, and for flood control (DWR 1998). A few small dams were developed and are still maintained for instream flow protection and management downstream, and/or for wet meadow habitat maintenance. Others were constructed by fisheries managers to provide barriers between sensitive native fish populations and introduced fish with capability to interbreed or prey upon the native species. The unnatural managed flows disrupt and degrade aquatic and riparian ecosystems. Below dams, river flows are ramped up and down and water temperatures are changed, often creating lethal conditions for aquatic species. Dams and diversions of the rivers that flow into the Sacramento and San Joaquin drainages have been particularly detrimental to anadromous Chinook salmon, steelhead trout, Pacific lamprey, sturgeon, and Delta smelt. Each of these species historically spawned in Sierra Mountain rivers and streams, their young swimming to the sea and returning a few years later as adult fish to spawn. The construction of dams and water diversions blocked fish passage, contributing to dramatic declines in salmon and steelhead populations of the Sacramento and San Joaquin drainages. Fewer anadromous fish also means fewer eggs, young fish, and fish carcasses that provide nutrients for numerous other aquatic species. Historically, one to three million Chinook salmon spawned each year in the western Sierra. Today, dams block salmon access to upstream spawning habitat in all but a few creeks. Late fall, winter, and spring runs of salmon have collapsed. Steelhead and the spring-run Chinook salmon are federally threatened, winter-run Chinook salmon are also listed by the state as endangered. Fall and late fall run salmon are taxa of special concern. Natural and hatchery produced fall run Chinook salmon continues to support ocean commercial and sport fisheries and a river fishery. Many other aquatic species are also affected by the migration impediments imposed by dams and their associated reservoirs.

In the foothills, residential development continues to add “river wells” located directly on stream aquifers. Increased water drafting has turned some year-round streams into seasonal creeks and dried up other streams (CDFG 2005). Native fish (such as hitch, hardhead, and native rainbow trout), amphibians, and native invertebrate populations are adversely affected where streams have receded. Similarly, the development of springs for domestic water supply on private and public lands has degraded riparian habitats for native amphibians and invertebrates.

Fire and Fire Suppression

Most of California’s forest ecosystems have evolved with recurring fire, and each plant community of the Sierra Nevada has adapted to some range of frequency of wildfire. The plant communities, topography, elevation, and climatic conditions influence the “fire regime,” the frequency and intensity of fire for a specific plant community (McKelvey et al. 1996). In turn, the extent and intensity of fire influence ecological processes, shape plant communities, and affect wildlife.

A continuum of fire regimes exists in the various forest types. For example, ponderosa pine-dominated mixed conifer forests of the Sierra have historically had a fire regime of frequent, low- to moderate-intensity fires, with less frequent large, uncharacteristic fires. Additionally, Sierran forests consisted of highly clustered groups of trees with sparsely treed or open gap conditions but have been converted to less resilient and more fire prone habitats. (North et al. 2009). At higher elevations, lodgepole pine communities evolved with less frequent but more severe fires (McKelvey et al. 1996). Wildfire is such an influential ecological element that the regeneration of some plant communities and the survival of many plant species require fire (Kilgore 1973). Fire suppression coupled with selective harvest of large trees, re-forestation with dense plantations of young conifers, invasive weeds, and intensive grazing have dramatically reshaped forest structure and altered ecosystems over the last 100 years.

In the early 1900s, the nature and role of wildfire was not understood and was generally viewed as damaging to forests. As a result, state and national policy for the last century has been to aggressively suppress forest fires and to put them out quickly, minimizing fire on the landscape of the West (van Wagtendonk 1995). USFS's "Smokey Bear" campaign was highly successful, training generations of Americans that wildfire was synonymous with waste and destruction and that it was everyone's duty to prevent forest fires (Dombeck et al. 2004; Kaufman 2004).

To restore native plant communities, forest ecologists generally agree that fire needs to returne to forests at intervals consistent with historical fire regimes. But a century of fire suppression has created an enormous backlog of forest acreage with dense tree stands and high fuel loads (Husari and McKelvey 1996). The 1964 federal Wilderness Act recognized the ecological role of fire and established a policy allowing natural fires to burn in national parks. NPS has implemented prescribed fires for many years; however, most of the forests needing fire are lower in elevation than most of the wilderness areas. In 1971, USFS policy was amended to allow prescribed fires on national forest lands as well (Caprio and Swetnam 1993; Chang 1996, Kilgore 1973; Skinner and Chang 1996). The results of prescribed fires in the Sierra have shown excellent ecological benefits (Keifer et al. 2000). Yet, while the use of prescribed fire is increasing and considered a necessary tool to restore ecosystems and reduce the risk of uncharacteristic wildfire, it is currently applied to very few forested acres of the Sierra.

Returning fire to forest ecosystems presents great challenges, because of current-day property and safety risks. The fire threat to people and expanding communities in the forests, excessive fuel loads created by fire suppression and past forest management practices, effects on air quality and conflicts with clean-air laws, and liability all impose difficult constraints on the increased use of prescribed fire and allowing natural fires to burn. Even with the best efforts to reduce fire conflicts and risks, in many areas, reintroducing fire will not be practical or politically possible, at least as a first treatment. Certainly in some locations, selective timber harvest may have to serve as the surrogate for natural fire to begin the process of restoring ecological diversity to forests. Mechanical thinning, however, will not provide all of fire's ecological benefits.

Recently, research priorities and questions relative to planning and implementing forest/fuels treatments are focusing on designing effective fuels treatment placement in landscapes under real world constraints; the historic and appropriate size of high-severity burn patches in a landscape with an active mixed-severity fire regime; planning for climate change; and better understanding historical forest conditions and fire regimes, and their relevance for management (North et al. 2012).

Climate Change

Climate change across the province is expected to occur as described below. These changes and their ecological impacts will likely interact with the other pressures described in this section, and in some cases will create a negative feedback (e.g., climate change could accelerate the spread of invasive species).

The climatic changes presented below will likely affect all conservation targets identified in this province. Climate change has only been included as a pressure for a subset of targets that are considered more vulnerable to climate impacts, and/or in instances where it was determined that interactions between climate change and other pressures could be addressed in a meaningful way through a conservation strategy.

Temperature

Average annual temperatures in the Central Valley are expected to increase 1.4 to 2.0°C (2.5 to 3.6°F) by 2070, and 1.5 to 4.5°C (2.9 to 7.9°F) by 2100 (PRBO 2011). January average temperatures are projected to increase 2.2 to 3.3°C (4 to 6°F) by 2050 and 4.4 to 6.7 °C (8°F and 12°F) by 2100. July average temperatures are projected to increase 3.3 to 3.9°C (6 to 7°F) in 2050 and 6.7 to 8.3°C (12°F to 15°F) by 2100 (CalEMA 2012). Within the Sierra Nevada and foothills region, topographic and elevation diversity are expected to vary the magnitude of temperature change at a very fine spatial resolution. Average annual temperatures are expected to increase 1.8 to 2.4°C (3.2 to 4.3°F) by 2070, and 3.6 to 3.8°C (6.5 to 6.8°F) by 2100 (PRBO 2011).

In the Northern Sierra, January average temperatures are projected to increase 1.4 to 2.2°C (2.5 to 4°F) by 2050 and 3.3 to 3.9°C (6°F to 7°F) by 2100. The largest changes are observed in the southern part of the region. July average temperatures are projected to increase 2.2 to 2.8 (4 to 5°F) by 2050 and 5.6°C (10°F) by the end of the century, with the greatest change in the northern part of the region (CalEMA 2012).

In the Southeast Sierra: January increase in average temperatures: 0.8 to 1.4°C (1.5 to 2.5°F) by 2050 and 2.8 to 5.6°C (5 to 10°F) by 2100. July average temperatures are projected to increase 1.7 to 2.8°C (3 to 5°F) by 2050 and 4.4 to 5.6°C (8 to 10°F) (CalEMA 2012).

Precipitation and Snowpack

Holly Gellerman, CDFW

Within the Central Valley, lower-elevation areas are projected to experience declines in annual precipitation of 2.5 to 5 cm (1 to 2 inches) by 2050 and up to 8.9 cm (3.5 inches) by 2100, while more elevated areas are projected to experiences losses of up to 25.4 cm (10 inches).

In the Northern Sierra, precipitation decline is projected throughout the region. The amount of decrease varies from 7.6 to 12.7 cm (3 to 5 inches) by 2050 and from 15 to 25 cm (6 to 10 inches) by 2100, with the larger rainfall reductions projected for the southern portions of the region. Snowpack levels are projected to decline dramatically in many portions of the region. In southern portions of the region, a decline of nearly 15 inches in snowpack levels – a more than 60 percent drop – is projected by 2090 (CalEMA 2012).

In the southeastern Sierra potential precipitation decline is between 0 and 10 cm (4 inches) by 2050 and 2.5 to 38 cm (1 and 15 inches) by 2100. The range varies widely depending on location. Some areas receive less than 15 cm (6 inches) annually, with projected reductions bringing totals under 10 cm (4 inches) by 2090. In other areas, total rainfall exceeds 114 cm (45 inches) per year and is projected to decrease by roughly 38 cm (15 inches) by 2090. Snowpack levels are projected to decline dramatically by 2090 in some areas, with declines of over 50 percent (CalEMA 2012).

Freshwater Hydrologic Regimes

In the Sierra Nevada, the considerable loss in snowpack is projected to decrease the duration and magnitude of flows. Approximately 20 percent decrease in runoff and riverflow is expected by 2090. The combined effect of changes in precipitation, temperature, and snowpack are expected to produce an earlier arrival of annual flow volume by as much as 36 days by 2071–2100; and, warmer temperatures and more precipitation falling as rain rather than as snow are also projected to cause snowmelt runoff to shift earlier under all model simulations (PRBO 2011). Declining snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and increase reliance on groundwater resources in the Central Valley, which are often already overdrafted (PRBO 2011).

Wildfire Risk

Within the eastern portion of the Central Valley, an increase in wildfire risk of four to six times current conditions is projected (CalEMA 2012).

In the Northern Sierra, wildfire risk is projected to increase in a range of 1.1 to 10.5 times throughout the region, with the highest risks expected in the northern and southern parts of the region. In the Southeastern Sierra, wildfire risk is projected to increase substantially (up to 19.1 times) by 2085 over current levels in Alpine County and the northern part of Mono County. The rest of Mono County and all of Inyo County is projected to have a wildfire risk between 1.1 to 4.8 times greater than current levels (CalEMA 2012).

In the Sierra Nevada overall, the probability of large fires (>200 hectares) is projected to increase by 2100, more so on the west slope and in the foothills; and, up to 50 percent increase in area burned is projected in the eastern Sierra Nevada by 2070-2090. Over the longer term, however, these conditions may lead to vegetation shifts that support less severe wildfire regimes (PRBO 2011).

Central Valley

Although climate change is already affecting wildlife throughout the state (Parmesan and Galbraith 2004), and its effects will continue to increase, it has particular significance for this region's major river and estuarine systems.

In general, California winters will likely become warmer and wetter during the next century. Instead of deep winter snowpacks that nourish valley rivers through the long, dry summer, most of the precipitation will be winter rain that runs off quickly. For the Central Valley, this means more intense winter flooding, greater erosion of riparian habitats, and increased sedimentation in wetland habitats (Field et al. 1999; Hayhoe et al. 2004).

Hotter, drier summers, combined with lower river flows, will dramatically increase the water needs of both people and wildlife. This is likely to translate into less water for wildlife, especially fish and wetland species. Lower river flows will allow saltwater intrusion into the Bay and Delta, increasing salinity and disrupting the complex food web of the estuary. Water contaminants may accumulate during the summer as the natural flushing action decreases.

Sea level worldwide during the past 100 years has been rising from 1 to 2 millimeters per year, 10 times faster than the rate over the past 3,000 years. Gauges along the California coast have already measured 4-inch to 6-inch increases in sea level since 1900 (NOAA 2005). By 2100, sea levels might rise as high as 3 feet above their present levels (ACIA 2004; IPCC 2001).

Sierra Nevada

While climate change will undoubtedly affect all regions of the state, the consequences for vegetation, wildlife, and water resources will likely be most dramatic in the Sierra Nevada. Depending on the model and assumptions, scientists project the average annual temperature in California to rise between 4 and 10.5°F above the current average temperature by the end of the century (Hayhoe et al. 2004; Schneider and Kuntz-Duriseti 2002; Turman 2002). Within 50 years, average wintertime temperatures are expected to rise between 2 and 2.5°F. A rise in this range would substantially reduce annual snowpack and increase fire frequency and intensity. By mid-century, the Sierra snowpack could be reduced by 25 percent to 40 percent and by as much as 70 percent at the end of the century (duVair 2003). Snow season would be shortened, starting later and melting sooner, while fire season would be longer and hotter. The reduction of snowpack and more extreme fire conditions would have cascading effects on water resources, plant communities, and wildlife.

The average annual Sierra snowpack, which is roughly equal to half the storage capacity of all the state's reservoirs combined, holds water until the melt in late spring and early summer. Rising temperature has already begun to reduce the total snowpack and melt it earlier in the year, further shifting stream- and river-flow regimes throughout the Sierra (Stewart et al. 2004; Vanrheenen et al. 2004). As the runoff comes earlier, spring and summer stream flow is projected to decline by 10 percent to 25 percent by 2050 and decline by potentially as much as 40 percent to 55 percent by the end of the century (duVair 2003). The changing flow regimes will alter riparian and aquatic ecosystems. Streams may be reshaped by different timing and intensity of flood conditions, while some perennial streams may dry up and transition to ephemeral streams no longer supportive of many aquatic species (Turman 2002). One strategy to alleviate these effects would rely on maintaining and restoring healthy mountain meadows, which act like sponges and would help to hold water later into the dry season.


Janine Waller, NPS

Average annual temperature is a key element that determines plant communities found across the elevation gradient of the Sierra Nevada. As temperature rises, alpine and sub-alpine plant communities will shrink as mixed conifer forest expands higher in the range. Alpine and sub-alpine plant communities may decline by 40 percent to 50 percent by mid-century. Oak woodlands may move higher, replacing pine and fir forest. At the lower elevations, the longer, warmer dry season could lead to increased fire frequency, likely converting some shrub communities to grasslands (du Vair 2003; Turman 2002). The expected changes in fire regimes will likely alter the abundance and distribution of plant communities, affecting habitats for wildlife (McKenzie et al. 2004; Miller and Urban 1999).

As climate change shifts annual average temperatures along the elevation gradient, as fire reshapes plant communities, and as stream flow regimes change, habitats and wildlife populations will be substantially affected.

Housing and Urban Areas; Annual and Perennial Non-Timber Crops

Central Valley

The main underlying cause of habitat loss and degradation is the increasing human population and its high demand for a limited supply of land, water, and other natural resources.

Up until the last few decades, much of the terrestrial habitat loss in the region has been because of agricultural land conversion. Recent land-use trends show a more mixed set of pressures from both urban and agricultural land conversion, depending on the habitat, topography, and proximity to major highways. Some habitats, such as wetlands and floodplains, are receiving increased environmental protection and thus less development pressure than other habitats (Landis and Reilly 2003). On the floor of the Central Valley, urbanization occurs mostly on previously cultivated lands, where much of the habitat has already been lost or highly degraded. In these areas, particularly in rural lands, the remaining fragments of habitat continue to be converted to intensive agriculture. In the eastern uplands and foothills of the Central Valley, urban and rural residential development has had a greater impact on habitat because it occurs generally on grasslands and other naturally vegetated lands.

The rate of population growth in the Central Valley and the Sierra Nevada is remarkable. Fifteen of the top 20 fastest-growing counties in California between 1990 and 2003 were in the Central Valley, all exceeding the statewide average growth rate. This pattern is likely to remain the same during the next 50 years. Between 1990 and 2003, the Central Valley gained 1.8 million residents, nearly 30 percent of the total gain statewide. By comparison, the San Francisco Bay Area gained 974,000 residents, and the Southern California coastal region gained 3 million. By 2050, the Central Valley will gain an additional 7.4 million people, exceeding the 7.1 million-person gain for Southern California and the 3.2 million-person gain of the Bay Area (California Department of Finance [CDOF] 2000; CDOF 2003; CDOF 2004; Sanders 2004). This region grew by approximately 2.8 percent from 2010 to 2014. Six counties exceeded the statewide average growth rate of 2.9 percent from 2010 to 2014 (Placer, Kern, Tulare, San Joaquin, Fresno, and Merced. Placer County had the highest growth rate in the state at 5.1 percent. Seven counties within the region had a negative growth rate between 2010 and 2014 (Amador, Sierra, Plumas, Tuolumne, Calaveras, Kings, and Nevada).

Natural habitats of this region have been converted to a variety of different land uses, including weedy pastureland, dryland farming, irrigated cropland, relatively permanent orchards and vineyards, large dairies, rural residential, and high-density urban. Wildlife species have different tolerances for each of these conversions, with many of them unable to adapt to the more-developed land uses. Beyond direct habitat loss, converting land to more intensive human-related uses brings additional stresses, including invasive species, human disturbance, fire suppression, and insect control, which further degrade ecosystem health and wildlife viability.

In the Central Valley, 99.9 percent of the historic native grasslands, 99 percent of valley oak savanna, about 95 percent of wetlands, 89 percent of riparian woodland, 66 percent of vernal pools, and 67 percent of San Joaquin Valley shrublands are gone (CVHJV 1990; Hickey et al. 2003; Kelly et al. 2005; TNC 1987; TNC 1995; TNC 1998). Habitat conversion has continued since these analyses were conducted.

Growth and development fragment habitats into small patches that cannot support as many species as larger patches can. These smaller fragments often become dominated by species more tolerant of habitat disturbance, while less-tolerant species decline. Populations of less-mobile species often decline in smaller habitat patches because of reductions in habitat quality, extreme weather events, or normal population fluctuations. Natural recovery following such declines is difficult for mobility-limited species. Such fragmentation also disrupts or alters important ecosystem functions, such as predator-prey relationships, competitive interactions, seed dispersal, plant pollination, and nutrient cycling (Bennett 1999; ELI 2003).

Growth and development, along with associated linear structures like roads, canals, and power lines, impede or prevent movement of a variety of animals. This is generally less significant than habitat loss but makes it more difficult for those species that need to move large distances in search of food, shelter, and breeding or rearing habitat and to escape competitors and predators. Animals restricted to the ground, like mammals, reptiles, and amphibians, face such obstacles as roads, canals, and new gaps in habitats. Attempts to cross these obstacles can be deadly, depending on the species and the nature of the gap (e.g., four-lane highways with concrete median barriers compared to narrow, rural two-lane roads). Fish and other water-bound aquatic species attempting to move either upstream or downstream are blocked by lack of water resulting from diversions, physical barriers like dams, and by entrainment in diverted water. Even the movement of highly mobile species like birds and bats can be impeded by such features as transmission lines and wind energy farms, particularly in focused flight corridors like Altamont Pass, and 50 new wind energy sites are currently proposed throughout the state on land managed by BLM (CDFG 2005) Such species either cannot see or do not avoid these structures, and many die as a result. The actual extent of bird fatalities because of power-line collision in California is unknown; however, the California Energy Commission (CEC) estimates that fatality rates because of Central Valley power-line collisions alone could reach as high as 300,000 birds per year (CEC 2002a; CEC 2002b).

Sierra Nevada

The Sierra Nevada underwent population growth of 130 percent between 1970 and 1990, compared to the state's average of 49 percent growth over the same period, and growth in the region is expected to continue at a pace exceeding the state average, adding about 175,000 new residents every decade (Duane 1998; SNEP 1996).

The greatest growth and development have occurred in the mostly privately owned western foothills, particularly in the watersheds of the Yuba, American, and San Joaquin rivers, in the Lake Tahoe Basin, and around Lake Almanor. Development pressure is strong in the foothills adjacent to the metropolitan centers of Sacramento, Stockton, Merced, Fresno, and Bakersfield, particularly along the foothill river corridors near these cities. On the Sierra Nevada's east side, growth pressure is greatest between Reno and Susanville and near Bishop.

Ranchette and residential communities are expanding from metropolitan areas of Reno and Redding along Highways 395, 299, and 44 along the eastern foothills and across the northern Sierra Nevada and Cascades (CDFG 2005). New development along these highway corridors is displacing wildlife habitat and creating barriers in important wildlife migration areas. For example, development along Highway 395 south of Susanville hinders the seasonal migration of deer across the Bass Hill Wildlife Area. Key wildlife corridors in the region are crossed by highways. Highway 299 descends the Cascades between Mount Lassen and Mount Shasta and winds northeast across the Modoc Plateau (Penrod et al. 2000). As development expands on the private lands adjacent to Highway 299, migrating mule deer, elk, and antelope will be less able to move between seasonal ranges. Without conservation planning, future development along these corridors will likely have a significant impact on the region's wildlife.

In the Sierra Nevada, development is also expanding into the forest. New golf courses, scattered single-family homes, commercial properties, ski resorts, industrial sites, and new roads are replacing and fragmenting wildlife habitat. Where development occurs, fire is suppressed, preventing regeneration of fire-dependent vegetation and altering plant communities. Development also requires new water diversions and creates new sources of pollution. Mountain meadows, oak woodlands, and riparian streams are places of high wildlife diversity, and they are also preferred sites for development.

As seasons change, the survival of many mammal, bird, and fish species depends on their ability to migrate between higher and lower elevations in the Sierra Nevada. But opportunities to migrate successfully have been compromised by dams, reservoirs, highways, altered stream flows, residential community development, and predation by free-roaming domestic pets.

For 150 years, the west-slope foothills have been the most seriously affected area of the Sierra Nevada, with cattle ranching having the greatest presence. Western foothill development has fragmented riparian corridors and other habitats (Kattelman 2000). Much of the development on the western slope of the Sierra Nevada has degraded oak woodlands, lower mixed conifer forests, and similar habitats that support more wildlife diversity than other plant communities of the region. More than 350 species of birds, mammals, reptiles, and amphibians inhabit the oak woodlands (CalPIF 2002). The Sierra Nevada Ecosystem Project documented that 85 terrestrial vertebrate species require west-slope foothill savanna, woodland, chaparral, or riparian habitats to retain population viability, and 14 of these species are at risk of extinction.

Many early homestead settlements in the high Sierra Nevada clustered in level areas close to water, areas that are also particularly important for wildlife habitats, including meadows and areas along rivers and streams. While most higher-mountain habitats are public lands managed by federal agencies, these older settled areas remain largely in private ownership. Today, these private lands, surrounded by national forests, are prized for development.

Development in the Sierra Nevada over the last three decades has been primarily via incremental single-home and small commercial development, lacking the benefit of regional conservation planning. Low-density development has been the norm. Such development has resulted in greater fragmentation of the landscape and its corresponding negative consequences for wildlife. In many locations throughout the foothills, larger land holdings are being broken up into smaller parcels for single homes. In other areas, mountain meadows and pastures are being converted to golf courses and residential communities.

Development also exacerbates existing stresses on wildlife and habitats. Invasive plant species are often introduced along new roads and with new landscaping. Invasive species outcompete native species in development-disturbed lands. Additional domestic water use further reduces water available for aquatic ecosystems.

Growth has also increased the need to suppress fire, thereby expanding the conflict with efforts to restore more natural fire regimes in these fire-adapted ecosystems. Adding residents to the region will likely result in more citizen resistance to prescribed fire and more objections to the smoke it generates.

The severity of future development's effects on species at risk will depend on whether conservation planning is embraced and if growth allowed by counties is designed to account for fire, to protect ecosystems, and to minimize further fragmentation of habitats.

Invasive Plants/Animals

Invasive plant and animal species are an important pressure on wildlife in this province, just as they are in other regions throughout the state (CALFED 2000; CalIPC 1999; CDFG 2005; Goals Project 1999; Hickey et al. 2003; Jurek 1994; Lewis et al. 1993; RHJV 2004). Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

Central Valley

Invasive plants can be found in many different habitats in this region. In grasslands, some of the more challenging plant invaders include eucalyptus, fountain grass, gorse, medusahead, tree of heaven, and yellow starthistle. In riparian and wetland areas, invading plants include edible fig, giant reed or arundo, Himalayan blackberry, pampas grass, Russian olive, tamarisk (or saltcedar), pennyroyal, pepperweed, tree of heaven, Scotch broom, and French broom. Oak woodlands are invaded by plants such as Scotch broom, French broom, pepperweed, medusahead, barbed goat grass, and yellow star thistle.

Introduced plants also invade aquatic habitats. These aquatic invaders include Brazilian waterweed, egeria, Eurasian watermilfoil, hydrilla, water hyacinth, water pennywort, and parrot feather.

Introduced animals have invaded both terrestrial and aquatic environments. Not all introduced vertebrates are invasive, and they have varying effects on wildlife. The species of most concern in the region parasitize songbird nests, dominate limited nesting habitat, prey on native species, or otherwise damage wildlife habitats.

Fifty-one new fish species have become established in California (Moyle 2002), dominating most of the rivers and streams in this region. These include species such as striped bass, white catfish, channel catfish, American shad, black crappie, largemouth bass, and bluegill. Many fish were historically introduced (via stocking) by federal and state resource agencies to provide sport fishing or forage fish to feed sport fish. Many introduced non-native fish and amphibians may out-compete native fish for food or space, prey on native fish (especially in early life stages), change the structure of aquatic habitats (increasing turbidity, for example, by their behaviors), and may spread diseases (Moyle 2002). However, not all non-native species are considered invasive, which typically refers to species whose introduction causes or is likely to cause economic or environmental harm to human health. Several of the introduced predatory fish may have increased predation levels on Chinook salmon and other native fishes (CALFED 2000).

In addition to introduced fish, native aquatic species are stressed by introduced bullfrogs, red-eared sliders (a turtle), and invertebrates. Introduced invertebrates, such as New Zealand mud snail, quagga mussels, Asian clam, zebra mussel, Chinese mitten crab, and mysid shrimp, are causing significant problems for native species in rivers, streams, and sloughs. While not all of the introduced aquatic species are invasive or have significant consequences for native species, biologists are concerned about the sheer dominance of these new species and their current and potential effects on the structure and function of the estuarine ecosystem.

Sierra Nevada

Invasive plants have transformed plant communities and contributed to the decline of native species in ecosystems of the Sierra Nevada. Foothill oak woodlands and riparian plant communities, so important for maintaining wildlife diversity, have been particularly affected by invasions of non-native grasses and shrubs. High desert shrublands on the east side of the Sierra have also been altered by invasive grasses. Sub-alpine and alpine plant communities, however, are relatively intact, with few invasive plants (Schwartz et al. 1996).

The understory of foothill woodlands of blue oak, interior live oak, valley oak, and gray pine are now dominated by wild oats, fescue, cheatgrass, and other invasive non-native grasses. Scotch broom and yellow starthistle have also degraded the Sierra Nevada foothills (Bossard et al. 2000; DiTomaso and Gerlach 2000). Both weed species displace native species and are toxic to browsing wildlife. Saltcedar, Russian olive, giant reed, eucalyptus, and English ivy are among the invasive plants that have invaded low- and mid-elevation riparian habitats. On the east side of the Sierra, the combined effects of invasive cheatgrass—which outcompetes native perennial and annual grasses—and livestock grazing have contributed to changes in fire regimes and transformed desert scrub and grassland communities.

Generally, invasive plants that replace native plants degrade habitat quality for native species. Some wildlife species are dependent on specific native plants. Other animal species become stressed when the invasive plants offer inferior nutrition or nesting or prey habitat. In some areas, invasive annual grasses make for greater fuel loads compared to native vegetation, which increases the intensity of fires and causes further ecological changes.

The introduction of non-native fish to lakes and streams has significantly affected the aquatic life of the province. In the past, decades of stocking fish for recreational fishing have contributed to the decline of native fish and frog species in the province. Stocking of trout into historically fishless high mountain lakes has contributed to the extirpation of native amphibians in some basins, with particularly severe consequences for the once-common mountain yellow-legged frog (Milliron 1999; Milliron et al. 2004; Vredenburg 2004). By consuming the native amphibians and aquatic insects, the predatory trout also are negatively affecting the western terrestrial garter snake and some birds and bats that depend on these prey species (Mathews et al. 2001).

Historic stocking of non-native rainbow trout (hatchery-raised or not native to a particular watershed), brook trout, and brown trout into native trout waters has degraded native trout populations through predation and interbreeding. The introduced eastern brook trout outcompetes the native Lahontan cutthroat trout. Introduced rainbow trout have interbred with and altered the genetics of Lahontan cutthroat trout, Paiute cutthroat trout, and three subspecies of golden trout in portions of their historical ranges. In western foothill streams, introductions of non-native sunfish and other non-native species have seriously threatened the continued existence of native minnow and amphibian populations. Many of these are now either listed as threatened or as species of special concern (CDFG 2005).

CDFW conducted a Sierra-wide field study of amphibians, trout, and other fauna in the high mountain lakes. The multiyear project, begun in 1998, has completed initial surveys of the Sierra Nevada's 10,000 high-mountain lakes that are not located in National Parks. The results of the study are serving to inform Aquatic Biodiversity Management Plans that are being prepared for the high mountain watersheds of the Sierra. Also, as a result of this study and others, less than 10 percent of the high mountain lakes stocked prior to 1998 are currently being stocked. The goal of these plans is to protect and restore native amphibians and other fauna while maintaining thriving recreational fisheries where appropriate. The results of the field studies have yielded information needed to design management plans that will achieve both of these goals. Lakes isolated by fish barriers and where non-native trout reproduction is absent have been identified for restoring native fauna. Other lakes and streams have been designated for non-native trout eradication efforts. Lakes identified as popular with anglers or where conflicts with native fauna restoration are absent are managed to maintain or improve their fisheries. Implementation of the completed aquatic biodiversity management plans and the completion of additional plans are contingent upon future funding and staffing.

Livestock, Farming, and Ranching

The effects of grazing on wildlife vary from beneficial to detrimental, depending upon how grazing is managed, including the seasonality and duration of grazing and the type and number of livestock. These effects also depend on the relative sensitivities of individual wildlife species, because not all species respond the same way to grazing. Well-managed livestock grazing can benefit sensitive plant and animal species, particularly by controlling annual grasses and invasive plants where these have become established, and by removing understory growth to create a fire-resilient landscape. These working lands are an essential part of the solution to conserving the state's wildlife.

While recognizing the values of compatible grazing practices, this plan focuses on the negative impacts of pressures affecting wildlife species at risk. Thus, the following discussion describes those situations where excessive grazing practices result in stresses to species. Excessive grazing, as used here, refers to livestock grazing at a frequency or intensity that causes degradation of native plant communities, reduces habitat values for native wildlife species, degrades aquatic or other ecosystems, or impairs ecosystem functions. (The term "overgrazing" has a different meaning; it usually refers to the productivity of the forage crop and range condition.)

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Over the past 150 years, grazing on forests, shrublands, and grasslands of the Sierra Nevada has been characterized as excessive and unsustainable, destroying native vegetation and degrading meadows and streams (Menke et al. 1996). At one time, millions of sheep and cattle grazed throughout the Sierra forests, on private and public lands of oak woodlands of the western foothills to high mountain meadows and the east-side high-desert slopes. Sheep and cattle grazing were unregulated on public lands until after the establishment of USFS in 1905, and livestock numbers continued to exceed sustainable levels and reduce forage quality as late as the 1960s. On the western foothills and on higher forest lands, shrubs were often cleared with fire or herbicides to expand rangelands or to respond to brush encroachment on overgrazed lands (Burcham 1982; Menke et al. 1996).

Today, livestock numbers have been lowered to levels that are more sustainable for livestock forage and production (Kondolf et al. 1996; Menke et al. 1996). However, grazing continues to have negative consequences for forage, cover, and nest sites for dozens of wildlife species throughout much of the Sierra Nevada. Plant communities and ecosystems that are particularly important for sustaining wildlife diversity, including riparian, aspen, meadow, aquatic, and oak woodland habitats, continue to be subject to livestock grazing.

The 1996 SNEP found that "over-grazing in mountain meadows is a threat to many rare species that are restricted to these habitats." Sierra high mountain meadows and plant communities evolved without the kind of grazing pressure caused by livestock. Yet, as described by USFS, "the riparian and meadow systems are the key livestock forage areas within allotments above 4,000-foot elevations. Studies have shown that 50 percent to 80 percent of the herbage used comes from these meadow systems, which constitute a small percentage (generally less than 5 percent) of the allotment area. In the Sierra Nevada forests, the meadow systems cover an estimated 2 percent of the allotment areas" (USFS 2001).

The SNEP and the SNFPA also found that aquatic and riparian habitats are particularly affected by livestock grazing. Cattle are attracted to the lush forage, water, and shade of riparian habitat. In late summer and fall, especially when upland habitats have dried out, cattle can decimate riparian plant communities, grazing and trampling meadows, converting meandering meadow streams into eroded channels, and stripping forage and cover needed by wildlife. The erosion increases sediment runoff, degrading aquatic ecosystems.

Revised riparian grazing standards and guidelines were implemented by USFS in the late 1990s and early 2000s and those standards and guidelines have made significant changes on the management of grazing lands in the Sierra Nevada. The standards and guidelines establish limits of the percentage of meadow forage production that can be used, sets a minimum residual height for vegetation following grazing, and limits the percentage of new vegetation growth that can be browsed. In addition, between 2000 and 2013 livestock animal unit months (AUMs) on National Forests in California have declined by 28 percent (Tate et al. 2015).

Livestock grazing is affecting the composition of plant communities important for wildlife diversity. Where livestock grazing is excessive, forage often becomes scarce, and both livestock and deer consume young aspen shoots, hindering the regeneration of aspen stands. Excessive grazing is a factor in reducing the regeneration of blue oak and many other plant species throughout the predominantly privately owned foothill region (CDFG 2005; McCreary 2001). Livestock compact soils and remove leaf litter, making conditions less than optimal for germination of acorns and new growth. Livestock also consume acorns and young oak saplings.

Several aquatic, riparian, and meadow-dependent species are at risk in the Sierra region (USFS 2001). Half of the occupied willow flycatcher nest sites in meadow and riparian areas in the Sierra Nevada continue to be grazed by cattle or sheep. Knapp and Mathews (1996) concluded that grazing at current levels is degrading streams and riparian components to the detriment of California golden trout. Wet meadow and stream areas for the Yosemite toad, a state species of special concern and federally listed species, are also grazed (USFS 2004b). The SNEP project concluded that “livestock grazing has been implicated in plant compositional and structural changes in foothill community types, meadows, and riparian systems, and grazing is the primary negative factor affecting the viability of native Sierran land bird populations” (SNEP 1996).

Livestock grazing also negatively affects native species by transmitting diseases to wild animals. *Pastuerella*, a bacteria transmitted from domestic sheep, has had a devastating effect on bighorn sheep in the Sierra Nevada. Efforts to reintroduce bighorn sheep to the Lava Beds National Monument and the Warner Mountains have failed as a result of disease transmission (Bleich et al. 1996; NCBSIAG 1991).

For the last decade, a major multiagency effort has implemented a recovery program for the Sierra Nevada bighorn sheep. Currently, there are 300-350 bighorn sheep in seven herds along the steep terrain of the eastern Sierra. The greatest threat to the survival of these endangered bighorn sheep is domestic sheep grazing nearby on public and private lands. The domestic sheep are still permitted to graze on allotments within the range of the wild bighorn sheep. If the California bighorn are exposed to these domestic sheep, pastuerellosis could wipe out the contacted wild sheep population within a few weeks (CDFG 2005).

Recreational Activities

The mountains and wildlands of the Sierra Nevada are very popular recreation destinations. National parks, wilderness areas, and wildlife areas provide recreational opportunities while also providing greater protection for wildlife. The public develops a better understanding and appreciation for wildlife by visiting these natural areas.

Recreational activities are diverse, from traditional ones like fishing, hiking, and back-packing to those requiring more infrastructure and visitor services, such as fixed camps, ski resorts, golf courses, and off-highway vehicle (OHV) areas. Some types of recreation have grown significantly in the last few decades, such as mountain biking and OHV use; the numbers of OHV users have risen several-fold over the past 30 years.

Accordingly, the effects of recreation on wildlife and ecosystems are diverse and increasing in many areas. Ski-resort runs and infrastructure crisscross steep mountains, and golf courses have replaced some mountain meadows. Vegetation is removed and soils are eroded along creeks in popular camping areas, and more land is cleared for recreation infrastructure. Recreation technologies, such as all-terrain vehicles, snowmobiles, and lighter, warmer, and waterproof camping gear and clothing, have allowed people to drive, mountain bike, ski, camp, and hunt in wild areas that years ago were natural refuges, too remote to be affected by recreation activities.

Recreation has consequences for soils, vegetation, wildlife, and aquatic resources. Soils become compacted or eroded, and habitat is cleared in areas that are heavily used by motorized vehicles, packhorses, and campers. A number of recreation activities inadvertently cause nest- or den-abandonment, displace wildlife from important foraging or watering sites, and interfere with migratory corridors (Leung and Marion 2000).

Providing more recreational opportunities while protecting wildlife habitats and aquatic ecosystems requires that sufficient resources be devoted to planning, management, and enforcement. Federal and state land agencies construct parking lots and restrooms, establish information kiosks, build and sign roads and trails, and manage garbage and sewage to accommodate recreational visitors. Additionally, there is an increased need for wildlife agencies to provide wildlife education to keep visitors safe and minimize their effects on species at risk.

5.4.6 Conservation Strategies

Conservation strategies were developed for 17 conservation targets in the Central Valley and Sierra Nevada Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted pressures. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.4-5 through 5.4-17 show the relationships between the stresses and the pressures for each target. Table 5.4-18 summarizes conservation strategies for the province. Strategies for the Sierra Nevada Ecoregion focus on the higher elevation areas (approximately 5,000 feet and above).

Target: American Southwest Riparian Forest and Woodland

Goals:

- By 2025, acres of functional riparian habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres of connected riparian habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres/miles with total dissolved solids (meeting TMDL) are decreased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire property and/or easements, including protection of land or water real property or rights through conservation easement.

Objective(s):
- Increase the acreage of valley riparian habitat protected through fee title or conservation easement.
- Protect high quality valley riparian habitat through fee title or conservation easement.

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; invasive plants/animals; livestock, farming, and ranching.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Acquire water rights focused on improving in-stream flow for fish and riparian habitat.

Objective(s):
- Water rights are acquired by CDFW to improve in-stream flow for fish and riparian habitat.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Identify priorities for acquisition.
- Coordinate with refuge water working groups.
- Advocate for "water for wildlife."
- Review existing in stream flow requirements.

Conservation Strategy 3 (Data Collection and Analysis): Conduct research focused on informing the development of new or updating of existing best management practices (BMPs) for invasive species, grazing, and water flow.

Objective(s):
- Collect and analyze adequate data to inform the development of new or updating existing invasive species BMPs.
- Collect and analyze adequate data to inform the development of new or updating of existing grazing BMPs.
- Collect and analyze adequate data to inform the development of new or updating of existing water flow BMPs.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals; dams and water management/use.

Conservation action(s):
- Identify study questions.
- Develop study design.

- Coordinate with experts.
- Conduct literature review.

Conservation Strategy 4 (Outreach and Education): Provide education and outreach for the conservation of natural resources.

Objective(s):

- Private landowners have increased knowledge in the identification and management of invasive species compared to 2015 levels.
- Public awareness and knowledge of the values of riparian habitats is increased from 2015 levels.
- The public is participating in monitoring invasive species and rapid response.
- The public has increased knowledge of grazing BMPs.
- The public has increased knowledge of wildlife-friendly land use policy compared to 2015 levels.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals; annual and perennial non-timber crops.

Conservation Strategy 5 (Law and Policy): Improve effective law enforcement focused on: complying with water rights and Section 1600 agreements, eliminating illegal water diversions, and increasing Law Enforcement Division (LED) staffing levels.

Objective(s):

- There is 100 percent compliance with water rights.
- There is 100 percent compliance with Section 1600 agreements.
- Illegal water diversions are reduced by 100 percent.
- LED staffing levels are increased by 50 percent.

Targeted pressure(s): Recreational activities; dams and water management/use.

Conservation action(s):

- Include BMPs as enforceable condition of Lake and Streambed Alteration Agreements.
- Include BMPs as enforceable condition of water right permit/license.
- Coordinate with LED.
- Advocate for opportunities to improve prosecutions of environmental laws and illegal diversions.
- Identify partners to improve enforcement capabilities.
- Evaluate and increase LED staffing levels.

Conservation Strategy 6 (Direct Management): Manage invasive species.

Objective(s):

- Develop and implement BMPs to control or eradicate invasive species.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Conduct assessment of the distribution and type of invasive species.
- Coordinate with National Resources Conservation Service (NRCS) and other agencies.
- Identify existing invasive species management plans and ongoing activities.
- Support existing efforts or develop and implement invasive species control management plan.
- Treat invasive species for removal.

Conservation Strategy 7 (Direct Management): Manage water flows.

Objective(s):

- Allow more flows to support riparian habitat.
- Restore critical flow dynamics to benefit riparian ecosystem functions, and incorporate climate considerations into water flow management practices.

Targeted pressure(s): Dams and water management/use.

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Conservation action(s):

- Coordinate with State and Federal Water Projects, counties and local water districts.
- Coordinate with Floodsafe and local flood agencies.
- Identify and prioritize critical streams to restore flow dynamics.
- Assess opportunities for dam removal on smaller streams.
- Identify or create working groups focused on flow and ecological function.
- Identify and review existing local groundwater policies to inform future policy recommendations.
- Encourage setback levees to restore hydrological and geomorphic function.

Conservation Strategy 8 (Management Planning): Develop and implement Habitat Conservation Plans (HCPs) (Central Valley Flood Protection Plan, South Sacramento HCP, San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, Bay Delta Conservation Plan [BDCP], Yolo, Solano, Butte, and Yuba-Sutter HCPs).

Objective(s):

- Riparian habitats are included and conservation measures proposed in the development of valley floor HCPs.
- The FERC re-license process is streamlined to better incorporate riparian conservation actions.
- Projects identified in the HCPs/NCCPs are compatible with ecosystem conservation requirements.
- Climate change adaptation strategies are incorporated into the conservation planning documents and activities by local, state and federal agencies.
- Invasive species are eradicated or controlled in riparian habitat areas.
- Riparian habitat is addressed and conservation measures are included in the Bay Delta Conservation Plan.

Targeted pressure(s): Housing and urban areas; utility and service lines; roads and railroads; recreational activities.

Conservation Strategy 9 (Management Planning): Provide input on local planning. Lead or participate in land use planning for rural, urban, or agricultural lands (e.g., provide input on local land use plans; develop county-wide zoning plans; participate in workgroup regarding low impact development siting).

Objective(s):

- Staff from local-governments are informed and knowledgeable about important wildlife habitats (riparian).
- Local policies are in place that protect important wildlife (riparian) habitats.

Targeted pressure(s): Housing and urban areas; utility and service lines; roads and railroads; recreational activities; annual and perennial non-timber crops; invasive plants/animals.

Table 5.4-5 Stresses and Pressures for American Southwest Riparian Forest and Woodland

Priority Pressures	Stresses												
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics							Ecosystem Conditions and Processes				
	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in water levels and hydroperiod	Change in water temperature	Change in groundwater tables	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents	X			X			X	X		X			
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X	X		X		X	X	X		X	X
Dams and water management/use	X	X	X	X	X	X			X	X		X	X
Household sewage and urban waste water	X			X			X	X		X	X		
Housing and urban areas	X	X	X	X		X		X	X	X		X	X
Invasive plants/animals				X					X	X	X	X	
Livestock, farming, and ranching	X		X				X		X	X	X		X
Logging and wood harvesting	X									X			
Roads and railroads	X	X								X		X	X
Utility and service lines										X			X

Target: Freshwater Marsh

Goals:

- By 2025, acres of freshwater emergent wetland habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, population abundance of key species (SGCN) is increased by at least 5 percent from 2015 population.
- By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5 percent from 2015.
- By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, population of key species (beaver) is increased by at least 5 percent from 2015 population.
- By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5 percent from 2015 acres/miles.
- By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Outreach and Education): Provide outreach and education.

Objective(s):

- Influence public awareness of proper land management for freshwater marshes by providing information to landowners regarding BMPs and proper wetland management.

Targeted pressure(s): Other ecosystem modifications; livestock, farming, and ranching.

Conservation action(s):

- Target Buckeye Conservancy and RCDs.
- Design and produce brochures with wetland conservation message.
- Employ web-based media for providing information to public.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Purchase land and conservation easements.

Objective(s):
- Improve land management by removing invasive species and creating better grazing practices.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Prioritize with Conceptual Area Protection Plan (CAPP) and Environmental Site Assessment.

Conservation Strategy 3 (Law and Policy): Advocate for laws and policies.

Objective(s):
- Strengthen regulatory authority over wetlands and integrate beaver ecology into wetland restoration activities.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Evaluate and update Wetlands Policy.
- Implement wetland and riparian technical memorandum.
- Review and modify CDFW policy on beaver depredation.
- Update wetlands implementation policy.

Conservation Strategy 4 (Management Planning): Develop management plans.

Objective(s):
- Develop BMPs for ecosystem management on CDFW lands.
- BMPs would provide guidance on managing CDFW lands for multi-species use and benefit both recreation and conservation of native species.

Targeted pressure(s): Invasive plants/animals; livestock, farming, and ranching; annual and perennial non-timber crops; climate change.

Conservation action(s):
- Revise Land Management Plan (LMP) guidelines to include ecosystem management.
- Update LMPs to be consistent with new guidelines for managing at an ecosystem level.
- Develop policy on ecosystem management on public lands.

Conservation Strategy 5 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):

- Provide economic incentives through restoration grants.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Table 5.4-6 Stresses and Pressures for Freshwater Marsh

Priority Pressures	Stresses											
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics						Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in pollutants	Change in nutrients	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure and composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents	X		X			X	X			X		
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X	X	X	X		X	X	X	X	X
Dams and water management/use	X	X	X	X	X			X	X	X	X	X
Household sewage and urban waste water	X		X			X	X			X		
Housing and urban areas	X	X	X	X	X	X		X	X	X	X	X
Invasive plants/animals	X		X					X	X	X	X	
Livestock, farming, and ranching	X	X		X			X			X	X	
Mining and quarrying	X					X						
Roads and railroads	X	X		X					X	X	X	X

Target: Chaparral; Desert Transition Chaparral; Montane Chaparral; California Foothill and Coastal Rock Outcrop Vegetation

Goals:

- By 2025, acres of macrogroup habitat (target) are maintained or increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired connectivity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition, easement, or lease.

Objective(s):

- Clear management and monitoring plans are developed.
- Funds are allocated by agency leadership for management and monitoring.
- Priority sites are put in easements.
- Sufficient funds are obtained.
- At each annual review, the easement or lease is in compliance.

Targeted pressure(s): Housing and urban areas; renewable energy.

Conservation action(s):

- Develop inter-regional and inter-agency team to develop priorities.
- Develop Conceptual Area Protection Plan (CAPP) for Great Valley.
- Develop protection criteria for conservation easements.
- Develop restoration and management plans.

Conservation Strategy 2 (Data Collection and Analysis): Collect and analyze data regarding the target.

Objective(s):

- Appropriate audiences are accessing data.
- Data are being used to inform conservation actions.
- Recommendations for conservation action have been developed.
- Research provides answer to relevant questions.
- The proposal includes management needs and outcomes that have been identified with input from relevant data users.

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; fire and fire suppression; renewable energy; invasive plants/animals.

Conservation action(s):
- Use data to inform state and federal land managers.
- Develop conservation strategies to reduce any pressures to target habitat that may be cumulative to climate change (e.g., recreation, grazing).

Conservation Strategy 3 (Direct Management): Conduct direct resource management.

Objective(s):
- Management actions are implemented, including the following:
    - implement measures to manage fire frequency (controlled burns or fuel management as appropriate),
    - control invasive species to prevent the spread of fire and invasive species,
    - conduct managed thinning and grazing,
    - remove non-native species, and
    - conduct resource assessments to inform management decisions.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):
- Manage fire frequency to recur no more than every 20 years.
- Minimize and control invasive species.
- Maintain and improve community structure and composition, and soil nutrient concentrations.
- Develop plans for fire management to avoid controlled burns and to favor fire avoidance measures in areas near human centers are developed.

Conservation Strategy 4 (Management Planning): Work with partners on the development of large landscape conservation planning. Develop or update management plans to integrate the effects of climate change. Development of management plans for species, habitats and natural processes. Develop a management plan for SGCN or its habitat. Reintroduction, relocation, or stocking of native animals or plants to an area where they can better adapt. Translocate/breed in captivity a SGCN to establish new populations in suitable habitat. Restore SGCN to historically occupied habitats.

Objective(s):
- Management plans include appropriate strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- Plan recommendations are being used to inform conservation actions.
- Within the first year and ongoing thereafter, fire management actions favor fire avoidance measures in areas near human centers.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):
- Prepare plan recommendations (management strategies, action and monitoring plans) to reach the right people in right format.

Conservation Strategy 5 (Partner Engagement): Engage conservation partners, including state and federal agencies, tribal governments, the non-governmental organization (NGO) community, and other partners to achieve shared objectives and broader coordination across overlapping areas. Establish partnership to co-monitoring species/habitats on federally managed lands. Establish decision-making processes with other public and private entities to determine or implement strategies. Convene an advisory committee to assist with implementation of strategies.

Objective(s):

- A joint, mutually agreed on project is developed and implemented (e.g., invasive plant early detection program is implemented).

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; fire and fire suppression; renewable energy; invasive plants/animals.

Table 5.4-7 Stresses and Pressures for Chaparral; Desert Transition Chaparral; Montane Chaparral; California Foothill and Coastal Rock Outcrop Vegetation

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Annual and perennial non-timber crops		X	X	X	X
Climate change	X	X	X	X	X
Fire and fire suppression	X	X	X	X	X
Housing and urban areas	X	X			X
Invasive plants/animals	X	X	X	X	X
Renewable energy		X	X	X	X

Target: California Foothill and Valley Forests and Woodlands

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species (oaks) are increased by at least 5 percent from 2015 population.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of water yield are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Economic Incentives): Provide economic incentives to landowners for managing grazing at to maintain appropriate levels of residual dry matter.

Objective(s):

- Provide economic incentives to landowners for managing grazing at to maintain appropriate levels of residual dry matter.

Targeted pressure(s): Livestock farming and ranching; invasive plants/animals.

Conservation action(s):

- Outreach to landowner regarding programs.
- Fund priority projects.
- Monitoring of effectiveness and compliance.
- Review and update CDFW's Private Lands Management (PLM) program.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Conservation Strategy 2 (Direct Management): Conduct ecologically sound controlled burns on CDFW lands.

Objective(s):

- Conduct ecologically sound controlled burns on CDFW lands.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Prioritize candidate locations.
- Conduct pre-burn baseline inventories.
- Coordinate with BLM and CAL FIRE.
- Complete Environmental Assessment.
- Prepare burn plan in coordination with CAL FIRE.
- Evaluate and perform relevant BMPs.
- Plan and conduct post-fire monitoring.

Conservation Strategy 3 (Direct Management; Outreach and Education): Conduct demonstration management, including providing public demonstrations of successful BMPs and scientifically documenting environmental change from implementation of BMPs.

Objective(s):

- Provide public demonstrations of successful BMPs.
- Scientifically documenting environmental change from implementation of BMPs.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):

- Develop monitoring study design.
- Identify existing demonstration programs.
- Develop implementation plan for BMPs and budget.

Conservation Strategy 4 (Land Acquisition/Easement/Lease): Purchase and provide long-term conservation of land.

Objective(s):

- Provide long-term conservation of land.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):

- Develop CAPP or Land Acquisition Evaluation (LAE).
- Refer to Wildlife Conservation Board (WCB).
- Evaluate consistency with regional priorities.
- Develop management plan for purchased lands.

Conservation Strategy 5 (Land Acquisition/Easement/Lease): Protect land through conservation easements.

Objective(s):

- Protect land through conservation easements.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals

Conservation action(s):

- Develop CAPP or LAE.
- Coordinate with WCB.
- Evaluate consistency with regional priorities.
- Develop management plan for acquired lands/easements.

Conservation Strategy 6 (Outreach and Education): Provide education and outreach, including introduce landowners and leasee to new or existing BMPs for grazing; inform public of incentive programs available to them; educate recreation focused landowners on wildlife-BMP's; and keep CDFW staff current on relevant science (e.g., on restoration techniques, science).

Objective(s):

- Work with landowners and leasee to implement BMPs for grazing.
- Inform public of incentive programs available to them.
- Educate recreation focused landowners on wildlife-BMPs.
- Keep CDFW staff current on relevant science (e.g., restoration techniques, etc.).
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 7 (Partner Engagement): Establish partnership: develop partnerships with agencies and organizations to enhance opportunities (currently BLM, RCDs, UCD, Audubon, and Blue Ridge Berryessa Partnership [BRBP]).

Objective(s):

- Develop partnerships with agencies and organizations to enhance opportunities (currently BLM, RCDs, UCD, Audubon, and BRBP).

Targeted pressure(s): Recreational activities; invasive plants/animals; livestock, farming, and ranching.

Conservation action(s):

- Engage partnerships through attendance at BRBP meetings.
- Participate in internal revamping of PLM program.
- Encourage use of CDFW's Shared Habitat Alliance for Recreational Enhancement program.

Table 5.4-8 Stresses and Pressures for California Foothill and Valley Forests and Woodlands

Priority Pressures	Stresses						
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes				
	Changes in natural fire regime	Changes in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X	X	X	X	X	X
Housing and urban areas	X		X	X			X
Invasive plants/animals	X	X		X	X	X	
Livestock, farming, and ranching	X		X	X	X	X	X
Recreational activities	X			X		X	
Roads and railroads				X			X

Target: North Coastal Mixed Evergreen and Montane Conifer Forests

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity (increase rotation age) are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat (with increased recruitment of oaks, aspen, and shrubs) are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired water yield are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition and conservation easements, including increasing the amount of key conifer areas protected through purchase or conservation easement. Key conifer areas include old-growth forest, watercourse zones, and nest sites.

Objective(s):

- Increase the amount of key conifer areas protected through purchase or conservation easement. Key conifer areas include old-growth forest, watercourse zones, and nest sites.

Targeted pressure(s): Logging and wood harvesting.

Conservation action(s):

- Identify potential areas, identify what is already conserved.
- Develop HCPs and advanced mitigation plans.
- Develop interdisciplinary team to facilitate land acquisition and conservation.
- Develop database to track acquisition/tracking.
- Develop protection criteria (uniformity in wording) for conservation easement language: standardizing, complete, doable, executable, legally enforceable, protection criteria.
- Develop CAPP or LAE.

Conservation Strategy 2 (Data Collection and Analysis): Conduct research regarding effective target management.

Objective(s):

- Research efficacy of different techniques to manage forest and reduce uncharacteristic fire; document the response of wildlife post-fire.
- Document response of wildlife to different types of logging.
- Document baseline conditions and monitor trends of SGCN using occupancy as a metric.
- Document baseline conditions and monitor trends of the conifer forests ecosystem.

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Conservation action(s):

- Develop study and monitoring design.
- Work with federal agencies and add wildlife component to ongoing/funded research.
- Conduct pilot research project.
- Sustain ongoing relevant monitoring and resources assessment work.

Conservation Strategy 3 (Outreach and Education): Provide education and outreach for the conservation of natural resources.

Objective(s):

- Educate the public on the ecological effects of fire and on recent landscape changes.
- Relate fire management to beneficial uses of wildlife.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):

- Coordination with federal agencies and private landowners.
- Identify objectives/goals for outreach and education strategy.
- Develop key message, identify target audience.
- Conduct field trips and workshops.
- Develop brochures and web content.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies; coordinate with agencies to allow fires to burn when possible.

Objective(s):
- Coordinate with agencies to allow fires to burn when possible.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Identify and work with agencies to review and modify their existing policies.
- Prioritize areas that can be allowed to burn.
- Link to education and outreach strategy.
- Coordinate with local Air Quality Management Districts to consider ways to allow for more prescriptive burn days.

Conservation Strategy 5 (Law and Policy; Partner Engagement): Engage in decision-making process to achieve shared objectives and broader coordination across overlapping area; cooperate with federal agencies and private landowners on where controlled burns and forest thinning would be most beneficial to wildlife.

Objective(s):
- Cooperate with federal agencies and private landowners on where controlled burns and forest thinning would be most beneficial to wildlife.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Coordinate with federal agencies, private landowners, and Fire Science Centers.
- Engage in forest treatment priorities and elevate wildlife.
- Work with USFS to identify possible treatment areas.
- Establish ways to identify and prioritize high value wildlife habitat.

Conservation Strategy 6 (Management Planning; Partner Engagement): Develop management plans and improve existing fire management plans.

Objective(s):
- Improve existing fire management plans; identify high value wildlife habitat.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Coordinate with state and federal agencies.
- Coordinate with partners to prevent intense wildfires to protect wildlife habitat, water quality, and recreation opportunities.
- Engage USFWS about listed species and management indicator species.
- Identify high value forested wildlife habitats.

Table 5.4-9 Stresses and Pressures for North Coastal Mixed Evergreen and Montane Conifer Forests

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X		X	X
Livestock, farming, and ranching	X	X	X	X	X
Logging and wood harvesting	X	X	X	X	X
Renewable energy					X
Utility and service lines		X			X

Target: Alpine Vegetation

Goals:

- By 2025, connected acres are maintained or increased by 5 percent within the ecoregion from 2015 acres.
- By 2025, acres of macrogroup (target) are maintained or increased by 5 percent within the ecoregion from 2015 acres.
- By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained or increased by 5 percent within the ecoregion from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Gather more information on alpine vegetation habitat, particularly on the physical and biological variables affected by climate change.

Objective(s):

- Within 10 years of research initiation, answers to relevant question are provided, appropriate audiences are accessing information, and data are being used to inform conservation actions. In particular, information is obtained on: macrogroup (target) habitat requirements and impacts to climate change on the macrogroup (target) and KEAs in the province, soil moisture regime and area requirements of target as a whole, soil temperature regime and area and requirements of target as a whole, snow pack levels and snow cover period requirement for habitat maintenance, minimal seasonality and weather regimes required to maintain target habitat, changes in the KEAs and area and extent of target in relation to current weather changes from climate change.

Targeted pressure(s): Climate change.

Conservation action(s):

- Develop conservation strategies to reduce any threats to alpine vegetation habitat that may be cumulative to climate change (e.g., recreation, grazing).
- Use data to inform state and federal land managers.

Conservation Strategy 2 (Outreach and Education): Engage urban citizens on climate change; expand conservation education programs (e.g., in grade schools) to include climate change.

Objective(s):

- Target audience receives the message, has desired attitudes and values, and continues the desired behavior.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreation activities.

Conservation Strategy 3 (Economic Incentives): Develop economic incentives to reduce the impacts of climate change within California.

Objective(s):

- Economic incentives are developed and provided, are implemented in a manner that is consistent with design, and the desired pressure reduction is observed.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Direct Management): Restore subalpine and alpine meadows, including restoration/enhancement of degraded habitats, monitoring populations, and removing barriers to species movement.

Objective(s):

- Management actions are implemented.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):

- Prioritize restoration of subalpine and alpine meadows.
- Remove non-native or invasive species.
- Add fencing to restrict livestock and human access to sensitive areas.
- Prioritize early detection of invasive species.
- Add BMPs for assisting vegetation shift from impending climate change.

Conservation Strategy 5 (Direct Management; Management Planning): Manage grazing and invasive species, remove trails, restrict grazing and pack animal use of subalpine and alpine meadows on public lands, remove trail and campground use away from subalpine and alpine meadows, and treat and remove invasive species.

Objective(s):

- Management actions are implemented.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 6 (Management Planning): Develop or update management plans to integrate the effects of climate change.

Objective(s):

- More information is obtained on local climate change impacts; management plans include appropriate strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- Plan recommendations are being used to inform conservation actions.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Conservation Strategy 7 (Partner Engagement): Establish partnerships to co-monitor alpine vegetation habitat on state and federal lands.

Objective(s):

- Mutually agreed upon partnership and monitoring strategy is developed.
- Engaging with the partner, monitoring is implemented.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Conservation action(s):

- Monitor extent of alpine vegetation habitat.

Conservation Strategy 8 (Training and Technical Assistance): Provide training on science-based applications and tools for climate change and natural resources management.

Objective(s):

- Target audience (land managers) that were trained have knowledge consistent with the training.
- Target audience (land managers) has adopted or continued actions consistent with the training.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Table 5.4-10 Stresses and Pressures for Alpine Vegetation

Priority Pressures	Stresses				
	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Climate change	X	X	X		X
Commercial and industrial areas		X	X		X
Invasive plants/animals	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X
Recreational activities	X		X		

Target: Pacific Northwest Subalpine Forest

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on climate-related impacts to species and habitats in the red fir/subalpine conifer zone, to better predict future distribution and viability and inform land acquisition and other strategies.

Objective(s):

- Proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- The research provides answers to relevant questions.
- The appropriate audiences are accessing data.
- Recommendations for conservation actions have been developed.
- The data are being used to inform conservation actions.

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 2 (Data Collection and Analysis): Collect data to evaluate effects of fuels treatments in the red fir zone, and whether treatments can partly offset climate-related increases in fire severity in the red fir zone.

Objective(s):

- Proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- The research provides answers to relevant questions, appropriate audiences are accessing data.
- Recommendations for conservation actions (e.g., fuels treatments) have been developed.
- The data are being used to inform conservation actions (e.g., fuels treatments).

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 3 (Economic Incentives): Develop economic incentives to reduce greenhouse gas emissions in California.

Objective(s):

- Economic incentives are developed and provided.
- The target population is using economic incentives.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Land Use Planning): Provide input on local land use plans to incorporate climate change; provide local assistance grant funds for participation in general plan updates favoring natural resource conservation and climate change.

Objective(s):

- Local land use planners receive input on land use plans from CDFW.
- Land use plans consistent with input provided by CDFW are approved.
- Plans are implemented in a manner consistent with the input.

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 5 (Direct Management): Implement fuels treatments in red fir forest, if determined to be effective (see "Data Collection and Analysis").

Objective(s):

- Implement management actions.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 6 (Management Planning): Develop or update management plans to integrate the effects of climate change.

Objective(s):

- The management plan/project includes clear management needs and outcomes that have been identified with input from relevant data users (particularly information on local impacts from climate change and management actions that exacerbate climate change impacts to KEAs specifically in the Sierra Nevada).
- Management plans include appropriate strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- The management plan, appropriate audiences are accessing data.

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 7 (Partner Engagement): Establish partnership to co-monitor target habitat on state and federal lands.

Objective(s):

- Mutually agreed upon partnership and monitoring strategy is developed and implemented.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 8 (Environmental Review): Review projects for potential increases in greenhouse gas emissions; require mitigation as needed.

Objective(s):

- Input on environmental review document is provided.
- An environmental review document is approved that is consistent with the input provided.
- The plan is implemented in a manner that is consistent with the input.
- The behavior of local entity is consistent with input.

Targeted pressure(s): Climate change.

Conservation Strategy 9 (Training and Technical Assistance): Provide science-based applications and tools for climate change and natural resources management.

Objective(s):

- Target audience (land managers) that was trained has knowledge consistent with the training.
- Target audience (land managers) has adopted or continued actions consistent with the training.

Targeted pressure(s): Climate change; fire and fire suppression.

Table 5.4-11 Stresses and Pressures for Pacific Northwest Subalpine Forest						
Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Change in biotic interactions (altered community dynamics)
Climate change	X	X	X	X	X	X
Fire and fire suppression	X	X	X	X	X	X
Parasites/pathogens/diseases	X			X		X
Recreational activities				X		

Target: Wet Mountain Meadow; Western Upland Grasslands

Goals:

- By 2025, acres of habitat (meadows) are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species (hydrophilic vegetation for SGCNs) are increased by at least 5 percent from 2015 population.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime are increased by at least 5 percent from acres/miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with suitable soil characteristics (reduced sediment input) are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of discharge are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition and conservation easements, with emphasis on restoring and protecting degraded wet meadow habitat and conserving high-quality wet meadow.

Objective(s):

- Restore and protect degraded wet meadow habitat, with focus on riparian areas that have the greatest ecological potential such as larger impaired systems and those that support SGCN.
- Conserve high-quality wet meadow habitat.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Coordinate with Regional Water Quality Control Board.
- Develop CAPP or LAE.
- Identify existing conserved areas to form linkages.
- Identify and prioritize areas of conservation emphasis (ACE).
- Direct and use conservation banking to address impacts to wet meadow habitat.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data on wet meadows and wildlife: establish baseline inventory of wet meadows and research ecosystem services of wet meadows (e.g., carbon sequestration).

Objective(s):

- Establish baseline inventory of wet meadows, and research ecosystem services of wet meadows (e.g., carbon sequestration).

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 3 (Outreach and Education): Provide education and outreach to broad resource users on multiple-use policy and educate the public on the beneficial use of fire.

Objective(s):

- Provide specific outreach to leaseholders and private landowners on grazing practices that benefit wildlife,
- Provide outreach to broad resource users on multiple-use policy, and
- Educate the public on the beneficial use of fire.

Targeted pressure(s): Parasites/pathogens/diseases; fire and fire suppression.

Conservation action(s):

- Coordinate with various Sierra Prescribed Fire Councils

Conservation Strategy 4 (Direct Management): Enhance habitat: improve water quality and temperature, coordinate water storage and timing of release to improve meadow hydrology, improve surface water recharge, reduce erosion and bank cutting, restore meadow hydrology, and improve resiliency of meadows to flood events.

Objective(s):

- Improve water quality and temperature, coordinate water storage and timing of release to improve meadow hydrology, improve surface water recharge, reduce erosion and bank cutting, restore meadow hydrology, and reduce effects of extreme events (improve resiliency of meadows to flood events).

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with state, federal, and local agencies and private landowners.
- Consult hydrologist and soil scientists.
- Develop methodology for meadow restoration/enhancement.
- Conduct temperature modeling to determine optimal flows.

Conservation Strategy 5 (Direct Management): Restore meadows impacted by roads and railroads: reduce sediment from existing and abandoned roads from entering meadows, restore hydrology altered by legacy roads and railroads, develop BMPs for road maintenance, and reduce the overall presence of roads and railroads in meadows (new and existing).

Objective(s):

- Reduce sediment from existing and abandoned roads from entering meadows.
- Restore hydrology altered by legacy roads and railroads.
- Develop BMPs for road maintenance.
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.
- Reduce the overall presence of roads and railroads in meadows (new and existing).

Targeted pressure(s): Roads and railroads.

Conservation action(s):

- Coordinate with high meadow landowners.
- Conduct road inventory and evaluation.
- Conduct post-treatment monitoring.

Conservation Strategy 6 (Direct Management): Manage invasive species.

Objective(s):

- Control invasive and problematic native vegetation (introduced from roads, pack animals, livestock feed).
- Control invasive fish and wildlife (livestock, pack animals, non-native fish).
- Prevent wet meadow habitat degradation.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Conduct invasive and problematic native plant removal projects.
- Construct exclusion fencing.
- Monitor post project habitat conditions.
- Link to education and outreach.
- Advocate BMPs for grazing practices.
- Minimize road access.
- Identify specific locations impacted by non-native species.

Conservation Strategy 7 (Management Planning): Implement grazing practices that benefit meadow ecosystems (conduct managed grazing).

Objective(s):

- Reduce grazing impacts to wet meadow function and structure (including impacts to vegetation and stream bank erosion and sedimentation).
- Implement practices to reduce cattle use of meadows.

Targeted pressure(s): Mining and quarrying; livestock, farming, and ranching.

Conservation action(s):

- Coordinate with USFS, NRCS, RCDs, and private landowners.
- Consult with UC Extension.
- Link to education and outreach strategy.
- Identify and work with existing stakeholder groups, watershed groups, and others involved in meadow conservation.
- Review and update grazing management practices that benefit wildlife.
- Promote meadow restoration in standard practices.

Conservation Strategy 8 (Management Planning): Provide input on grazing management plans.

Objective(s):

- Reduce adverse impacts from allotment grazing practices.
- Improve enforcement of grazing lease conditions.
- Permanently retire problematic grazing allotments.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Coordinate with federal agencies to better link grazing leases, BMPs, standard practices, and Lake and Streambed Alteration Agreements.
- Conduct review of proposed allotment leases.
- Coordinate with development of total maximum daily load (TMDL).
- Work with federal agencies to amend/alter lease criteria that favor conservation.
- Coordinate with NRCS to implement Standard Practices and provide incentives.
- Incentivize rotational grazing, seasonal resting.
- Advocate for improved capacity within federal agencies in range specialists.
- Develop/support education and outreach in cooperation with NRCS and UC Cooperative Extension to leaseholders and private landowners on management practices that benefit wildlife.
- Review existing science and support ongoing research on grazing practices in high elevation meadows.
- Work with Cattlemen’s Association and California Rangeland Conservation Coalition to explore efficacy of developing grass banks.

Table 5.4-12 Stresses and Pressures for Wet Mountain Meadow; Western Upland Grasslands

Priority Pressures	Stresses										
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics				Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in groundwater tables	Change in nutrients	Change in soil moisture	Change in sediment quality	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development
Agricultural and forestry effluents			X		X						
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X
Catastrophic geological events	X		X				X		X	X	X
Dams and water management/use	X		X	X	X		X	X	X	X	X
Fire and fire suppression	X	X					X	X	X	X	X
Housing and urban areas	X	X	X	X	X	X		X	X	X	X
Industrial and military effluents			X								
Invasive plants/animals (non-native species)		X					X			X	
Invasive plants/animals* (native species)				X			X		X	X	X
Livestock, farming, and ranching	X	X	X		X	X	X	X	X	X	X
Logging and wood harvesting	X	X	X				X		X	X	X
Mining and quarrying					X						X
Parasites/pathogens/ diseases					X		X				X
Recreational activities		X						X		X	X
Roads and railroads	X		X							X	X

* This addresses native species encroachment

Target: Clear Lake Native Fish Assemblage

Goals:
- By 2025, acres of habitat (wetland) are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat (riparian) are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species (tule perch, prickly sculpin, and Clear Lake hitch) are increased by at least 5 percent from 2015 population.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, water flow of Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake County is increased by at least 5 percent during spring and early summer season so that native fish species could more effectively migrate in these creeks.
- By 2025, miles with desired stream stage (in Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake Co. during spring and early summer season) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level water quality are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles with desired channel pattern are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Purchase land and/or acquire easements.

Objective(s):
- Acquire riparian water rights by purchasing lands along the critical streams.
- Protect riparian areas by acquiring land adjacent to critical streams.
- Acquire appropriative water rights in the watershed.
- Reduce water diversions from the critical streams during late spring to summer.

Targeted pressure(s): Strategy acts directly on target.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):
- Educate the public on the need for water management BMPs, impacts associated with their activities, and impacts of invasive species introductions on native species.
- Keep the public informed on development/status of water management BMPs.

Targeted pressure(s): Dams and water management/use; invasive plants/animals; recreational activities; annual and perennial non-timber crops.

Conservation Strategy 3 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Reduce economic burdens on original owners in upgrading water systems to meet BMP standards while enhancing parcel values.
- Provide incentives for water users to leave water in streams during critical seasons (late spring and summer).

Targeted pressure(s): Dams and water management/use; annual and perennial non-timber crops.

Conservation Strategy 4 (Law and Policy): Increase Law Enforcement Division (LED) staffing levels and implement effective law enforcement related to: illegal water diversions, illegal fishing, and invasive species introductions; compliance with Section 1600 agreements; and compliance with water rights.

Objective(s):
- Ensure compliance with water rights and Section 1600 agreements.
- Reduce illegal diversions.
- Increase LED staffing levels.

Targeted pressure(s): Recreational activities; invasive plants/animals; dams and water management/use; annual and perennial non-timber crops; mining and quarrying.

Conservation action(s):
- Include BMPs as enforceable condition of Lake and Streambed Alteration Agreements.
- Include BMPs as enforceable condition of water right permit/license.
- Advocate for opportunities to improve prosecutions of environmental laws.
- Identify partners to improve enforcement capabilities.
- Evaluate and increase LED staffing levels.

Conservation Strategy 5 (Direct Management): Manage invasive species.

Objective(s):
- Manage invasive species to improve conditions for native fish.
- Prevent additional future invasive species from becoming established in Clear Lake.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Update data on extent and distribution of native and non-native species in Clear Lake.
- Examine alternative strategies for removal of non-native fish species and aquatic weeds.
- Coordinate with Lake County and private landowners.
- Conduct post treatment monitoring.
- Initiate long-term monitoring and management plan.
- Implement mechanical and chemical treatment of invasive weeds.

Conservation Strategy 6 (Direct Management): Control damage to creeks from OHV use.

Objective(s):

- Limit sediment entering creeks from OHV crossings.
- Limit access to creeks by OHVs.

Targeted pressure(s): Recreational activities.

Conservation action(s):

- Identify and close unauthorized roads.
- Identify locations where creek crossings could be constructed.
- Coordinate with federal and state partners.
- Link to education and outreach strategy.
- Coordinate with LED.

Conservation Strategy 7 (Direct Management): Develop BMPs for increased spring/summer flows for improved lake and fish health, improved fish passage, and water diversions.

Objective(s):

- Increase spring/summer flows for improved lake and fish health, improve fish passage (e.g., remove barriers created for diversions).
- Develop BMPs for water diversions.

Targeted pressure(s): Dams and water management/use; annual and perennial non-timber crops.

Conservation action(s):

- Develop agreement between partners to work together on BMPs.
- Look for existing management plans and evaluate their scope and success.
- Link to education and outreach plan to keep public informed.
- Develop options for optimal timing of diversions.
- Develop options for maintaining fish passage around diversion barriers.
- Identify water conservation actions.

Conservation Strategy 8 (Partner Engagement): Establish collaborative partnerships.

Objective(s):

- Understand stakeholders' diverse needs and how to meet those needs while meeting BMP standards.
- Develop trust among agencies and other stakeholders.

Targeted pressure(s): Dams and water management/use; recreational activites; annual and perennial non-timber crops.

Table 5.4-13 Stresses and Pressures for Clear Lake Native Fish Assemblage

Priority Pressures	Stresses									
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics					Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water chemistry	Change in water levels and hydroperiod	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure and composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X
Dams and water management/use	X	X		X			X	X	X	X
Invasive plants/animals							X	X	X	X
Mining and quarrying	X		X			X		X		
Recreational activities	X	X					X	X		X

Target: Carson River Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish population are increased by at least 5 percent from 2015 miles in the Carson River basin.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5 percent from 2015 acres/miles (consistent with TMDL).
- By 2025, acres/miles with total dissolved solids are decreased by at least 5 percent from 2015 acres.
- By 2025, miles with desired stream stage are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Purchase land and/or acquire easements: acquire water rights by purchasing lands along the critical Carson River tributaries, acquire conservation easements to protect riparian areas in the Carson River Basin, acquire large mountain meadow ranches for conservation, and acquire water storage rights in the Carson River Basin.

Objective(s):

- Acquire (by CDFW and partners) water rights by purchasing lands along the critical Carson River tributaries.
- Acquire conservation easements to protect riparian areas in the Carson River Basin.
- Acquire large (> 500 acres) mountain meadow ranches for conservation (e.g., Charity Valley, Pleasant Valley, Wolf Creek Meadows).
- Acquire water storage rights in the Carson River Basin.

Targeted pressure(s): Dams and water management/use; housing and urban areas.

Conservation action(s):

- Develop CAPP.
- Survey the interests from willing sellers.
- Partner with land trusts or NGOs for acquisition and management.
- Partner with Sierra Nevada Conservancy and TNC.

Conservation Strategy 2 (Data Collection and Analysis): Conduct research on SGCN; study the distribution and abundance of mountain whitefish and mountain sucker in the Carson River Basin, and the susceptibility of the Carson River Basin to invasive species.

Objective(s):

- Natural Resource Managers understands mountain whitefish, mountain sucker, and other SGCN distribution and abundance in the Carson River basin.
- Natural Resource Managers understands the susceptibility of the Carson River basin to invasive species.

Targeted pressure(s): Introduced genetic material; invasive plants/animals.

Conservation Strategy 3 (Outreach and Education): Conduct outreach; inform public of issues related to introduced genetic material, risks of invasive species, and importance of aquatic biodiversity management plants.

Objective(s):

- Introduced genetic material is reduced.
- The public is knowledgeable about the importance of aquatic biodiversity management plans and the risks of invasive species.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation Strategy 4 (Law and Policy): Implement effective law enforcement related to: illegal water diversions, illegal fishing, and introduction of invasive species in the Carson River Basin; compliance with 1600 agreements; and compliance with water rights.

Objective(s):

- Reduce illegal diversions in the Carson River basin.
- Reduce illegal fishing in the Carson River basin.
- Reduce invasive species in the Carson River basin.
- Increase LED staffing levels to enforce fishing regulations and Section 1600 regulations.
- Achieve compliance with Section 1600 agreements.
- Achieve compliance with water rights.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 5 (Direct Management): Restore native species; manage invasive species and restore/maintain native fish populations in target streams.

Objective(s):

- Remove non-native trout species from select streams (tributaries of the Carson and East Carson Rivers).
- Implement BMPs to prevent future contamination by invasive species.
- Restore native fish to target streams.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):

- Update data on extent and distribution of native and non-native species in the Carson Basin.
- Non-native trout removal strategy from selected waters developed.
- Coordinate with USFS, BLM, County and private landowners.
- Conduct post-treatment monitoring.
- Develop reintroduction and genetic management plan for native species.
- Initiate long-term monitoring and implement management plan.
- Link to education and outreach strategy.

Conservation Strategy 6 (Direct Management): Enhance habitat, improve water quality and temperature consistent with the Basin Plan, and coordinate water storage and timing of release between CDFW and water agencies to benefit fish habitat and water users.

Objective(s):

- Water quality and temperature are improved and consistent with the Basin Plan.
- Water storage and timing of release is coordinated by water agencies and CDFW to benefit fish habitat and water users.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Conduct temperature modeling to determine optimal flows.
- Coordinate with USFS, BLM, Alpine County, and private landowners.
- Coordinate water releases from Red, Heenan, Lost, and Kinney Lakes.

Conservation Strategy 7 (Direct Management): Manage dams and other barriers to fish passage.

Objective(s):
- Fish barriers are removed on private lands and water agencies agree to increase bypass flows based on gains made through water conservation.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Coordinate with USFS, BLM, Alpine County and private landowners.
- Inventory barriers and assess flow and water condition.
- Obtain funding for CDFW management plan.
- Implement water conservation flow.

Conservation Strategy 8 (Direct Management): Reintroduce Lahontan cutthroat trout and Paiute cutthroat trout to their historic ranges.

Objective(s):
- Reintroduce native fisheries of Lahontan cutthroat trout and Paiute cutthroat trout to their historic ranges.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):
- Conduct feasibility analysis to identify target streams.
- Identify source population or propagate.
- Evaluate eradication methods for non-native species.
- Develop reintroduction plan including post treatment monitoring.
- Coordinate with agencies and NGOs.

Conservation Strategy 9 (Management Planning): Develop basin management plans.

Objective(s):
- Develop and implement a basin-wide fisheries management plan.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):

- Coordinate with USFS, BLM, Alpine County, and CDFW Fisheries Branch.
- Facilitate regional sub-committee to develop plan.
- Conduct stakeholder meetings.
- Implement trout management plan.

Conservation Strategy 10 (Training and Technical Assistance): Provide training to staff and managers on non-native genetic issues, invasive species management and control techniques, and fish identification.

Objective(s):

- Introduction of non-native genetic material is in the Carson River Basin.
- Staff has knowledge and skills on techniques for modeling, invasive species management/control techniques, and fish identification.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Table 5.4-14 Stresses and Pressures for Carson River Native Fish Assemblage

Priority Pressures	Stresses									
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics				Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water temperature	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Agricultural and forestry effluents	X				X	X		X		
Annual and perennial non-timber crops	X		X	X	X	X	X	X	X	X
Dams and water management/use	X		X	X			X	X	X	X
Fire and fire suppression	X	X	X							X
Household sewage and urban waste water	X		X		X	X				
Housing and urban areas	X	X	X			X	X	X		X
Introduced genetic material							X	X	X	
Invasive plants/animals		X					X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X		X			
Mining and quarrying	X					X	X			X
Roads and railroads	X			X		X	X	X		

Target: Walker River Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish population (SGCN) are increased by at least 5 percent from 2015 miles.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles connected (i.e., past barriers) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on the impacts of diversions, water management, water use, and the distribution of introduced genetic material on the native fish community.

Objective(s):

- Understand the impacts of diversions, water management and water use to the native fish community.
- Understand the distribution of introduced genetic material and impacts to the native fish community within the hydrologic unit.

Targeted pressure(s): Introduced genetic material; invasive plants/animals; dams and water management/use.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education on native aquatic resource conservation efforts.

Objective(s):

- Ensure that the public is aware, concerned, and participating in native aquatic resource conservation efforts within the hydrologic unit.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 3 (Law and Policy): Implement effective enforcement of laws.

Objective(s):

- Increase Law Enforcement Division capacity to allow greater enforcement of water laws.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Identify laws and regulations governing riparian areas and work with governing agencies to apply effectively.
- Design and implement instream flow studies to collect empirical evidence to support/defend enforcement actions to protect aquatic public trust resources.
- Increase the number of branch and regional scientific staff working on water rights and instream flow studies.
- Make recommendations to enhance enforcement of existing laws and regulations.
- Provide law enforcement with maps of critical problem areas.
- Provide funding for CDFW enforcement to enforce laws protecting streams and flows.
- Develop Law Enforcement Division Academy curriculum emphasizing water law.
- Conduct Office of Training and Development (OTD) training for non-enforcement water policies.

Conservation Strategy 4 (Direct Management): Manage water for beneficial uses by native aquatic species.

Objective(s):

- State and federal agencies manage water for beneficial uses by native species (e.g., provide adequate water for species survival). Engage with the Walker Lake Acquisition/Transfer Program under desert terminal lakes program.

Targeted pressure(s): Dams and water management/use; recreational activities; invasive plants/animals.

Conservation action(s):

- Coordinate with water agencies.
- Identify/coordinate with key stakeholders.
- Collaborate with state and federal agencies for management plan development and review.
- Identify and quantity water needs for native SGCN, non-SGCN, and introduced trout species.
- Evaluate existing occupied habitats.

Conservation Strategy 5 (Direct Management): Translocate or reintroduce native fish species.

Objective(s):

- Establish self-sustaining and genetically viable native fish populations in the basin.

Targeted pressure(s): Dams and water management/use; recreational activities; invasive plants/animals.

Conservation actions:

- Identify source populations.
- Remove invasive or problematic species from historic native fish habitat.

- Create georeferenced map/data base for native fish habitats.
- Complete basin-wide native fish surveys, and develop basin plan for native fish management.
- Obtain funding for strategy implementation.
- Coordinate management actions with natural resource agencies, NGOs and private landowners.
- Collect/analyze genetic data to define priorities.

Conservation Strategy 6 (Direct Management): Remove introduced brook trout in the context of recovery of listed Lahontan cutthroat trout.

Objective(s):

- The extent and distribution of invasive species are known and a plan is developed by federal agencies and land owners to remove or control invasive species within the hydrologic unit.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Update data on extent and distribution of native and non-native species.
- Develop strategy for removal.
- Coordinate with USFS and private landowners.
- Secure permits and conduct environmental review.
- Conduct post-treatment monitoring.
- Initiate long-term monitoring and management plan.
- Monitor for re-establishment of invasive species.
- Develop a management and control plan for invasive species.

Conservation Strategy 7 (Direct Management): Implement direct management activities to restore aquatic habitats and ensure that SGCN are maintained or enhanced.

Objective(s):

- Direct management activities to restore aquatic habitats are implemented to ensure SCGN are maintained or enhanced within hydrologic unit.

Targeted pressure(s): Introduced genetic material.

Conservation Strategy 8 (Management Planning): Ensure that planning and decision-making processes support the conservation of stream habitats and flows as a result of CDFW input.

Objective(s):

- Ensure that planning and decision-making processes support the conservation of stream habitats and flows as a result of CDFW input.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 9 (Management Planning): Develop or update and implement grazing BMPs.

Objective(s):

- Land managers within the hydrologic unit implement BMPs for grazing practices that reduce impacts to aquatic habitats.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Identify partners and stakeholders.
- Identify and review existing grazing management policies.
- Develop MOU/MOA between partners.
- Schedule regular working group meetings.
- Develop BMPs including enforcement policy.
- Provide input to land management agencies on grazing policies.
- Link to education and outreach strategy.

Conservation Strategy 10 (Management Planning): Reduce impacts to native fish as a result of roads and railroads and invasive species through development and use of BMPs.

Objective(s):

- Land managers implement BMPs to reduce impacts to native fish community from roads and railroads.
- BMPs for road and rail maintenance activities are established and used by land managers to reduce impacts to native fish community from invasive species.
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Invasive plants/animals; roads and railroads.

Conservation action(s):

- Collaborate with partner in development of BMPs.
- Collaborate with state and federal agencies and land owners.
- Identify existing BMPs, develop BMPs database.
- Establish working group to define BMPs.

Conservation Strategy 11 (Partner Engagement): Establish and develop co-management partnership to affect change in dams and/or water management and use following interagency agreement.

Objective(s):
- Establish a joint partnership to affect change in dams and/or water management and use following interagency agreement.

Targeted pressure(s): Dams and water management/use.

Table 5.4-15 Stresses and Pressures for Walker River Native Fish Assemblage

Priority Pressures	Stresses											
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics					Ecosystem Conditions and Processes				
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water chemistry	Change in water levels and hydroperiod	Change in groundwater tables	Change in nutrients	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Dams and water management/use	X		X	X	X	X	X	X	X	X	X	X
Introduced genetic material								X	X	X		X
Invasive plants/animals		X	X	X	X	X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X			X				X	X
Roads and railroads	X		X	X	X	X						X

Target: San Joaquin Native Fish Assemblage

Goals:
- By 2025, connected miles of native fish habitat are increased by at least 5 percent from 2015 miles.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level of water yield (flow) are increased by at least 5 percent from 2015 miles.
- By 2025, miles of streams with target fish population are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles of native fish habitat with desired temperature are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Data Collection and Analysis): Gather and analyze data; establish baseline inventory of SGCN and habitat, and pressure distributions.

Objective(s):
- Establish baseline inventory of SGCN and habitat, and threat distributions.

Targeted pressure(s): Household sewage and urban waste water; invasive plants/animals.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):
- Raise public awareness and support for native fish restoration projects.
- Educate the public on the risks of invasive species.
- Educate the public on the importance of aquatic biodiversity management plans.

Targeted pressure(s): Recreational activities; invasive plants/animals.

Conservation action(s):
- Coordinate with federal and county resource agencies, agricultural organizations, and NGOs.
- Install and maintain signs along sensitive areas that receive high recreational use.

Conservation Strategy 3 (Law and Policy): Advocate for effective enforcement of laws related to protection of significant riparian areas.

Objective(s):
- Fewer significant riparian areas are impacted by waste and disturbance.

Targeted pressure(s): Household sewage and urban waste water.

Conservation action(s):
- Identify laws and regulations governing riparian areas and work with governing agencies to apply effectively.
- Make recommendations to enhance enforcement of existing laws and regulations.
- Provide law enforcement with maps of critical problem areas.
- Create an ACE database viewable by all CDFW staff.
- Develop baseline inventory.

Conservation Strategy 4 (Direct Management): Protect and restore floodplain function; implement and maintain priority floodplain restoration projects.

Objective(s):
- Align policies, regulations, and planning and agency coordination to support multi-benefit floodplain management.
- Implement and maintain priority floodplain restoration projects.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 5 (Direct Management): Restore natural flows.

Objective(s):

- Identify streams/stream reaches in greatest need of flow remediation and create a plan for restoration.
- Restored stream reaches will be monitored for recolonization and translocation will be implemented, as necessary, to reestablish populations.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Conduct flow compliance monitoring.
- Conduct fish population monitoring.

Conservation Strategy 6 (Direct Management): Improve fish passage: assess, prioritize, and remove/modify fish passage barriers.

Objective(s):

- Assess, prioritize, and remove/modify fish passage barriers.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Develop barrier assessment protocols.
- Develop barrier removal guidelines, BMPs, and plan to monitor barrier removal effectiveness.
- Coordinate with state, federal agencies, local government, and private landowners.

Conservation Strategy 7 (Direct Management): Control invasive species: assess, map, and develop control plans for invasive aquatic species.

Objective(s):

- Comprehensively assess and map aquatic invasive species distributions and develop an integrated control plan for each.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Develop Invasive Species Coordination Group to streamline and coordinate current agencies, organizations, and activities.
- Implement priority species control plans.
- Prioritize species to focus on.
- Implement top-priority control plans.
- Monitor invasive species and continue removal efforts as needed to control populations.
- Provide outreach and education specific to spread of invasive species.

Conservation Strategy 8 (Management Planning): Provide input on local planning; engage in local planning to encourage the use of bio(soft) engineering for flood control, retention of functional floodplains, and deterrence and capture of waste and pollution.

Objective(s):

- Channel incision is reduced and riparian vegetation is increased in floodplain.
- Fewer significant riparian areas are impacted by waste and disturbance.
- No more than two horizontal interspersion and vertical biotic structure levels are missing for each alliance.
- SGCN diversity improves to historic/normal levels.
- There is a reduction to area that has non-native invasive plant infestations and/or invasive animal species.
- Ephemeral and permanent surface water flows are restored to mimic historic patterns of flooding and low flow patterns (+/- 25 percent). An adequate low flow is maintained to sustain dependent aquatic life.

Targeted pressure(s): Housing and urban areas.

Conservation action(s):

- Encourage use of biofilters for urban runoff.
- Maintain treated effluent flows into riparian.
- Engage in development and implementation of IRWMPs.
- Direct increased resources/staffing towards engagement in local planning.
- Encourage appropriate site-specific native riparian plants for adjacent landscaping.
- Communicate BMPs to local planners.

Table 5.4-16 Stresses and Pressures for San Joaquin Native Fish Assemblage

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics			Ecosystem Conditions and Processes	
	Change in natural fire regime	Change in runoff and river flow	Change in flood occurrence, frequency, and intensity	Change in groundwater tables	Change in community structure and composition	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X	X	X	X
Dams and water management/use		X	X	X	X	X
Household sewage and urban waste water	X	X			X	
Housing and urban development	X	X	X	X	X	X
Invasive plants/animals	X			X	X	
Marine and freshwater aquaculture					X	
Recreational activities	X				X	

Target: Upper Kern River Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish populations are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5 percent from 2015 acres/miles (consistent with TMDL).
- By 2025, acres/miles with total dissolved solids are decreased by at least 5 percent from 2015 acres.
- By 2025, miles with desired stream stage are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Conduct research on SGCN; update genetic status for golden trout; refine distribution for hardhead and Kern River rainbow trout.

Objective(s):

- Natural Resource Management staff understands mountain whitefish, mountain sucker, and other SGCN distribution and abundance.
- The susceptibility to invasive species is understood.

Targeted pressure(s): Introduced genetic material; invasive plants/animals.

Conservation Strategy 2 (Outreach and Education): Conduct outreach; inform public of issues related to introduced genetic material, risks of invasive species, and importance of aquatic and riparian habitat restoration.

Objective(s):

- Introduced genetic material is reduced.
- The public is knowledgeable about the importance of aquatic biodiversity management plans (ABMP) and risks of invasive species.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation Strategy 3 (Land Acquisition/Easement/Lease): Purchase land and/or acquire easements.

Objective(s):

- Acquire (by CDFW and partners) water rights by purchasing lands, acquiring conservation easements to protect riparian areas.

Targeted pressure(s): Livestock, farming, and ranching; housing and urban areas.

Conservation action(s):

- Develop CAPP.
- Survey the interests from willing sellers.
- Partner with land trusts or NGOs for acquisition and management.
- Partner with Sierra Nevada Conservancy and TNC.

Conservation Strategy 4 (Direct Management): Restore native species; manage invasive species, and remove non-native trout from target streams.

Objective(s):

- Remove non-native trout species from select streams (tributaries of the Upper Kern River).
- Implement BMPs to prevent future contamination by invasive species.
- By 2025, restore native fish to target streams.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):

- Update data on extent and distribution of native and non-native species in the Upper Kern River.
- Utilize existing golden trout Conservation Assessment and Strategy and genetics management plans to develop non-native trout removal strategies for selected waters.
- Coordinate with USFS, NPS, County and private landowners.
- Implement chemical treatments and/or mechanical treatments.
- Conduct pre- and post-treatment monitoring.
- Implement reintroductions using genetic management plans for native species.
- Initiate long-term monitoring and implement Conservation Assessment Strategy and management plans.
- Link to education and outreach strategy.

Conservation Strategy 5 (Direct Management): Restore and enhance meadow habitat; improve water quality and temperature consistent with the Basin Plan.

Objective(s):

- Water quality and temperature are improved and consistent with the Basin Plan.
- Water storage and timing of release is coordinated by water agencies and CDFW to benefit fish habitat and water users.

Targeted pressure(s): Livestock, farming, and ranching; dams and water management/use.

Conservation action(s):

- Conduct temperature modeling to help prioritize habitat restoration.
- Coordinate with USFS and engage in Forest Plan revision process and grazing management allotment planning process.
- Support habitat restoration projects with USFS, NGOs and volunteers; support seeking grants for restoration.

Conservation Strategy 6 (Direct Management): Reintroduce golden trout to its historic range.

Objective(s):

- Restore native fisheries of golden trout to its historic range.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):

- Conduct feasibility analysis and prioritize target streams.
- Coordinate with agencies and NGOs.
- Conduct environmental review and obtain permits.
- Evaluate eradication methods for non-native species and hybrid golden trout and implement treatments.
- Utilize guidance in genetics management plants to develop reintroduction plans.
- Develop monitoring plan to evaluate reintroductions.

Conservation Strategy 7 (Management Planning): Develop new or revised management plans for native fish and implement existing Conservation Assessment and Strategy for golden trout.

Objective(s):

- Develop and implement a basin-wide fisheries management plan.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):

- Coordinate with USFS, NPS, Tulare County, and NGOs.
- Engage stakeholders in planning process.
- Collect and compile status and distribution data.
- Review/revise and implement existing golden trout Conservation Strategy.
- Develop/revise Kern River rainbow trout Conservation Strategy and revise Management/Recovery Plan for Little Kern golden trout.

Conservation Strategy 8 (Training and Technical Assistance): Provide training to staff and managers on non-native genetic issues, invasive species management, and control techniques.

Objective(s):

- Introduction of non-native genetic material is reduced in the Upper Kern River Basin
- Staff has knowledge and skills on techniques for modeling, invasive species management/control techniques, and fish identification.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Table 5.4-17 Stresses and Pressures for Upper Kern River Native Fish Assemblage

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes			Ecosystem Conditions and Processes		
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in spatial distribution of habitat types	Change in community structure and composition	Habitat fragmentation
Housing and urban areas	X	X	X	X	X	X
Introduced genetic material				X	X	X
Invasive plants/animals		X		X	X	X
Livestock, farming, and ranching	X		X	X	X	X

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Table 5.4-18 Conservation Targets and Strategies for Central Valley and Sierra Nevada Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
American Southwest Riparian Forest and Woodland	• By 2025, acres of functional riparian habitat are increased by at least 5% from 2015 acres. • By 2025, acres connected riparian habitat are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from 2015 acres/miles. • By 2025, acres/miles with total dissolved solids (meeting TMDL) are decreased by at least 5% from 2015 acres.	• Area and extent of community • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Logging and wood harvesting • Roads and railroads • Utility and service lines	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
Chaparral Desert Transition Chaparral Montane Chaparral California Foothill and Coastal Rock Outcrop Vegetation	• By 2025, acres of macrogroup habitat (target) are maintained or increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired connectivity are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Housing and urban areas • Livestock, farming, and ranching • Invasive plants/animals • Renewable energy	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Partner Engagement
California Foothill and Valley Forests and Woodlands	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, populations of key species (oaks) are increased by at least 5% from 2015 population. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of water yield are increased by at least 5% from 2015 miles.	• Community structure and composition • Fire regime • Soil quality and sediment deposition regime • Successional dynamics	• Climate change • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities • Roads and railroads	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Outreach and Education • Partner Engagement
North Coastal Mixed Evergreen and Montane Conifer Forests	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity (increase rotation age) are increased by at least 5% from 2015 acres. • By 2025, acres of habitat (with increased recruitment of oaks, aspen, and shrubs) are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired water yield are increased by at least 5% from 2015 acres/miles.	• Community structure and composition • Hydrological regime • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Livestock, farming, and ranching • Logging and wood harvesting • Renewable energy • Utility and service lines	• Data Collection and Analysis • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education

Table 5.4-18 Conservation Targets and Strategies for Central Valley and Sierra Nevada Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[1]	Strategy Categories
Alpine Vegetation	• By 2025, acres connected are maintained within the ecoregion from 2015 acres. • By 2025, acres of macrogroup (target) are maintained within the ecoregion from 2015 acres. • By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained within the ecoregion from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems	• Climate change • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities	• Data Collection and Analysis • Direct Management • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Pacific Northwest Subalpine Forest	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Parasites/pathogens/diseases • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Environmental Review • Land Use Planning • Management Planning • Partner Engagement • Training and Technical Assistance
Wet Mountain Meadow Western Upland Grasslands,	• By 2025, acres of habitat (meadows) are increased by at least 5% from 2015 acres. • By 2025, populations of key species (hydrophilic vegetation for SGCNs) are increased by at least 5% from 2015 population. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres/miles with a natural hydrologic regime are increased by at least 5% from acres/miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres with suitable soil characteristics (reduced sediment input) are increased by at least 5% from 2015 acres. • By 2025, miles with desired level of discharge are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Soil quality and sediment deposition regime • Water level fluctuations	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Housing and urban areas • Invasive plants/animals (non-native) • Invasive plants/animals (native species) • Livestock, farming, and ranching • Logging and wood harvesting • Parasites/pathogens/diseases • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Outreach and Education
Clear Lake Native Fish Assemblage	• By 2025, acres of habitat (wetland) are increased by at least 5% from 2015 acres. • By 2025, acres of habitat (riparian) are increased by at least 5% from 2015 acres. • By 2025, populations of key species (tule perch, prickly sculpin, and Clear Lake hitch) are increased by at least 5% from 2015 population. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, water flow of Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake County is increased by at least 5% during spring and early summer season so that native fish species could better migrate in these creeks. • By 2025, miles with desired stream stage (in Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake Co. during spring and early summer season) are increased by at least 5% from 2015 miles. • By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Nutrient concentrations and dynamics • Pollutant concentration and dynamics • Soil quality and sediment deposition regime • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Invasive plants/animals • Mining and quarrying • Recreational activities	• Direct Management • Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Outreach and Education • Partner Engagement

Table 5.4-18 Conservation Targets and Strategies for Central Valley and Sierra Nevada Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[1]	Strategy Categories
Carson River Native Fish Assemblage	• By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles in the Carson River basin. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles (consistent with TMDL). • By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Fire regime • Pollutant concentration and dynamics • Soil quality and sediment deposition regime • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Household sewage and urban waste water • Housing and urban areas • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education • Training and Technical Assistance
Walker River Native Fish Assemblage	• By 2025, miles of streams with target fish population (SGCNs) are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles connected (i.e., past barriers) are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5% from 2015 miles. • By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5% from 2015 miles. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Surface water flow regime • Water quality	• Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Data Collection and Analysis • Direct Management • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
San Joaquin Native Fish Assemblage	• By 2025, miles connected native fish habitat are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles with desired level of water yield (flow) are increased by at least 5% from 2015 miles. • By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. • By 2025, acres/miles of native fish habitat with desired temperature are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Surface water flow regime • Water level fluctuations • Water quality • Water temperature and chemistry	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Household sewage and urban waste water • Invasive plants/animals • Marine and freshwater aquaculture • Recreational activities	• Data Collection and Analysis • Direct Management • Law and Policy • Management Planning • Outreach and Education
Upper Kern River Native Fish Assemblage	• By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles (consistent with TMDL). • By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Fire regime • Soil quality and sediment deposition regime • Surface water flow regime	• Climate change • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Outreach and Education • Training and Technical Assistance

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2]Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

South Coast Province

5.5 South Coast Province

5.5.1 Geophysical and Ecological Description of the Province

California's South Coast Province encompasses more than eight million acres, extending along the coast from the Santa Barbara County in the north to the Mexico border in the south (Figure 5.5-1). Inland, the region is bounded by the Peninsular Mountain Ranges and the transition to the Mojave and Colorado Deserts on the east and by the Transverse Mountain Ranges on the north. It is an area of strikingly varied landscapes, ranging from wetlands and beaches to hillsides, rugged mountains, arid deserts, and densely populated metropolitan areas.

Robb Hannawacker, NPS

The region's coastal habitats include coastal strand, lagoons, and river-mouth estuaries that transition from riparian wetlands to fresh and saltwater marshes. California least tern, western snowy plover, light-footed Ridgway's rail, California brown pelican, and other waterfowl and shorebirds depend on these habitats. Moving inland, the predominant hillside and bluff communities are coastal sage scrub and chaparral. Southern California's coastal sage scrub is composed of a mix of drought-resistant shrubs and forbs found no place else in the country, commonly including California sagebrush, bush monkeyflower, buckwheat species, and black, purple, or white sage. Coastal sage scrub is a globally endangered community whose worldwide distribution is a narrow coastal strip from Ventura County to El Rosario in northern Baja. Chaparral plant communities (also drought tolerant) are characterized by a greater component of woody species, including chamise, manzanita, California lilac, and scrub oak. Inhabitants of sage scrub and chaparral communities include the Blainville's horned lizard, California gnatcatcher, San Diego cactus wren, Pacific pocket mouse, and Quino checkerspot butterfly. Isolated grasslands and vernal pool habitats are interspersed in the coastal landscape and support unique and endemic species such as Stephens' kangaroo rat and fairy shrimp species. Low- to mid-elevation uplands often feature oak woodlands, including Engelmann oak. Higher-elevation mountainous areas are dominated by coniferous forests, including Jeffrey pine, Ponderosa pine, big-cone Douglas fir, and white fir, and support sensitive species such as long-eared and long-legged myotis bats. Along the Peninsular Mountain Range, coniferous forests transition to the western edge of the Colorado and Mojave Desert ecosystems.

The province's largest river drainages include the Tijuana, San Diego, San Luis Rey, Santa Margarita, Santa Ana, San Gabriel, Los Angeles, Santa Clara, Santa Ynez, and Ventura rivers. Coniferous forests occur along high-elevation stream reaches, and some mountain drainages host mountain yellow-legged frog, California red-legged frog, Santa Ana sucker, and Santa Ana speckled dace. Lower-elevation river reaches support riparian vegetation species, including cottonwood, willow, sycamore, and coast live oak, which provide habitat for such riparian bird species as the least Bell's vireo, southwestern willow flycatcher, Swainson's thrush, yellow-billed cuckoo, and yellow warbler, as well as the arroyo chub and arroyo toad. In urbanized coastal areas, many sections of the province's river corridors are channelized with concrete and support mostly non-native species.

Coastal Cactus Wren Conservation

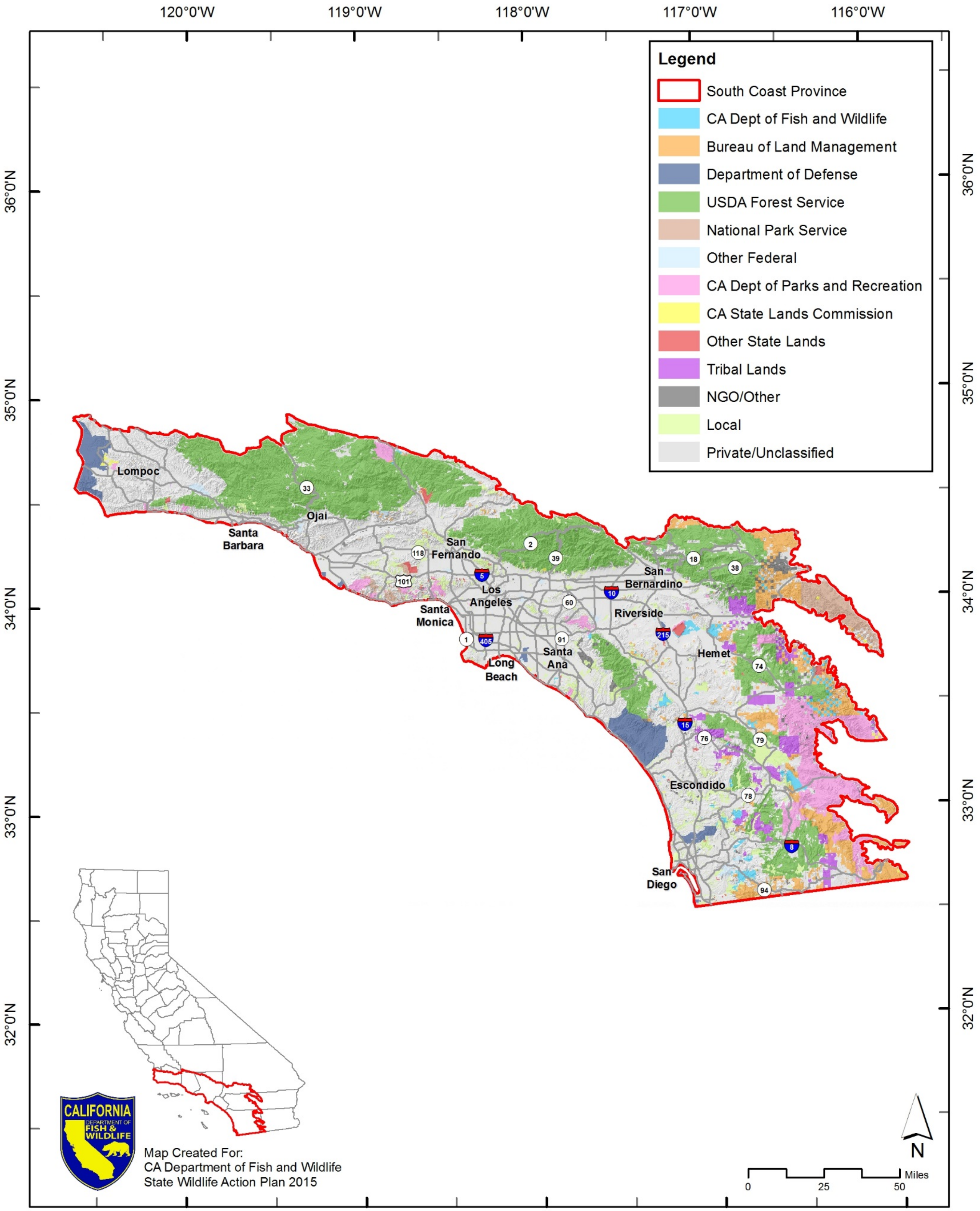
By Nancy Frost, CDFW

In 2010, CDFW South Coast Region biologists from multiple programs (Habitat Conservation Planning, Natural Community Conservation Planning, and Wildlife, Fisheries, and Lands) formed Taxa Teams to prioritize the species most in-need of conservation efforts (Taxa are groups of similar organisms, such as birds). To do so, they asked: "Is the species declining or in eminent danger of extirpation within the region? Has there been a significant reduction in its historic range? Is the species endemic within all or a portion of the region? To what degree is the species affected by recent habitat loss? Is a limited amount of the species' habitat conserved? Does the species have narrow habitat requirements such that it is sensitive to known threats?"

Based on this effort, coastal cactus wren (*Campylorhynchus brunneicapillus sandiegensis*) was ranked as the top priority bird species. In 2014, the Bird Taxa Team collaborated on a Conservation Blueprint, which included a description of the species, conservation partners and efforts underway, conservation goals, and strategies (priority acquisition areas, management directives for CDFW reserves, and resource assessment needs). Designated a California Species of Special Concern, the coastal cactus wren is an obligate, nonmigratory resident of coastal cholla and prickly pear cactus dominated stands of the coastal sage scrub plant community.

Key impacts include habitat loss, degradation, and fragmentation due to urbanization and human-caused wildfires that have resulted in genetic isolation. Restoration of cactus habitat is needed to support genetic stepping stones to improve gene flow. Standardized population monitoring at regular intervals is needed to inform adaptive management efforts. This work will be done in partnership with the Coastal Cactus Wren Conservation Network, a regional effort developed between interested stakeholders to coordinate and exchange information for the protection and management of the species. CDFW used State Wildlife Grant funds to contract with the California Wildlife Foundation to complete a report titled "Cactus Wren Data Summary: California Natural Diversity Database and the Coastal Cactus Wren Conservation Network (CCWCN)" that mapped survey data collected by CCWCN members between 2006-2013 and analyzed California Natural Diversity Database (CNDDB) records to determine which sites should be resurveyed. Subsequently, CDFW staff resurveyed 29 high priority CNDDB records that had not been recently surveyed in Orange and San Diego counties.

Next steps will include working towards the conservation goals of protecting and enhancing the remaining cactus wren habitat to increase connectivity and occurrence size throughout core populations, obtaining taxonomic resolution of the subspecies, and keeping the coastal cactus wren from warranting protection by State or Federal Endangered Species Acts. Even though this SGCN does not occur in one of the current conservation targets, this is an example of how the needs of a habitat specialist can be addressed in the SWAP (for more information, see the Coastal Cactus Wren Data Portal at http://www.southcoastsurvey.org).



Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands

Figure 5.5-1 Land Ownership of the South Coast Province

The province is recognized as one of the world's hotspots of biological diversity and is home to more than 470 vertebrate animal species, approximately 38 percent of all the vertebrate species found in California. It is also distinguished by the tremendous population growth and urbanization that have transformed the landscape since the 1940s. This intersection of biological resources and urbanization has made the South Coast Province the most-threatened biologically diverse area in the continental U.S. (U.S. Geological Survey [USGS] 2003). More than 150 species of vertebrate animals and 200 species of plants are either listed as protected or considered sensitive by wildlife agencies and conservation groups (Hunter 1999).

Despite the province's rapid growth and subsequent loss of habitat, Southern California retains some large and valuable natural lands, including the national forests, which form an interconnected system of wildlands flanking the coast's metropolitan areas. Wide-ranging species, including the mountain lion, coyote, and golden eagle, can still be found in these large habitats.

On the outskirts of Los Angeles, hiking trails traversing canyons in the Santa Monica Mountains pass through the range of the mountain lion and golden eagle. Only from the mountaintops, where the view reveals the Los Angeles metropolis spreading to the ocean, is it clear that these natural lands exist within one of the world's most urbanized regions. The San Diego metropolitan area is the second most populous area in the state, but is also surrounded by natural areas with extraordinary biodiversity. This juxtaposition of urban landscapes with remaining significant natural areas is one of the defining characteristics of the South Coast. The ongoing pressures of growth and urbanization require substantial and timely efforts to preserve the province's remaining wildlife diversity.

The South Coast Missing Linkages

The South Coast Missing Linkages project has developed a comprehensive plan for such a regional network that would maintain and restore critical habitat linkages between existing reserves. These linkages form the backbone of a conservation strategy for southern California where the whole would be greater than the sum of the parts. This strategy represents the best hope for maintaining what remains of southern California's wildlife legacy, while ensuring quality of life for our citizens via clean air, clean water, and recreational opportunities. The plan is available at: http://www.scwildlands.org/reports/SCMLRegionalReport.pdf.

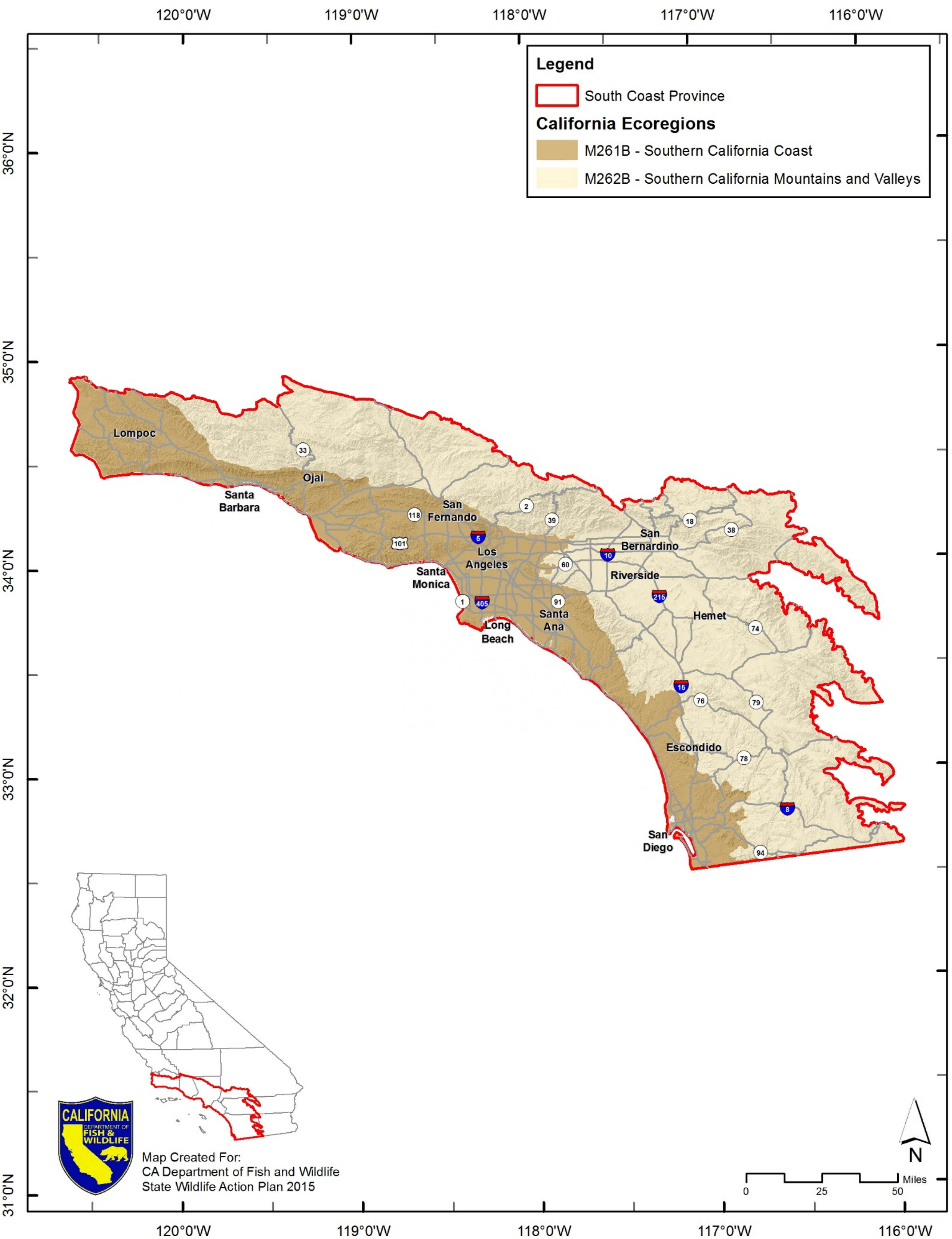
South Coast Missing Linkages is a highly collaborative inter-agency effort to identify and conserve the highest-priority linkages in the South Coast Ecoregion. Partners include South Coast Wildlands, National Park Service, U.S. Forest Service, California State Parks, The Wildlands Conservancy, The Resources Agency, California State Parks Foundation, The Nature Conservancy, Santa Monica Mountains Conservancy, Resources Legacy Foundation, Conservation Biology Institute, San Diego State University Field Stations Program, Environment Now, Mountain Lion Foundation, and the Zoological Society of San Diego's Conservation and Research for Endangered Species, among others.

Cross-border alliances have also been formed with Pronatura, Universidad Autonoma de Baja California, Terra Peninsular, and Conabio, in recognition of our shared vision for ecological connectivity across the border into Baja.

5.5.2 Conservation Units and Targets

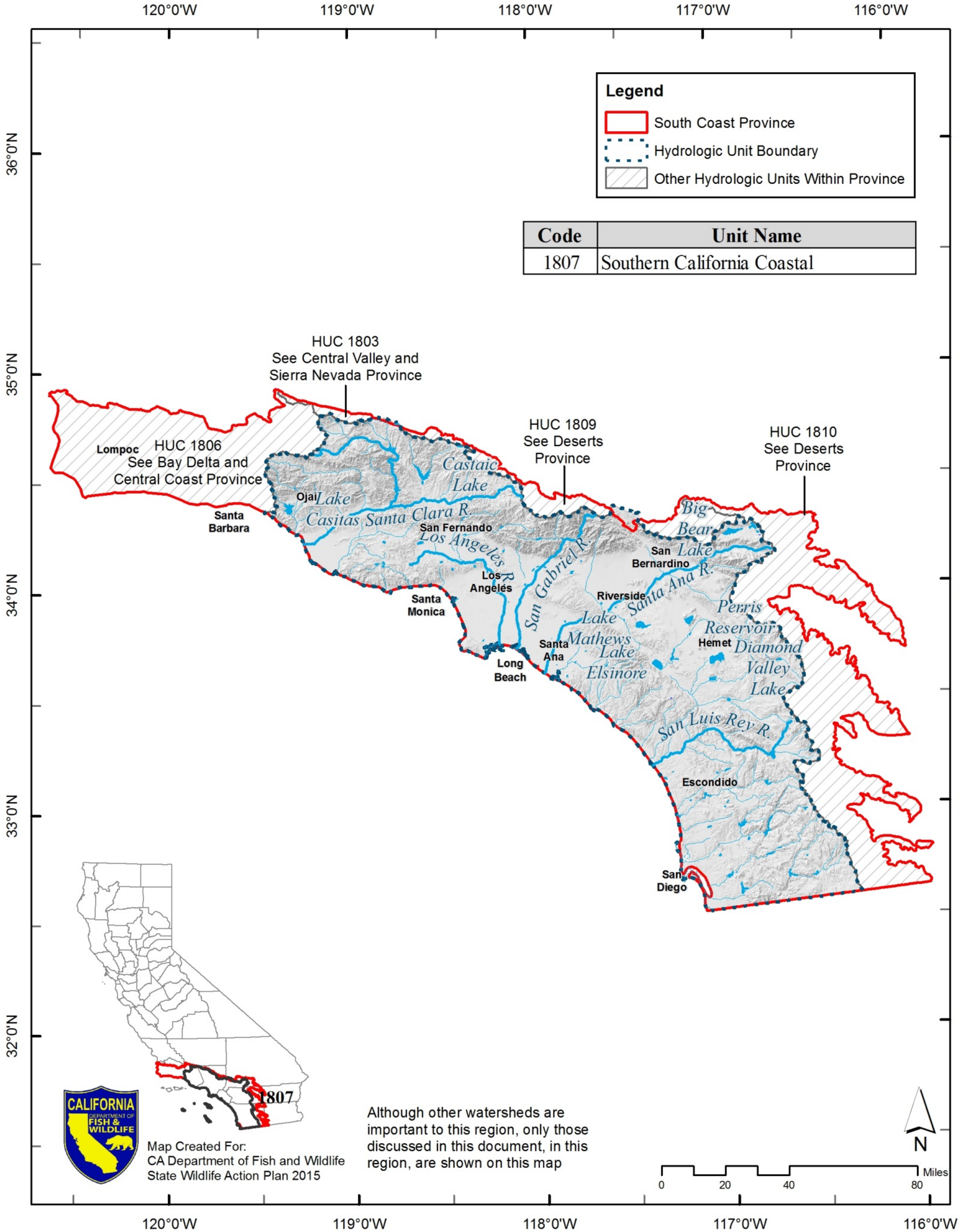
The conservation units associated with the South Coast Province are the Southern California Coast and Southern California Mountain and Valley ecoregions (Figure 5.5-2), and the Southern California Coastal hydrologic unit (Figure 5.5-3). The selected targets for each of these conservation units are summarized in Table 5.5-1. Figure 5.5-4 shows the distribution of the plant communities within the province.

Although numerous conservation targets were identified within the South Coast Province, conservation strategies were only developed for California grassland and flowerfields, freshwater marsh, American southwest riparian forest and woodland, native fish assemblage, and native aquatic herp assemblage, those targets which contained the greatest number of SCGN and were considered more immediately under threat. Coastal sage scrub was not among those targets selected because this habitat type is being conserved through the Natural Community Conservation Planning *(*NCCP) program. By developing conservation strategies for key conservation targets that are less emphasized under the NCCP program, SWAP both builds upon and complements the NCCP program. Additional key targets, including Salt Marsh and California Foothill and Valley Forests and Woodlands, will be addressed through future conservation planning efforts. Information about the methods used to prioritize conservation targets is presented in Appendix D.



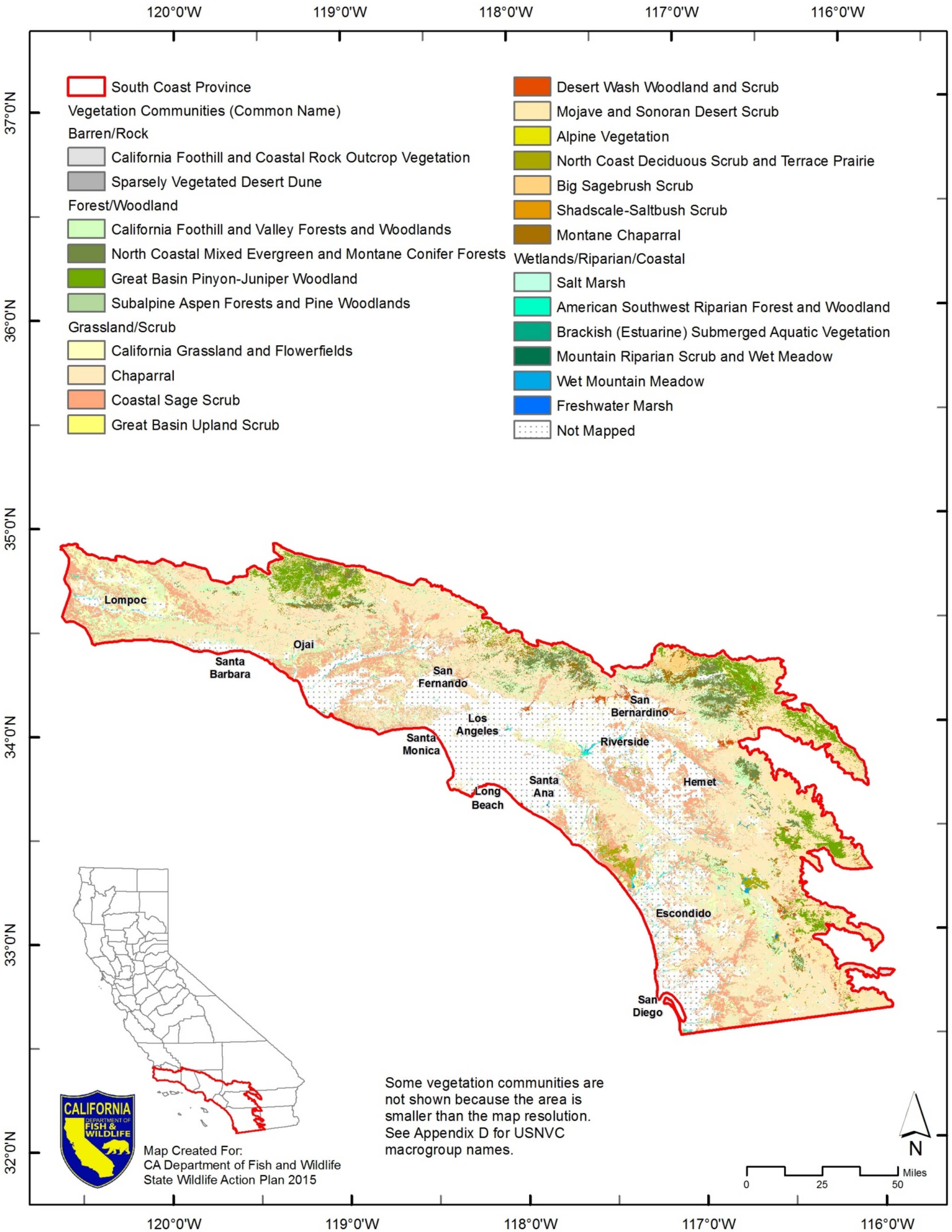
Data Source: USDA Forest Service (ecoregions); US Geological Survey (hillshade)

Figure 5.5-2 Ecoregions of the South Coast Province



Data Source: National Hydrologic Dataset (NHD); US Geological Survey (hillshade)

Figure 5.5-3 Hydrologic Units of the South Coast Province



Data Source:fveg (Calfire)

Figure 5.5-4 Plant Communities of the South Coast Province

Table 5.5-1 Conservation Units and Targets – South Coast Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Southern California Coast Ecoregion	This unit contains mountains, hills, valleys, and plains of the Transverse Ranges and of the Peninsular Ranges that are close enough to the Pacific Ocean for the climate to be modified greatly by marine influence. Elevation range: 0 to 3,000	American Southwest Riparian Forest and Woodland	Riparian forests and thickets are included in this target. The range of the main indicator trees and shrubs are the SW US and N Mexico. Most stands of this target occur below 4,000 feet elevation and are replaced by the cool-temperate version of riparian (Montane and North Coast Riparian Forest and Scrub) in the mountains. Diagnostic species include Fremont cottonwood, Black and red willow, California sycamore, California wild grape, arroyo willow, narrow-leaf willow, button-bush, spice bush and California fan palm (native stands in the warm desert). Most stands are found in permanently moist settings or riparian settings where sub-surface water is available year-round.	Valley Foothill Riparian; Palm Oasis
		California Grassland and Flowerfields	Includes all annual forb/grass vegetation native and non-native, as well as native perennial grasslands growing within the California Mediterranean climate. This does not include the cool-moist north coastal terrace prairies, the montane meadow/upland grasslands, and non-native perennial pasture grasses. Native perennial grasslands include needle grass species (*Stipa*, *Achnatherum*, *Nassella*), melicgrass and giant wild rye. Annual native forb and wildflower fields including species of poppy, goldfields, popcorn flowers, *Phacelia*, fiddleneck, and others. Non-native annual grasslands composed of Eurasian species such as wild oat, brome, annual fescue, starthistle, mustards, fennel, and others are also included in this target.	Annual Grassland; Perennial Grassland
		Freshwater Marsh	This vegetation type consists of freshwater emergent marshes and coastal/tidal marshes and meadows. It can be found surrounding streams, rivers, lakes and wet meadows. These habitats occur on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. Dominant species are generally perennial monocots including graminoids such as rushes, reeds, grasses and sedges. Dominant species include: common reeds, hardstem bulrush, small-fruited bulrush, water parsley, slough sedge, soft rush, salt rush, and pacific silverweed.	Fresh Emergent Wetland
Southern California Mountain and Valley Ecoregion	This unit includes mountains, hills and valleys of the Transverse Ranges and the Peninsular Ranges that are near the Pacific Ocean, but not bordering it. Much of the section is close enough to the Pacific Ocean for the climate to be modified moderately marine influence. Elevation range: 300 to 11,500	American Southwest Riparian Forest and Woodland	See summary description in Southern California Coast Ecoregion.	Valley Foothill Riparian; Palm Oasis
		California Grassland and Flowerfields	See summary description in Southern California Coast Ecoregion.	Annual Grassland; Perennial Grassland
Southern California Coastal HUC 1807	Includes the drainage that discharges into the Pacific Ocean from the Rincon Creek Basin boundary south to the California-Baja California border. Covers an area of 11,100 square miles. Elevation range: 0 to 9,700	Native Fish Assemblage	SGCN associated with target are unarmored three spine stickleback, tidewater goby, Santa Ana sucker, Santa Ana speckled dace, and arroyo chub.	N/A
		South Coast Native Aquatic Herp Assemblage	SGCN associated with target are California red-legged frog, California tiger salamander, mountain yellow-legged frog, arroyo toad, western pond turtle, coast range newt, and two-striped garter snake.	N/A

* Description referenced from CDFG 1988, USDA 1994, USDA 2007 and Keeler-Wolf 2010.

5.5.3 Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the South Coast Province are listed in Table 5.5-2. The most commonly identified attributes for the South Coast Province are:

- area and extent of community;
- connectivity among communities and ecosystems;
- community structure and composition; and
- surface water flow regime.

Table 5.5-2 Key Ecological Attributes – South Coast Province

Key Ecological Attributes	Conservation Units and Targets						
	Southern California Coast			Southern California Mountain and Valley		Southern California Coastal HUC 1807	
	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Freshwater Marsh	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Native Fish Assemblage	South Coast Native Aquatic Herp Assemblage
Area and extent of community	X	X	X	X	X		X
Community structure and composition	X	X	X	X	X	X	X
Connectivity among communities and ecosystems	X	X	X	X	X	X	
Fire regime		X			X		
Hydrological regime	X			X			
Nutrient concentrations and dynamics		X			X		
Successional dynamics		X	X		X		
Soil quality and sediment deposition regime		X			X		
Surface water flow regime	X		X	X		X	X
Water level fluctuations	X			X		X	

5.5.4 Species of Greatest Conservation Need in the South Coast Province

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.5-3). Not all of the focal species meet the criteria to be considered Species of Greatest Conservation Need (SGCN). SGCN are indicated with an asterisk. SGCN associated with the South Coast Province are shown by ecoregion in Tables C-20 and C-21 in Appendix C.

Table 5.5-3 Focal Species of Conservation Strategies Developed for Conservation Targets – South Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]						
		Southern California Coast			Southern California Mountain and Valley		Southern California Coastal HUC 1807	
		American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Freshwater Marsh	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Native Fish Assemblage	South Coast Native Aquatic Herp Assemblage
Invertebrates								
Quino checkerspot butterfly*	*Euphydryas editha quino*		X					
Fishes								
Arroyo chub*	*Gila orcuttii*						X	
Santa Ana speckled dace*	*Rhinichthys osculus* ssp.						X	
Santa Ana sucker*	*Catostomus santaanae*						X	
Unarmored threespine stickleback*	*Gasterosteus aculeatus williamsoni*						X	
Tidewater goby*	*Eucyclogobius newberryi*						X	
Amphibians								
California Tiger salamander*	*Ambystoma californiense*	X	X		X	X		X
California newt* (Monterey County and South)	*Taricha torosa*	X			X			X
Western spadefoot*	*Spea hammondii*	X	X	X	X	X		
Arroyo toad*	*Anaxyrus californicus*	X	X		X	X		X
California red-legged frog*	*Rana draytonii*	X	X	X	X	X		X
Southern mountain yellow-legged frog*	*Rana muscosa*	X			X			X
Reptiles								
Southern western pond turtle*	*Actinemys pallida*	X	X	X	X	X		X
Two-striped gartersnake*	*Thamnophis hammondii*	X			X			X
Birds								
White-faced ibis	*Plegadis chihi*	X	X		X	X		
Great egret	*Adea alba*	X			X			
Great blue heron	*Ardea herodias*			X				
Black-crowned night heron	*Nycticorax nycticorax*		X	X		X		
Least bittern*	*Ixobrychus exilis*			X				
California condor*	*Gymnogyps californianus*		X			X		
Osprey	*Pandion haliaetus*	X		X	X			
Golden eagle*	*Aquila chrysaetos*		X	X		X		
Ferruginous hawk	*Buteo regalis*		X			X		
Swainson's hawk*	*Buteo swainsoni*	X			X			
Northern harrier*	*Circus cyaneus*	X	X	X	X	X		
White-tailed kite*	*Elanus leucurus*	X	X	X	X	X		

Table 5.5-3 Focal Species of Conservation Strategies Developed for Conservation Targets – South Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]						
		Southern California Coast			Southern California Mountain and Valley		Southern California Coastal HUC 1807	
		American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Freshwater Marsh	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Native Fish Assemblage	South Coast Native Aquatic Herp Assemblage
Long-billed curlew	*Numenius americanus*		X			X		
Yellow-billed cuckoo*	*Coccyzus americanus*	X			X			
Greater roadrunner*	*Geococcyx californianus*		X			X		
Short-eared owl*	*Asio flammeus*		X	X		X		
Long-eared owl*	*Asio otus*	X	X		X	X		
Burrowing owl*	*Athene cunicularia*		X			X		
Belted kingfisher	*Megaceryle alcyon*	X			X			
Southwestern willow flycatcher*	*Empidonax traillii extimus*	X			X			
Vermilion flycatcher*	*Pyrocephalus rubinus*	X			X			
Loggerhead shrike*	*Lanius ludovicianus*		X			X		
Least Bell's vireo*	*Vireo bellii pusillus*	X			X			
Cactus wren*	*Campylorhynchus brunneicapillus*		X			X		
Yellow-breasted chat*	*Icteria virens*	X			X			
Summer tanager*	*Piranga rubra*	X			X			
Tricolored blackbird*	*Agelaius tricolor*	X	X	X	X	X		
Yellow-headed blackbird*	*Xanthocephalus xanthocephalus*	X			X			
Mammals								
California leaf-nosed bat*	*Macrotus californicus*	X			X			
Pallid bat*	*Antrozous pallidus*		X			X		
Western red bat*	*Lasiurus bossevillii*	X			X			
Hoary bat	*Lasiurus cinereus*	X			X			
Long-eared bat*	*Myotis evotis*	X			X			
Yuma myotis	*Myotis yumanensis*	X			X			
Western mastiff bat*	*Eumops perotis californicus*		X	X		X		
Pocketed free-tailed bat*	*Nyctinomops femorosaccus*	X			X			
Big free-tailed bat*	*Nyctinomops macrotis*	X			X			
San Diego black-tailed jackrabbit*	*Lepus californicus bennettii*		X			X		
Pallid San Diego pocket mouse*	*Chaetodipus fallax pallidus*	X	X		X	X		
Jacumba pocket mouse*	*Perognathus longimembris internationalis*	X			X			
Southern grasshopper mouse*	*Onychomys torridus ramona*	X	X		X	X		
Ringtail	*Bassariscus astutus*	X			X			

Table 5.5-3 Focal Species of Conservation Strategies Developed for Conservation Targets – South Coast Province

Common Name	Scientific Name	Conservation Units and Targets[1]						
		Southern California Coast			Southern California Mountain and Valley		Southern California Coastal HUC 1807	
		American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Freshwater Marsh	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Native Fish Assemblage	South Coast Native Aquatic Herp Assemblage
American badger*	*Taxidea taxus*		X			X		
Western spotted skunk	*Spilogale gracilis*	X			X			

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion see Appendix C.
* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.5.5 Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have strong influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified as for conservation targets in the South Coast Province are summarized in Table 5.5-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures for the province. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.5.6. Some of the major pressures for the province are discussed in more detail below.

Housing and Urban Areas

Intensive population and development pressures in the South Coast have resulted in the greatest number of threatened and endangered species in California. By far, the most significant pressure on the South Coast's wildlife is urban, suburban, and rural development and resulting habitat loss and fragmentation. With approximately 24 million residents, the area is the state's most populous region. The two largest cities on the west coast, Los Angeles and San Diego are located in southern California (California Coastal Conservancy 2010). Despite comprising only eight percent of the land area of California, the South Coast contains 56 percent of the total population (Keeley 2010).

Table 5.5-4 Key Pressures on Conservation Targets – South Coast Province

Pressure	Conservation Units and Targets						
	Southern California Coast			Southern California Mountain and Valley		Southern California Coastal HUC 1807	
	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Freshwater Marsh	American Southwest Riparian Forest and Woodland	California Grassland and Flowerfields	Native Fish Assemblage	South Coast Native Aquatic Herp Assemblage
Agricultural and forestry effluents			X				
Annual and perennial non-timber crops		X	X		X	X	X
Catastrophic geological events	X			X			
Climate change	X	X	X	X	X	X	X
Commercial and industrial areas			X				
Dams and water management/use	X		X	X		X	X
Fire and fire suppression	X	X		X	X		
Garbage and solid waste	X			X			
Household sewage and urban waste water	X		X	X		X	
Housing and urban areas	X	X	X	X	X	X	X
Industrial and military effluents			X				
Invasive plants/animals	X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X		
Mining and quarrying	X			X		X	X
Parasites/pathogens/diseases							X
Recreational activities	X	X		X	X		X
Roads and railroads	X	X	X	X	X		X
Tourism and recreation areas	X			X			

Following World War II, Southern California experienced an economic and population boom spurred by military and industrial growth. The region's development patterns followed agricultural land uses and the availability of easily developed land. Across inland valleys that had supported citrus orchards and grazing, small agricultural towns grew to meet the needs of growing industry. Along the coast, development spread across the relatively flat coastal plains and mesas. Over the last few years, the region has continued to grow. Between 2010 and 2014, Los Angeles County grew from 9.82 million residents to 10.04 million, San Diego County from 3.09 to 3.19 million, and Orange County from 3.01 to 3.11 million (California Department of Finance 2014).

Dave Feliz, CDFW

Large portions of the province's natural areas have been converted to other uses; currently, nearly 40 percent the South Coast's land area is in urban and suburban use (California Department of Forestry and Fire Protection [CAL FIRE] Fire and Resource Assessment Program 2010). Beyond the immediate footprint of development, urban, suburban, and rural growth patterns have fractured the landscape. Land-use planning and zoning laws have allowed sprawling development, including residential projects that are located far from existing urban centers, requiring new roads and infrastructure, along with communities designed with large lot sizes and little or no preserved open space. Presently, the region's remaining rural areas and natural lands are highly threatened by zoning for 4- to 8-acre lots for rural ranchette-style development.

As in other provinces, these development patterns not only reduce the amount of habitat available but also degrade the quality of adjacent habitat. With the expansion of the urban-wildland interface, remaining natural lands become more vulnerable to the incursion of invasive plants and animals, air and water pollution, and altered fire regimes. Developed areas, roads, and utility corridors fragment landscapes and sever connections between habitat areas.

Invasive Plants/Animals

As in other provinces across the state, invasive species problems on the South Coast are tied to regional land use and management issues. Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

In terrestrial ecosystems, a number of highly aggressive non-native plant species invade grasslands and scrub, including yellow starthistle, artichoke thistle, medusahead, Pampas grass, fennel, pepper weed, black mustard, vinca, fountain grass, ivy, iceplant, and castor bean. These species lower habitat quality for sensitive wildlife species such as the Quino checkerspot butterfly and the California gnatcatcher. Some of these species dry out earlier in the summer than native species and contribute to increased wildfire frequencies. Access roads and rights-of-way for infrastructure and powerline maintenance, as well as recreational use of natural areas, can facilitate the spread of these species. In addition to degrading habitat quality, invasive species change the community structure and composition within the target habitats, making them more vulnerable to altered fire regimes.

Among terrestrial animals, Argentine ants pose a significant regional threat. Favoring irrigated areas and edge habitats, such as irrigated golf courses and residential neighborhoods, Argentine ants tend to outcompete and displace native ants in the region's fragmented landscapes, disrupting larger community food-web relationships. For example, the coast horned lizard (a California Species of Special Concern), whose major prey is native harvester ants, cannot sustain itself on a diet of Argentine ants and so can be driven locally extinct in fragmented habitat patches. Two pest species of boring beetles adversely affect trees and woodland habitats in portions of southern California. The goldspotted oak borer feeds beneath the bark of oak trees and damages tissues of the main stem and larger branches, eventually causing tree damage and mortality. The polyphagous shot hole borer is a relatively new pest in southern California; it infects a variety of tree species with a fungus, sometimes resulting in tree damage or mortality.

Nest parasitism by brown-headed cowbirds also threatens many of the region's sensitive bird species, including least Bell's vireo, southwestern willow flycatcher, and California gnatcatcher. Although a native species, cowbirds thrive in many human-altered habitats, including suburban areas and agricultural and grazing lands, where they are attracted to livestock droppings and feed. With the expansion of these land uses over the last century, cowbirds have thrived, greatly expanding both their range and population across California. Other problems are caused by introduced red fox, feral animals, and pets, which prey upon native wildlife, particularly ground-nesting birds.

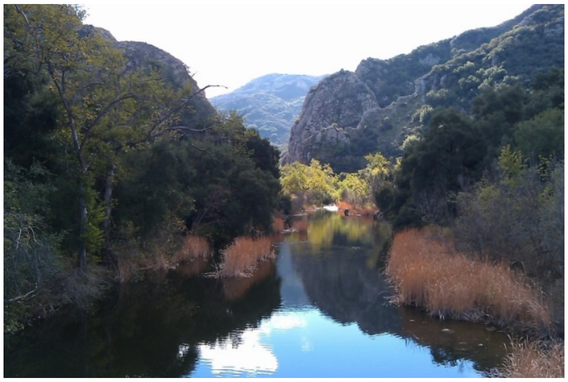
European starling, introduced from Europe and now widespread in the region and in most human-modified habitats across much the state, aggressively competes with native woodpeckers, bluebirds, and other native song birds for cavity nest sites. In aquatic systems, the most problematic invasive plant species is *Arundo*, or giant reed. *Arundo* is widespread along major coastal river basins, particularly the Ventura, Santa Clara, Santa Ana, Santa Margarita, San Luis Rey and San Diego rivers. Tamarisk is less widespread but also invades regional riparian habitats. Tamarisk is distributed in coastal and desert drainages (Stephenson and Calcarone 1999). Both species choke waterways, increase flash flood risks, crowd out native plants, and provide inferior habitat for riparian species. Tamarisk also consumes prodigious amounts of water, reducing available surface water, and *Arundo* provides limited shade, resulting in higher water temperatures and lower dissolved oxygen levels.

Among non-native wildlife species, bullfrogs, African clawed frogs, non-native crayfish, mosquito fish (which are sometimes introduced for mosquito control), and introduced sport and bait fish (including sunfish, bass, bluegill, carp, and fathead minnow) all pose predatory or competitive threats to native fish and amphibians, particularly in stream systems. Many of these species are well adapted to the deep water conditions in ponded areas above dams, and dam releases can introduce them to downstream habitats. Most voracious and widespread are bullfrogs, which are documented predators of California red-legged frogs, California tiger salamanders, arroyo toads, western pond turtles, and two-striped garter snakes (Stephenson and Calcarone 1999). A broad diet and an extended breeding season give bullfrogs a competitive advantage over native amphibians. Additionally, human-modified habitats favor bullfrogs. They can tolerate elevated water temperatures and, unlike native amphibians, make use of standing pools resulting from urban runoff to complete their two-year life cycle.

Aquatic invasive species pose a serious threat to aquatic habitat functions and ecosystem stability. In the South Coast Province, aquatic invasive animal species of concern include quagga mussel, New Zealand mud snail, African clawed frog, Asian clam, and bullfrog.

Recreational Activities

With nearly 20 million people living within driving distance of the region's national forests and other public lands, outdoor recreational access and its effects are a major concern. Recreational off-highway vehicle (OHV) use, particularly illegal use within protected conservation areas, can have adverse effects on natural communities and sensitive species. On public lands, OHV trails can open relatively undisturbed areas to increased use. The vehicles can disturb or run over wildlife, crush and uproot plants, spread seeds of invasive plants, and disturb soils, contributing to erosion and sedimentation of aquatic habitats. OHV use also increases the risk of human-caused fires.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Concentrated recreational use of streams and riparian areas is of particular concern in some locations. Hikers, picnickers, and equestrians, in large numbers, can damage these systems by reducing vegetative cover and disturbing sensitive species. Some recreational users build rock dams on streams to create ponds for swimming. The San Gabriel River, for example, has been altered by extensive ponded areas, as well as other effects of heavy recreational use, such as the deposition of trash and human waste (California Department of Fish and Game [CDFG] 2005). Particularly vulnerable riparian species include the two-striped garter snake, southern mountain yellow-legged frog, and arroyo toad (Stephenson and Calcarone 1999).

Intensive recreational activities not only reduce the amount of habitat available, but can also degrade the quality of the habitat in some cases. Habitats become more vulnerable to the incursion of invasive plants and animals, air and water pollution, and altered fire regimes. Roads and trails fragment landscapes and sever connections between habitat areas. Roads and trails also serve as vectors for invasive plant introductions and subsequent spread.

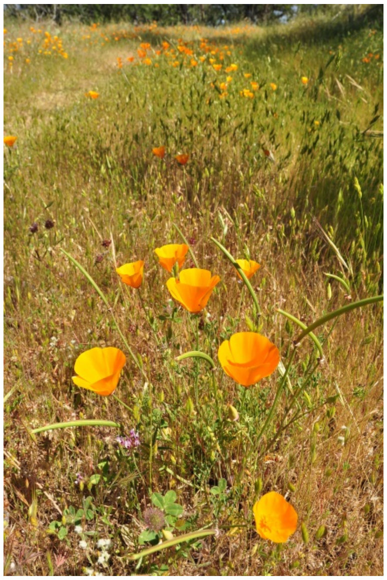
Although recreation activities adversely affect biological resources in many cases, the specific effects of recreational uses on wildlife depend on several factors, including the type, magnitude, frequency, and predictability of recreation activity; location and timing of activity (e.g., seasonal and time of day); habitat types exposed to the activities; and the sensitivity of a species based on its life history characteristics (Knight and Cole 1995).

Annual and Perennial Non-Timber Crops

Despite the large urban population, the South Coast is still a base for significant agricultural production. Los Angeles County was once the most important agricultural county in the United States, measured by the value of its agricultural production. The South Coast's moderate climate and usually frost-free growing seasons make it suitable for high-value crops. Nursery products, foliage and flowers, avocados, citrus, strawberries, and wine grapes are the main crops in the region (Johnston 2003).

In agricultural river valleys, substantial habitat alteration results from river diversions and water use. Many small-scale irrigation diversions deplete the flows of regional river systems, sometimes resulting in rivers completely drying up. Stream habitats are also adversely affected by sedimentation. Agricultural consequences for the region's wildlife and ecosystems include runoff of agricultural chemicals and sediment, consumption of oversubscribed water resources, and conversion and fragmentation of habitat.

Climate Change



The projected climate changes in the South Coast are expected to mainly intensify patterns that are characteristic of a semi-arid Mediterranean climate (periodic droughts, intense cyclonic rainstorms, dry and hot summers). An important factor for coastal populations is the continuing role of the ocean in moderating coastal climates because of its high heat capacity (National Marine Fisheries Service 2012).

Temperature

Average annual temperatures across both the coastal and mountainous regions of the South Coast province are expected to increase between 1.7 to 2.2°C (3.1 to 4.0°F) by 2070 (PRBO 2011). January average temperatures are expected to increase 0.6 to 1.4°C (1 to 2.5°F) by 2050 and 2.8 to 3.3°C (5 to 6°F) by 2100. July average temperature increases are projected from 1.7 to 2.2°C (3 to 4°F) by 2050 and 2.8 to 5.6°C (5 to 10°F) by 2100, with larger increases projected inland (California Emergency Management Agency [CalEMA] 2012).

Precipitation

Annual precipitation is expected to vary by area but decline overall throughout the 21st century. Low-lying coastal areas will lose up to 5 cm (2 inches) by 2050 and 7.6 to 12.7 cm (3 to 5 inches) by 2090, while high elevations will see a drop of 10.2 to 12.7 cm (4 to 5 inches) by 2050 and 20.3 to 25.4 cm (8 to 10 inches) by 2090 (CalEMA 2012). Annual rainfall will decrease in the most populous, urbanized areas. Wetter areas like the western part of Riverside and southwestern San Bernardino counties will experience a 5 to 10 cm (2 to 4 inch) decline by 2050 and 8.9 to 15.2 cm (3.5 to 6 inch) decline by the end of the century. Annual rainfall in the Big Bear vicinity is expected to decline by approximately 20.3 cm (8 inches) by 2090. Southern Imperial County is projected to experience a small decline of about 1.3 cm (0.5 inches).

March snowpack in the San Gabriel Mountains will decrease from the 1.8 cm (0.7-inch) level in 2010 to zero by the end of the century. Snowpack is also expected to decline and disappear at similar rates in the Big Bear area by the end of the century (CalEMA 2012).

Wildfire Risk

The South Coast province is already frequently at risk for wildfire, and as such the degree to which climate change will effect existing wildfire risk is variable (Westerling and Bryant 2006). Wildfire frequency and severity will depend on longer-term shifts in vegetation (e.g., from conifer forest to chaparral) and changes in Santa Ana wind behavior (Miller and Schlegal 2006; Westerling et al. 2009). Increased temperature and decreased moisture, along with longer drought periods, are expected to increase wildfire vulnerability in a number of areas, such as areas in San Diego County near Ojai, Castaic, Fallbrook, and Mission Viejo (CalEMA 2012).

Sea-Level Rise

By 2100, sea levels may rise 1.4 m (55 inches) or more, posing threats to many areas in the region including Venice Beach, the Port of Long Beach, the South Coast naval stations, and San Diego Harbor. As a result of sea level rise, 45 percent more land in Los Angeles County, 40 percent more land in San Diego County, 35 percent more land in Ventura County, and 28 percent more land in Orange County will be vulnerable to 100-year floods (CalEMA 2012).

5.5.6 Conservation Strategies

Conservation strategies were developed for five conservation targets in the South Coast Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.5-5 through 5.5-9 show the relationship between the stresses and the pressures for each target. Table 5.5-10 summarizes conservation strategies for the province.

Target: California Grassland and Flowerfields

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres connected are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired endemic plant/animal diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species are increased by at least 5 percent from 2015 population.
- By 2025, acres/miles with desired plant/animal diversity are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres with desired genetic connectivity are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime are increased by at least 5 percent 2015 from acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire and conserve high-value grassland habitats.

Objective(s):

- Identify, prioritize, and conserve high value grassland habitat.

Targeted pressure(s): Housing and urban areas; annual and perennial non-timber crops; livestock, farming, and ranching.

Conservation action(s):

- Coordinate with non-governmental organizations (NGOs), such as regional land trusts, to develop regional conservation strategies.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data to establish baseline inventory of SGCN distribution.

Objective(s):

- Establish a baseline inventory of SGCN distribution.

Targeted pressure(s): Housing and urban areas; annual and perennial non-timber crops; livestock, farming, and ranching; invasive plants/animals; recreational activities; climate change; fire and fire suppression.

Conservation Strategy 3 (Direct Management): Reduce extent and spread of invasive species, with emphasis on ecosystem function for SGCN.

Objective(s):
- Reduce the extent and spread of invasive species.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):
- Identify areas with high restoration potential.
- Develop management plans.
- Identify funding sources to implement management plans.
- Partner with California Invasive Plant Council on training, management, and advocacy.
- Identify appropriate and effective restoration techniques for each location.
- Identify restoration success criteria.
- Develop and implement monitoring plan.
- Implement priority invasive plant removal.
- Develop invasive plant tax.
- Develop public outreach program.
- Restore and enhance native plant species.

Conservation Strategy 4 (Management Planning): Coordinate with U.S. Department of Fish and Wildlife (USFWS) and other agencies to assist local jurisdictions with conservation of grasslands (e.g., via the natural communities conservation plan/habitat conservation plan process) in light of increasing extent of vineyard development in grasslands.

Objective(s):
- Influence local government decision making processes for local land use plans to fully incorporate the ecological values of grassland habitat.

Targeted pressure(s): Annual and perennial non-timber crops; invasive plants/animals.

Conservation action(s):
- Identify and prioritize areas of conservation emphasis (ACE).
- Identify existing conserved areas.
- Pursue conservation easements and habitat acquisitions to protect grassland habitats.
- Encourage/promote the use of NCCPs to identify and prioritize conservation areas.
- Direct project mitigation to priority areas needing conservation.
- Direct and use conservation banking.
- Create ACE database viewable by all CDFW staff.
- Split parcels for conservation.
- Incorporate conservation goals and best management practices (BMPs) into California Environmental Quality Act (CEQA) comment letters.
- Provide input at local government public meetings on relevant land use decisions.

Conservation Strategy 5 (Partner Engagement): Partner for joint advocacy for the conservation of natural resources.

Objective(s):

- Establish partnerships with agencies and landowners that benefit wildlife.
- Implement habitat restoration projects jointly with agencies and landowners that benefit wildlife.

Targeted pressure(s): Livestock, farming, and ranching; fire and fire suppression; invasive plants/animals.

Conservation action(s):

- Advocate for appropriate grazing practices.
- Review existing ranching and grazing BMPs.
- Partner and advocate for reducing rodenticide use.
- Work with Natural Resources Conservation Service, California Cattleman's Association, California Farm Bureau Federation, and landowners to modify BMPs as needed.
- Incorporate BMPs into CEQA comment letters.
- Identify key private land owners to whom outreach is directed.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.
- Advocate for prescribed burns where appropriate (e.g., where risk of conversion of native habitat types as a result of burning is low).
- Advocate for post-burn weed control in collaboration with Cal-IPC and CAL FIRE.
- Work with local governments to incorporate structural fire treatments (e.g., building hardening, boxed eves, fire rated windows, etc.) to minimize impacts at the urban/wildland interface.

Table 5.5-5 Stresses and Pressures for California Grassland and Flowerfields

Priority Pressures	Stresses							
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics			Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in nutrients	Change in pollutants	Change in soil moisture	Change in spatial distribution of habitat types	Change community structure or composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Annual and perennial non-timber crops		X	X	X	X	X	X	X
Fire and fire suppression	X	X				X	X	X
Housing and urban areas	X				X	X	X	X
Invasive plants/animals	X			X	X	X	X	
Livestock, farming, and ranching		X	X	X	X	X	X	X
Recreational activities						X	X	

Target: Freshwater Marsh

Goals:

- By 2025, acres of freshwater emergent wetland habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, population abundance of key species (SGCN) is increased by at least 5 percent from 2015 population.
- By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5 percent from 2015.
- By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, population of key species (beaver) is increased by at least 5 percent from 2015 population.
- By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5 percent from 2015 acres/miles.
- By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Outreach and Education): Provide outreach and education.

Objective(s):

- Influence public awareness of proper land management for freshwater marshes by providing information to landowners regarding BMPs and proper wetland management.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Target Buckeye Conservancy and Resource Conservation Districts.
- Design and produce brochures with wetland conservation message.
- Employ web-based media for providing information to public.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Purchase land and conservation easements.

Objective(s):

- Improve land management by removing invasive species and creating better grazing practices.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):

- Prioritize with Conceptual Area Protection Plan (CAPP) and Environmental Site Assessment.

Conservation Strategy 3 (Law and Policy): Advocate for laws and policies.

Objective(s):

- Strengthen regulatory authority over wetlands and integrate beaver ecology into wetland restoration activities.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):

- Evaluate and update Wetlands Policy.
- Implement wetland and riparian technical memorandum.
- Review and modify CDFW policy on beaver depredation.
- Update Wetlands Implementation Policy.

Conservation Strategy 4 (Management Planning): Develop management plans.

Objective(s):

- Develop BMPs for ecosystem management on CDFW lands.
- BMPs provide guidance on managing CDFW lands for multi-species use and benefit both recreation and conservation of native species.

Targeted pressure(s): Invasive plants/animals; livestock, farming, and ranching; annual and perennial non-timber crops; climate change.

Conservation action(s):

- Revise Land Management Plan (LMP) guidelines to include ecosystem management.
- Update LMPs to be consistent with new guidelines for managing at an ecosystem level.
- Develop policy on ecosystem management on public lands.

Conservation Strategy 5 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):

- Provide economic incentives through restoration grants.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Table 5.5-6 Stresses and Pressures for Freshwater Marsh

Priority Pressures	Stresses												
	Coastal and Oceanic Characteristics	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics						Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Sea level rise	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change zin groundwater tables	Change in pollutants	Change in nutrients	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure and composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents		X					X	X			X		
Annual and perennial non-timber crops		X	X	X	X	X	X	X	X	X	X	X	X
Climate change	X	X	X	X	X	X			X	X	X	X	
Commercial and industrial areas		X	X	X	X	X	X		X	X	X	X	X
Dams and water management/use		X	X	X	X	X			X	X	X	X	X
Household sewage and urban waste water		X					X	X			X		
Housing and urban areas		X	X	X	X	X	X		X	X	X	X	X
Industrial and military effluents		X					X	X			X	X	
Invasive plants/animals		X		X	X				X	X	X	X	
Livestock, farming, and ranching		X	X		X			X		X	X	X	X
Roads and railroads		X	X		X					X	X	X	X

Target: American Southwest Riparian Forest and Woodland

Goals:

- By 2025, acres of habitat are maintained or increased by at least 5 percent in every watershed throughout the ecoregion.
- By 2025, acres/miles of continuous riparian habitat are increased by at least 5 percent.
- By 2025, the range of more than one riparian SGCN is maintained or increased by at least 5 percent.
- By 2025, miles of stream that display the full range of age classes and vegetation layers (herb, shrub, subtree, trees) are increased by at least 5 percent from 2015 levels.
- By 2025, miles of surface water flows, both ephemeral and permanent, are restored to be functional enough to provide flooding and low flow patterns by at least 5 percent from 2015 miles.
- By 2025, acres where native species are dominant are increased by at least 5 percent of riparian habitat (acres).
- By 2025, miles connected are increased by at least 5 percent from 2015 miles of riparian habitat connected.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire and conserve high-functioning riparian areas that have the greatest ecological potential (e.g., Santa Clara, San Luis Rey, and Ventura River watersheds, followed by larger impaired systems and those that support SGCN), and functioning riparian habitat on private property.

Objective(s):

- Increase riparian habitat function and protection on private property (e.g., through conservation easement on agricultural land, fencing of cattle, limiting water diversions, and erosion control).

Targeted pressure(s): Housing and urban areas; livestock, farming, and ranching.

Conservation action(s):

- Purchase lands or secure easements from willing sellers through grants and other funding sources.
- Integrate National Pollutant Discharge Elimination System (NPDES) permitting and NCCPs to allow water quality mitigation to complement habitat conservation planning.
- Identify, prioritize, protect, and manage wildlife corridors necessary to complete regional protected area networks across the entire region to facilitate the movement of native species whose distributions are projected to shift with climate change, and to provide “refuge” areas, which may allow species to persist as the climate changes.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data to establish baseline inventory of SGCN distribution, habitats, and pressures.

Objective(s):

- Establish baseline inventory of SGCN/habitat and threat distributions.

Targeted pressure(s): Livestock, farming, and ranching; housing and urban areas; tourism and recreation areas; garbage and solid waste; household sewage and urban waste water; catastrophic geological events; fire and fire suppression; dams and water management/use; invasive plants/animals.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education focused on improving vegetation structural diversity, reducing infestations of invasive species (for plants, specifically *Arundo* and tamarisk), and protecting functioning riparian habitat on private property.

Objective(s):

- Improve vertical and horizontal structural diversity of riparian habitat.
- Reduce the aerial extent of invasive infestations (to 35-50 percent of area that has invasive plant infestations [specifically *Arundo* and tamarisk] and/or invasive animal species). For controlling riparian invasive plant species such as *Arundo* and tamarisk, this objective includes identifying upstream stream bank sources.
- Increase riparian habitat function on private property.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 4 (Law and Policy): Advocate for effective enforcement laws to reduce impacts of waste and disturbance on significant riparian areas.

Objective(s):

- Reduce the number of riparian areas that are impacted by waste and disturbance.

Targeted pressure(s): Garbage and solid waste; household sewage and urban waste water.

Conservation Strategy 5 (Direct Management): Manage invasive species, with focus on reducing the extent of invasive species (particularly *Arundo* and tamarisk) and improving structural diversity of native vegetation.

Objective(s):
- Improve vertical and horizontal structural diversity of riparian habitat.
- Reduce the aerial extent of invasive infestations (to 35-50 percent of area that has invasive plant infestations [specifically *Arundo* and tamarisk] and/or invasive animal species).
- Pursue funding for invasive species eradication and control.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Identify areas with greatest restoration potential and upstream sources of invasive species.
- Develop management plans.
- Identify and develop restoration partnerships.
- Identify appropriate and effective restoration techniques for each location.
- Identify restoration success criteria.
- Develop and implement monitoring plan.
- Implement priority invasive removal.
- Develop invasive plant tax.
- Develop public outreach program.
- Restore and enhance native plant species.
- Streamline permitting for restoration projects.

Conservation Strategy 6 (Direct Management): Manage barriers to water movement, with focus on improving stream water volume, groundwater levels, vegetation age-class heterogeneity, channel pattern, and seasonal flow variation.

Objective(s):
- Restore ephemeral and perennial surface water flows to mimic historic patterns of flooding and low-flow patterns (+/- 25 percent).
- Maintain low flows to sustain aquatic species.
- Increase age class heterogeneity and successional dynamics in impaired areas to maintain at least two age classes.
- Reduce channel incision and increase riparian vegetation in floodplains.
- Restore seasonal flow variation (so that annual hydrographs track the natural hydrographs of drainages [+/- 10 percent], particularly in reaches with breeding amphibian SGCN).
- Increase and maintain ground water levels.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Inventory barriers and assess flow and water condition.
- Coordinate with private landowners.
- Prioritize watershed or reaches for barrier treatment.
- Develop an eco-regional water management plan.
- Obtain permits, conduct environmental review.
- Implement water management plan.
- Coordinate with the various dam operators to discuss opportunities and constraints.
- Engage in State Water Resources Control Board (SWRCB) permitting process.
- Streamline permitting for conservation projects.

Conservation Strategy 7 (Management Planning): Engage in local planning to encourage the use of bio (soft)-engineering for flood control, retention of functional floodplains, and deterrence and capture of waste and pollution.

Objective(s):

- Restore ephemeral and perennial surface water flows to mimic historic patterns of flooding and low-flow patterns (+/- 25 percent), maintain low flows to sustain aquatic species.
- Improve vertical and horizontal structural diversity of riparian habitat.
- Reduce the aerial extent of invasive infestations (to 35-50 percent of area that has invasive plant infestations [specifically *Arundo* and tamarisk] and/or invasive animal species).
- Increase SGCN diversity to 50-70 percent of historic/normal conditions
- Reduce channel incision and increase riparian vegetation in floodplains.
- Reduce the number of riparian areas that are impacted by waste and disturbance.

Targeted pressure(s): Garbage and solid waste; household sewage and urban waste water; dams and water management/use.

Conservation action(s):

- Encourage use of bio filters for urban runoff.
- Maintain treated effluent flows into riparian areas.
- Engage in development and implementation of Integrated Regional Management Plans.
- Direct increased resources/staffing towards engagement in local planning.
- Encourage appropriate site-specific native riparian plants for adjacent landscaping.
- Communicate BMPs to local planners.
- Obtain funding for program implementation.
- Identify key areas within watersheds where wetland banks to streamline NPDES permitting can be established to improve water quality and provide benefits to biological resources.
- Integrate NPDES permitting and NCCPs to allow water quality mitigation to complement habitat conservation planning.

Table 5.5-7 Stresses and Pressures for American Southwest Riparian Forest and Woodland

Priority Pressures	Stresses											
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics					Ecosystem Conditions and Processes				
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Catastrophic geological events	X		X	X				X	X		X	X
Dams and water management/use	X		X	X	X			X	X		X	
Fire and fire suppression	X	X	X	X				X	X		X	X
Garbage and solid waste			X				X		X			
Household sewage and urban waste water	X						X		X			
Housing and urban areas		X	X	X	X	X	X		X	X	X	X
Invasive plants/animals				X				X	X	X	X	
Livestock, farming, and ranching	X					X	X		X	X	X	X
Mining and quarrying			X	X			X	X	X		X	
Recreational activities									X			
Roads and railroads												X
Tourism and recreation areas									X			

Target: Native Fish Assemblage

Goals:

- By 2025, miles of streams containing their historic native fish composition are increased by at least 5 percent.
- By 2025, at least two more streams than in 2015 have improved connectivity.
- By 2025, the ratio of native fish to non-native fish in Big Tujunga Creek, Haines Creek, and the Santa Clara River mainstem is increased by at least 5 percent.
- By 2025, all species and their life stages are present and commonly encountered during summer fish surveys within their currently known range.
- By 2025, suitable flows are released to maintain target populations below Big Tujunga and Cogswell dams.
- By 2025, the natural hydrologic regime in coastal lagoons that support target species is maintained or increased by at least 5 percent.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect and restore unarmored threespine stickleback (UTS) habitat within the Santa Clara River mainstem, Soledad Canyon, and Bouquet Canyon.

Objective(s):

- Protect and enhance UTS habitat within the Santa Clara River mainstem, Soledad Canyon, and Bouquet Canyon.

Targeted pressure(s): Dams and water management/use; housing and urban areas.

Conservation action(s):

- Develop and implement restoration and acquisition projects and funding sources.
- Survey and map extent of UTS populations in all three streams.
- Survey and map all potential UTS habitat in the three streams.
- Provide education and outreach.
- Obtain funding for plan implementation and staff.

Conservation Strategy 2 (Data Collection and Analysis): Collect and analyze data to establish a baseline inventory of SCGN distribution.

Objective(s):

- Establish baseline inventory of SGCN distribution.
- Complete comprehensive UTS surveys in the Santa Clara watershed with focus on Soledad and Bouquet Canyons.

Targeted pressure(s): Dams and water management/use; housing and urban areas.

Conservation Strategy 3 (Data Collection and Analysis): Identify areas that may act as climate refugia.

Objective(s):

- Identify representative habitats to accommodate species movement and adaptation.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Outreach and Education): Implement outreach.

Objective(s):

- Raise public awareness and support for native fish restoration projects.
- Educate public on risks of invasive species and importance of aquatic biodiversity management plans.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 5 (Direct Management): Translocate species to increase current distribution; specifically, translocate Santa Ana sucker, Santa Ana speckled dace, and UTS into suitable habitat in the Big Tujunga, San Gabriel, and Santa Clara watersheds.

Objective(s):
- Increase the distribution of native fish.

Targeted pressure(s): Dams and water management/use; invasive plants/animals.

Conservation action(s):
- Develop a translocation plan.
- Work with federal agencies and flood control agencies to identify constraints and obtain buy-in.
- Monitor target fish populations.
- Obtain funding for plan implementation and staff.

Conservation Strategy 6 (Direct Management): Improve fish passage by working with federal, state, and local agencies to identify and remove key fish barriers to fish movement and sediment flow, and keep priority areas barrier free.

Objective(s):
- Assess, prioritize, and remove/modify fish passage barriers.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Develop barrier assessment protocols.
- Develop barrier removal guidelines, BMPs, and plan to monitor barrier removal effectiveness.
- Obtain funding for plan implementation and staff.
- Coordinate with state, federal agencies, local government, and private landowners.
- Identify partners.

Conservation Strategy 7 (Direct Management): Protect and restore floodplain function.

Objective(s):
- Align policies, regulations, planning, and agency coordination to support multi-benefit floodplain management; implement and maintain priority floodplain restoration projects.

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; mining and quarrying.

Conservation Strategy 8 (Direct Management): Restore natural flows.

Objective(s):
- Identify streams/reaches in greatest need of flow remediation and create plans for restoration.
- Monitor restored stream reaches for recolonization and implement translocation, as necessary, to re-establish populations.
- Work with relevant agencies and partners to develop a flow prescription for Bouquet Creek and the Santa Clara River.

Targeted pressure(s): Dams and water management/use; invasive plants/animals.

Conservation action(s):
- Monitor flow compliance.
- Identify partners.
- Coordinate with state and federal agencies, local governments, and private landowners.
- Monitor fish populations.
- Obtain funding for plan implementation and staff.

Conservation Strategy 9 (Direct Management): Control invasive species.

Objective(s):
- Assess, map, and develop control plans for invasive aquatic species.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Compile maps of invasive species already completed for planning area.
- Conduct additional mapping as necessary to fill gaps.
- Develop control plans for priority species.
- Develop Invasives Coordination Group to streamline and coordinate current agencies, organizations, activities.
- Implement priority species control plans.
- Map invasive species and develop control plans.
- Implement top-priority controls plans.
- Monitor invasive species and continue removal efforts as needed to control populations.
- Implement outreach and education specific to spread of invasive species.

Table 5.5-8 Stresses and Pressures for Native Fish Assemblage

Priority Pressures	Stresses									
	Hydrology and Water Characteristics						Ecosystem Conditions and Processes			
	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in nutrients	Change in pollutants	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Annual and perennial non-timber crops	X	X		X	X	X	X	X	X	X
Dams and water management/use	X	X	X	X			X			X
Household sewage and urban waste water					X	X				
Housing and urban areas	X	X	X	X	X	X	X	X	X	X
Invasive plants/animals							X	X		
Mining and quarrying						X			X	

Target: South Coast Native Aquatic Herp Assemblage

Goals:

- By 2025, area occupied by assemblage is increased by at least 5 percent from 2015 levels.
- By 2025, all populations contain both juvenile (egg and tadpole) and adult life stages in adequate abundance to ensure population sustainability.
- By 2025, non-native invasive aquatic species are reduced by at least 5 percent within sensitive amphibian habitat, and their source populations are identified to aid recovery of native amphibians.
- By 2025, flow regimes to provide access to suitable habitat for native species are restored by at least 5 percent from 2015.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land in fee or with conservation easements, with focus on riparian habitats that have the greatest ecological potential such as larger impaired systems and those that support SGCN.

Objective(s):

- Increase riparian habitat function and protection on private property (e.g., through conservation easement on agricultural land, fencing of cattle, limiting water diversions, and erosion control).
- Conserve high functioning riparian areas, with focus on areas that have the greatest ecological potential such as larger impaired systems and those that support SGCN.

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; invasive plants/animals; recreational activities.

Conservation action(s):

- Purchase lands or secure conservation easements from willing sellers through grants and other funding sources.
- Encourage/promote the use of NCCPs to identify and prioritize conservation areas.
- Implement in lieu fee program.
- Develop CAPPs.
- Identify and prioritize ACE.
- Obtain funding for program implementation, land acquisition and restoration.
- Identify existing conserved areas.
- Direct project mitigation to priority areas needing conservation.
- Direct and use conservation banking.
- Create ACE database viewable by all CDFW staff.
- Split parcels for conservation.
- Identify which parcels to be acquired in fee or as conservation easement.
- Conduct baseline inventory.

Conservation Strategy 2 (Data Collection and Analysis): Conduct research to identify causal mechanism for Chytrid fungus and prevent its spread in amphibian populations.

Objective(s):

- Identify causal mechanisms for Chytrid fungus and prevent its spread in amphibian populations.

Targeted pressure(s): Parasites/pathogens/diseases.

Conservation action(s):

- Conduct literature review.
- Gather existing information.
- Develop study design.
- Consult with experts.
- Obtain funding.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education.

Objective(s):

- Educate public on impacts associated with their activities and damage to native species from introduction of non-native species.
- Keep public informed on development and status of BMPs.

Targeted pressure(s): Recreational activities; annual and perennial non-timber crops; invasive plants/animals.

Conservation Strategy 4 (Direct Management): Protect and restore habitat, and create riparian buffers adjacent to streams.

Objective(s):

- Create buffers of properly functioning riparian habitat adjacent to streams.

Targeted pressure(s): Housing and urban areas; recreational activities; annual and perennial non-timber crops; invasive plants/animals; annual and perennial non-timber crops.

Conservation Strategy 5 (Direct Management): Manage invasive species to improve conditions for native fish and aquatic herps.

Objective(s):

- Prevent additional future invasive species from becoming established, and manage invasive species levels to improve conditions for native fish and aquatic herps.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Update data on extent and distribution of native and non-native species.
- Develop strategy for removal of non-native fish species and aquatic weeds.
- Coordinate with other agencies and private landowners.
- Obtain permits and environmental review if needed.
- Obtain funding for implementation and staff.
- Conduct management activities (e.g., electroshock, seine, etc.).
- Conduct post treatment monitoring.
- Initiate long-term monitoring and management plan.
- Implement mechanical and chemical treatment of invasive weeds within riparian areas.

Conservation Strategy 6 (Direct Management): Reintroduce native species.

Objective(s):

- Re-establish native amphibians and reptiles in their historic range.

Targeted pressure(s): Invasive plants/animals; housing and urban areas.

Conservation action(s):

- Conduct feasibility analysis to identify target streams.
- Identify source population or propagate.
- Evaluate control methods for non-native species.
- Develop reintroduction plan including post-treatment monitoring.
- Coordinate with agencies and non-governmental organizations.
- Conduct environmental review and obtain permits.
- Obtain funding for implementation and staff.

Conservation Strategy 7 (Direct Management): Manage flows, dams, and other barriers to best benefit aquatic herps and for fish passage.

Objective(s):

- Allow more bypass flows through water conservation and allow fish passage.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Coordinate with state and federal agencies, counties, and private landowners.
- Inventory barriers and assess flow and water condition.
- Develop plan for prioritization and construction.
- Obtain funding for implementation and staffing.
- Obtain permits, conduct environmental review.
- Remove or retrofit barriers.
- Implement water conservation flow.

Table 5.5-9 Stresses and Pressures for South Coast Native Aquatic Herp Assemblage

Priority Pressures	Stresses							
	Hydrology and Water Characteristics					Ecosystem Conditions and Processes		
	Change in runoff and river flow	Change in water levels and hydroperiod	Change in groundwater tables	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Habitat fragmentation
Annual and perennial non-timber crops		X	X	X	X	X	X	
Housing and urban areas	X	X	X	X	X	X	X	X
Invasive plants/animals						X	X	X
Dams and water management/use	X	X	X			X		X
Parasites/pathogens/diseases						X		
Recreational activities						X		
Roads and railroads						X		X

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Table 5.5-10 Conservation Targets and Strategies for the South Coast Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
California Grassland and Flowerfields	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres connected are increased by at least 5% from 2015 acres. • By 2025, acres with desired endemic plant/animal diversity are increased by at least 5% from 2015. • By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. • By 2025, populations of key species are increased by at least 5% from 2015 population levels. • By 2025, acres/miles with desired plant/animal diversity are increased by at least 5% from 2015 acres/miles. • By 2025, acres with desired genetic connectivity are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Fire regime • Nutrient concentrations and dynamics • Successional dynamics • Soil quality and sediment deposition regime	• Annual and perennial non-timber crops • Climate change • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Management Planning • Partner Engagement
Freshwater Marsh	• By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. • By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. • By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. • By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. • By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. • By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Surface water flow regime	• Agricultural and forestry effluents • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Economic Incentives • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education
American Southwest Riparian Forest and Woodland	• By 2025, acres of habitat are maintained or increased by at least 5% in every watershed throughout the ecoregion. • By 2025, acres/miles of continuous riparian habitat are increased by at least 5% from 2015 levels. • By 2025, the range of more than one riparian SGCN is maintained or increased by at least 5%. • By 2025, miles of stream that display the full range of age classes and vegetation layers (herb, shrub, subtree, trees) are increased by at least 5% from 2015 levels. • By 2025, miles of surface water flows, both ephemeral and permanent, are restored to mimic historic patterns (hydrographs) of flooding and low flow patterns by at least 5% from 2015 miles. • By 2025, acres where native species are dominant are increased by at least 5% of riparian habitat. • By 2025, miles connected are increased by at least 5% from 2015 miles of riparian habitat connected.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Surface water flow regime • Water level fluctuations	• Catastrophic geological events • Climate change • Dams and water management/use • Fire and fire suppression • Garbage and solid waste • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Recreational activities • Roads and railroads • Tourism and recreation areas	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Law and Policy • Management Planning • Outreach and Education

Table 5.5-10 Conservation Targets and Strategies for the South Coast Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Native Fish Assemblage	• By 2025, miles of streams containing their historic native fish composition are increased by at least 5%. • By 2025, at least two more streams than in 2015 have improved connectivity. • By 2025, the ratio of native fish to non-native fish in Big Tujunga Creek, Haines Creek, and the Santa Clara River mainstem is increased by at least 5%. • By 2025, all species and their life stages are present and commonly encountered during summer fish surveys within their currently known range. • By 2025, suitable flows are released to maintain target populations below Big Tujunga and Cogswell dams. • By 2025, the natural hydrologic regime in coastal lagoons that support target species is maintained or increased by at least 5%.	• Community structure and composition • Connectivity among communities and ecosystems • Surface water flow regime • Water level fluctuations	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Household sewage and urban waste water • Housing and urban areas • Invasive plants/animals • Mining and quarrying	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Outreach and Education
South Coast Native Aquatic Herp Assemblage	• By 2025, area occupied by assemblage is increased by at least 5% from 2015 levels. • By 2025, all populations contain both juvenile (egg and tadpole) and adult life stages in adequate abundance to ensure population sustainability. • By 2025, non-native invasive aquatic species are reduced by at least 5% within sensitive amphibian habitat, and their source populations are identified to aid recovery of native amphibians. • By 2025, flow regimes to provide access to suitable habitat for native species are restored by at least 5% from 2015.	• Area and extent of community • Community structure and composition • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Housing and urban areas • Invasive plants/animals • Mining and quarrying • Parasites/pathogens/diseases • Recreational activities • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/ Lease • Outreach and Education

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

Deserts Province

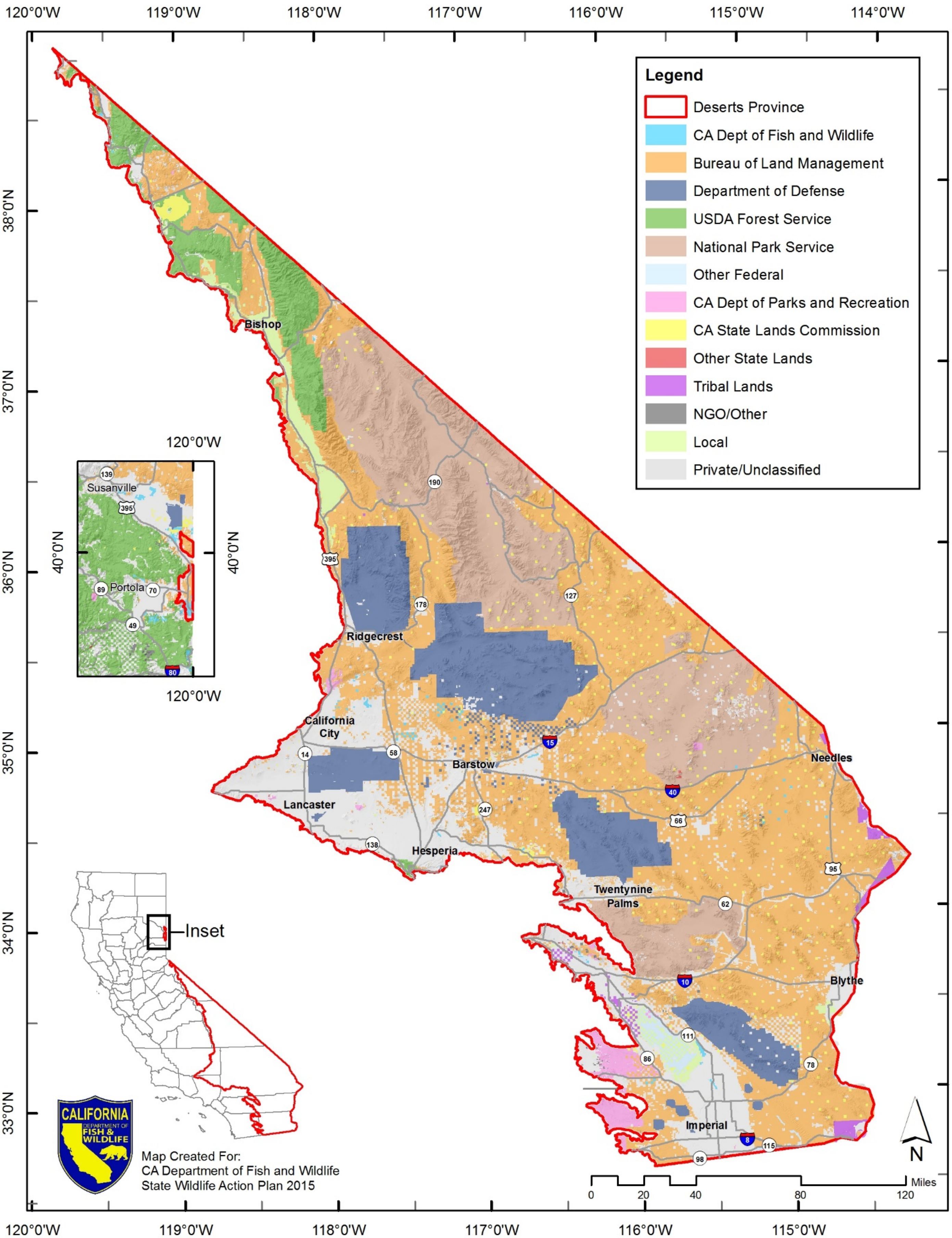
5.6 Deserts Province

5.6.1 Geophysical and Ecological Description of the Province

The Deserts Province extends from the California-Mexico border on the south and Colorado River on the southeast north to Topaz Lake on the California-Nevada border (Figure 5.6-1). The province's western border is formed by the Peninsula Mountain Ranges and Transverse Mountain Range in southern California, and the Sierra Nevada in central California. The province is the extension of desert regions located to the east and south of California in the states of Nevada and Arizona, and in Mexico. The Deserts Province has five different subregions: from north to south these are the Mono subregion, the Southeastern Great Basin, Mojave Desert, Sonoran Desert, and Colorado Desert. Each subregion has unique combinations of climate, topography, ecology, and land-use patterns.

The province as a whole is in the rain shadow of mountain ranges that form the western border. The dry landscape created by this barrier is characterized by unique geologic features composed of cliffs, peaks, canyons, dry washes, sand dunes, and large dry lake playas. Elevations are generally low in the southern portion of the province and rise to the north. The elevation in the south (Sonoran and Colorado deserts subregion) is generally below 1,000 feet with the lowest point at 275 feet below sea level in the Salton Trough. The topography of the more northerly portion of the province (Mojave Desert subregion) is characterized by a moderately high plateau: elevations range from 282 feet below sea level in Death Valley to 11,000 feet above sea level in the Panamint Mountains. The northernmost portion of the province (the Mono subregion) is composed of isolated mountain ranges separated by alluvial fans and basins. Elevations range from 4,400 to more than 14,200 feet in the White Mountains. The Southeastern Great Basin subregion is characterized by basin and range topography (i.e., widely-separated short ranges in desert plains) and contains isolated mountains, plateaus, alluvial fans, basins, and dunes; elevations range from approximately 1,000 to 11,000 feet.

The climate of the province varies from cooler and wetter in the north to hotter and drier in the south. The climate of the southern portion of the province (Sonoran and Colorado deserts) is distinct in that it experiences higher daytime temperatures than high desert regions to the north, and has two rainy seasons per year: winter and late summer. Its hydrology is characterized by groundwater springs and runoff from seasonal rains that form canyon-mouth alluvial fans, desert arroyos, desert fan palm oases, freshwater marshes, brine lakes, desert washes, and ephemeral and perennial streams. Perennial streams in the Panamint Range are found in Surprise Canyon and Cottonwood Creek, and the Amargosa and Mojave rivers. Major rivers and hydrologic features in the northern portion of the province include Owen's River, Owens Dry Lake, Crowley Lake (reservoir), Mono Lake, and Walker River. The most significant aquatic systems in the southern portion of the province are the Salton Sea and the Colorado River. These aquatic features provide vital wet habitats that support wildlife diversity in the province.



Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands

Figure 5.6-1 Land Ownership of the Deserts Province

The variations in elevation, soil composition, and sun and wind exposure, along with desert springs, seeps, and riparian corridors provide isolated microclimates and ecosystems throughout the province.

Common habitats in the province are big sagebrush, creosote bush scrub, desert saltbush, Joshua tree scrub, desert wash, alkali scrub, mixed scrub (including yucca and cholla cactus), sandy soil grasslands and desert dunes, and juniper-pinyon woodlands in the Mojave desert region. Aquatic and wetland habitats support cottonwood, willow, and non-native tamarisk. Desert fan palm oases are found only in the southern portion of the province where permanent water sources are available (e.g., springs). Higher elevation habitats include pinyon pine and California juniper, with areas of manzanita and Coulter pine.

The harsh and diverse environment found in this province has resulted in the evolution of numerous endemic species adapted to specialized desert habitats. Among these are the Joshua tree, barred and prickly pear cactus, pinyon pine, California fan palm, Mojave ground squirrel, and Amargosa vole. The province provides habitat for burrowing owl, Gambel's quail, greater sage-grouse, rosy boa, red diamond rattlesnake, desert horned lizard, collared and leopard lizard, Mohave ground squirrel, desert kangaroo rat, cactus mouse, Mojave and Amargosa vole, black-tailed jackrabbit, bobcat, kit fox, mountain lion, mule deer, and desert bighorn sheep. State and federally listed species include flat-tailed horned lizard, Coachella Valley fringe-toed lizard, desert tortoise, prairie falcon, Andrew's dune scarab beetle, Peninsular bighorn sheep, and California leaf-nosed bat. Species reliant on aquatic and wetland habitats include arroyo toad, desert pupfish, Yuma Ridgeway's rail, and southwestern willow flycatcher. Fan palm oases host species such as the blue-black giant palm-boring beetle and species such as the western yellow bat, which is strongly associated with this habitat.

Sky Islands

Sky islands are isolated mountains surrounded by radically different lowland environments. This has significant implications for natural habitats. Endemism, altitudinal migration, and relict populations are some of the natural phenomena to be found on sky islands. One of the key elements of a sky island is separation by physical distance from the other mountain ranges, resulting in a habitat island, such as a forest surrounded by desert. Some sky islands serve as refugia for boreal species stranded by warming climates since the last ice age. Mountains in the Sonoran desert subregion may be considered sky islands because they function as a habitat island for species associated with forested and montane communities.

The wildlife of the province is affected by ecosystem degradation from urban growth, off-highway vehicle activity, large-scale renewable energy development, cattle and sheep grazing, groundwater overdraft, illegal harvesting or commercialization of resources, and dominance of introduced invasive plants. These activities and conditions have resulted in and continue to result in fragmentation of the landscape, degradation of habitat, and disruption of ecosystems.

In the Mojave Desert subregion of the province, 80 percent of the region is managed by federal agencies (U.S. Bureau of Land Management [BLM], National Park Service [NPS], and U.S. Department of Defense [DOD]); 18 percent of the region belongs to private landowners or municipalities. In the Colorado Desert and Sonoran Desert subregions of the province, the federal government manages approximately 50 percent of the region (BLM and DOD). Other public land management agencies within the region are California State Parks, CDFW, and U.S. Fish and Wildlife Service (USFWS). Joshua Tree National Park spans the transition zone from the Mojave to the Colorado Desert. Anza Borrego Desert State Park encompasses nearly nine percent of the Colorado and Sonoran desert subregion. Together, Joshua Tree National Park, Anza Borrego Desert State Park, and the Santa Rosa Wildlife Area, along with other protected lands in the Mojave Desert, are part of the Mojave and Colorado Deserts Biosphere Reserve, designated by the United Nations as an important global site for preservation of the biological and cultural resources of these desert regions. In addition, a 25-million acre expanse of land in the province is designated as the California Desert Conservation Area (CDCA) through the Federal Land Policy and Management Act,

Human activities have had substantial impacts on the province's habitats and wildlife. Some of the greatest human-caused effects on the region have resulted from the water diversions and flood control measures along the Colorado River. These measures have dramatically altered the region's hydrology by redistributing the province's water supply to large expanses of irrigated agriculture and metropolitan areas. Of the province's species at risk, many are dependent on habitats that have limited distribution. Pressures from population growth and development are particularly acute for species that depend on restricted habitats, such as Peninsular bighorn sheep.

Conservation and Restoration of the Salton Sea

The Salton Sea, located in southern Riverside and northern Imperial counties in Southern California, is California's largest lake. Although large seas have cyclically formed and dried over historic time in the basin due to natural flooding from the Colorado River, the current Salton Sea was formed when Colorado River floodwater breached an irrigation canal being constructed in the Imperial Valley in 1905 and flowed into the Salton Sink. The Sea has since been maintained by irrigation runoff in the Imperial and Coachella valleys and local rivers. Because the Sea is a terminal lake, increasingly concentrated salts have resulted in a salinity that is currently 50 percent greater than that of the ocean.

Although it has only existed for about 100 years, the Salton Sea has become an extremely critical resource for many species of resident and migratory birds, including several species of special concern. Due to the significant loss of wetlands in California and other areas, the Salton Sea ecosystem has become one of the most important wetlands for birds in North America and supports some of the highest levels of avian

biodiversity in the southwestern United States. Recent studies have documented the great importance of the Salton Sea ecosystem in providing habitat for migrating and resident waterbirds, particularly Pacific Flyway waterbirds. More than 400 resident, migratory, and special-status bird species have been recorded in the Salton Sea area since its formation, with about 270 of those species using the Salton Sea on a fairly regular basis. In addition to the diversity of birds, studies have indicated that the large number of individual birds using the Salton Sea is even more ecologically relevant than the number of species.

Until recently, the Sea also supported a robust marine sport fishery that included orangemouth corvina (*Cynoscion xanthulus*), Gulf croaker (*Bairdiella icistia*), and sargo (*Anisotremus davidsoni*). Increasing salinity has eliminated the marine fishery, leaving only the euryhaline tilapia to provide sport fishing. Tilapia and several smaller nonsport fish species, of which only the endangered desert pupfish (*Cyprinodon macularius*) is native, currently sustain a number of bird species.

Declining inflows in future years will result in collapse of the Salton Sea ecosystem due to increasing salinity and other water quality issues, such as temperature, eutrophication, and related anoxia and algal productivity. Pileworms and barnacles, primary components of the Salton Sea food web, already appear to be affected by deteriorating water quality. Tilapia, which is presently the primary forage species for piscivorous (fish-eating) birds at the Salton Sea, may be eliminated when salinity exceeds 60 parts per thousand (ppt). Salinity reached 50 ppt in 2008 and could exceed 60 ppt as early as 2018. Tilapia will likely continue to persist in areas of lower salinity where the rivers, creeks, and agricultural drains enter the Salton Sea. However, the loss of fish populations from the open water area would significantly reduce and possibly eliminate use of the Salton Sea by piscivorous birds, such as pelicans, double-crested cormorants, and black skimmers by the early 2020s. In addition, the relative abundance of bird species that forage on invertebrates likely would change over time with increases in salinity and resultant changes in the invertebrate community.

The Quantification Settlement Agreement (QSA) is one of the factors contributing to declining inflows to the Salton Sea. California historically used more than its normal year apportionment of Colorado River water, obtaining the excess from water apportioned to Arizona and Nevada but not used by those states, and by water designated as surplus by the Secretary of the Interior. The amount of unused apportionment previously available to California has diminished, however, and is unlikely to be available in the future. After prolonged negotiations between the Federal government and the California water districts that have entitlements to Colorado River water, a series of agreements, collectively known as the QSA, were made among the Federal government, State of California, Imperial Irrigation District (IID), Metropolitan Water District of Southern California, San Diego County Water Authority, and Coachella Valley Water District in October 2003. The QSA imposes water conservation measures within the IID service area to allow the transfer of this water elsewhere, which reduces the volume of agricultural runoff that constitutes the Salton Sea's chief source of water. IID is required to provide conserved water to the Sea to mitigate the effects of the transfer on salinity until 2017. After 2017, however, the Sea's salinity is expected to exceed the tolerance limit for fish and, thus, mitigation for effects on salinity ceases at that time. The reduction in water to the Sea after 2017 is anticipated to result in loss of the fishery, exposure of soils to wind erosion, and bird declines due to loss of food. Reduction of inflows to the Sea from other factors, such as water recycling in Mexico, is also contributing to increases in salinity and a declining sea elevation. IID is currently petitioning to provide conserved water to the Salton Sea until 2014 rather than 2017 so that funds be employed for habitat mitigation sooner. IID is currently in the process of preparing a Natural Community Conservation Plan (NCCP) and Habitat Conservation Plan (HCP) in consultation with CDFW and U.S. Fish and Wildlife Service (USFWS).

California Department of Water Resources is leading an ecosystem restoration program for the Salton Sea and is implementing a Monitoring and Adaptive Management Plan. For more information, see http://www.water.ca.gov/saltonsea.

5.6.2 Conservation Units and Targets

The conservation units associated with the Deserts Province are the Mono, Mojave Desert, Sonoran Desert, Colorado Desert, and Southeastern Great Basin ecoregions (Figure 5.6-2), as well as portions of the Central Lahontan (HUC 1605), Northern Mojave-Mono Lake (HUC 1809), and the Southern Mojave-Salton Sea (HUC 1810) hydrologic units (Figure 5.6-3). HUC 1503 (Lower Colorado Subregion), shown on Figure 5.6-3, is not specifically addressed in SWAP 2015, because the Lower Colorado River Multi-Species Conservation Plan is already in its implementation stage and addresses many conservation strategies important in HUC 1503.

Thirteen conservation targets were selected in this province: big sagebrush scrub, great basin pinyon-juniper woodland, shadscale-saltbush scrub, Mojave and Sonoran desert scrubs, desert wash woodland and scrub, sparsely vegetated desert dunes, American southwest riparian forest and woodland, high desert wash and "rangeland" scrub, Great Basin upland scrub, walker river native fish assemblage, cienegas, springs and spring brooks, and anthropogenically-created aquatic features (Table 5.6-1). Information about the methods used to prioritize these conservation targets is presented in Appendix D.

Although numerous potential conservation targets were identified within the province, conservation strategies were fully developed only for the targets that contained the greatest number of SCGN and that were most immediately threatened. Aquatic conservation targets currently under strategy development include rivers; streams; ponds, lakes, and reservoirs; aquatic refuges; and natural ephemeral aquatic habitats. Additional key targets will be addressed through future conservation planning efforts in more details.

Key Aquatic Habitats in the Deserts Province

Because of the extreme weather conditions and limited water availability, the aquatic ecosystems of the deserts significantly differ from the rest of the state and provide unique environments for native species. The Deserts Province team facilitated the HUC system (see Chapter 1) as much as possible to select aquatic targets and developed strategies for SWAP 2015; however the approach did not capture all the prominent features of the desert aquatic systems. The following eight key habitats were identified as the aquatic conservation targets for SWAP 2015 and future plan updates, some of which are examined and reported more in details under this document. SGCN found in the habitats are given under the end of each habitat description.

Rivers*: **Large ocean-bound rivers from sizeable montane watersheds and are usually groundwater-dependent and include the upper and lower Colorado River and Rio Grande, as well as their major tributaries like the Gila, San Juan, and Pecos rivers. [bonytail chub, Colorado pikeminnow, Colorado toad, razorback suckers]**

Streams*: **Fed by underground springs or runoff from rain and snow melt, streams such as the San Rafael (Upper Colorado), Rio Nutria (Lower Colorado), Black River (Pecos Basin), as well as isolated, often groundwater-driven relic drainage systems such as the Upper White River (Basin and Range) connect to these larger river systems.**

These include both perennial and intermittent (baseflow fed by groundwater) streams. Examples include the Owens River, Amargosa River, and Mojave River. [Amargosa (River) pupfish, Amargosa (Canyon) speckled dace, Long Valley Speckled dace, Mohave tui chub, Owens sucker, Owens tui chub, Salt Creek pupfish, Shoshone pupfish]

Springs and Spring Brooks:* Smaller spring-fed pool and run systems occur throughout the arid west and are included in the spring/spring brook habitats. [Cabin Bar tui chub, Cottonball Marsh pupfish, desert pupfish, Long Valley Speckled dace, Owens pupfish, Owens speckled dace, Owens tui chub, Saratoga Spring pupfish, Shoshone pupfish]

Cienegas (and submersed wetlands):* Cienegas are water-saturated and poorly drained wetland areas associated with perennial spring and seep systems in isolated arid basins of the southwest. Cienega habitats are unique to the desert west and rapidly disappearing. [desert pupfish, Long Valley speckled dace, Owens speckled dace, Owens pupfish]

Ponds, Lakes, Reservoirs: Natural perennial stillwater (lentic) habitats plus man-made reservoirs. [Cabin Bar tui chub, desert pupfish, Mohave tui chub, Owen sucker, Owen tui chub]

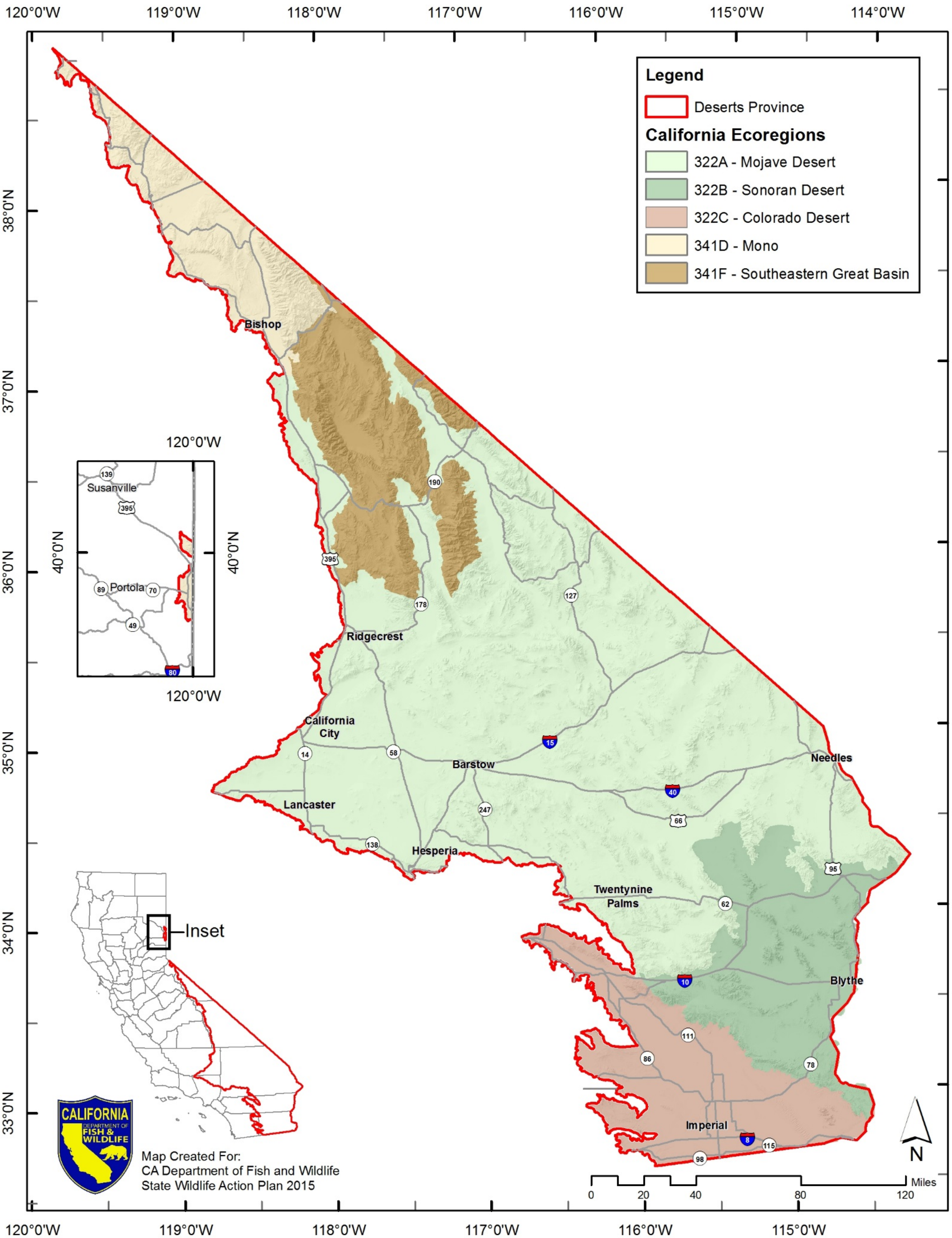
Aquatic Refuges: Natural, human-modified, or man-made watercourses/waterbodies that are specifically managed or created for the recovery/restoration/conservation of at-risk native fishes. [Cabin Bar tui chub, desert pupfish, Long Valley speckled dace, Owen pupfish, Owen speckled dace, Owen tui chub, Shoeshone pupfish]

Natural Ephemeral Aquatic Habitats: These include desert washes, dry arroyos, ephemeral (flowing in response to storm events, not groundwater) streams, playas, and vernal pools. [Couch's spadefoot]

Anthropogenically Created Aquatic Features: Various man-made features that function as perennial, intermittent, or ephemeral aquatic habitat, including: agricultural drainage ditches, irrigation canals, roadside ditches, flood control basins, borrow pits, railroad berms, golf course ponds, cattle stock ponds, and duck club ponds that incidentally support native fish and/or amphibians. These features were <u>not</u> created with the intent of providing fish or amphibian habitat. [desert pupfish, Owen speckled dace]

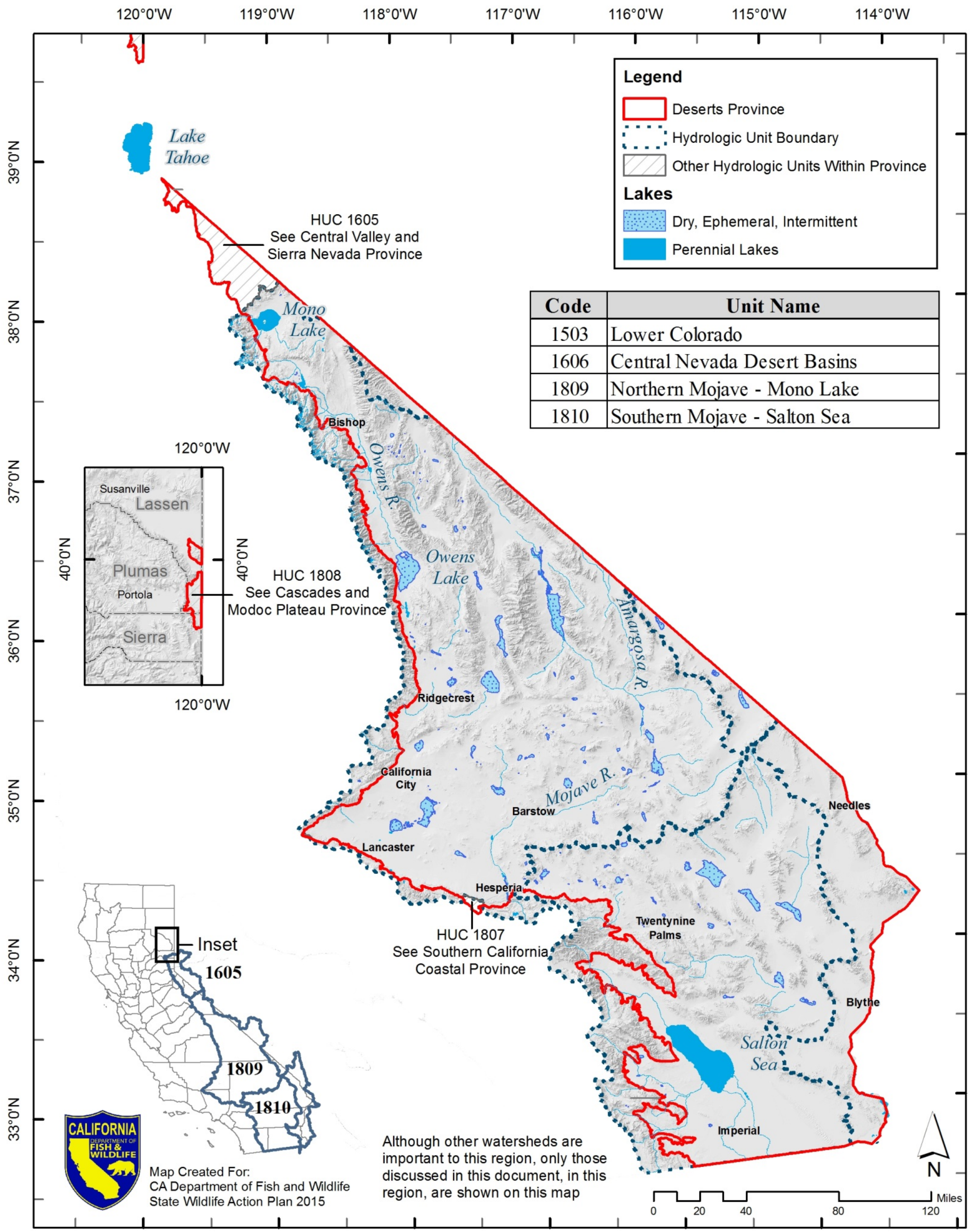
** The habitats definitions with (*) above are adapted from the Desert Fish Habitat Partnership Working Group, 2008, "Framework for Strategic Conservation of Desert Fishes" (http://www.nature.nps.gov/water/fisheries/assets/docs/DFH/strategicPlan.pdf).*

Figure 5.6-4 shows the distribution of the plant communities within the province. Some of the plant communities identified as conservation targets occur in areas smaller than the mapping unit and do not appear on the figure.



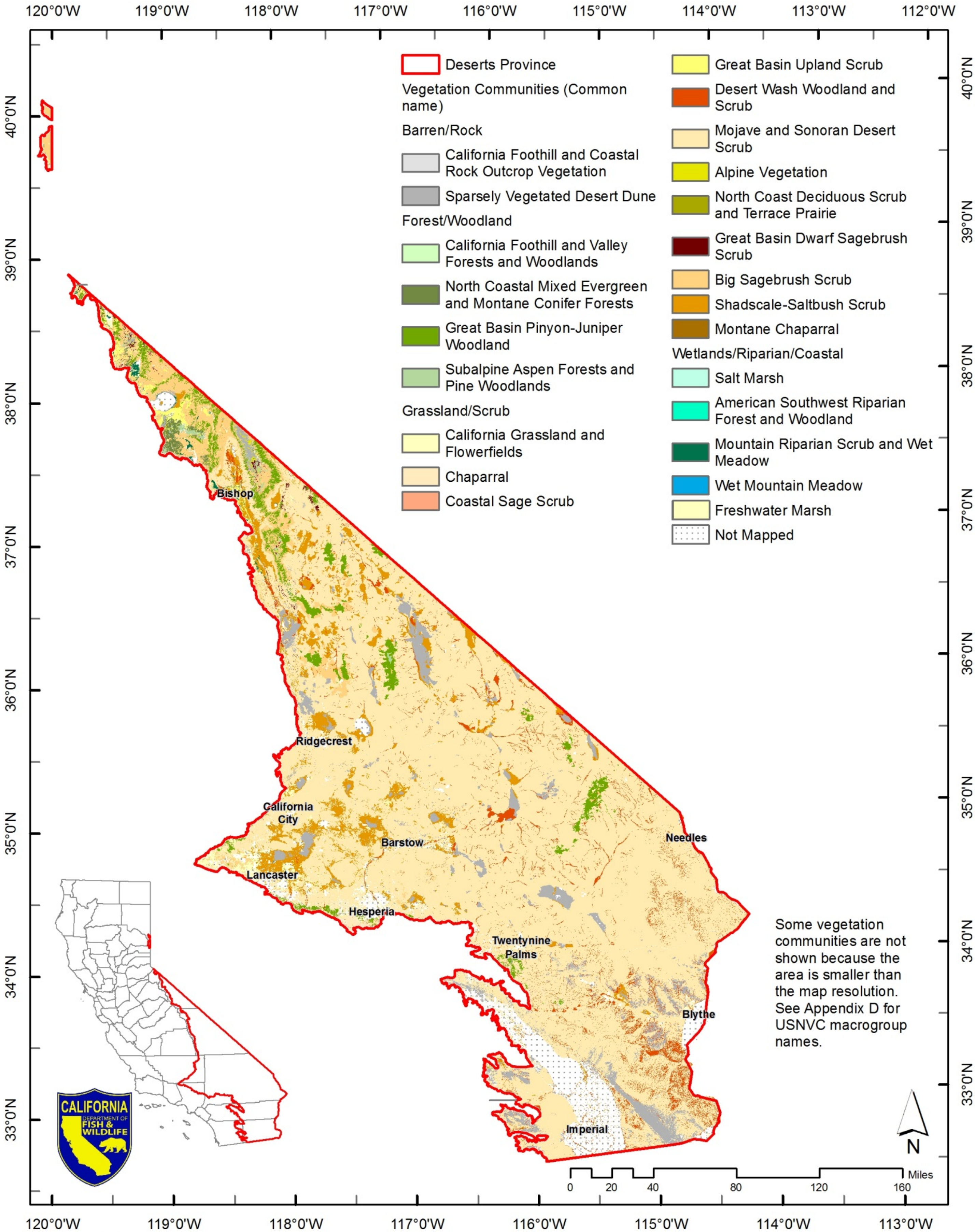
Data Source: USDA Forest Service (ecoregions); US Geological Survey (hillshade)

Figure 5.6-2 Ecoregions of the Deserts Province



Data Source: National Hydrologic Dataset (NHD); US Geological Survey (hillshade)

Figure 5.6-3 Hydrologic Units of the Deserts Province



Data Source: fveg (Calfire)

Figure 5.6-4 Plant Communities of the Deserts Province

Table 5.6-1 Conservation Units and Targets – Deserts Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR types associated with target
Mono Ecoregion	This ecoregion is in the western part of the Great Basin, just east of the Sierra Nevada. Elevation range: 4,400 to 14,200	Great Basin Pinyon-Juniper Woodland	Includes all mixed and pure pinyon and juniper stands in trans-montane California. These are largely found in the Mojave Desert mountains, and in the mountains of the Modoc Plateau and great basin. They also occur on the eastern slopes of the Sierra Nevada and the Peninsular Ranges and the northern slopes of the Transverse Ranges.	Pinyon-Juniper; Juniper
		Big Sagebrush Scrub	Emblematic of the valleys and lower slopes of the great basin desert and enters California in the Modoc Plateau, south and east of the Cascades and Sierra Nevada, into the higher mountains of the Mojave desert. It also occurs in isolated patches in the Transverse and Peninsular ranges, the south and the inner north Coast Ranges sporadically northward to the eastern Klamath Mountains.	Sagebrush
Mojave Desert Ecoregion	This section is the hot part of the Basin and ranges from the southern end of the Sierra Nevada and the north-northeastern side of the Transverse Ranges to Nevada and Arizona. Elevation range: –280 to 7,900	Shadscale-Saltbush Scrub	The shrubby cool-desert saltbush species often form distinct bands above closed basins and below extensive sagebrush belts in the great basin desert. This conservation target addresses those saltbush scrubs, which typically do not grow in strongly saline or alkaline soils, but do tolerate higher pH (alkalinity) and often finer soil texture than *Artemisia tridentata* and related taxa of sagebrush.	Alkali Desert Scrub; Desert Wash; Desert Scrub
Sonoran Desert	This section is the hot part of the Basin and Range geomorphic province, from the eastern end of the Transverse Ranges and the Salton Trough east to Arizona. Elevation range: 250 to 4,400	Mojave and Sonoran Desert Scrubs	Upland desert scrub found on hill slopes and alluvial fans throughout the arid southwest where winter temperatures are not as cold as in the great basin desert and summer temperatures are very hot. The Mojave desert has frost and occasional winter snows; the Sonoran desert rarely has any frost. The warmer Sonoran desert tends to have more summer rain, and more distinctive emergent arborescent species, such as saguaro, ocotillo, and the Mojave is cooler with fewer large cacti and large thorny trees, but has Joshua trees and other Yucca species.	Desert Scrub; Desert Succulent Shrub; Joshua Tree
Colorado Desert Ecoregion	This section is a very hot part of the Basin and Range geomorphic province that is sometimes called the Salton Trough. The surface of sediments in the middle of the trough is about 275 feet below sea-level. Elevation range: –230 to 2,200	Desert Wash Woodland and Scrub	Includes the warm desert washes of the Sonoran and Colorado desert. These have trees and large shrubs associated with them while the cooler Mojave desert has fewer trees but several shrub species. Stands vary depending upon subsurface water availability, minimum winter temperature, and intensity and frequency of flooding. Also called microphyll woodland. Consists of drought-deciduous, small-leaved (microphyllous), mostly leguminous trees of riparian or wash areas. This plant community is consider an Important Bird Area by the Audubon Society. Wildlife species richness is much higher in this than other community types in the desert, and this community is slow to recover from disturbance	Desert Wash; Desert Scrub
		Sparsely Vegetated Desert Dunes	Characteristic of the desert dunes and contains both annual and perennial species with special strategies to deal with the shifting sands and the dry and unpredictable climate. Vegetation cover is variable depending upon unpredictable rainfall patterns.	Barren

Table 5.6-1 Conservation Units and Targets – Deserts Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR types associated with target
Southeastern Great Basin Ecoregion	This section comprises the southern Great Basin in the Basin and Range geomorphic province. Characterized by basin and range topography (i.e., widely-separated short ranges in desert plains) and contains isolated mountains, plateaus, alluvial fans, basins, and dunes. Elevation range: 1,000 to 11,000	American Southwest Riparian Forest and Woodland	The Great Valley, South Coast, and warm desert riparian forests and thickets are included in this target. The range of the main indicator trees and shrubs are the southwestern U.S. and northern Mexico. Most stands of this target occur below 4,000 feet elevation and are replaced by the cool-temperate version of riparian (Montane and North Coast Riparian Forest and Scrub) in the mountains and on the north coast. Diagnostic species include Fremont cottonwood, arroyo willow, narrow-leaf willow. Most stands are found in permanently moist settings or riparian settings where sub-surface water is available year-round.	Desert Riparian
		Great Basin Upland Scrub	Occurs in the cooler Mojave desert mountains, the uplands of the Great Basin and Modoc Plateau, and in isolated pockets of the inner South Coast Ranges such as Temblor Range and Carrizo Plains. It is composed of shrublands with cool desert affinities but has been segregated from the short and tall species of sagebrush (*Artemisia* spp.). Most of the vegetation in this plant community occurs well beyond the eastern borders of California into the Great Basin Province. Successional relationships exist between the several groups of alliances in this community; some are disturbance followers and may also occur in episodic washes. Some are persistent resprouting shrubs, which recover well after fire, and some are fire and browsing-sensitive with longer recovery times. Some perennial desert grasslands are also part of this community and increase with short fire intervals.	Bitterbrush; Sagebrush; Low Sage
		High Desert Wash and "Rangeland" Scrub	This is a cool desert plant community that is most common in the eastern portions of the state from Modoc Plateau, southward and east of the Cascades and Sierra Nevada into the mountains of the Mojave Desert. Stands form when fire or other clearing and disturbance remove stands of *Artemisia* (in big sagebrush scrub) or other shrubs characteristic of the Great Basin Upland Scrub community.	Bitterbrush; Sagebrush; Low Sage
Central Lahontan HUC 1605	Includes the Central Lahontan Basin, consisting of the Carson, Truckee, and Walker River Basins in California and Nevada. Covers an area of 12,500 square miles. Elevation range: 4,230-to 11,385	Walker River Native Fish Assemblage	SGCN associated with target are Lahontan cutthroat trout, mountain sucker, and mountain whitefish. Other, non-SGCN species include freshwater mussels.	N/A
Northern Mojave-Mono Lake HUC 1809	Includes the closed desert basins of eastern California that discharge into South Central California, including Mono Lake, Owens Lake, Death Valley, and the Upper Mojave Desert in	Anthropogenically-Created Aquatic Features	Various man-made features including: agricultural drainage ditches, irrigation canals, roadside ditches, flood control basins, borrow pits, railroad berms, golf course ponds, cattle stock ponds, and duck club ponds. These features were not created with the intent of providing fish or amphibian habitat.	N/A

Table 5.6-1 Conservation Units and Targets – Deserts Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR types associated with target
Northern Mojave-Mono Lake HUC 1809 (continued)	California and Nevada. Covers an area of 28,000 square miles. Elevation range: –195 to 12,530	Cienegas	Includes springs and marshy areas at the base of a mountain, in a canyon, or on edges of grasslands where groundwater flows to the surface. Cienegas are often isolated features (i.e., not draining into a stream) and evaporate, forming a small playa. Species of Greatest Conservation Need associated with target are Long Valley speckled dace, Owens speckled dace, and Owens pupfish.	N/A
		Springs and Spring Brooks	Species of Greatest Conservation Need associated with target are Cabin Bar tui chub, Cottonball Marsh pupfish, Long Valley speckled dace, Owens pupfish, Owens tui chub, Owens speckled dace, Shoshone pupfish, Saratoga Springs pupfish, south western pond turtle, black toad, Hydrobiidae springsnails, and arroyo toad.	N/A
Southern Mojave-Salton Sea HUC 1810	Includes the closed desert basins in southeastern California, including the lower Mojave Desert and the Salton Sea in California. Covers an area of 16,000 square miles. Elevation range: –230 to 10,040	Anthropogenically-Created Aquatic Features	Various man-made features including: agricultural drainage ditches, irrigation canals, roadside ditches, flood control basins, borrow pits, railroad berms, golf course ponds, cattle stock ponds, and duck club ponds. These features were not created with the intent of providing fish or amphibian habitat. Species of Greatest Conservation Need associated with target is desert pupfish.	N/A
		Cienegas	Includes springs and marshy areas at the base of a mountain, in a canyon, or on edges of grasslands where groundwater flows to the surface. Cienegas are often isolated features (i.e., not draining into a stream) and evaporate, forming a small playa. Species of Greatest Conservation Need associated with target is desert pupfish.	N/A

* Description referenced from CDFG 1988, USDA 1994, USDA 2007 and Keeler-Wolf 2010.

5.6.3 Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the Deserts Province are listed in Table 5.6-2. The most commonly identified attributes for the Deserts Province are:

- area and extent of community;
- connectivity among communities and ecosystems;
- successional dynamics;
- community structure and composition;
- hydrological regime;
- surface water flow regime; and
- soil quality and sediment deposition regime.

Table 5.6-2 Key Ecological Attributes – Deserts Province

Key Ecological Attributes	Conservation Units and Targets														
	Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave - Salton Sea HUC 1810	
	Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash Woodland and Scrub	Sparsely Vegetated Desert Dune	American Southwest Riparian Forest and Woodland	Great Basin Upland Scrub	High Desert Wash and "Rangeland" Scrub	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
Area and extent of community		X	X	X	X	X	X	X	X	X	X	X	X		X
Community structure and composition	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Connectivity among communities and ecosystems			X	X	X	X				X	X		X	X	
Fire regime	X	X										X			X
Hydrological regime			X			X				X		X	X		X
Soil quality and sediment deposition regime			X		X	X				X	X		X	X	
Successional dynamics	X		X	X				X	X				X		
Surface water flow regime					X		X			X	X		X	X	
Water quality										X	X		X	X	
Weather regime				X											

5.6.4 Species of Greatest Conservation Need in the Deserts Province

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.6-3). Not all of the focal species meet the criteria to be considered SGCN. SGCN are indicated with an asterisk. SGCN associated with the Deserts Province are shown by ecoregion in Tables C-22 through C-26 in Appendix C.

Table 5.6-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Deserts Province

		Conservation Units and Targets[1]														
		Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave - Salton Sea HUC 1810	
Common Name	**Scientific Name**	Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash woodland and scrub	Sparsely vegetated Desert Dune	High Desert Wash and "Rangeland" Scrub	Great Basin Upland Scrub	American Southwest Riparian Forest and Woodland	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
Invertebrates																
California floater	*Anodonta californiensis*										X					
Western pearlshell	*Margaritifera falcata*										X					
Wong's springsnail	*Pyrgulopsis wongi*													X		
Fishes																
Lahontan cutthroat trout*	*Oncorhynchus clarkii henshawi*										X					
Mountain whitefish	*Prosopium williamsoni*										X					
Long Valley speckled dace	*Rhinichthys osculus*													X		
Amargosa Canyon speckled dace*	*Rhinichthys osculus ssp. 1*													X		
Owens speckled dace*	*Rhinichthys osculus ssp. 2*													X		
Mohave tui chub*	*Siphateles bicolor mohavensis*													X		
Lahontan Lake tui chub*	*Siphateles bicolor pectinifer*													X		
Owens tui chub*	*Siphateles bicolor snyderi*													X		
Owens sucker*	*Catostomus fumeiventris*													X		
Mountain sucker*	*Catostomus platyrhynchus*										X					
Tahoe sucker	*Catostomus tahoensis*										X					
Desert pupfish*	*Cyprinodon macularius*														X	X
Amargosa pupfish*	*Cyprinodon nevadensis amargosae*													X		
Saratoga Springs pupfish*	*Cyprinodon nevadensis nevadensis*													X		
Shoshone pupfish*	*Cyprinodon nevadensis shoshone*													X		
Owens pupfish*	*Cyprinodon radiosus*													X		
Cottonball Marsh pupfish*	*Cyprinodon salinus milleri*													X		
Salt Creek pupfish*	*Cyprinodon salinus salinus*													X		
Paiute sculpin	*Cottus beldingi*										X					
Amphibians																
Inyo Mountains slender salamander*	*Batrachoseps campi*									X						

Table 5.6-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Deserts Province

Common Name	Scientific Name	Conservation Units and Targets[1]														
		Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave - Salton Sea HUC 1810	
		Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash woodland and scrub	Sparsely vegetated Desert Dune	High Desert Wash and "Rangeland" Scrub	Great Basin Upland Scrub	American Southwest Riparian Forest and Woodland	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
Couch's spadefoot*	*Scaphiopus couchii*				X	X						X			X	X
Arroyo toad*	*Anaxyrus californicus*			X										X		
Black toad*	*Anaxyrus exsul*									X						
Sonoran desert toad	*Incilius alvarius*				X											
Northern leopard frog	*Lithobates pipiens*		X									X				
Lowland leopard frog	*Lithobates yavapaiensis*				X											
Reptiles																
Sonora mud turtle	*Kinosternon sonoriense*				X											
Southern western pond turtle*	*Actinemys pallida*			X										X		
Mohave Desert tortoise*	*Gopherus agassizii*			X	X	X		X	X							
Flat-tailed horned lizard*	*Phrynosoma mcallii*			X			X									
Coachella Valley fringe-toed lizard*	*Uma inornata*						X									
Colorado Desert fringe-toed lizard*	*Uma notata*						X									
Mohave fringe-toed lizard*	*Uma scoparia*			X	X		X									
sandstone night lizard*	*Xantusia gracilis*						X									
Panamint alligator lizard*	*Elgaria panamintina*		X							X						
Southern California legless lizard*	*Anniella stebbinsi*			X		X										
Gila monster*	*Heloderma suspectum*			X	X	X										
Regal ring-necked snake	*Diadophis punctatus regalis*			X												
Red diamond rattlesnake*	*Crotalus ruber*			X	X	X										
Birds																
Greater sage-grouse*	*Centrocercus urophasianus*	X	X													
Least bittern*	*Ixobrychus exilis*									X						
California condor*	*Gymnogyps californianus*			X												
Cooper's hawk (nesting)	*Accipiter cooperii*		X			X										
Golden eagle*	*Aquila chrysaetos*	X	X	X	X	X		X	X							
Ferruginous hawk	*Buteo regalis*	X						X	X							
Swainson's hawk*	*Buteo swainsoni*			X												
Northern harrier*	*Circus cyaneus*		X	X	X			X	X	X						

Table 5.6-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Deserts Province

Common Name	Scientific Name	Conservation Units and Targets[1]														
		Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave - Salton Sea HUC 1810	
		Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash woodland and scrub	Sparsely vegetated Desert Dune	High Desert Wash and "Rangeland" Scrub	Great Basin Upland Scrub	American Southwest Riparian Forest and Woodland	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
Snowy plover (interior population)*	*Charadrius nivosus*			X	X											
Short-eared owl*	*Asio flammeus*		X	X												
Long-eared owl	*Asio otus*		X		X			X	X							
Burrowing owl*	*Athene cunicularia*	X		X	X	X		X	X							
Prairie falcon (nesting)	*Falco mexicanus*		X													
American peregrine falcon*	*Falco peregrinus anatum*	X						X	X							
Willow flycatcher*	*Empidonax traillii*			X	X											
Vermilion flycatcher*	*Pyrocephalus rubinus*			X	X											
Loggerhead shrike*	*Lanius ludovicianus*	X	X	X	X	X		X	X	X						
Least Bell's vireo*	*Vireo bellii pusillus*			X	X											
Gray vireo*	*Vireo vicinior*			X	X					X						
Bank swallow*	*Riparia riparia*			X				X	X							
Bendire's thrasher*	*Toxostoma bendirei*			X	X											
Crissal thrasher*	*Toxostoma crissale*			X	X	X	X									
Le Conte's thrasher (San Joaquin population)*	*Toxostoma lecontei*					X	X									
Common yellowthroat*	*Geothlypis trichas**							X	X							
Yellow-breasted chat*	*Icteria virens*			X	X					X						
Lucy's warbler*	*Oreothlypis luciae*			X	X											
Yellow warbler*	*Setophaga petechia*			X	X					X						
Sage sparrow	*Artemisiospiza spp.*							X	X							
Inyo California towhee*	*Melozone crissalis eremophilus*							X	X	X						
Savannah sparrow*	*Passerculus sandwichensis*							X	X							
Large-billed savannah sparrow*	*Passerculus sandwichensis rostratus*				X											
Summer tanager*	*Piranga rubra*			X	X					X						
Vesper sparrow	*Pooecetes gramineus*							X	X							
Brewer's sparrow	*Spizella breweri*		X													
Chipping sparrow	*Spizella passerina*		X													
Tricolored blackbird*	*Agelaius tricolor*			X	X											
Yellow-headed blackbird*	*Xanthocephalus*			X	X					X						

Table 5.6-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Deserts Province

Common Name	Scientific Name	Conservation Units and Targets[1]														
		Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave - Salton Sea HUC 1810	
		Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash woodland and scrub	Sparsely vegetated Desert Dune	High Desert Wash and "Rangeland" Scrub	Great Basin Upland Scrub	American Southwest Riparian Forest and Woodland	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
	xanthocephalus															
Gray-crowned Rosy-Finch*	*Leucosticte tephrocotis*	X														
Mammals																
Broad-footed mole*	*Scapanus latimanus*							X	X							
California leaf-nosed bat*	*Macrotus californicus*			X	X	X										
Pallid bat*	*Antrozous pallidus*		X	X	X	X		X	X	X						
Townsend's big-eared bat	*Corynorhinus townsendii*			X												
Western yellow bat*	*Lasiurus xanthinus*			X	X	X										
Long-eared bat*	*Myotis evotis*	X	X			X										
Fringed myotis*	*Myotis thysanodes*	X	X			X				X						
Cave myotis*	*Myotis velifer*					X										
Arizona cave myotis*	*Myotis velifer velifer*					X										
Long-legged myotis*	*Myotis volans*		X			X				X						
Western mastiff bat*	*Eumops perotis californicus*			X	X	X		X	X	X						
American pika*	*Ochotona princeps*	X														
Pygmy rabbit*	*Brachylagus idahoensis*		X													
White-tailed jackrabbit	*Lepus townsendii*									X						
Western white-tailed jackrabbit*	*Lepus townsendii townsendii*		X					X	X							
Sierra Nevada mountain beaver*	*Aplodontia rufa californica*		X													
Mohave ground squirrel*	*Spermophilus [=Xerospermophilus] mohavensis*			X												
Palm Springs round-tailed ground squirrel*	*Xerospermophilus tereticaudus chlorus*					X										
American beaver	*Castor canadensis*		X	X												
Owens Lake pocket gopher	*Ithomomys bottae operarius*			X		X										
Little pocket mouse	*Perognathus longimembris*							X	X							
Great Basin pocket mouse	*Perognathus parvus*							X	X							
Mohave river vole*	*Microtus californicus mohavensis*			X												
Owens Valley vole*	*Microtus californicus vallicola*			X												

Table 5.6-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Deserts Province

Conservation Units and Targets[1]

Common Name	Scientific Name	Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave - Salton Sea HUC 1810	
		Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash woodland and scrub	Sparsely vegetated Desert Dune	High Desert Wash and "Rangeland" Scrub	Great Basin Upland Scrub	American Southwest Riparian Forest and Woodland	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
Desert woodrat	*Neotoma lepida*							X	X							
Southern grasshopper mouse*	*Onychomys torridus ramona*			X	X					X						
Porcupine*	*Erethizon dorsatum*		X													
Kit fox	*Vulpes macrotis*			X		X										
Sierra Nevada red fox	*Vulpes vulpes necator*	X	X													
California wolverine*	*Gulo gulo*		X													
American badger*	*Taxidea taxus*	X	X	X	X	X		X	X							
Western spotted skunk	*Spilogale gracilis*	X														
Pronghorn*	*Antilocapra americana*		X	X	X											
Mule deer	*Odocoileus hemionus*	X	X	X	X	X										
Bighorn sheep*	*Ovis canadensis*		X	X	X					X						
Desert bighorn sheep*	*Ovis canadensis nelsoni*					X		X	X							

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion see Appendix C.

* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.6.5 Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have strong influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified as affecting the viability of conservation targets in the Deserts Province are summarized in Table 5.6-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures for the province. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.6.6. Some of the major pressures for the province are discussed in more detail below.

Table 5.6-4 Key Pressures on Conservation Targets – Deserts Province

Pressure	Conservation Units and Targets: Mono		Mojave Desert	Sonoran Desert	Colorado Desert		Southeastern Great Basin			Central Lahontan HUC 1605	Northern Mojave-Mono Lake HUC 1809			Southern Mojave – Salton Sea HUC 1810	
	Great Basin Pinyon-Juniper Woodland	Big Sagebrush Scrub	Shadscale-Saltbush Scrub	Mojave and Sonoran Desert Scrub	Desert Wash Woodland and Scrub	Sparsely Vegetated Desert Dune	American Southwest Riparian Forest and Woodland	Great Basin Upland Scrub	High Desert Wash and "Rangeland" Scrub	Walker River Native Fish Assemblage	Anthropogenically Created Aquatic Features	Cienegas	Springs and Spring Brooks	Anthropogenically Created Aquatic Features	Cienegas
Agricultural and forestry effluents											X			X	
Airborne pollutants			X												
Annual and perennial non-timber crops			X	X			X					X	X		X
Climate change	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas			X	X	X	X							X		
Dams and water management/use					X		X			X	X	X	X	X	X
Fire and fire suppression	X	X						X	X			X			X
Housing and urban areas		X	X	X	X	X	X					X			X
Industrial and military effluents			X												
Introduced genetic material										X		X	X		X
Invasive plants/animals	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X			X		X	X	X		X	X		X
Marine and freshwater aquaculture											X		X	X	
Military activities			X		X										
Mining and quarrying			X		X			X	X						
Other ecosystem modifications	X														
Parasites/pathogens/diseases		X					X					X			X
Recreational activities		X	X		X	X	X				X		X	X	
Renewable energy			X	X	X	X	X	X	X		X	X	X	X	X
Roads and railroads			X	X	X					X	X			X	
Tourism and recreation activities					X	X									
Utility and service lines			X	X	X										

Dams and Water Management/Use

The primary pressures to aquatic habitats in the Deserts Province are the diversion of the Colorado River, decline of the Salton Sea, diversion of water from the Mono and Owens basins, and groundwater pumping and diversion for agricultural, industrial, and domestic uses.

Colorado River

The Colorado River is the region's largest perennial waterway, with aquatic species inhabiting the river's main stem and backwaters. Numerous bird species and other wildlife are dependent on the Colorado River riparian areas and the river delta at the Sea of Cortez.

The diversion of the Colorado River for agricultural and urban water uses substantially affects the region's wildlife and ecosystems. More than a dozen large dams control, store, divert, and allow for the consumptive use of nearly all the water in the Colorado River. These dams, as well as channelization, flood control structures, and flow regulation practices have drastically altered the river's flows and sediment transport processes. Flows are much reduced and have less variation. The delta wetlands at the Sea of Cortez have been reduced to about one-tenth of their original two million acres. Additionally, water is not available to recharge the groundwater table. In many locations, groundwater levels in riparian areas along the Colorado River have receded from historical levels of less than three feet to more than ten feet below the surface. Historically, sediment was deposited at the river delta or along the river's banks by flood events, creating deep floodplain soils. Over-bank flooding also flushed the soils of built-up salts, creating more favorable conditions for vegetation. Today, however, sediment transport is blocked by dams, and natural flooding is prevented along most of the river's length (CDFG 2005).

Salton Sea

The Salton Sea is the most recent in a series of inland lakes that have historically occupied the Salton Basin. Created by inadvertent flooding resulting from anthropogenic activities and partly sustained today by agricultural drainage water, the Salton Sea can be considered neither a natural nor an entirely artificial ecosystem. It is clear, however, that the sea provides critical resources for the region's wildlife, particularly for a great diversity of birdlife. More than 400 bird species have been recorded in the Salton Sea area, including approximately 100 locally breeding species.

The sea's importance stems from its status as the major remaining aquatic habitat of inland Southern California, from its location on the Pacific Flyway, and from the diverse array of habitat types it provides. The sea's proximity to the Imperial Valley's canals and fields creates a landscape mosaic uniquely able to fulfill multiple habitat requirements for nesting, foraging, and breeding.

The Salton Sea hosts the largest populations of several waterfowl and shorebird species in California south of the San Francisco Bay-Delta region. Several species protected as threatened or endangered (or other categories) maintain populations in and around the sea, including Yuma Ridgeway's rail and California black rail, and each of these uses a slightly different array of habitat types. The Salton Sea is a major staging area for waterbirds during migration in spring and late summer. A large percentage of the North American/global populations of eared grebe and ruddy duck overwinter on the open water of the sea and nearby impoundments. The sea is a primary wintering area in the interior U.S. for both American white and brown pelicans, western grebe, and western snowy plover, and is a major nesting area for the double-crested cormorant and Caspian tern. Each of these species is being monitored by Audubon Society due to population decline and sensitivity to climate change.

The Salton Sea is vital to migratory, wintering, and breeding waterbirds (Shuford et al. 2002). Birds may number in the millions during the winter. In some years, eared grebe numbers alone have been as high as 3.5 million. Several waterbirds of high conservation concern inhabit the sea, including brown pelican, American bittern, white-faced ibis, and ruddy duck. A significant portion of the North American populations of several sensitive species, including the eared grebe, American white pelican, and Ridgway's rail, are supported by the sea. Threatened by a number of environmental problems, ranging from reduced freshwater inflows and increasing salinity to eutrophication, avian disease outbreaks, and the presence of toxic contaminants, the sea's health is declining, and birds that rely on the sea are at risk. Based on predicted trends, the brown pelican, white-faced ibis, California black rail, black tern, large-billed savannah sparrow, and most shorebirds (including long-billed curlew) are expected to struggle to maintain current population levels at the Salton Sea. The sea's decline prompted local agencies in 1993 to establish the Salton Sea Authority (composed of Imperial Irrigation District, Coachella Valley Water District, Imperial County, Riverside County, and the Torres Martinez Tribe) to address both biological and economic recovery. Most recently, the state of California established a Salton Sea Restoration Fund and took on responsibility for selecting a method for its restoration. At the federal level, the need to restore the sea was recognized with the enactment of the 1998 Salton Sea Reclamation Act, which charged the U.S. Department of the Interior (DOI) and U.S. Bureau of Reclamation (USBR) with the responsibility for restoring the sea.

The Salton Sea flooded several springs in the Salton Basin, which were inhabited by desert pupfish. The Sea and the agricultural drains that feed it now act as habitat for desert pupfish, and a conduit for connecting all remaining wild populations, including the spring-fed San Felipe Creek and Salt Creek. Without restoration, however, the Salton Sea will become too saline to support desert pupfish, and the creeks and agricultural drain habitats will become isolated from one another.

Groundwater Pumping

Groundwater pumping for agricultural, industrial, and domestic uses has lowered groundwater levels. Throughout the Mojave River basin, springs and riparian areas have dried up, causing water-stressed cottonwoods, willows, and mesquite to perish. In some areas, where groundwater levels dropped seven to ten feet, more than 50 percent of the cottonwood trees have perished. Where the water table has dropped by 20 feet beneath the Mojave River, 95 percent of the riparian forest has died. Many of the remaining areas of the riparian corridor are dominated by tamarisk (saltcedar), a non-native plant that invades areas where the native riparian habitat is stressed. Tamarisk roots can reach deeper for water, causing groundwater to recede farther (CDFG 2005).

Although population growth has slowed over the past several years, development and demand for water have still grown. While natural inflows to the basin during the last decade have exceeded the long-term average, studies indicate that groundwater levels have continued to drop. Pressure to further overdraft groundwater, especially in the Mojave basin will be intense, as the projected annual water deficit for the area will reach 57,200-79,600 acre-feet (AF) by the year 2020 (Mojave Water Agency 2004).

Stabilizing and increasing groundwater levels, in part by recharging overdrafted sub-basins, are essential to maintaining riparian habitats and allowing riparian-dependent wildlife to return to several areas of the Mojave River and adjacent streambeds. For example, the Mojave Water Agency has developed a plan to recharge the groundwater basin that would require importing about 59,000 AF of water per year by 2020 to maintain groundwater at levels that would support riparian habitats along the river and its tributaries. Recharging the region will likely require increasing water purchases from the State Water Project (SWP) and other outside sources.

Groundwater overdrafting also imperils the Amargosa River basin riparian habitat and wetlands. Also, groundwater pumping in the Amargosa Valley and in the upstream watershed is expected to increase. Increasing water use by expanding small residential communities is projected in the upper basin region of Amargosa Valley and Pahrump, Nevada. Ten thousand new homes have already been approved for construction in the small community of Pahrump. In addition, the city of Las Vegas also is seeking to tap into the groundwater basins of the surrounding rural areas in Nye County, Nevada. The Pahrump Valley is itself short of water for predicted local growth and is among the areas being examined to export water to Las Vegas (CDFG 2005). If the Amargosa River Basin is overdrafted, wildlife diversity will decline in Ash Meadows, the Amargosa Canyon, and in Death Valley National Park as the Amargosa riparian corridor withers.

Water Transfers and Diversions

With the natural aquatic and wetland systems of the desert dramatically altered and diminished, wildlife species in the region must depend on the water features related to irrigated agricultural lands. The once-arid landscape is now transected by a network of water delivery and drainage canals. Imperial Valley's 475,000 irrigated acres and Coachella Valley's 75,000 acres receive 3.2 million AF of Colorado River water annually (Cohn 2000; Cohen et al. 1999). Orchards and date palm plantations in the Coachella Valley and fields of cotton, alfalfa, Sudan grass, lettuce, sugar beets, onions, and melons in the Imperial Valley have replaced native desert communities. The New and Alamo rivers, created when the Colorado River formed the Salton Sea, are now fed principally by agricultural drainage water and provide isolated pools, marshlands, and mudflats used by shorebirds. The drains and canals used to transport water now support wetland vegetation communities and a number of sensitive species, including California black rail, western burrowing owl, and desert pupfish. Agricultural fields also provide wintering habitat for mountain plover, long-billed curlew, and sandhill crane (CDFG 2005).

In recent years, a number of regional agreements have been negotiated to transfer water from agricultural use to meet growing urban needs in other parts of the state. These water transfers will help the state to reduce its use of Colorado River water to its federal apportionment of 4.4 million AF/year.

In 2003, the Quantification Settlement Agreement (QSA) and related agreements allowed the transfer of 300,000 AF/year of Colorado River water from the Imperial Irrigation District (IID) to urban areas, primarily in coastal Southern California. The parties to these agreements included the IID, San Diego County Water Authority, the Metropolitan Water District of Southern California, USBR, and the state of California. Ultimately, water conservation through irrigation efficiency measures and lining canals with concrete (to prevent water loss through seepage) will supply the water for the transfer. Initially, however, large-scale fallowing of agricultural fields will provide surplus water for transfer. Litigation was quickly brought against the QSA, including a lawsuit to determine the validity of the agreements. Most recently, in July 2013, a Sacramento Superior Court judge entered a final judgment validating the QSA and rejecting all of the remaining legal challenges. Another round of appeals is anticipated in the near future (San Diego County Water Authority 2014).

In addition to the water transfers covered by the QSA agreements, other changes in the management of Colorado River water are planned in California and in the lower Colorado River basin states. These changes include additional agriculture-to-urban water transfers, increased water-transport efficiency, and changes in diversion points and dam release schedules to meet water supply and power generation needs. The environmental effects of these changes are addressed in the 2005 Lower Colorado River Multi-Species Conservation Program (Lower Colorado River Program). The federal Lower Colorado Program allows changes in diversion points and dam release schedules on the Colorado River by water and power agencies in California, Arizona, and Nevada, as well as by USBR and sovereign Native American tribes. The program allows total water transfers of up to 1.574 million AF of Colorado River water per year. In California, the program allows up to 800,000 AF of Colorado River water to be transferred annually. These include transfers to urban areas, including some areas in Coachella Valley, from the IID, the Palo Verde Irrigation District, and the Bard Water District.

If unmitigated, these water transfers would have substantial effects on the region's aquatic habitats and the wildlife species that depend on them. With less water applied to agricultural fields, less tailwater will flow through drains and be available to sustain the Salton Sea. Canal, drain, and irrigation-fed river habitats will be reduced. Lining canals with concrete will prevent groundwater recharge, reducing the amount of water that feeds seeps and springs as well as the Salton Sea. At the sea, lower water levels will affect shoreline habitat, and salinity will increase more rapidly with less incoming fresh water. Additionally, changes in water diversion points and in the timing of dam releases in the upper Colorado River basin will affect flows, habitats, and species in the lower Colorado River.

To address these effects, parties to the QSA and the Lower Colorado River Program committed to a number of conservation measures to mitigate for the water transfers. Permits issued in conjunction with these agreements will allow for the take of protected species under the California and federal Endangered Species Acts (CESA, ESA) that results from the water management activities covered by these agreements. The QSA also includes commitments to work toward restoration of the Salton Sea.

Housing and Urban Areas; Roads and Railroads

The western Mojave region has experienced growth as residential development spread eastward from the Los Angeles Basin. Existing local government General Plans provide for residential growth in the western Mojave to reach a population of 5 million (CDFG 2005). Significant growth is not anticipated in the eastern Mojave of California, where there is little infrastructure. But growth across the California-Nevada state border, in Pahrump and Las Vegas, will likely have an increasing effect on California's eastern Mojave Desert.

Mojave Desert

In the western Mojave, sprawling development replaces and fragments desert habitat. Growing communities require additional rights-of-way for power lines, pipelines, and roads, which further fragments habitat. This pattern and density of growth dramatically increases the severity of development's effects on wildlife (CDFG 2005). Development also increases pressure to overdraw groundwater. Groundwater levels began dropping as a result of over-drafting in the 1950s, drying up riverbeds, springs, and seeps and diminishing riparian ecosystems that depend on flowing water and saturated soils. The new water demands of rapid growth also reduce the options for recharging and restoring groundwater levels.

For more than a decade, federal, state, and local wildlife- and land-management agencies have worked to develop a multispecies regional conservation plan for the rapidly growing western Mojave. Its purpose is to conserve and protect the threatened desert tortoise, Mohave ground squirrel, and nearly 50 other sensitive plants and animals and their corresponding natural communities, while accommodating anticipated rapid growth and development in the region (BLM 2005). The challenge of developing the conservation plan is to design scientifically supported conservation measures and land-use restrictions that will ensure the long-term survival of all native species. The West Mojave Plan, as currently proposed, envisions that the conservation of species would occur primarily on existing public lands managed by BLM. A very limited amount of additional private lands within the proposed conservation area would be purchased or protected, in conjunction with facilitating development and expansion of desert cities and communities. This is not consistent with the other Southern California regional conservation planning efforts, because it will provide BLM funding to be used for conservation of species on lands they already manage rather than securing protection of species on important lands at risk of being developed (CDFG 2005).

Colorado and Sonoran Deserts

As a whole, the Colorado Desert region does not face the level of population and development pressures experienced across most of California, and it remains the state's second-least populous region (CERES 2015). However, some areas of the Colorado Desert have seen significant growth in recent decades and are facing the resulting challenges to regional wildlife. The two most notable examples are the Coachella Valley and southern Imperial County near the U.S.-Mexico border cities of Calexico and Mexicali.

Despite California's recession, communities stretching from Palm Springs eastward to Indio, including outlying communities of Mecca, Coachella, Thermal, and North Shore in the southeast, have continued to expand. For example, Cathedral City continued to grow by 2.7 percent between 2010 and 2014; Palm Desert grew by 4.1 percent (California Department of Finance [CDOF] 2014). New residential development, resort complexes, and golf courses have expanded, moving further up the canyons onto the lower slopes of the Peninsular Mountain Range and spreading across the natural communities and agricultural areas of the valley floor. Population in the valley's nine cities and surrounding unincorporated areas is projected to increase from approximately 330,000 in 2000 to between 475,000 and 518,000 residents in 2020 (Coachella Valley Association of Governments 2007).

The Coachella Valley's unique and diverse habitats host a number of sensitive, rare, and endemic species. Conflicts between these species and the rapid pace of development and recreational uses are at the forefront of wildlife agencies' concerns. Federal, state, and local agencies, along with conservation organizations, are addressing these issues through the regional habitat conservation plan, the Coachella Valley Multi-Species Habitat Conservation Plan.

Growth is also noteworthy in southern Imperial County, near the border cities of El Centro and Calexico on the U.S. side and Mexicali on the Mexico side. Some residents, drawn from coastal areas by affordable housing, commute up to two hours to the San Diego area. El Centro grew by 4 percent to 44,311 residents between 2010 and 2014; Calexico grew by 5.17 percent to a population of 40,564 (CDOF 2014). Conversion of agricultural fields to residential development is a major pressure on wildlife populations. As previously described, irrigated agricultural fields are a critical component of the habitat mosaic that sustains the great diversity and number of birds in this region. Among the species most reliant upon the Imperial Valley's agricultural fields are mountain plover and western burrowing owl, California black rail, and sandhill crane.

Expanding communities also increase the need for infrastructure, including roads, powerlines, and water supply. As in other areas of the state, pressures on wildlife populations include direct destruction of habitat, pollution, fragmentation of habitats, blockage of migratory corridors, and introduction of non-native and potentially invasive species. Population growth in neighboring regions, especially along the South Coast and across the larger Sonoran Desert, also puts demands on the resources of the Colorado Desert. Utility corridors that traverse the desert—including electric lines, gas and oil pipelines, aqueducts, and supporting service roads—are continually expanded; increasing amounts of Colorado River water are directed to growing urban areas; and visitors seek recreation opportunities in the desert's open landscapes.

Invasive Plants/Animals

Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

Mojave Desert

Numerous non-native plants have altered plant communities across large areas of the Mojave Desert, outcompeting native species and degrading upland and riparian habitats for native wildlife.

Invasive annual grasses and forbs have displaced native plants, often greatly diminishing the native forage for the desert tortoise, lizards, birds, and small mammals. These non-native grasses and forbs now dominate plant communities throughout the region. In desert tortoise critical habitat of the western Mojave, non-native plants account for more than 60 percent of the annual vegetative biomass (CDFG 2005). Some invasive plants, such as Saharan mustard, continue to spread across the region.

The abundance of non-native forbs and annual grasses (particularly *Schismus barbatus*, *S. arabicus*, and *Bromus madritensis rubens*) increases the fuel and continuity of fuels, facilitating more-frequent and hotter fires. This changes the fire frequency and fire intensity that native plants evolved with and favors other non-native plants that thrive in disturbed areas, further transforming the plant communities (CDFG 2005).

Imported tamarisk, a plant of inferior habitat value for native wildlife, has replaced native cottonwoods and willows in much of the riparian habitat of the Mojave River and of other watercourses in the region. A 1995 survey found that tamarisk dominated half of the 10,000 acres of riparian corridor along the Mojave River (CDFG 2005; Lines 1999). The leaves of tamarisk concentrate and shed salts, thus degrading soil conditions for native plants (Smith 1999). Tamarisk is more drought tolerant than native cottonwood trees and willows. In areas where groundwater levels are receding, tamarisk outcompetes water-stressed native plants (Cleverly et al. 1997; CDFG 2005).

In 2002, local, state, and federal agencies signed the Mojave Weed Management Area Memorandum of Understanding (MOU), which spells out a coordinated planning effort to prevent, control, and eradicate weeds and to educate the public about weed control in the region (Desert Managers Group [DMG] 2002). The MOU identifies a priority list of species to control in the Mojave.

The Mohave tui chub is an endangered fish that occurs only in the Mojave River. One primary cause of its population decline has likely been hybridization with arroyo chub, which was introduced into the headwaters of the Mojave River in the 1930s. Hybridization with arroyo chub has likely caused elimination of genetically pure Mohave tui chub species. The arroyo chub also competes with Mohave tui chub for food.

Colorado and Sonoran Deserts

In the Colorado and Sonoran Desert regions tamarisk presents the greatest challenge. Tamarisk is virtually ubiquitous in riparian areas along the Colorado River. Alteration of the river's natural flow regime favors invasive tamarisk over native vegetation, in part because some native species are adapted to the historical seasonal flooding regime for dispersal and germination. Decreased flooding frequency results in salt buildup in riparian soils, and native species are less salt-tolerant than tamarisk. Tamarisk can also withstand reduced sediment deposition and lowered groundwater levels. In many places, tamarisk has completely replaced native cottonwood, willow, and mesquite and grows in dense mono-species stands. Even where native riparian trees remain, tamarisk usually grows among them (Glenn et al. 2001). It can also be found along most of the region's other waterways and aquatic habitats, including irrigation canals and drains and some springs. Tamarisk provides lower-quality habitat than native trees for nesting birds and other wildlife (including the southwestern willow flycatcher) and uses larger quantities of water than native vegetation, lowering groundwater levels and drying up desert springs while raising soil salinity.

In dune habitats, invasive plant species stabilize dunes with extensive root systems or block sand movement preventing natural migration and shifting. These invasive species often spread from adjacent development or along road corridors. Principle species of concern include Russian thistle, Saharan mustard, annual grasses of the genus *Schismus*, and tamarisk.

Non-native burros were introduced to the Colorado Desert more than a century ago and now range throughout the region. They can be particularly damaging to riparian areas and springs. Along the Colorado River and around springs in the Chocolate Mountains where they congregate, burros consume available forage, increase sediment runoff, and compete with bighorn sheep and other native wildlife for access to drinking water. Under the BLM North Eastern Colorado Desert Plan, target limits were set for burro herd size. Because of the requirement under the Wild Horse and Burro Act that burros be managed through capture and relocation, herd control is time-consuming, labor-intensive, and costly. Burros have high reproduction rates. Thus, even where target herd-size limits have been set, herd sizes exceed target numbers.

Brown-headed cowbirds thrive in many human-altered habitats, including fragmented landscapes like suburban developments and golf courses, as well as in agricultural and grazing lands, where they are attracted to livestock droppings and feed. With the expansion of these land uses over the last century, cowbird populations have increased substantially in the Colorado Desert region, particularly in the Imperial and Coachella valleys. Brown-headed cowbirds lay eggs in flycatcher nests, and the flycatcher parent birds may desert the nest or raise the cowbird young at the expense of their own. In California, brown-headed cowbirds have been reported using from 50 percent to 80 percent of flycatcher nests (Coachella Valley Association of Governments 2007). Parasitism of southwestern willow flycatcher nests by brown-headed cowbirds has been identified as a major cause of the flycatcher's decline.

Four of five endemic fishes in the Owens River basin have been excluded from nearly their entire natural habitat by the presence of introduced sport fishes, particularly largemouth bass and several species of imported trout. Competitive exclusion by mosquitofish is believed to play an important role in the imperilment of Long Valley speckled dace.

Another regionally sensitive species threatened by non-native species is the desert pupfish, state and federally listed as endangered. Competition, disturbance, and predation by introduced fish species, particularly sailfin molly, mosquito fish, and tilapia and crayfish species, threaten desert pupfish populations.

Livestock, Farming, and Ranching

Excessive livestock grazing has altered ecosystems across the desert. Grazing has been particularly detrimental to the wetland and riparian habitats important for maintaining wildlife diversity in the desert, denuding and eroding fragile soils around rivers, springs, and seeps and polluting scarce surface water. Livestock reshape streambeds and trample and consume vegetation and seedlings of native trees and shrubs, preventing regeneration. Grazing has also altered the desert scrub ecosystems, reducing preferred native shrubs and herbaceous plants that support the desert tortoise and other reptiles, the Mohave ground squirrel, and other small mammals, birds, and butterflies (Avery 1999). Heavy grazing also facilitates the spread of cheatgrass and other invasive annual grasses, replacing native grasses, herbs, and perennial shrubs, further diminishing habitat conditions for wildlife (CDFG 2005). In turn, fires are more frequent where invasive annual grasses are abundant, preventing the natural restoration of native vegetation and further disturbing habitat for native wildlife. In addition, livestock may spread certain diseases to desert bighorn sheep populations, causing massive die-offs.

Public agencies are altering grazing management on public lands to benefit desert species. For example, BLM removed grazing on nearly 1,214,000 hectares (3,000,000 acres) within the California portions of the Mojave and Sonoran deserts (USFWS 2011). The NPS has also dramatically reduced grazing in the Mojave National Preserve and sheep grazing has been halted in tortoise habitat of San Bernardino County, based on agreement among scientists and resource agencies that sheep grazing significantly degraded feed and habitat for the threatened desert tortoise. However, sheep and cattle continue to graze in wildlife habitats, including desert tortoise habitat, in the western Mojave areas within Inyo and Kern Counties. Cattle graze within Areas of Critical Environmental Concern (ACEC) and in areas designated as critical habitat for the desert tortoise, and they continue to degrade riparian habitats vital to numerous birds and mammals (CDFG 2005).

The 1971 Wild Free-Roaming Horses and Burros Act requires BLM to manage wild free-roaming horses and burros "in a manner designed to achieve and maintain a thriving natural ecological balance on public lands." BLM is also required to remove horses and burros where overpopulation exists "in order to restore a thriving ecological balance to the range." Although they have inhabited the West since the end of the 16th century, burros and horses have likely grazed the California desert in significant numbers because they were released by settlers and miners in the 1800s (Beever 2003; McKnight 1958). Descendants of wild asses from northeastern Africa, burros are well-adapted to the desert environment, and they readily propagate in Mojave Desert habitats where water and forage occur. Horses, although less adapted to the desert, have established herds in a few areas. BLM established appropriate management levels for burro and horse herds in the Mojave Desert pursuant to the amended California Desert Plan of 1980. The levels were mostly established in the 1980s, based on the range capacity for grazing rather than on limits that would protect wildlife habitat and sensitive plant and animal species.

The appropriate management levels (AML) for burro and horse numbers are often greatly exceeded. Between 1981 and 1987, 18,700 burros were removed from the desert, but, since 1987, efforts to control burros have been limited because of lack of funding. Today there are 13 burro- and a few horse-herd areas in the Mojave region. Burro numbers exceed the AML in five of the 13 herd areas. In one management area, there are 280 horses where the AML is 168 horses (CDFG 2005). Excessive burro numbers have led to overgrazing and degradation of desert resources. Riparian habitats associated with seeps and springs are often denuded and trampled by burros and horses. Water quality at seeps and springs frequented by burros or horses is usually poor because of accumulated sediment, urine, and feces. Feral burros and horses, non-native animals in the desert, place additional stress on the natural ecological balance of sensitive desert habitats (CDFG 2005).

Recreational Activities

The impacts of off-highway vehicles (OHVs) on fragile desert landscapes have been described by scientists and resource managers for more than 30 years. The 1980 California Desert Conservation Area Plan referred to OHVs as the "most pervasive management issue in the area." Along with direct collisions with desert tortoises and other wildlife, and the crushing of animal burrows, OHVs compact soils, induce erosion, spread invasive plant species, trigger ill-timed emergence of toads from their


Jim Rorabaugh, USFWS

hibernacula, and denude the landscape of vegetation. Off-highway driving or riding has essentially a nonrestorable impact on some desert habitat; damaged soils and perennial vegetation are not likely to recover for several hundred years or more (CDFG 2005).

The number of OHV registrations in California has more than doubled since 1980, and the rapid growth of the numbers of OHV recreationists continues. In addition to resident recreationists, the Mojave Desert attracts millions of OHV visitors annually. While the vast majority of motorcyclists and all-terrain vehicle riders are responsibly recreating at designated OHV parks or on designated trails and roads on public lands, many others are carving new trails across threatened desert tortoise and Mohave ground squirrel habitat, often across sensitive habitats in closed portions of designated ACEC. For example, BLM closed the 18,000-acre West Rand ACEC to OHV use in 2002 because of extensive damage to critical habitat for the desert tortoise. However, OHV users have routinely violated the closure (DMG 2002).

While desert planning efforts attempt to minimize OHV damage to natural resources by designating open, limited use, and closed areas, damage to natural resources continues. The lack of public education regarding the rules and road networks, lack of adequate enforcement staff, and outright defiance by a small segment of the OHV community have thwarted efforts to protect wildlife and vegetation, including areas around desert springs and other sensitive sites.

There are a limited number of BLM rangers per the million acres they are assigned to patrol, so the risk of receiving a citation for riding in restricted areas is very small. Agencies have posted signs indicating where vehicles are prohibited, but in many areas this is futile. BLM concluded in the June 2003 Decision Record for the Western Mojave Desert Off-Road Vehicle Designation Project: "The least effective short-term action taken in the Ord Mountains was signing the closed route network. Not only did this effort consume a great deal of staff time; in addition, signs were removed almost as quickly as they were put up. The need to resign routes placed additional demands on scarce staff time and material."

The Decision Record also revealed that BLM was unable to keep OHVs out of sensitive areas. The frequent destruction of signs led BLM to sign the open route network and to cease signing the closed areas, reasoning that people are less likely to destroy "open area" signs than "closed area" signs. While this saves signs, this policy makes it difficult to inform recreationists where OHV activities are prohibited, providing less protection for important habitats.

Sensitive habitats are particularly at risk where OHV parks or open areas are located on lands adjacent to those habitats. For example, riparian vegetation in the Jawbone-Butterbredt ACEC is routinely crossed by vehicles straying from the Jawbone and Dove Spring Canyon OHV open areas. The El Mirage and the Spangler Hills OHV open areas are contiguous to the Fremont-Kramer Desert Wildlife Management Area (DMG 2002).

In the Colorado Desert region, some of the greatest levels of OHV use occur in sand dune habitats. OHV use and trespass also has substantial effects on areas along the U.S.-Mexico border in Anza Borrego Desert State Park, and in stream beds and washes surrounding the Salton Sea. OHVs are particularly problematic in dune environments because compaction can inhibit the sand movement that is vital to dune replenishment and migration. Sand compaction may also negatively affect fringe-toed lizards, which can only burrow in fine, loose sand.

Renewable Energy

Renewable energy projects, including geothermal energy, wind energy, and solar energy, have been constructed and are proposed throughout the Deserts Province. Siting, construction, decommissioning, and operational activities associated with wind turbine development and solar array installations, as well as transmission facilities result in loss of native vegetation and habitat for wildlife. California's deserts contain some of the highest rated, solar energy resources in the world.

BLM and county planners have received a large numbers of applications for wind and solar energy development projects, many of which are located in remote parts of the region, raising concerns over the possible negative environmental effects associated with construction, maintenance, and access. Wind power expansion is a particular concern for birds and bats, because poorly designed or sited wind turbines and transmission lines can interfere with flight corridors and cause direct mortality (CDFG 2005). Renewable energy construction, maintenance, and access may increase the potential for introducing and spreading invasive plant species. Small-scale renewable energy development can also threaten habitat.

Recognizing the pressures exerted on the desert ecosystem, preparation of the Desert Renewable Energy Conservation Plan (DRECP) was initiated in 2008 with a MOU between the California Energy Commission (CEC), CDFW, BLM, and USFWS, also known as the Renewable Energy Action Team (REAT). DRECP is a major conservation planning effort underway in the province, is intended to help provide effective protection and conservation of desert ecosystems while allowing for the appropriate development of renewable energy projects. The DRECP is being prepared through a collaborative effort between REAT agencies. Approximately 22.5 million acres of federal and non-federal California desert land are in the DRECP Plan Area (CEC et al. 2014).

Bird collisions with power towers, heliostats, solar arrays, and injury or mortality from exposure to concentrated solar flux, are all known impacts of solar generation facilities (CEC et al. 2014). Based on planned development most collision and injury risk to avian and bat species would occur in the Colorado Desert and western edge of the Mojave Desert portions of the Province.

Both large transmission lines and networks of smaller collector lines present collision and electrocution hazards to bird species. In particular, lines running perpendicular to migratory corridors or close to bird refuges represent greater hazards.

Fire and Fire Suppression

Human-caused ignitions of fires that result from operational and maintenance activities associated with renewable energy facilities can destroy the natural communities found in the surrounding area. Desert scrub natural communities are naturally slow to recover from fire episodes and are more vulnerable to proliferation of non-native grasses that can often successfully compete with and overcome native assemblages (CEC et al. 2014). This pressure has come to the forefront as frequency of wildfire increases because of the invasion of desert habitats by non-native plant species has increased (Brooks 1998; USFWS 1994). Changes in plant communities caused by non-native plants and recurrent fire can negatively affect the desert tortoise by altering habitat structure and species available as food plants (Brooks and Esque 2003). OHV activity, roads, livestock grazing, agricultural uses, and other activities contribute to the spread of non-native species (or the displacement of native species) and the direct loss and degradation of habitats (Avery 1998; Brooks 1995). For example, unmanaged livestock grazing, especially where plants are not adapted to large herbivorous mammals or where the non-native species are less palatable than the natives, can preferentially remove native vegetation, leaving non-native plants to grow under reduced competition (Wittenberg and Cock 2005).

Climate Change

The climatic changes presented below will likely affect all conservation targets identified in this province. Climate change has only been included as a pressure for a subset of targets that are considered more vulnerable to climate impacts, and/or in instances where it was determined that interactions between climate change and other pressures could be addressed in a meaningful way through a conservation strategy.

Temperature

Average annual temperatures within the Mojave, Sonoran, and Colorado Deserts are expected to increase between 1.9 to 2.6°C (3.4 to 4.7°F) by 2070 (PRBO 2011). January average temperatures are projected to increase 2°F to 4°F by 2050 and 5°F to 8°F by 2100, while July average temperatures are projected to increase 3°F to 5°F by 2050 and 6°F to 9°F by 2100 (California Emergency Management Agency [CalEMA] 2012).

Precipitation and Snowpack

The Deserts Province is projected to experience geographic variation in annual rainfall with some locations receiving more rain in the future and others less. Some locations may experience little to no change in annual rainfall (CalEMA 2012). A thorough discussion of the predicted effects of climate change on desert ecosystems can be found in the Draft DRECP, Appendix P (http://www.drecp.org/draftdrecp/).

Wildfire Risk

Most areas are projected to have the same or slightly increased likelihood of wildfire risk. The major exceptions are the Mecca San Gorgonio and San Jacinto Mountains, where wildfire will be 1.5 and 2.0 times more likely (CalEMA 2012).

Apple Valley Multispecies Habitat Conservation Plan/Natural Community Conservation Plan

The town of Apple Valley in San Bernardino County is currently preparing a Multispecies Habitat Conservation Plan/Natural Community Conservation Plan (MSHCP/NCCP). Much like SWAP 2015, the MSHCP/NCCP planning effort is focusing on addressing landscape-scale conservation needs, climate change, and protection of species diversity while at the same time addressing local community needs to ensure ecological and economic resilience now and in the future.

The Planning Area includes Apple Valley, surrounding San Bernardino County lands, Bureau of Land Management lands, and state lands. The Plan Area is approximately 345.6 square miles. The Town's MSHCP/ NCCP planning effort focuses on landscape level conservation. Overall the Plan will connect through its linkages over 2.1 million acres on conservation lands in the West Mojave Desert.

Apple Valley's MSHCP/NCCP Plan Area is rich in natural resources and important to the West Mojave Desert. The area was recently identified by the U.S. Geological Survey as one of ten genetic divergence and diversity hotspots in the West Mojave Desert. These areas, due to the high degree of genetic diversity and divergence among species present, can be considered evolutionary hotspots (Vandergast 2013).

Because of the variation in elevation, slope, and aspect, the Town's Plan Area is composed of 21 plant communities as recently mapped by the DRECP. These communities include, but are not limited to, forest and woodland communities, desert scrub communities, grasslands, and riparian/wetland areas. Due to the rich variation in community types, the Town is evaluating 50 listed and/or sensitive species that may occur within the Plan Area for inclusion in the MSHCP/NCCP.

The Town is situated at the intersection of three landscape-level linkages. These important features are critical for desert conservation. Their preservation will benefit the region by maintaining connectivity for plant and wildlife species and by helping mitigate impacts from climate change. The three linkages are:

- The San Bernardino-Granite Mountain Connection is a north-south linkage connecting the desert ranges to the coastal ranges via the Granite and San Bernardino Mountains. In 2005, South Coast Wildlands ranked this linkage as one of the top 12 southern California linkages for priority conservation. The linkage represents a landscape-level connection between the coastal and desert mountains. It facilitates the direct dispersal and multigenerational movement of over 14 focal species, including desert bighorn sheep, American badger, Pacific kangaroo rat, and Joshua tree.
- The Northern Lucerne Wildlife Linkage/Wild Wash Linkage is an east-west linkage created by a series of interconnected desert valleys that provides regional connectivity between three of the four Desert Wildlife Management Areas (DWMAs) in the West Mojave Desert. The Northern Lucerne Wildlife Linkage/Wild Wash Linkage incorporates the Wild Wash, the only natural and undeveloped I-15 undercrossing between Victorville and Barstow. This linkage has high quality tortoise habitat and is critical for mitigating the effects of climate change on desert tortoise populations. It is a multigenerational linkage between designated critical habitat units for desert tortoise. The linkage also benefits the movement of other desert plants and animals allowing them to adjust to climate change.
- The Mojave River Corridor is a north-south linkage that is recognized as an important regional wildlife corridor in San Bernardino County. The Mojave River, specifically the Mojave Narrows, provides critical riparian habitat for a wide variety of resident and neotropical migrating birds. The portion of the Mojave River within the Town's MSHCP/NCCP Plan Area supports the highest number of special status species in the Plan Area and is designated critical habitat for southwestern willow flycatcher.

As stated previously, these linkages connect approximately 2.1 million acres of federal lands currently managed for conservation of species and habitats, and they are built upon a largely contiguous framework of federal land managed by BLM.

The Apple Valley MSHCP/NCCP planning effort will aid the state in achieving many of the conservation strategies proposed for the Mojave Desert Ecoregion (Shadescale-Saltbush Scrub) because of the natural resource values found within the Planning Area.

5.6.6 Conservation Strategies

Conservation strategies were developed for conservation targets in the Deserts Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted pressures. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.6-5 through 5.6-16 show the relationships between the stresses and the pressures for each target. Table 5.6-17 summarizes conservation strategies for the province.

Target: Big Sagebrush Scrub

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition and easements. Identify land for protection of high-quality sagebrush habitat within the Desert Creek/Fales, Bodie, and South Mono sage-grouse population management units (PMUs) within the Bi-State DPS.

Objective(s):

- Identify high quality sagebrush habitat for protection within the Fales, Bodie, and South Mono PMUs.
- Acquire 1,000 acres in fee title, conservation easement, or lease with the goal of protecting high priority sagebrush habitat within the Fales, Bodie, and South Mono PMUs.

Targeted pressure(s): Housing and urban areas.

Conservation action(s):

- Identify conservation and funding partners.
- Coordinate with Wildlife Conservation Board (WCB).
- Coordinate with state and federal agencies and private landowners.
- Develop inter-disciplinary team to facilitate land acquisition and conservation.
- Determine what areas are already conserved, identify gaps.
- Develop regionally appropriate criteria for conservation.

- Identify and prioritize potential areas for acquisition and conservation.
- Identify willing landowners of suitable habitat.
- Prepare Conceptual Area Protection Plan (CAPP) or Land Acquisition Evaluation (LAE).
- Develop conservation plans or agreements.
- Identify and obtain funding for implementation of strategy.
- Acquire land or conservation easements.

Conservation Strategy 2 (Data Collection and Management): Prioritize and coordinate sage-grouse research efforts with landowners and land managers, and monitor pinyon-juniper and cheatgrass invasions per the 2012 Bi-State Sage Grouse Action Plan.

Objective(s):

- Prioritize and coordinate sage-grouse research efforts with landowners and land managers.
- Monitor pinyon-juniper and cheatgrass invasions.

Targeted pressure(s): Invasive plants/animals; parasites/pathogens/diseases.

Conservation action(s):

- Participate with efforts to map cheatgrass and pinyon-juniper encroachment in sage scrub habitat.
- Coordinate with land management agencies and private landowners.
- Coordinate use of decision support tools to guide restoration and enhancement efforts as outlined in the Bi-State Sage Grouse Action Plan.
- Set priorities for treatment of invasive species.
- Coordinate with stakeholder/expert groups.
- Identify and obtain funding to implement strategy.
- Conduct management treatments in high priority areas.
- Coordinate research with Bi-State Cooperative.

Conservation Strategy 3 (Economic Incentives): Provide economic incentives and purchase leases, acquisitions, or conservation easements on important sage grouse habitat with various funding sources.

Objective(s):

- Purchase leases, acquisitions, or conservation easements on 1,000 acres of important sage grouse habitat with various funding sources.

Targeted pressure(s): Housing and urban areas.

Conservation action(s):

- Coordinate with state and federal agencies.
- Identify and evaluate incentive programs applicable to private and public lands.

- Identify willing landowners/lease holders.
- Identify funding sources and obtain funding for implementation of strategy.
- Design or support existing incentive programs.
- Create coalition of conservation partners to help implement strategy.

Conservation Strategy 4 (Direct Management): Implement resource management to promote healthy sagebrush ecosystems through controlled burns (where appropriate and not in conflict with sage-grouse conservation), control of invasive species, and removal of pinyon-juniper.

Objective(s):
- Implement management actions to promote healthy sagebrush ecosystems, including controlled burns, invasive species control, and removal of pinyon-juniper on 1,000 acres.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals; parasites/pathogens/diseases.

Conservation action(s):
- Coordinate with state and federal agencies, California Cattleman's Association, California Farm Bureau Federation, and private landowners to implement grazing best management practices (BMPs).
- Coordinate with state and federal agencies and private landowners to conduct controlled burns.
- Coordinate with state and federal agencies to manage pinyon-juniper encroachment through thinning.
- Develop management plan for invasive species.
- Identify and prioritize areas for habitat restoration.
- Obtain funding to implement strategy.

Conservation Strategy 5 (Partner Engagement): Establish partnerships, coordinate efforts, and identify and combine funding sources with other agency funding, for protecting, restoring, and enhancing sagebrush habitat.

Objective(s):
- Local agencies and counties coordinate efforts for protecting, restoring, and enhancing sagebrush habitat.
- Funding sources are identified and combined with other agency funding for protection, restoration, and enhancement of sagebrush habitat.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals; parasites/ pathogens/diseases; housing and urban areas.

Table 5.6-5 Stresses and Pressures for Big Sagebrush Scrub

Priority Pressures	Stresses			
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes		
	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development
Fire and fire suppression	X	X	X	X
Housing and urban areas	X	X	X	X
Invasive plants/animals (non-native species)	X	X	X	X
Invasive plants/animals* (native species)		X	X	X
Livestock, farming, and ranching	X	X	X	

*This row addresses native species encroachment

Target: Great Basin Pinyon-Juniper Woodland

Goals:

- By 2025, acres where desired native species are dominant and desired structural diversity are increased by at least 5 percent within the presettlement range of pinyon-juniper and juniper habitats in the ecoregion.
- By 2025, acres of desired successional stage are increased by at least 5 percent from presettlement habitat area.
- By 2025, acres with desired fire return level are increased by at least 5 percent from 2015 levels.

Conservation Strategy 1 (Data Collection and Analysis): Research impacts of climate change on pinyon-juniper woodland viability and distribution.

Objective(s):

- Conduct research and increase CDFW knowledge on climate change impacts on target habitat.
- Land management agencies, non-governmental organizations (NGOs), and research scientists are able to research initiation and access data.
- Areas have been prioritized for restoration, protection, or fuels treatments; and findings are used to design management actions.

Targeted pressure(s): Climate change.

Conservation action(s):

- Collect additional information on climate change projections on habitat health and distribution within the ecoregion.
- Collect data that answers relevant questions on climate change impacts on ecoregional habitat.

- Prepare and publish papers on research of underlying mechanisms or climate change emission impacts.

Conservation Strategy 2 (Direct Management): Identify highest priority areas for restoration and rehabilitation to manage and protect from annual grass and weed invasion.

Objective(s):
- Restoration is implemented in burn areas and invasive species are treated.

Targeted pressure(s): Climate change; invasive plants/animals.

Conservation action(s):
- Restore areas of burned presettlement macrogroup habitats by planting native shrub, forbs and grasses to restrict invasion by annual invasive species.
- Treat invasive species for removal.

Conservation Strategy 3 (Direct Management): Identify highest priority areas and manage for restoration and rehabilitation to lower or eliminate fire risk: conduct controlled burns and managed thinning in areas of post-settlement (1860) pinyon-juniper and juniper expansion or old growth stands with high canopy cover and fire risk; protect old growth pinyon-juniper and juniper; and continue implementation of Bi-State Action Plan.

Objective(s):
- Implement management actions, and prioritize for management the highest fire-risk areas. Management actions include:
  - identify and remove 10 percent of priority areas of post-settlement habitat that threaten other targets,
  - identify and thin 10 percent of areas of presettlement and old growth habitats requiring thinning to protect them from high intensity fire
  - identify areas of old growth pinyon-juniper and juniper and place fuels treatments around 10 percent of them for protection.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 4 (Partner Engagement): Maintain partnerships through the Bi-state Action Plan, BLM, USFS, NPS, and U.S. Geological Survey (USGS) to help coordinate data collection and implement management plan.

Objective(s):
- Current partnerships such as the Bi-State Action plan are maintained, management plan is being implemented, and data are being collected for plan.
- Areas of removal, restoration, or protection of target habitat are prioritized and implemented.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Climate change; invasive plants/animals; fire and fire suppression.

Conservation action(s):

- Prioritize and implement areas of removal, restoration or protection of macrogroup habitat.
- Collect data in coordination with partnership groups.

Table 5.6-6 Stresses and Pressures for Great Basin Pinyon-Juniper Woodland

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or compositio n	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development
Climate change		X	X	X		
Fire and fire suppression	X		X	X	X	X
Invasive plants/animals	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X		X
Other ecosystem modifications*			X			

* This includes the removal of vegetation to restore sagebrush scrub habitats.

Target: Shadscale-Saltbush Scrub

- By 2025, acres of disturbed areas showing signs of successional dynamics are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired endemic plant/animal diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with habitat connectivity are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime are increased by at least 5 percent from acres/miles.
- By 2025, acres with suitable soil characteristics are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect high-quality alkali desert scrub habitat through acquisition and easements.

Objective(s):

- Increase the amount of acreage that is protected through purchase or conservation easement by 20 percent, and identify high quality habitat for protection through purchase or easement.

Targeted pressure(s): Roads and railroads; renewable energy; commercial and industrial areas; utility and service lines.

Conservation action(s):

- Identify and prioritize potential areas for acquisition/easement.
- Identify areas already conserved.
- Evaluate availability of suitable habitat.
- Acquire land or conservation easements.
- Develop habitat conservation plan.
- Develop advance mitigation plan.
- Establish criteria for minimum and maximum habitat size (conserved).
- Evaluate feasibility of acquisition/easement.
- Create interdisciplinary team to facilitate land acquisition and conservation.
- Develop database to track acquisition/tracking.
- Develop standard protection criteria for conservation easement.
- Obtain funding for acquisition/easements.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data, particularly on the distribution of invasive species and their impacts on shadscale-saltbush scrub.

Objective(s):

- The distribution of invasive species and impacts to the target habitat are understood through research, and the distribution of invasive species within conserved lands is understood.

Targeted pressure(s): Housing and urban areas; invasive plants/animals; annual and perennial non-timber crops; recreational activities.

Conservation action(s):

- Identify basic tools needed for data and analysis.
- Gather baseline information.
- Develop scope of involvement.
- Develop survey design and implementation plan.
- Conduct economic impact analysis.
- Evaluate ecosystem impacts.

- Evaluate species impacts.
- Identify and evaluate existing data.
- Obtain funding to implement strategy.
- Integrate climate change influence and modeling.
- Conduct Geographic Information Systems (GIS) analysis.
- Evaluate impacts to other ecoregions.

Conservation Strategy 3 (Data Collection and Analysis): Gather data and conduct research to better understand alkali desert scrub ecology (e.g., population size, distribution, habitat relationships), pressures, and climate change effects; and collect and analyze baseline assessment information for alkali desert scrub.

Objective(s):

- Alkali desert scrub ecological parameters are better understood, and baseline assessment information have been collected and analyzed.

Targeted pressure(s): Roads and railroads; renewable energy; commercial and industrial areas; utility and service lines.

Conservation action(s):

- Identify goals and objectives.
- Coordinate with state and federal agencies and universities.
- Design monitoring and implementation plan.
- Prepare summary reports.
- Obtain funding for strategy implementation.
- Evaluate feasibility/efficacy of study design.

Conservation Strategy 4 (Education and Outreach): Develop and implement an outreach program on the impacts of invasive species.

Objective(s):

- Desert land managers are more knowledgeable about the impacts of invasive species.

Targeted pressure(s): Housing and urban areas; invasive plants/animals; annual and perennial non-timber crops; recreational activities.

Conservation Strategy 5 (Education and Outreach): Provide outreach and education on resource conservation practices.

Objective(s):

- Desert managers and users are more knowledgeable, aware, concerned and participating in resource conservation practices.

Targeted pressure(s): Roads and railroads; renewable energy; commercial and industrial areas; utility and service lines.

Conservation Strategy 6 (Management Planning): Develop and implement management plans to guide maintaining or restoring connectivity for alkali desert scrub and SGCN.

Objective(s):

- Develop and implement management plans to guide maintaining or restoring connectivity for alkali desert scrub and SCGN.

Targeted pressure(s): Roads and railroads; renewable energy; commercial and industrial areas; utility and service lines.

Conservation Strategy 7 (Partner Engagement): Establish joint partnerships with desert land managers, including local governments such as the Town of Apple Valley, particularly to manage invasive species on conserved lands.

Objective(s):

- Establish joint partnerships with desert land managers to manage invasive species on conserved lands.
- Develop a mutually agreeable project after engaging with the partners.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Airborne pollutants; military activities; industrial and military effluents; housing and urban areas; invasive plants/animals; annual and perennial non-timber crops; recreational activities.

Conservation Strategy 8 (Partner Engagement): Establish and develop co-management partnerships, use partnerships with desert land managers to manage invasive species on conserved lands, and integrate climate change considerations into management plans for species and habitats.

Objective(s):

- Establish joint partnerships with desert land managers to manage invasive species on conserved lands.

Targeted pressure(s): Roads and railroads; renewable energy; commercial and industrial areas; utility and service lines.

Conservation Strategy 9 (Partner Engagement): Partner for joint advocacy, increase political awareness for conservation of alkali desert scrub in the Mojave ecoregion through education and outreach, and secure additional funding through grants or legislation; and ensure renewable energy development is consistent with DRECP conservation strategies.

Objective(s):

- Increase political awareness of conservation of alkali desert scrub in the Mojave ecoregion through education and outreach.
- Establish additional funding through grants or legislation.
- Ensure that renewable energy development is consistent with Desert Renewable Energy Conservation Plan strategies.

Targeted pressure(s): Roads and railroads; renewable energy; commercial and industrial areas; utility and service lines.

Conservation action(s):

- Coordinate with WCB; Office of Communication, Education, and Outreach; and Legislative Office.
- Conduct bill analysis related to renewable energy.
- Identify partners such as NGOs to advocate position.
- Advocate science based decisions and process.
- Develop renewable energy BMPs.
- Identify and prioritize conservation areas.
- Conduct economic impact analysis.
- Identify existing funding options.
- Obtain funding to implement strategy.

Conservation Strategy 10 (Training and Technical Assistance): Provide training on invasive species control and management.

Objective(s):

- Increase the knowledge of mangers about invasive species management and control techniques.
- Conduct regular training (e.g., annually) for CDFW staff and make available to other organizations.

Targeted pressure(s): Invasive plants/animals.

Table 5.6-7 Stresses and Pressures for Shadscale-Saltbush Scrub

Priority Pressures	Stresses								
	Geophysical and Disturbance regimes	Hydrology and Water Characteristics		Soil and Sediment Characteristics		Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in soil chemistry	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Airborne pollutants				X		X	X	X	X
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X	X	X	X	X	X	X
Housing and urban areas	X	X	X	X	X	X	X	X	X
Industrial and military effluents				X		X	X	X	X
Invasive plants/animals	X		X		X	X	X	X	X
Military activities						X	X	X	X
Recreational activities	X					X	X	X	X
Renewable energy	X	X	X		X	X	X	X	X
Roads and railroads	X					X	X	X	X
Utility and service lines	X					X	X	X	X

Target: Desert Wash Woodland and Scrub

Goals:

- By 2025, acres of (desert wash) habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired endemic plant/animal diversity are increased by at least 5 percent from 2015 acres.
- By 2025, population of key species (Couch's spadefoot) is increased by at least 5 percent from 2015 population levels.
- By 2025, acres with desired structural diversity are increased from at least 5 percent from 2015 acres.
- By 2025, miles with habitat connectivity (desert wash habitat) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with stable bank (desert wash) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired stream stage (water volume and flow) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Gather biological data and conduct research on SGCN and response to disturbance.

Objective(s):

- Collect ecological/biological data on SGCN and responses to disturbance.

Targeted pressure(s): Roads and railroads.


Dave Feliz, CDFW

Conservation action(s):

- Identify partner agencies and organizations.
- Conduct literature review-develop study design.
- Develop budget.
- Identify funding sources and apply for funding.
- Determine SGCN-friendly structure designs.
- Determine extent of disturbance from railroad use.
- Define movement and habitat use patterns of SGCN.
- Define distribution of SGCN.

Conservation Strategy 2 (Outreach and Education): Provide education, including to BLM and USFWS on impacts from operations and maintenance activities within railroad right-of-ways (ROW).

Objective(s):

- BLM and USFWS are knowledgeable about the impacts from operations and maintenance activities within railroad ROW.

Intended pressure(s) reduced: Roads and railroads.

Conservation Strategy 3 (Land Use Planning): Develop BMPs for roads and railroads.

Objective(s):

- BMPs for road maintenance and construction are implemented.
- Agreement is reached with Caltrans on construction and repair of roads to minimize sediment effects.
- Railroad employees become knowledgeable about seasonality of conditions and presence of listed and other sensitive species.
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Roads and railroads.

Conservation Strategy 4 (Partner Engagement): Partner for joint advocacy, with focus on conservation of SGCNs that use railroad ROW, and development of BMPs for ROW maintenance activities.

Objective(s):

- BLM offices are more knowledgeable about SGCN that use railroad right-of-ways.
- BMPs to protect SGCN are established for right-of-way maintenance practices.
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Roads and railroads.

Table 5.6-8 Stresses and Pressures for Desert Wash Woodland and Scrub

Priority Pressures	Stresses						
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics		Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Commercial and industrial areas	X	X	X	X	X	X	X
Dams and water management/use	X	X	X	X	X	X	X
Housing and urban areas	X	X	X	X	X	X	X
Mining and quarrying	X	X		X	X	X	X
Recreational activities	X			X	X	X	X
Renewable energy	X	X	X	X	X	X	X
Roads and railroads	X	X			X		X
Utility and service lines	X				X		X

Target: Sparsely Vegetated Desert Dune

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat are maintained or increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat with suitable soil characteristics regimes are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat with desired ground water levels are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat with desired connectivity are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on plant community and SGCN status within ecoregion through range-wide surveys, climate change studies, and monitoring invasive species population trends.

Objective(s):

- Appropriate audiences are accessing data.
- Data are being used to inform conservation actions.
- Research clearly provides answers to relevant questions on needs identified.
- Research informs conservation actions.

Targeted pressure(s): Climate change; invasive plants/animals.

Conservation action(s):

- Collect data on macrogroup and SCGN status within ecoregion through range-wide surveys, climate change studies, and monitoring invasive species population trends.
- Study climate impacts and invasive species impacts.

Conservation Strategy 2 (Land Use Planning): Continue to provide input on local land use plans.

Objective(s):

- At each annual review, the behaviors of local entities are consistent with input.
- Local land use planners receive input on land use plans.
- A land use plan is approved that is consistent with the input provided. Relevant land use plans include Imperial Sand Dunes Regional Advance Mitigation Plan (RAMP), Heber Dunes State Vehicular Recreation Area (SVRA) General Plan, Lower Colorado Multiple Species Conservation Plan (MSCP), San Diego East County MSCP, Coachella Valley Multiple Species Habitat Conservation Plan (MSHCP), IID, and DRECP.

Targeted pressure(s): Climate change; housing and urban areas; recreational activities; invasive plants/animals.

Conservation Strategy 3 (Direct Management): Support implementation of existing habitat conservation plans (HCPs) to protect, restore, or enhance those areas of target habitat that are prioritized for such or have been degraded by invasive species or OHV; and enhance enforcement of existing HCPs, including illegal OHV use. Existing HCPs include Imperial Sand Dunes RAMP, Heber Dunes SVRA General Plan, Lower Colorado River MSCP, San Diego East County MSCP, Coachella Valley MSHCP, IID, and the DRECP.

Objective(s):

- Implement management actions.

Targeted pressure(s): Recreational activities; invasive plants/animals.

Conservation action(s):

- Prioritize plant communities requiring invasive weed treatment or restoration from OHV or grazing impacts.
- Remove invasive weeds with mechanical, manual or other means from target habitats.
- Plant prioritized areas denuded of vegetation or invaded with weeds with appropriate plants.
- Enhance enforcement activities.
- Fund the activities identified in any HCPs.

Conservation Strategy 4 (Management Planning): Support the development and implementation of ongoing/existing management plans.

Tomás Castelazo, CDFW

Objective(s):

- Ensure that management plans include strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- The plan recommendations are being used to inform conservation actions.

Targeted pressure(s): Climate change; housing and urban areas; recreational activities; invasive plants/animals.

Conservation action(s):

- Acquire funding for planning, implementation, monitoring and management of the planning area.
- Identify priorities for management plan development.
- Create management and monitoring plans for priority areas.

Conservation Strategy 5 (Partner Engagement): Maintain partnership presence in the planning process of HCPs to ensure the conservation of this target.

Objective(s):

- The HCP/Natural Community Conservation Plan (NCCP) continues to be implemented.

Targeted pressure(s): Climate change; renewable energy; housing and urban areas; recreational activities; invasive plants/animals.

Conservation action(s):

- Active engagement by CDFW in HCPs and NCCPs in the planning and implementation process.

Table 5.6-9 Stresses and Pressures for Sparsely Vegetated Desert Dune

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in sediment quality*	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Climate change	X		X		X	X
Commercial and industrial areas	X		X		X	X
Housing and urban areas	X		X		X	X
Invasive plants/animals	X	X	X	X	X	X
Livestock, farming, and ranching			X			
Recreational activities	X	X	X			X
Renewable energy	X		X		X	X
Roads and railroads	X		X		X	X

*This category focuses on issues not related to aeolian (wind) process.

Target: American Southwest Riparian Forest and Woodland

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres of target habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired stream stage are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Identify critical or sensitive riparian habitats in areas that may require special protections.

Objective(s):

- Identify critical or sensitive riparian habitats in areas that may require special protections.

Targeted pressure(s): Invasive plants/animals; parasites/pathogens/diseases.

Conservation action(s):

- Identify degraded riparian habitats.
- Inventory riparian habitats within the range of Inyo California towhee.
- Monitor riparian habitats within the range of Inyo California towhee.
- Obtain funding to implement strategy.

Conservation Strategy 2 (Direct Management): Manage invasive species: control invasive and problematic vegetation, control invasive mammals (feral horse and burro), and prevent degradation of riparian habitat and springs from feral horses and burros.

Objective(s):

- Implement procedures (e.g., vegetation removal projects and long-term monitoring) to control invasive and problematic native vegetation.
- Implement procedures to control invasive mammals (e.g., feral horse and burro populations).
- Implement procedure to prevent riparian (springs) habitat degradation (e.g., construct feral horse and burro exclusion fencing around severely degraded riparian habitat).

Targeted pressure(s): Invasive plants/animals; parasites/pathogens/diseases.

Conservation action(s):

- Conduct invasive and problematic native plant removal projects.
- Collaborate with appropriate agencies to conduct invasive animal roundups (e.g., feral horse and burro).
- Construct exclusion fencing.
- Monitor post-project habitat conditions.
- Obtain funding to implement strategy.

Conservation Strategy 3 (Partner Engagement): Establish co-management partnership to conserve target habitat.

Objective(s):

- Establish cooperative partnership with all interested groups to conserve target habitat target.

Targeted pressure(s): Invasive plants/animals; parasites/pathogens/diseases.

Conservation action(s):

- Identify and contact NGOs interested in conserving target habitat (riparian springs).
- Create working alliance between all interested parties (e.g., BLM, USFS, CDFW, NGOs, NPS, China Lake Naval Weapons Station [CLNWS]).
- Ensure consistency of SWAP conservation strategies with DRECP.
- Identify conservation needs of riparian (springs) habitat.
- Identify funding sources to implement projects.

Conservation Strategy 4 (Land Use Planning): Engage in decision-making process, and share information and agency priorities.

Objective(s):

- Share information and agency priorities. Pool all entity information and conservation priorities to formulate a more comprehensive, complete habitat conservation strategy that satisfies all entity conservation concerns.

Targeted pressure(s): Invasive plants/animals; parasites/pathogens/diseases.

Conservation action(s):

- Create a list of conservation goals from each partner in the group.
- Prioritize the conservation goals from the list.
- Develop a collaborative conservation management plan.

Table 5.6-10 Stresses and Pressures for American Southwest Riparian Forest and Woodland

Priority Pressures	Stresses							
	Hydrology and Water Characteristics			Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in runoff and river flow	Change in water levels and hydroperiod	Change in groundwater tables	Change in sediment quality	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X		X	X	X	X
Dams and water management/use	X	X	X		X	X	X	
Housing and urban areas	X	X	X		X	X		X
Invasive plants/animals	X	X	X		X	X	X	
Parasites/pathogens/diseases					X	X	X	
Recreational activities				X		X		X
Renewable energy	X	X	X		X	X		

Target: High Desert Wash and "Rangeland" Scrub; Great Basin Upland Scrub

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Monitor and map invasive species, and study fire and climate-related effects on target habitats.

Objective(s):

- Identify the locations of priority invasive species.
- Ensure that NGOs, land managers, and land owners can access data and are using it to design management actions.
- By the end of the project, data are being used to prioritize areas of restoration, rehabilitation, and protection.

Targeted pressure(s): Climate change; fire and fire suppression; invasive plants/animals.

Conservation action(s):

- Prioritize areas for restoration, rehabilitation, and protection.
- Protect intact target habitat areas from fire.
- Restore and rehabilitate target habitat areas.

Conservation Strategy 2 (Direct Management): Restore and protect priority areas: identify highest priority areas for restoration, rehabilitation, and protection from fire, invasive species, or wild burros.

Objective(s):

- Implement management actions.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):

- Identify and remove pockets of invasive species from otherwise intact target habitat in 10 percent of prioritized areas within ecoregion.
- Conduct managed thinning in pinyon juniper encroached areas, as well as decadent bitterbrush and mahogany groups in 10 percent of prioritized areas in the ecoregion.
- Restore and rehabilitate 50 percent of target habitat that hs been impacted by fires.
- Identify intact stands of target habitats and identify and implement fuels reduction and protection treatment areas for 10 percent of these areas.
- Fence areas damaged by wild burrows or remove wild burros from 10 percent of prioritized areas.

Conservation Strategy 3 (Management Planning): Comment on and amend plans.

Objective(s):
- By 2025, maintain current partnerships such as the Bi-State Local Area Working Group.
- By 2025, implement management actions consistent with the management plans.

Targeted pressure(s): Climate change; fire and fire suppression; invasive plants/animals.

Conservation Strategy 4 (Partner Engagement): Maintain and enhance partnerships, particularly with NPS; form a collaborative group for data collection and research, especially with BLM.

Objective(s):
- Maintain current partnerships such as the Bi-State Local Area Working Group.
- Implement management plan, and collect data.
- Form a collaborative group aimed at conservation and management of target habitat and collect data on climate-related impacts.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Climate change; fire and fire suppression; invasive plants/animals.

Conservation action(s):
- Identify and contact NGOs interested in conserving target habitat (riparian springs).
- Create working alliance between all interested parties (e.g., BLM, USFS, CDFW, NGOs, NPS, and CLNWS).
- Identify conservation needs of riparian (springs) habitat.
- Identify funding sources to implement projects.

Table 5.6-11 Stresses and Pressures for High Desert Wash and "Rangeland" Scrub; Great Basin Upland Scrub

Priority Pressures	Stresses			
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes		
	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Habitat fragmentation
Climate change	X	X	X	X
Fire and fire suppression	X	X	X	X
Invasive plants/animals	X	X	X	
Livestock, farming, and ranching		X	X	X
Mining and quarrying		X	X	X
Renewable energy		X		X

Target: Mojave and Sonoran Desert Scrub

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with habitat connectivity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species are increased by at least 5 percent from 2015 population.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Conserve lands to maintain long-term viability of SGCN.


Tony Hisgett, CDFW

Objective(s):

- Maintain long-term viability of SGCN through conservation of land.

Targeted pressure(s): Renewable energy.

Conservation action(s):

- Identify availability of prime habitat.
- Prioritize acquisition.
- Evaluate feasibility of acquisition.
- Evaluate connectivity to existing conserved or preserved lands.
- Consider protection using conservation easement.
- Conduct appropriate project/document review.
- Establish/foster partnerships with conservation NGO.
- Ensure coordination with HCPs/NCCPs.
- Collect data on SCGN to identify priority lands.
- Identify and address data gaps.
- Implement interagency coordination/acquisition.

Conservation Strategy 2 (Outreach and Education and Partner Engagement): Partner for joint advocacy, increase political awareness for conservation of desert scrub in the Sonoran Desert ecoregion, secure additional funding through grants or legislation, and advocate for development consistent with strategy.

Objective(s):

- Increase political awareness for conservation of desert scrub in the Sonoran Desert ecoregion.
- Solicit additional funding through grants or legislation.
- Advocate for development consistent with strategy.

Targeted pressure(s): Housing and urban areas; invasive plants/animals; utility and service lines; annual and perennial non-timber crops.

Conservation Strategy 3 (Land Use Planning): Provide input on project planning and decision making process, and conserve stream habitats and flows through participation in the planning and decision making process.

Objective(s):

- Conserve stream habitats and flows through participation in the planning and decision making processes.

Targeted pressure(s): Housing and urban areas; invasive plants/animals; utility and service lines; annual and perennial non-timber crops.

Conservation action(s):

- Conduct environmental (California Environmental Quality Act [CEQA]/National Environmental Policy Act [NEPA]) review.
- Participate in review of general plans/amendments.
- Develop master Section 1600 permit (Lake and Streambed Alteration [LSA] Agreement) template consistent with strategy.
- Develop standard permit requirements/criteria.
- Identify and prioritize areas for conservation/protection.
- Encourage establishment of mitigation banks.
- Develop mitigation alternatives consistent with strategy.
- Define success criteria for adaptive management.
- Obtain funding to maintain mitigation areas and implement strategy.
- Conduct Property Analysis Record analysis for mitigation sites.
- Maintain mitigation and project tracking data base.

Conservation Strategy 4 (Management Planning): Develop HCP, NCCP, and management plans, with an emphasis on minimizing impacts of housing and urban growth.

Objective(s):
- Minimize the impact of housing and urban growth through the establishment of conservation plans.

Targeted pressure(s): Housing and urban areas; roads and railroads; invasive plants/animals; utility and service lines; annual and perennial non-timber crops.

Conservation Strategy 5 (Partner Engagement): Establish co-management partnership.

Objective(s):
- Establish cooperative partnership with all interested groups to conserve target habitat.
- Increase funding opportunities through combined funding and resources.
- Share management responsibilities.
- Develop and share baseline data for conservation of SGCN and target habitat.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Renewable energy.

Conservation action(s):
- Identify and contact NGOs interested in conserving target habitat.
- Create working alliance between all interested parties (e.g., BLM, CDFW, NGOs, NPS, and CLNWS).
- Identify conservation needs of desert scrub habitat.
- Identify funding sources to implement projects.

Conservation Strategy 6 (Training and Technical Assistance): Provide training to agency staff on renewable energy issues, including technology, relevant research, ecological impacts, and conservation strategies.

Objective(s):
- Educate agency staff on new renewable energy technology, current scientific research, and conservation strategies.
- Provide training to renewable energy companies/contractors on pre-project planning process and ecological needs, areas to avoid, and mitigation.

Targeted pressure(s): Renewable energy.

Conservation action(s):
- Identify target audience.
- Conduct interagency coordination.
- Develop training curriculum.
- Obtain funding for strategy implementation.

Table 5.6-12 Stresses and Pressures for Mojave and Sonoran Desert Scrub

Priority Pressures	Stresses			
	Ecosystem Conditions and Processes			
	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X	X
Commercial and industrial areas	X	X		X
Housing and urban areas	X	X	X	X
Invasive plants/animals	X	X	X	X
Renewable energy	X	X	X	X
Roads and railroads	X	X	X	X
Utility and service lines	X	X	X	X

Target: Walker River Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish population (SGCNs) are increased by at least 5 percent from 2015 miles.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles connected (i.e., past barriers) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level of water quality (meeting total daily maximum load [TMDL] standards) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on the impacts of diversions, water management, water use, and the distribution of introduced genetic material on the native fish community.

Objective(s):
- Understand the impacts of diversions, water management and water use to the native fish community.
- Understand the distribution of introduced genetic material and impacts to the native fish community within the hydrologic unit.

Targeted pressure(s): Introduced genetic material; invasive plants/animals; dams and water management/use.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education on native aquatic resource conservation efforts.

Objective(s):
- Ensure that the public is aware, concerned, and participating in native aquatic resource conservation efforts within the hydrologic unit.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 3 (Law and Policy): Implement effective enforcement of laws.

Objective(s):
- Increase Law Enforcement Division capacity to allow greater enforcement of water laws.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Identify laws and regulations governing riparian areas and work with governing agencies to apply effectively.
- Design and implement instream flow studies to collect empirical evidence to support/defend enforcement actions to protect aquatic public trust resources.
- Increase the number of branch and regional scientific staff working on water rights and instream flow studies.
- Make recommendations to enhance enforcement of existing laws and regulations.
- Provide law enforcement with maps of critical problem areas.
- Provide funding for CDFW enforcement to enforce laws protecting streams and flows.
- Obtain funding for strategy implementation.
- Develop Law Enforcement Division Academy curriculum emphasizing water law.
- Conduct Office of Training and Development (OTD) training for non-enforcement water policies.

Conservation Strategy 4 (Direct Management): Manage water for beneficial uses by native aquatic species.

Objective(s):

- State and federal agencies manage water for beneficial uses by native species (e.g., provide adequate water for species survival). Engage with the Walker Lake Acquisition/Transfer Program under desert terminal lakes program.

Targeted pressure(s): Dams and water management/use; recreational activities; invasive plants/animals.

Conservation action(s):

- Coordinate with water agencies.
- Identify/coordinate with key stakeholders.
- Collaborate with state and federal agencies for management plan development and review.
- Identify and quantity water needs for native SGCN, non-SGCN, and introduced trout species.
- Evaluate existing occupied habitats.

Conservation Strategy 5 (Direct Management): Translocate or reintroduce native fish species.

Objective(s):

- Establish self-sustaining and genetically viable native fish populations in the basin.

Targeted pressure(s): Dams and water management/use; recreational activities; invasive plants/animals.

Conservation action(s):

- Identify source populations.
- Remove invasive or problematic species from historic native fish habitat.
- Create georeferenced map/data base for native fish habitats.
- Complete basin-wide native fish surveys, and develop basin plan for native fish management.
- Obtain funding for strategy implementation.
- Coordinate management actions with natural resource agencies, NGOs and private landowners.
- Collect/analyze genetic data to define priorities.

Conservation Strategy 6 (Direct Management): Remove introduced brook trout in the context of recovery of listed Lahontan cutthroat trout.

Objective(s):

- The extent and distribution of invasive species are known and a plan is developed by federal agencies and land owners to remove or control invasive species within the hydrologic unit.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):

- Update data on extent and distribution of native and non-native species.
- Develop strategy for removal.
- Coordinate with USFS and private landowners.
- Secure permits and conduct environmental review.
- Apply for funding.
- Conduct treatments.
- Conduct post-treatment monitoring.
- Initiate long-term monitoring and management plan.
- Monitor for re-establishment of invasive species.
- Develop a management and control plan for invasive species.

Conservation Strategy 7 (Direct Management): Implement direct management activities to restore aquatic habitats and ensure that SGCNs are maintained or enhanced.

Objective(s):

- Direct management activities to restore aquatic habitats are implemented to ensure SCGN are maintained or enhanced within the watershed.

Targeted pressure(s): Introduced genetic material.

Conservation Strategy 8 (Management Planning): Ensure that planning and decision-making processes support the conservation of stream habitats and flows as a result of CDFW input.

Objective(s):

- Ensure that planning and decision-making processes support the conservation of stream habitats and flows as a result of CDFW input.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 9 (Management Planning): Develop, update, and implement grazing BMPs.

Objective(s):

- Land managers within the watershed implement BMPs for grazing practices that reduce impacts to aquatic habitats.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Identify partners and stakeholders.
- Identify and review existing grazing management policies.
- Develop MOU/MOA between partners.
- Schedule regular working group meetings.
- Develop BMPs including enforcement policy.
- Provide input to land management agencies on grazing policies.
- Implement BMPs.
- Link to education and outreach strategy.
- Identify funding sources, apply for funding.

Conservation Strategy 10 (Management Planning): Reduce impacts to native fish as a result of roads and railroads and invasive species through development and use of BMPs.

Objective(s):

- Land managers implement BMPs to reduce impacts to native fish community from roads and railroads.
- BMPs for road and rail maintenance activities are established and used by land managers to reduce impacts to native fish community from invasive species.
- When Caltrans is currently implementing BMPs, look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Invasive plants/animals; roads and railroads.

Conservation action(s):

- Collaborate with partner in development or updating of BMPs.
- Collaborate with state and federal agencies and land owners.
- Identify existing BMPs, develop BMPs database.
- Establish working group to define BMPs.
- Obtain funding to implement strategy.

Conservation Strategy 11 (Partner Engagement): Establish and develop co-management partnership to affect change in dams and/or water management and use following interagency agreement.

Objective(s):

- Establish a joint partnership to affect change in dams and/or water management and use following interagency agreement.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Dams and water management/use.

Table 5.6-13 Stresses and Pressures for Walker River Native Fish Assemblage

Priority Pressures	Stresses											
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics					Ecosystem Conditions and Processes				
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water chemistry	Change in water levels and hydroperiod	Change in groundwater tables	Change in nutrients	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Dams and water management/use	X		X	X	X	X	X	X	X	X	X	X
Introduced genetic material								X	X	X		X
Invasive plants/animals		X	X	X	X	X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X			X				X	X
Roads and railroads	X		X	X	X	X						X

Target: Cienegas

Goals:

- By 2025, acres of cienegas habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired fire regime (frequent low-intensity fire) are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired inches of groundwater (stable depth) are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect high-quality cienegas through acquisition/easement/lease.

Objective(s):

- Increase the protection of high quality cienegas habitat through acquisition/easement/lease.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Identify potential areas.
- Identify what is already conserved.
- Prioritize acquisition sites.
- Determine availability of suitable habitat.
- Acquire conservation easements.
- Develop habitat conservation plan.
- Develop advance mitigation plan.
- Determine minimum and maximum habitat size (conserved).
- Determine feasibility.
- Develop interdisciplinary team to facilitate land acquisition and conservation.
- Develop database to track acquisition/tracking.
- Develop protection criteria for conservation easement language.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data on impacts of water management and water use, renewable energy projects, groundwater use for farming and livestock, and invasive species on native species within cienegas.

Objective(s):

- Understand impacts of water management and water use, renewable energy projects, groundwater use for farming and livestock, and invasive species to cienegas and associated species.

Targeted pressure(s): Annual and perennial non-timber crops; livestock, farming, and ranching; renewable energy; invasive plants/animals.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education about the need for resource management of cienegas.

Objective(s):

- The public is aware of the need for resource management of cienegas.

Targeted pressure(s): Invasive plants/animals; fire and fire suppression.

Conservation Strategy 4 (Direct Management): Translocate or reintroduce native aquatic SGCN and establish genetically viable populations.

Objective(s):
- Self-sustaining and genetically viable populations of native aquatic SGCN species established are reintroduced and reproduced one generation in the wild.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Identify source population.
- Remove invasive or problematic species.
- Map suitable habitats.
- Develop management plan.
- Secure funding.
- Connect to barrier aspects.
- Engage in cooperative management with agencies and NGOs.
- Perform genetic analysis.
- Develop a genetic management plan.

Conservation Strategy 5 (Direct Management): Participate in interagency review of water management and use, particularly groundwater withdrawals.

Objective(s):
- Reduce groundwater withdrawals through agreements with water agencies and private landowners.

Targeted pressure(s): Dams and water management/use; housing and urban areas; annual and perennial non-timber crops; livestock, farming, and ranching; renewable energy.

Conservation Strategy 6 (Partner Engagement): Establish and develop co-management partnerships.

Objective(s):
- Establish a joint partnership with USFS and CAL FIRE to affect change in fire management and fire suppression.
- Develop a joint partnership with water agencies focused on management of impacts from water use.
- Establish a joint partnership with CIPC, USDA, and NRCS to address management of invasive species.
- Develop a joint partnership with BLM focused on managing impacts from renewable energy projects.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Dams and water management/use; renewable energy; invasive plants/animals; fire and fire suppression

Table 5.6-14 Stresses and Pressures for Cienegas

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics			Ecosystem Conditions and Processes	
	Change in natural fire regime	Change in water chemistry	Change in water levels and hydroperiod	Change in groundwater tables	Change in spatial distribution of habitat types	Change in community structure or composition
Annual and perennial non-timber crops	X	X	X	X	X	X
Dams and water management/use			X	X	X	X
Fire and fire suppression	X				X	X
Housing and urban areas	X		X	X	X	X
Introduced genetic material	X	X			X	X
Invasive plants/animals	X		X	X	X	X
Livestock, farming, and ranching	X	X		X	X	X
Parasites/pathogens/ diseases	X				X	X
Renewable energy	X		X	X	X	X

Target: Springs and Spring Brooks

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles with habitat connectivity are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles with desired inches of groundwater are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres/miles with desired water yield are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect high-quality springs and spring brooks through acquisition/easement/lease.

Objective(s):
- Protect high-quality springs and spring brooks.

Targeted pressure(s): Annual and perennial non-timber crops; livestock, farming, and ranching.

Conservation action(s):
- Identify potential areas.
- Identify what is already conserved.
- Prioritize acquisition sights.
- Determine availability of suitable habitat.
- Acquire conservation easements.
- Develop habitat conservation plan.
- Develop advance mitigation plan.
- Determine minimum and maximum habitat size (conserved).
- Determine feasibility.
- Develop interdisciplinary team to facilitate land acquisition and conservation.
- Develop database to track acquisition/tracking.
- Develop protection criteria for conservation easement language.

Conservation Strategy 2 (Data Collection and Analysis): Study and document impacts of invasive species, renewable energy projects, and dams and water management and use on spring ecosystems and associated species for future management actions.

Objective(s):
- Document the impacts of invasive species on spring systems and aquatic species.
- Impacts of renewable energy projects to spring systems and species.
- Impacts of dams, water management, and water use to the spring systems for future management actions.

Targeted pressure(s): Livestock, farming, and ranching; recreational activities; commercial and industrial areas; renewable energy; introduced genetic material; invasive plants/animals; marine and freshwater aquaculture.

Conservation Strategy 3 (Outreach and Education): Provide outreach and education, with emphasis on improving public awareness, concern, and participation in resource conservation that leads to improved conditions for native fish.

Objective(s):
- Improve public awareness, concern, and participation in resource conservation within the watershed, leading to improved conditions for native fish.

Targeted pressure(s): Livestock, farming, and ranching; recreational activities; commercial and industrial areas; renewable energy; invasive plants/animals; marine and freshwater aquaculture.

Conservation Strategy 4 (Direct Management): Translocate or reintroduce native aquatic SGCN and establish genetically viable populations.

Objective(s):
- Establish self-sustaining and genetically viable populations of native fish species within the watershed.

Targeted pressure(s): Livestock, farming, and ranching; recreational activities; commercial and industrial areas; renewable energy; introduced genetic material; invasive plants/animals; marine and freshwater aquaculture.

Conservation action(s):
- Identify source populations.
- Remove invasive or problematic species from historic native fish habitat.
- Create georeferenced map/data base for native fish habitats.
- Develop basin plan for native fish management.
- Obtain funding for strategy implementation.
- Coordinate management actions with natural resource agencies, NGOs and private landowners.
- Collect/analyze genetic data to define priorities.

Conservation Strategy 5 (Direct Management): Manage dams and other barriers to control fish passage.

Objective(s):
- Agreement is reached by state and federal agencies, and water agencies, to modify management of Mono Lake springs, brooks, dams, and barriers to encourage fish passage and prevent genetic mixing with non-native fish.

Targeted pressure(s): Invasive plants/animals; dams and water management/use.

Conservation action(s):
- Create/develop geospatial data base of barriers and dams.
- Conduct literature review, consult with experts to gather species distribution information.
- Conduct viability study of barrier designs to determine optimal design.
- Obtain required permits for installation of barriers.
- Evaluate barrier design and efficiency.
- Develop manmade barrier maintenance protocol.
- Obtain funding to implement strategy.

Conservation Strategy 6 (Direct Management): Manage invasive species to expand range of native fishes.

Objective(s):
- Treat 20 percent of acres having invasive species within the watershed.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Update data on extent and distribution of native and non-native species.
- Develop strategy for removal.
- Coordinate with USFS and private landowners.
- Obtain permits and environmental review.
- Apply for and obtain funding.
- Conduct treatments.
- Conduct post treatment monitoring.
- Initiate long-term monitoring and management plan.
- Monitor for re-establishment of invasive species.
- Develop a management and control plan for invasive species.

Conservation Strategy 7 (Management Planning): Provide input on local planning decisions.

Objective(s):
- Ensure that local plans account for the need to conserve Mono Lake tributary stream habitats and flows.

Targeted pressure(s): Livestock, farming, and ranching; recreational activities; commercial and industrial areas; renewable energy; introduced genetic material; invasive plants/animals; marine and freshwater aquaculture.

Conservation action(s):
- Coordinate early and often with lead agencies.
- Identify and prioritize ACE and refine ACE for aquatic and riparian communities.
- Identify existing conserved areas.
- Direct project mitigation to priority areas needing conservation.
- Direct and use conservation banking.
- Create ACE database viewable by all CDFW staff.
- Incorporate conservation goals and BMPs into CEQA comment letters.
- Provide input at meetings.
- Obtain funding for plan implementation.
- Participate in CEQA review, General Plan review.
- Develop standard permit requirements, master Section 1600 LSA Agreement permit template.

Conservation Strategy 8 (Partner Engagement): Establish and develop co-management partnerships.

Objective(s):
- Establish a joint partnership with water agencies and users to affect change in dams and/or water management and use.
- Establish a joint partnership with land managers and land owners to manage invasive species.
- Establish a joint partnership with state and federal agencies to manage renewable energy project impacts and mitigation.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Livestock, farming, and ranching; recreational activities; commercial and industrial areas; renewable energy; invasive plants/animals; marine and freshwater aquaculture.

Table 5.6-15 Stresses and Pressures for Springs and Spring Brooks

Priority Pressures	Stresses				
	Hydrology and Water Characteristics		Ecosystem Conditions and Processes		
	Change in runoff and river flow	Change in groundwater tables	Change in spatial distribution of habitat types	Change in community structure or composition	Habitat fragmentation
Commercial and industrial areas	X	X	X	X	X
Dams and water management/use	X	X	X	X	X
Introduced genetic material		X	X	X	X
Invasive plants/animals	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X
Marine and freshwater aquaculture	X	X	X	X	X
Recreational activities		X	X	X	X
Renewable energy	X	X	X	X	X

Target: Anthropogenically Created Aquatic Features

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired genetic connectivity are increased (between Salton Sea drains) by at least 5 percent from 2015 acres.
- By 2025, miles with stable bank are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired stream stage (mimic natural flow hydrograph) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on the distribution of invasive species and impacts to the target habitat, species utilization of anthropogenic waterways, and the distribution of temporary aquatic habitats associated with roads and railroads to inform management.

Objective(s):

- Scientifically study the distribution of invasive species and impacts to the target and use study results to inform management.
- Understand species utilization of anthropogenic waterways and sources through surveys and reporting.
- Study the distribution of aquatic species in temporary aquatic habitats associated with roads and railroads and use study results to inform management.

Targeted pressure(s): Roads and railroads; dams and water management/use; invasive plants/animals; agricultural and forestry effluents.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education, with emphasis on improving public awareness, concern, and participation in resource conservation.

Objective(s):

- Improve public awareness, concern, and participation in resource conservation.

Targeted pressure(s): Dams and water management/use; invasive plants/animals; agricultural and forestry effluents.

Conservation Strategy 3 (Law and Policy): Develop and implement BMPs for managed grazing, maintenance of drains/canals, and road and railway maintenance.

Objective(s):

- Establish BMPs for maintenance of drains/canals, and for road and railway maintenance.

Targeted pressure(s): Roads and railroads; agricultural and forestry effluents.

Conservation action(s):

- Coordinate with USFS, NRCS, and private landowners.
- Consult with University of California, Extension.
- Conduct education and outreach.
- Create stakeholder group.
- Review and update BMPs.

Conservation Strategy 4 (Land Use Planning): Provide input on project planning and decision making process; conserve anthropogenic aquatic habitats through participation in the planning and decision making process.

Objective(s):

- Conserve 20 percent more anthropogenic aquatic habitats through participation in the planning and decision making process.

Targeted pressure(s): Roads and railroads; dams and water management/use; invasive plants/animals.

Conservation action(s):

- Conduct environmental (CEQA/NEPA) review.
- Participate in review of general plans/amendments.
- Develop master Section 1600 LSA permit template consistent with strategy.
- Develop standard permit requirements/criteria.
- Identify and prioritize areas for conservation/protection.
- Encourage establishment of mitigation banks.
- Develop mitigation alternatives consistent with strategy.
- Define success criteria for adaptive management.
- Obtain funding to maintain mitigation areas and implement strategy.
- Conduct Property Analysis Report for mitigation sites.
- Maintain mitigation and project tracking data base.

Conservation Strategy 5 (Direct Management): Manage invasive species to expand range of aquatic/semi-aquatic SGCN.

Objective(s):
- Manage invasive species on public lands and ROW.

Targeted pressure(s): Roads and railroads; dams and water management/use; invasive plants/animals; agricultural and forestry effluents.

Conservation action(s):
- Update data on extent and distribution of native and non-native species.
- Develop strategy for removal.
- Coordinate with USFS and private landowners.
- Obtain permits and conduct environmental review.
- Apply for funding.
- Conduct treatments.
- Conduct post-treatment monitoring.
- Initiate long-term monitoring and management plan.
- Monitor for re-establishment of invasive species.
- Develop a management and control plan for invasive species.

Conservation Strategy 6 (Partner Engagement): Establish co-management partnerships and cooperative management plans with land management agencies, water agencies, private landowners, regional land trusts, environmental organizations, railroads, and transportation agencies.

Objective(s):
- Establish cooperative management plans with water agencies, railroads, and transportation agencies.
- Ensure consistency of SWAP conservation strategies with DRECP.

Targeted pressure(s): Roads and railroads; dams and water management/use; invasive plants/animals.

Table 5.6-16 Stresses and Pressures for Anthropogenically Created Aquatic Features

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics		Ecosystem Conditions and Processes	
	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in nutrients	Change in spatial distribution of habitat types	Change in community structure or composition
Agricultural and forestry effluents			X		X
Dams and water management/use	X	X		X	
Invasive plants/animals				X	X
Marine and freshwater aquaculture					X
Recreational activities	X			X	
Renewable energy	X	X		X	
Roads and railroads	X	X		X	

Table 5.6-17 Conservation Targets and Strategies for the Deserts Province

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Big Sagebrush Scrub	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. • By 2025, acres where native species are dominant and are increased by at least 5% from 2015 acres. • By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Fire regime	• Climate change • Fire and fire suppression • Housing and urban areas • Invasive plants/animals • Parasites/pathogens/diseases • Recreational activities	• Data Collection and Analysis • Direct Management • Economic Incentives • Land Acquisition/Easement/Lease • Partner Engagement
Great Basin Pinyon-Juniper Woodland	• By 2025, acres where desired native species are dominant and desired structural diversity are increased by at least 5% within the presettlement range of pinyon-juniper and juniper habitats in the ecoregion. • By 2025, acres of desired successional stage are increased by at least 5% from presettlement habitat area. • By 2025, acres with desired fire return level are increased by at least 5% from 2015 levels.	• Community structure and composition • Fire regime • Successional dynamics	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Other ecosystem modifications	• Data Collection and Analysis • Direct Management • Partner Engagement
Shadscale-Saltbush Scrub	• By 2025, acres of disturbed areas showing signs of successional dynamics are increased by at least 5% from 2015 acres. • By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired endemic plant/animal diversity are increased from at least 5% from 2015 acres. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with habitat connectivity are increased by at least 5% from 2015 acres. • By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from acres/miles. • By 2025, acres with suitable soil characteristics are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Successional dynamics • Soil quality and sediment deposition regime	• Airborne pollutants • Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Housing and urban areas • Industrial and military effluents • Invasive plants/animals • Livestock, farming, and ranching • Military activities • Mining and quarrying • Recreational activities • Renewable energy • Roads and railroads • Utility and service lines	• Data Collection and Analysis • Land Acquisition/Easement/Lease • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Desert Wash Woodland and Scrub	• By 2025, acres of (desert wash) habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired endemic plant/animal diversity are increased by at least 5% from 2015 acres. • By 2025, population of key species (Couch's spadefoot) is increased by at least 5% from 2015 population levels. • By 2025, acres with desired structural diversity are increased from at least 5% from 2015 acres. • By 2025, miles with habitat connectivity (desert wash habitat) are increased by at least 5% from 2015 miles. • By 2025, miles with stable bank (desert wash) are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (water volume and flow) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Soil quality and sediment deposition regime • Surface water flow regime	• Climate change • Commercial and industrial areas • Dams and water management/use • Housing and urban areas • Military activities • Mining and quarrying • Recreational activities • Renewable energy • Roads and railroads • Tourism and recreation areas • Utility and service lines	• Data Collection and Analysis • Land Use Planning • Outreach and Education • Partner Engagement
Sparsely Vegetated Desert Dune	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres of habitat are maintained or increased by at least 5% from 2015 acres. • By 2025, acres of habitat with suitable soil characteristics regimes are increased by at least 5% from 2015 acres. • By 2025, acres of habitat with desired ground water levels are increased by at least 5% from 2015 acres. • By 2025, acres of habitat with desired connectivity are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime	• Climate change • Commercial and industrial areas • Housing and urban areas • Invasive plants/animals • Livestock, farming, and ranching • Recreational activities • Renewable energy • Tourism and recreation activities	• Data Collection and Analysis • Direct Management • Land Use Planning • Management Planning • Partner Engagement

Table 5.6-17 Conservation Targets and Strategies for the Deserts Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
American Southwest Riparian Forest and Woodland	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres of target habitat are increased by at least 5% from 2015 acres. • By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Surface water flow regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Housing and urban areas • Invasive plants/animals • Recreational activities • Renewable energy	• Data Collection and Analysis • Direct Management • Land Use Planning
High Desert Wash and "Rangeland" Scrub Great Basin Upland Scrub	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, acres with desired structural diversity are increased at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Successional dynamics •	• Climate change • Fire and fire suppression • Invasive plants/animals • Livestock, farming, and ranching • Mining and quarrying • Renewable energy	• Data Collection and Analysis • Direct Management • Management Planning • Partner Engagement
Mojave and Sonoran Desert Scrub	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, acres with habitat connectivity are increased by at least 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. • By 2025, populations of key species are increased by at least 5% from 2015 population. • By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Successional dynamics • Weather regime	• Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Housing and urban areas • Invasive plants/animals • Renewable energy • Roads and railroads • Utility and service lines	• Land Acquisition/Easement/Lease • Land Use Planning • Management Planning • Outreach and Education • Partner Engagement • Training and Technical Assistance
Walker River Native Fish Assemblage	• By 2025, miles of streams with target fish population (SGCNs) are increased by at least 5% from 2015 miles. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles with habitat connectivity (i.e., past barriers) are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5% from 2015 miles. • By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5% from 2015 miles. • By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Surface water flow regime • Water quality	• Climate change • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Roads and railroads	• Data Collection and Analysis • Direct Management • Law and Policy • Management Planning • Outreach and Education • Partner Engagement
Cienegas	• By 2025, acres of cienaga habitat are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, acres with desired fire regime (frequent low-intensity fire) are increased by at least 5% from 2015 acres. • By 2025, acres/miles with desired inches of groundwater (stable depth) are increased by at least 5% from 2015 acres/miles.	• Area and extent of community • Community structure and composition • Fire regime • Hydrological regime	• Annual and perennial non-timber crops • Climate change • Dams and water management/use • Fire and fire suppression • Housing and urban areas • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Parasites/pathogens/diseases • Renewable energy	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/Lease • Outreach and Education • Partner Engagement
Springs and Spring Brooks	• By 2025, acres of habitat are increased by at least 5% from 2015 acres. • By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. • By 2025, miles with habitat connectivity are increased by at least 5% from 2015 miles. • By 2025, acres/miles with desired inches of groundwater are increased by at least 5% from 2015 acres/miles. • By 2025, acres/miles with desired water yield are increased by at least 5% from 2015 acres/miles. • By 2025, acres with suitable soil characteristics are increased by 5% from 2015 acres. • By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Hydrological regime • Soil quality and sediment deposition regime • Successional dynamics • Surface water flow regime • Water quality	• Annual and perennial non-timber crops • Climate change • Commercial and industrial areas • Dams and water management/use • Introduced genetic material • Invasive plants/animals • Livestock, farming, and ranching • Marine and freshwater aquaculture • Recreational activities • Renewable energy	• Data Collection and Analysis • Direct Management • Land Acquisition/Easement/Lease • Management Planning • Outreach and Education • Partner Engagement

Table 5.6-17 Conservation Targets and Strategies for the Deserts Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Anthropogenically Created Aquatic Features	• By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. • By 2025, acres with desired genetic connectivity are increased (between Salton Sea drains) by at least 5% from 2015 acres. • By 2025, miles with stable bank are increased by at least 5% from 2015 miles. • By 2025, miles with desired stream stage (mimic natural flow hydrograph) are increased by at least 5% from 2015 miles.	• Area and extent of community • Community structure and composition • Connectivity among communities and ecosystems • Soil quality and sediment deposition regime • Surface water flow regime • Water quality	• Agricultural and forestry effluents • Climate change • Dams and water management/use • Invasive plants/animals • Marine and freshwater aquaculture • Recreational activities • Renewable energy • Roads and railroads	• Data Collection and Analysis • Direct Management • Land Use Planning • Law and Policy • Outreach and Education • Partner Engagement

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.

5.7 Marine Province

5.7.1 Geophysical and Ecological Description of the Province

California's Marine Province is part of the California Current Large Marine Ecosystem (Sherman et al. 2004). The combination of California's bathymetry, ocean currents, and seasonal wind patterns provide the necessary conditions that lead to significant abundance and richness of its coastal ocean waters (California Department of Fish and Game [CDFG] 2008). The large array of ecosystems and habitats in California's marine region gives way to a high level of plant and animal biodiversity and abundance (CDFG 2005a). Examples of this unique province's many types of habitats include ridges, submarine canyons, and kelp forests (CDFG 2005a). Because of its productivity, many Californians depend on it for their livelihoods (in terms of consumptive and non-consumptive uses). Examples of consumptive and non-consumptive uses include aquaculture (e.g., shellfish, finfish, and aquatic plants), fishing, recreation, and sight-seeing. In addition, California is ranked in the top five states for its ocean economy across the United States and is "the only state ranked in the top five states by employment for five of the six ocean economy sectors" (National Ocean Economics Program 2014).

The Marine Province, composed of the portion of the Pacific Ocean within the state's three-mile territorial limit, stretches along approximately 1,100 miles of California's coastline. CDFW defines California's state waters as the three-nautical mile maritime limit as shown on National Oceanic and Atmospheric Administration (NOAA) navigational charts. (For information about these charts see http://www.nauticalcharts.noaa.gov/csdl/boundarymetadata_CA.html.) The state marine waters include the coastline of mainland California, coastline of islands, offshore rocks, and three-nautical miles of ocean that extends between selected points across the mouth of coastal bays (primarily Monterey Bay) (FindLaw 2015). Typically no wider than five miles, California's shallow continental shelf is quite narrow compared to the Atlantic and Gulf coasts (Johnson and Sandell 2014). For much of the year, the California Current brings colder northern waters southward along the shore as far as Baja California, while the Southern California Countercurrent flows into the Santa Barbara Channel. These currents, and other minor currents, are critical for driving connectivity and larval dispersal across the coastline and among Marine Province targets (Gaines et al. 2003;

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Gaines et al. 2010a). Seasonal changes in wind direction commonly create seasonal patterns for these currents. For example, northwesterly winds help trigger upwelling of cold, nutrient-rich water from the depths, which lead to high levels of primary productivity that attracts foraging marine life. When these northwesterly winds die down in fall each year, a surface current, known as the Davidson Current, develops and flows in a northerly direction north of Point Conception. Laid over this pattern are both short-term and long-term changes arising from sources such as massive changes in atmospheric pressure (El Niño and La Niña), large-scale change in ocean temperatures, local winds, topography, tidal motions, and discharge from rivers (CDFG 2008).

The marine environment includes a variety of ecosystems, including (1) embayments, estuaries, lagoons; (2) intertidal zone; (3) nearshore subtidal zone; (4) mid-depth zone; (5) deep zone; and (6) offshore rocks. Water depth, temperature, salinity, light penetration, wave energy, substrate type, available nutrients, currents, and many other factors contribute to creating marine habitats.

Many embayments occur along the California coast. They are often bordered on the landward side by shoreline and/or estuarine habitats. Although there is often reduced wave and tidal energy in embayments, there is still a predominant influence of seawater and association with the marine environment (Shaffer 2002). Many species of fish, such as Pacific herring and Chinook salmon, rely on embayments for food, shelter, and spawning habitat. Depending on their life cycles, they may use local watersheds, shallow mud flats, or tidal marshes, as well as deeper portions of the embayment. Like embayments, estuaries are bodies of water that have constant exchanges and interactions with ocean water or marine embayments (Shaffer 2002). There are currently 121 recognized California estuaries covering 393,784 acres. As a water passage where the tide meets a freshwater source, estuaries provide food and habitat for a diverse range of species including crabs, salmon, rockfish, marine mammals, and shorebirds. California's nearly 20 estuaries, greater than 0.5 square mile, support a high biodiversity of fish, birds, invertebrates, and marine mammals in the Marine Province (CDFW 2014a). Coastal lagoons, on the other hand, are bodies of water often separated from ocean water exchange by a strip of terrestrial substratum such as sand dunes, gravel, or mud berms. Breaching can be infrequent and unusual in lagoons and may not occur annually or for several years. Lagoon salinities fluctuate accordingly. In addition, lagoons are often frequented by terrestrial vertebrates, and when breached are occupied by marine and estuarine aquatic species (Shaffer 2002).

The intertidal zone includes all coastal habitats that are subject to periodic tidal inundation and exposure to air (Tillman 2013; Shaffer 2002). The intertidal zone can include different types of habitats, such as intertidal rocky areas, sandy beaches, beach wrack, seagrass beds, wetlands, or mudflats (Tillman 2013; Shaffer 2002). The intertidal zone along with headlands, offshore rocks, and islands provide crucial habitat for marine birds and mammals. These areas provide habitat for numerous types of marine algae, fish, crustaceans, mollusks, sponges, and other invertebrates (NPS 2015).

The nearshore subtidal marine zone contains benthic and pelagic habitats bounded inshore by the coastal intertidal and extending out to where the ocean bottom reaches a depth of 30 meters. This area of shallow water adjoining the coast provides habitat for different plant and animal species including seagrasses, fish, and shellfish (Shaffer 2002). These areas support seagrass beds, kelp forests, subtidal reefs, and vast expanses of muddy or sandy bottom, as well as open water where birds and marine mammals feed upon coastal pelagic species like anchovies and squid.

The mid-depth zone includes the water column and substrate between 30 and 100 meters depth. The mid-depth zone is bound by the nearshore subtidal (Shaffer 2002). The mid-depth zone support rocky reefs and outcrops that provide habitat for sea anemones, sponges, and a variety of fish and invertebrates (OceanSpaces 2015a). Tops of ridges and canyon heads may be found in this zone. The deep zone includes the water column and substrate found below 100 meters and its uppermost limit is bound by the deepest depth of the mid-depth zone (Shaffer 2002).

The deep zone supports vast expanses of both rocky, and muddy or sandy bottoms, where species such as rockfish, flatfish, and spot prawns inhabit the wide home range ecosystem (OceanSpaces 2015b). The base of underwater mountain ridges, as well as canyon walls and floors, occur in this zone.

Offshore rocks include rocks and small islands stretching the length of the California coast from shore out to 12-nautical miles. They are included within the California Coastal National Monument (CCNM), which is protected and managed by the Bureau of Land Management (BLM). Offshore rocks do not include major islands such as the eight Channel Islands, the Farallon Islands, or the islands in San Francisco Bay (BLM 2013). CDFW and California State Parks are partners with BLM for managing the CCNM. The management plan for offshore rocks can be found at the following link: http://www.blm.gov/ca/st/en/prog/blm_special_areas/nm/ccnm/ccnm_rmp_index.html.

Further information and conservation strategies for Offshore Islands, such as the Channel Islands and the Farallon Islands, can be found in Appendix H.

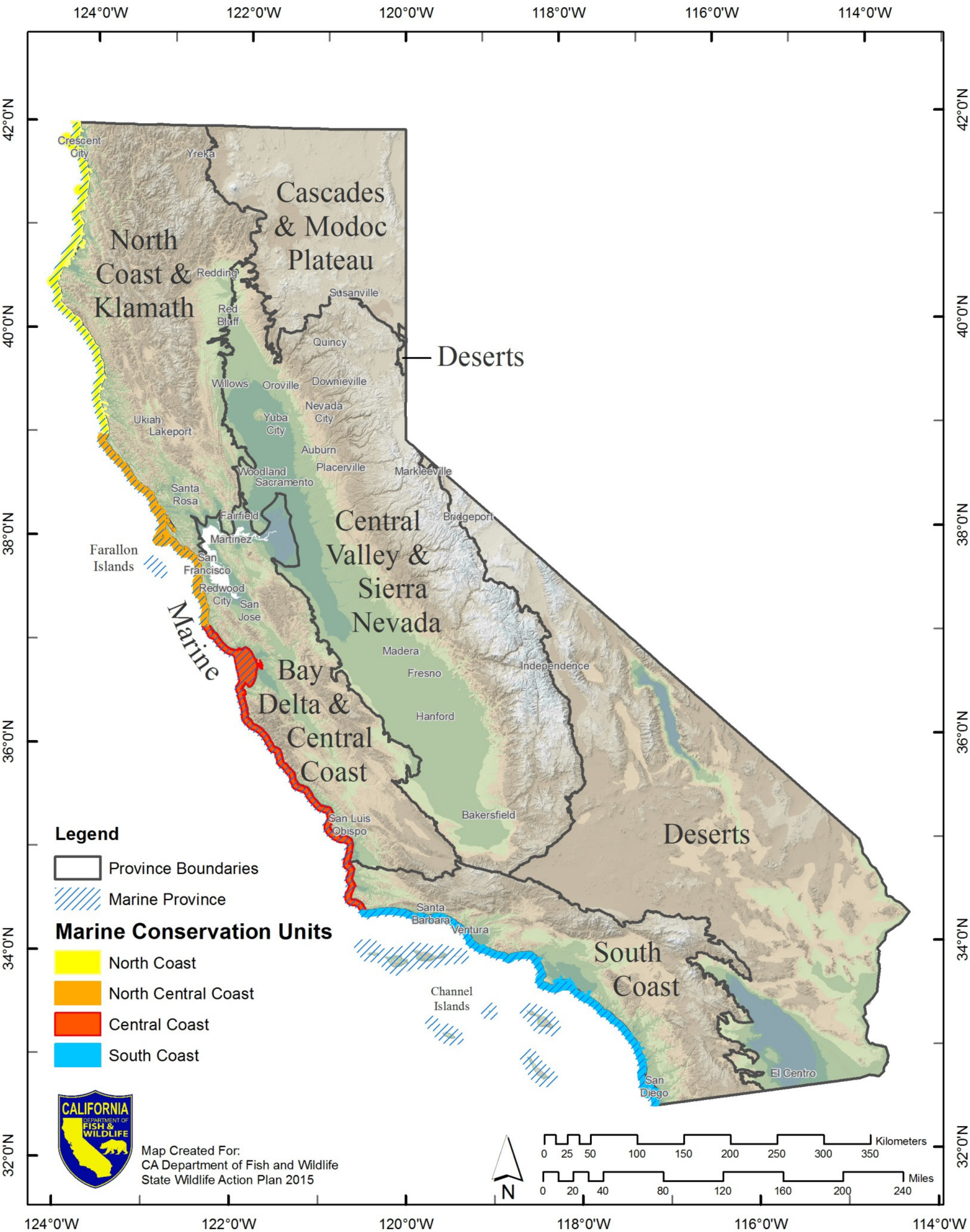
Because of the diversity of its ecosystems, California's Marine Province is home to an array of macroscopic and microscopic animals (mammals, birds, fish, reptiles, amphibians, and invertebrates) and plants (vascular and non-vascular) (CDFG 2005a). Seasonal upwelling fosters high productivity and biodiversity in the nearshore marine, supporting biogenic habitats such as the extensive kelp forests and animals that depend on them like the rockfish, greenlings, lingcod, and kelp crabs. Offshore rocks and islands provide important nesting and haul-out sites for marine birds and mammals (CDFW 2014a).

While being one of the most biologically diverse ecosystems, the combined 220,000 square miles of the state's Marine Province and federal waters, the latter of which extends from 3 to 200 nautical miles from shore, also support some of the busiest shipping lanes and ports in the world, multimillion-dollar commercial and recreational fisheries, and coastal tourism. These waters also offer unparalleled opportunities for wildlife viewing and other non-consumptive forms of recreation. The coast's natural beauty and economic opportunities support residents and attract many visitors. For example, in 2010 more than 80 percent of the state's 37.35 million residents lived in coastal watershed counties compared to a national average of 52 percent of residents living in coastal watershed counties (NOAA 2013a). With such a significant portion of the population residing along California's coast, there are many pressures and impacts to consider and address, such as habitat loss, pollution, invasive species, resource extraction, and global climate change (CDFG 2005a). Because of its global significance, productivity, and biodiversity, the activities implemented in the Marine Province have consequences for marine fauna and flora across the Pacific Ocean (CDFG 2005a). In recognizing this regional and global significance, the Marine Province boasts a number of marine managed areas (MMA) and protected areas including, but not limited to, marine protected areas (MPA) developed through the Marine Life Protection Act (MLPA); the latter include State Marine Reserves (SMR), State Marine Conservation Areas (SMCA), State Marine Parks (SMP), State Marine Recreational Management Areas (SMRMA), and Special Closures (to learn more about each type of managed or protected area, please see http://www.dfg.ca.gov/marine/mpa/defs.asp#mma). More detail on these state managed and protected areas is provided in the sections below. Augmenting state-protected and managed areas, federal protected and managed areas exist including, but not limited to, National Marine Sanctuaries, the Channel Islands National Park, and National Estuarine Research Reserves. In addition, specific fishery closures have been designated in regulation, such as the Cowcod Conservation Areas.

5.7.2 Marine Conservation Units and Targets

The Marine Province is divided into four Marine Conservation Units (MCU): North Coast, North Central Coast, Central Coast, and South Coast (Figure 5.7-1). For the purposes of SWAP 2015, the boundary between each MCU uses those defined and used in the MLPA process (Aseltine-Neilson, pers. comm., 2014). Although the conservation strategies for the Marine Province were developed across the province as a whole and are not differentiated by MCU, they provide the spatial foundation for future planning efforts.

Since San Francisco Bay is part of an ecologically and economically important region of the state (the San Francisco Bay Delta), a separate interdisciplinary team including CDFW staff from Marine Region, Bay Delta Region, Water Branch, and Fisheries Branch developed conservation strategies for this area, designated as the Bay Delta conservation unit. Information on this unit can be found within Section 5.3.



Data Source: CA Dept of Fish and Wildlife Marine Region (marine conservation units), U.S.Geological Survey (hillshade).

Figure 5.7-1 Marine Conservation Units

Six conservation targets have been identified for the Marine Province based on marine ecosystems: (1) embayments, estuaries, lagoons; (2) intertidal; (3) nearshore subtidal zone; (4) mid-depth zone; (5) deep zone; and (6) offshore rocks. However, conservation strategies have only been developed for the embayments, estuaries, lagoons target at this time. This target was chosen because of the available information from similar strategic planning processes, its high level of diversity that includes a number of endangered and threatened species, the ecosystem services it provides at the land-sea interface, its vulnerability to climate change impacts (such as sea level rise), the greater coordination needed among multiple agencies and organizations with jurisdiction over its management, and the in-depth process undertaken using the system *Open Standards for the Practice of Conservation*. As described in Section 1.5.4, the *Open Standards* process included developing key ecological attributes (KEAs); identifying stresses and pressures for each KEA; ranking these stresses and pressures for the target; and developing strategies, goals, and activities. As such, the discussion below of stresses and pressures, as well as strategies and goals focuses on the embayments, estuaries, lagoons target. The five additional targets will be addressed in the future using a similar process, as described in the Section 5.7.7, "Next Steps for the Marine Province." Please note, unless otherwise stated, information for each MCU is drawn from corresponding MPA Guides that may be found at CDFW's California's MPA Network website: http://www.dfg.ca.gov/marine/mpa/mpa_summary.asp.

North Coast Marine Conservation Unit

The North Coast MCU encompasses approximately 1,027 square miles of state water from the California-Oregon border south to Alder Creek in Mendocino County. A network of 20 MMAs, including 19 MPAs and one SMRMA, covers approximately 137 square miles, or about 13 percent of northern California's state waters. Specifically the North Coast MCU includes six SMRs, 13 State SMCA, one SMRMA, and seven Special Closures (CDFW 2014a). This North Coast MCU includes the coastline of Del Norte, Humboldt, and most of Mendocino counties. It is adjacent to the towns of Crescent City, Eureka, Fort Bragg, and Trinidad. The following major rivers or portions of these rivers flow into the North Coast MCU: Eel River, Klamath River, Mad River, Navarro River, Noyo River, Smith River, and Ten Mile River. The Smith River is the largest river system in California that flows freely along its entire course, while the Eel River has the third largest watershed in California, and has the highest average sediment yield per drainage area of any river of its size or larger in the contiguous United States (CDFW 2014a; CDFG 2010).

Thousands of species, including invertebrates, plants, fish, marine mammals, and seabirds, live in the North Coast MCU. Seasonal upwelling along the coast contributes to its high productivity and biodiversity. With this upwelling, nutrients travel from the depths to surface waters where they support plankton blooms and serve as the basis for the unit's food web. Unlike other MCUs, the North Coast has some of the least developed adjacent coastal areas in the state.

In the widespread, bull kelp-dominated forests that grow on the North Coast's rocky reefs, many marine species thrive including juvenile and adult rockfish, greenlings, lingcod, kelp crab, and red abalone. In addition, blades from bull kelp and giant kelp are torn away during storms and provide food for some species including the red abalone (CDFW 2014a; CDFG 2010).

In the offshore portions of the MCU, several submarine canyons (such as Mendocino, Mattole, Delgada, and Spanish) shelter and/or serve as forage areas for fish, marine mammals, and invertebrates, including deep-water corals. Offshore rocks and islands also support key marine bird nesting and foraging sites. For example, the largest population of common murres resides at Castle Rock, near Crescent City, while numerous marine mammals (primarily California sea lions, northern elephant seals, and harbor seals) use rocky islands, shores, sandy beaches, tidal flats, and estuaries, as haul-out and rookery sites (CDFW 2014a; CDFG 2010).

The brackish water of estuaries along the North Coast plays an important part in marine plant and animal life cycles. Many fish depend on estuaries for breeding, foraging, and transit between fresh water and seawater including sharks, staghorn sculpin, surf perches, Chinook salmon, steelhead, and smelt. Many shorebirds and seabirds roost and forage in estuaries, while numerous invertebrates such as crabs, shrimps, and snails inhabit estuaries (CDFW 2014a). For example, the state's second largest estuary, Humboldt Bay, supports nearly 40 percent of the state's eelgrass beds. Estuary plants, such as eelgrass, are beneficial for humans and wildlife, not only do they support diverse marine species, they also cushion shorelines from wave energy and break down pollutants (CDFW 2014a).

The North Coast MCU provides habitat for productive commercial fisheries, targeting a wide diversity of species that helps support economies of coastal communities. Recreational consumptive use opportunities include shore- and vessel-based fishing, kayak angling, clamming, and abalone picking and diving. Recreational non-consumptive use activities include diving, surfing, kayaking, beach-going, swimming, and shore- and boat-based wildlife viewing (CDFW 2014a; CDFG 2010).

North Central Coast Marine Conservation Unit

The North Central Coast MCU encompasses approximately 763 square miles of state waters from Alder Creek, near Point Arena in Mendocino County, to Pigeon Point in San Mateo County. Within these waters, a network of 25 MMAs, including 22 MPAs and three SMRMAs, covers approximately 152 square miles (approximately 20 percent of the unit's waters). Specifically the North Central Coast has 10 SMRs, 12 SMCAs, three SMRMAs, and six Special Closures (CDFW 2014b). The North Central MCU includes the coastlines of several counties, Mendocino from Alder Creek south, Sonoma, Marin, San Francisco, and San Mateo, as well as being adjacent to the towns of Bodega Bay, Gualala, and Half Moon Bay. The Russian River is the unit major ajor river (CDFW 2014b; CDFG 2007). The North Central Coast MCU does not include marine and estuarine waters and associated ecosystems that occur within the San Francisco Bay complex. These are included within the San Francisco Bay Conservation Unit (Section 5.3).

The diverse marine ecosystems found in this MCU support thousands of animal and plant species. Coastal embayments, estuaries, and lagoons provide resting and feeding grounds for migratory waterfowl and shorebirds, such as Bolinas Lagoon, Drakes Estero, and Tomales Bay. Nearshore kelp forests dominated by bull kelp support many types of fish assemblages including species of rockfish; whereas, submerged surfgrass beds serve as shrimp, fish, and crab nurseries. Rocky reefs found nearshore support species or species groups such as sea urchin, abalone, lingcod, sculpin, and octopus (CDFG 2007; CDFW 2014b).

Although outside of the Marine Province, a unique and significant feature of the North Central Coast MCU is the Farallon Islands, which serve as key habitat for the ashy storm-petrel and dozens of other threatened or endangered bird species (CDFW 2014b). The islands also serve as a rookery for one of the largest concentrations of nesting seabirds in the United States. The islands also provide shelter for numerous migrating bird species. Please see Appendix H for more information on Offshore Islands.

The waters of the North Central Coast MCU support "26 species of marine mammals, 94 species of seabirds, 345 species of fish, four species of sea turtles, over 5,000 species of invertebrates and more than 450 species of marine algae" (CDFG 2007; CDFW 2014b). This area also supports many consumptive and non-consumptive activities including fishing (commercial and recreational), diving, kayaking, and whale-watching (CDFG 2007; CDFW 2014b).

Central Coast Marine Conservation Unit

The Central Coast MCU includes approximately 1,144 square miles of state waters from Pigeon Point in San Mateo County to Point Conception in Santa Barbara County. Of these waters, 207 square miles (18 percent) are protected as a network of 29 MMAs composed of (28 MPAs and one SMRMA). Specifically the Central Coast MCU includes 13 SMRs, 14 SMCAs, one SMCA/State Marine Park, and one SMRMA (CDFW 2014c). This Central Coast MCU touches the coastlines of counties including some of San Mateo, Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara. It also is adjacent to the towns and cities of Santa Cruz, Monterey, and Morro Bay, as well as receiving flows from the San Lorenzo, Pajaro, Salinas, Carmel, and Big Sur rivers (CDFG 2005b; CDFW 2014c).

Habitats found in this unit range from rocky tide pools to large submarine canyons. Like other MCUs, this unit receives nutrient rich water from upwelling, which supports the area's high biodiversity. The coastal intertidal includes sandy beaches, rocky shores, coastal marsh, and tidal flats. Estuaries, where coastal streams meet the sea, provide habitat for fish, invertebrates, plants, birds, and mammals. In addition to the bull kelp dominated kelp forests similar to the North Coast and North Central Coast, the Central Coast also has kelp forests dominated by giant kelp in nearshore areas south of the Monterey Bay Submarine Canyon. There are two regionally important estuaries in this unit, Elkhorn Slough (part of the National Estuarine Research Reserve System) and Morro Bay (part of the National Estuary Program). Public awareness about the marine ecosystem is supported by the education activities in and adjacent to estuaries like these and numerous marine research and educational institutions that study this MCU (CDFG 2005b; CDFW 2014c).

In total, central California waters are home to 26 species of marine mammals, 94 species of seabirds, 345 species of fish, four species of sea turtles, thousands of species of invertebrates, and more than 450 species of marine algae (CDFG 2005b; CDFW 2014c).

Like other MCUs, the Central Coast supports fishing (commercial and recreational) and offers unparalleled diving, kayaking, fishing, and whale-watching (CDFG 2005b; CDFW 2014c).

South Coast Marine Conservation Unit

The South Coast MCU covers approximately 2,351 square miles of state waters from Point Conception in Santa Barbara County to the California-Mexico border and includes state waters around the offshore islands. Within these waters, nearly 355 square miles (approximately 15 percent) are protected by 50 MPAs and two Special Closures. Specifically the South Coast MCU includes 19 SMRs, ten "no-take" SMCAs, 21 SMCAs, and two Special Closures (CDFW 2014d). The South Coast MCU follows the southern coastline and includes most of Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties as well as being adjacent to the cities of Santa Barbara, Ventura, Santa Monica, Long Beach, Oceanside, and San Diego. Key rivers or portions of rivers flowing into this unit include the Santa Clara, Los Angeles, San Gabriel, and Santa Ana rivers (CDFG 2009; CDFW 2014d).

A unique feature of the South Coast MCU is that it is part of the Southern California Bight, where waters from two major biogeographic regions intersect: cold, temperate water from the north, and warmer water from the south. The South Coast MCU includes a wide range of habitats from soft and hard-bottomed deep water to nearshore rocky reefs. Its giant kelp dominated kelp forests support species such as white seabass and California spiny lobster. The estuaries and lagoons provide opportunities for foraging and/or breeding, as well as serve as nurseries for young animals. Anaheim Bay, Upper Newport Bay, and Bolsa Chica lagoons are a few of the nearly 40 estuaries and lagoons found in the South Coast MCU.

Offshore islands (including the Channel Islands, which form an archipelago of eight major islands) support a diverse array of plants, invertebrates, fish, birds, and mammals that are found in the coastal intertidal and ocean waters surrounding the offshore islands (Aseltine-Neilson, pers. comm., 2015; CDFW 2014d). In total, this area is home to 481 species of fish, four species of sea turtle, 195 species of birds, seven species of pinnipeds, and more than 5,000 species of invertebrates. The island waters also offer unparalleled recreation opportunities including diving, kayaking, and wildlife viewing (CDFG 2009; CDFW 2014d). For more information about the Offshore Islands, please see Appendix H.

Like other MCUs, the South Coast unit provides for productive fisheries and offers diverse recreational opportunities such as diving, surfing, kayaking, beach-going, swimming, and shore and boat-based wildlife viewing. The South Coast MCU is adjacent to several large urban centers, which contribute to water quality challenges (CDFG 2009; CDFW 2014d). For example, between 1970 and 2010 Los Angeles had the highest single county population growth in the state, increasing by over 2.7 million people (NOAA 2013b).

The Marine Province includes six targets:

- **Embayments, Estuaries, Lagoons**
- **Intertidal Zone**
- **Nearshore Subtidal Zone**
- **Mid-depth Zone**
- **Deep Zone**
- **Offshore Rocks**

SWAP 2015 addresses Embayments, Estuaries, Lagoons as the priority target. See Appendix H for discussion of Offshore Islands.

Embayments, Estuaries, Lagoons

In embayments, ocean wave action is not an essential component of the shoreline-water interface because the shoreline creates a semi-protected water body with relatively restricted flow to the open ocean (Shaffer 2002). Embayment habitats are not only important for aquatic organisms, but also sea birds and some mammals that move between deep and shallow waters. Embayment habitats are typically divided into two categories: areas of deep water (deep bays and channels) and areas of shallow water (shallow bays and channels). Deep bay sediments range from coarse sand to very fine clays and silts and provide habitat for species such as harbor seals, salmon, and clams. Shallow bays are primarily composed of mud sediment and provide important feeding grounds for jacksmelt and other fish (Monroe et al. 1999).

Estuaries connect rivers with the sea and act as a nursery, feeding ground, and shelter for migratory birds and other organisms. Freshwater collected over vast regions of the land pours into an ocean primarily through major rivers, and ocean tides send higher density salt water into estuaries and occasionally upstream far beyond the river mouth. Mixing between fresh and salt water creates a unique environment, and provides habitat for species that can handle variability in environmental conditions (Tomczak 1996). In addition, these environments offer unique research opportunities. For example, Elkhorn Slough National Estuarine Research Reserve is one of the 22 National Estuarine Research Reserves around the country that serve as representative estuaries for research, education, and ecosystem stewardship. Estuaries include an array of habitats such as salt marsh, eelgrass bed, and mud flat. Eelgrass is an important estuarine plant that provides nursery habitat for many fish and other aquatic organisms. Estuaries are exceedingly valuable for residing biodiversity, as well as for providing ecosystem services including improving water quality, buffering against sea level rise and storm surge impacts, providing food and recreation opportunities, and serving as natural barriers to erosion (Gleason et al. 2011; NOAA 2013c). There are many potential threats to estuaries, including altered tidal exchange, altered nutrient dynamics and water quality, altered freshwater inputs, altered sediment regime, invasive species, direct habitat loss, and climate change impacts such as sea level rise and enhanced storm surge (California Coastal Conservancy and Ocean Protection Council 2010).

Lagoons are areas of shallow salty to brackish water periodically separated from the ocean by sand dunes or other features (Merriam-Webster 2015). Periodic opening and flooding allow for efficient sediment export from the lagoon systems (Jacobs et al. 2011). Lagoons, whether natural or artificial, may or may not receive water inflow from a stream or other form of uplands runoff. Lagoons support many of the same aquatic invertebrates and fishes that occur in nearby shallow bays and channels. They also provide feeding grounds for a variety of waterfowl such as brown pelican, canvasback, and ruddy duck (Monroe et al. 1999).

5.7.3 Key Ecological Attributes

To identify the KEAs, the SWAP regional team for the Marine Province participated in a process to assess and better understand the overall health of the embayments, estuaries, and lagoons target. Through this process, the team developed indicators for each attribute that can be used to measure change in the attribute's status.

The attributes for the embayments, estuaries, lagoons target that are the most important for the viability of the target are:

- area or extent of the communities for embayments, estuaries, or lagoons, such as total area or the area of eelgrass beds in estuaries;
- community structure and composition including various aspects of biotic assemblages, such as age class heterogeneity, diversity, key species population, or native versus non-native diversity, and indicated by metrics, such as the number of shorebirds or other key species or the proportion of native species to non-native species;
- hydrologic characteristics of freshwater input into target, such as surface flow, channel pattern, level of natural hydrologic regime and quality of freshwater inflow;
- circulation and connectivity of waters within the target such as tidal circulation, connectivity between the back and front sections of the target, and connectivity to the ocean, indicated by residence times and salinity profiles;
- characteristics of ocean or estuarine water input into target in terms of water quantity and quality;
- water quality levels, indicated by square miles with level of desired water quality as defined by the level of contamination of pollutants or changes in dissolved oxygen or pH within the target or linear miles entering target; and
- sediment quality indicated by square miles with level of desired sediment quality as defined by the level of contamination of pollutants or changes in dissolved oxygen.

5.7.4 Species of Greatest Conservation Need in the Marine Province

The SWAP regional team identified the Species of Greatest Conservation Need (SGCN) for the Marine Province (Table 5.7-1). The criteria used to determine SGCN are described in Section 2.4. The complete list of SGCN for California is presented in Appendix C and the SGCN associated with the Marine Province are shown in Table C-27. In Table 5.7-1, species are indicated for embayments, estuaries, lagoons, intertidal zone, nearshore subtidal zone, and other (includes species found in one or more of the following targets: mid-depth zone, deep zone, and offshore rocks).

SWAP 2005 identified 638 vertebrate species that inhabit the Marine Province at some point in their life cycle, including 163 birds, 62 mammals, 15 reptiles, four amphibians, and 394 fish (CDFG 2005a). For SWAP 2015, 31 bird species, nine mammalian species, nine reptilian species, four amphibian species, 32 finfish species, seven invertebrate species, and five plant species are included as SGCN for the Marine Province (Table 5.7-1).

Marine invertebrate diversity is poorly known, but it is known that marine invertebrate species far outnumber vertebrate species in the ocean (CDFG 2005a). In the Marine Province, the seven invertebrate taxa included on the SGCN list are all mollusks.

In the table below, climate vulnerable species have also been identified using expert opinion and available literature research. Those species identified in this manner are ones that may be adversely affected by changes in climate such as habitat, food, and water availability shifts.

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Invertebrates						
Pink abalone	*Haliotis corrugate*			X		X
Black abalone	*Haliotis cracherodii*		X	X		X
Green abalone	*Haliotis fulgens*		X	X		X
Pinto abalone	*Haliotis kamtschatkana*			X		X
White abalone	*Haliotis sorenseni*			X	X	X
Flat abalone	*Haliotis walallensis*			X		X
Speckled (bay) scallop	*Argopecten circularis*	X				X
Fish						
Pacific lamprey	*Entosphenus tridentatus*	X		X	X	X
River lamprey	*Lampetra ayresii*	X		X		X
White shark	*Carcharodon carcharias*			X	X	
Green sturgeon	*Acipenser medirostris*	X		X	X	X
White sturgeon	*Acipenser transmontanus*	X				X
Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	X		X		X
Coho salmon - central California coast ESU	*Oncorhynchus kisutch*	X		X	X	X

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Coho salmon - southern Oregon / northern California ESU	*Oncorhynchus kisutch*	X		X	X	X
Steelhead - Central Valley DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - northern California DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - south/central California coast DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Steelhead - southern California DPS	*Oncorhynchus mykiss irideus*	X		X	X	X
Chinook salmon - California coastal ESU	*Oncorhynchus tshawytscha*	X		X	X	X
Chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	X		X	X	X
Chinook salmon - Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	X		X	X	X
Delta smelt	*Hypomesus transpacificus*	X			X	X
Longfin smelt	*Spirinchus thaleichthys*	X		X		X
Eulachon	*Thaleichthys pacificus*	X		X	X	X
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	X				X
Pacific Ocean perch	*Sebastes alutus*				X	
Darkblotched rockfish	*Sebastes crameri*				X	
Bronzespotted rockfish	*Sebastes gilli*				X	
Cowcod	*Sebastes levis*			X	X	
Bocaccio rockfish	*Sebastes paucispinis*			X	X	
Yelloweye rockfish	*Sebastes ruberrimus*			X	X	
Giant sea bass	*Stereolepis gigas*			X		
Gulf grouper	*Mycteroperca jordani*			X		
Broomtail grouper	*Mycteroperca xenarcha*			X		
Tidewater goby	*Eucyclogobius newberryi*	X				X
Bluefin tuna	*Thunnus orientalis*				X	
Garibaldi	*Hypsypops rubicundus*			X		
Amphibians						
Santa Cruz long-toed salamander	*Ambystoma macrodactylum croceum*	X				
California newt (Monterey County and South)	*Taricha torosa*	X				
Northern red-legged frog	Rana aurora	X				X
California red-legged frog	*Rana draytonii*	X				
Reptiles						
Loggerhead sea turtle (North Pacific)	*Caretta caretta*	X		X	X	X

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Green sea turtle	*Chelonia mydas*	X		X	X	X
Olive ridley sea turtle	*Lepidochelys olivacea*	X		X	X	X
Leatherback sea turtle	*Dermochelys coriacea*	X		X	X	X
Northern western pond turtle	*Actinemys marmorata*	X				
Southern western pond turtle	*Actinemys pallida*	X				
Two-striped gartersnake	*Thamnophis hammondii*	X				
California red-sided gartersnake (Ventura County and South)	*Thamnophis sirtalis infernalis*	X				
San Francisco gartersnake	*Thamnophis sirtalis tetrataenia*	X				
Birds						
Barrow's goldeneye	*Bucephala islandica*	X				X
Ashy storm-petrel	*Oceanodroma homochroa*			X	X	X
American white pelican	*Pelecanus erythrorhynchos*	X				X
California brown pelican	*Pelecanus occidentalis californicus*	X		X		X
Pelagic cormorant	*Phalacrocorax pelagicus*			X	X	X
Brandt's cormorant	*Phalacrocorax penicillatus*	X		X	X	X
California black rail	*Laterallus jamaicensis coturniculus*	X				X
Light-footed Ridgway's rail	*Rallus obsoletus levipes*	X				X
California Ridgway's rail	*Rallus obsoletus obsoletus*	X				X
Snowy plover (coastal population)	*Charadrius nivosus*		X			X
Black oystercatcher	*Haematopus bachmani*		X		X	X
Ruddy turnstone	*Arenaria interpres*		X		X	X
Black turnstone	*Arenaria melanocephala*		X		X	X
Sanderling	*Calidris alba*		X			X
Red knot	*Calidris canutus*	X	X			X
Surfbird	*Calidris virgata*		X		X	X
Wandering tattler	*Tringa incana*		X		X	X
Black skimmer	*Rynchops niger*	X				X
Gull-billed tern	*Gelochelidon nilotica*	X				X
California least tern	*Sternula antillarum browni*	X		X		X
Elegant tern	*Thalasseus elegans*	X		X		X
Royal tern	*Thalasseus maximus*	X		X		X
Marbled murrelet	*Brachyramphus marmoratus*			X		X
Pigeon guillemot	*Cepphus columba*			X	X	X
Rhinoceros auklet	*Cerorhinca monocerata*			X	X	X
Tufted puffin	*Fratercula cirrhata*			X	X	X
Cassin's auklet	*Ptychoramphus aleuticus*			X	X	X
Craveri's murrelet	*Synthliboramphus craveri*			X		X
Guadalupe murrelet	*Synthliboramphus hypoleucus*			X		X
Scripps's murrelet	*Synthliboramphus scrippsi*			X		X
Common murre	*Uria aalge*			X	X	X

Table 5.7-1 Species of Greatest Conservation Need – Marine Province

Common Name	Scientific Name	Conservation Target				Climate Vulnerable
		Embayments, Estuaries, Lagoons	Coastal Intertidal	Nearshore Marine	Other[1]	
Mammals						
Guadalupe fur seal[2]	*Arctocephalus townsendi*			X	X	NE
Southern sea otter[2]	*Enhydra lutris nereis*	X		X	X	NE
Sei whale[2]	*Balaenoptera borealis*			X	X	NE
Blue whale[2]	*Balaenoptera musculus*			X	X	NE
Fin whale[2]	*Balaenoptera physalus*			X	X	NE
North Pacific right whale[2]	*Eubalaena japonica*			X	X	NE
Humpback whale[2]	*Megaptera novaeangliae*			X	X	NE
Killer whale (southern resident DPS)[2]	*Orcinus orca*			X	X	NE
Sperm whale[2]	*Physeter macrocephalus*			X	X	NE
Biogenic Habitat						
Southern sea palm	*Eisenia arborea*		X	X		
Giant kelp	*Macrocystis sp.*			X		X
Surfgrass	*Phyllospadix spp.*		X	X		X
Sea palm	*Postelsia palmaeformis*		X			
Eelgrass	*Zostera spp.*	X	X	X		X

DPS= distinct population segment, ESU= evolutionarily significant unit, NE= Not evaluated

[1] SGCN occurs in other marine ecosystems.

[2] Species not evaluated for climate vulnerability.

5.7.5 Pressures on Conservation Targets

The diversity and abundance of marine wildlife in California are profoundly affected by human activities in, on, and alongside the water. The focus of this subsection is on ten pressures most commonly identified by the Marine Province regional team. The conservation strategies presented in Section 5.7.6 describe ways to address the pressures.

Because of large-scale shifts in oceanographic conditions, marine stresses need to be considered in the context of the natural variation, such as intra-annual (strengthening and relaxing of the Davidson Current), and decadal variations (Pacific decadal oscillation), as well as global warming and climate change related conditions (such as sea level rise, ocean acidification, storm surge, and deoxygenation). These shifts create a background of natural change that has a profound impact on marine diversity. For example, the distribution and abundance of marine species depend on the strength and temperature of the California Current, which itself varies on a scale measured in decades. When atmospheric pressure in the north Pacific is high, the California Current is stronger, the water temperature is colder, and significant upwelling drives high productivity of the ecosystem, allowing populations of many species adapted to colder water to flourish. When atmospheric pressure in the far northern Pacific is lower, the California Current weakens, water temperatures rise, and there is less upwelling of nutrient-laden water. As a result, the planktonic biomass shrinks, as do the size and range of populations of marine wildlife positioned higher in the food web and adapted to colder water (CDFG 2005a). Another possible response is a range shift, particularly for mobile species.

An oceanographic process that also affects the distribution and abundance of marine species is the El Niño–Southern Oscillation (ENSO), when the temperature of the equatorial ocean rises. When ENSOs are particularly strong, warming of ocean water extends further north of the equator than usual, affecting the California Current. Warmer ocean temperatures off the coast favor the presence of more of the species that prefer warmer water and are less hospitable for the cold water species, which then typically move offshore or to the north. The opposite occurs during a La Niña when the waters off the coast become cooler than usual. La Niñas often occur the year after an El Niño.

These regime shifts in oceanographic conditions mean that, over millions of years, marine organisms have evolved life-history strategies (growth processes, feeding preferences, movement patterns, and reproductive behaviors) that enable populations of species to survive periods of low food availability or years when ocean temperatures or ocean current characteristics do not favor successful reproduction and/or recruitment. The distribution and abundance of marine species naturally fluctuate over time with shifts and changes in the ocean, and populations and ecosystems remain intact because they are large and resilient enough to make it through years with unfavorable conditions (CDFG 2005a).

In addition to these shifts in oceanographic conditions, global warming and climate change also play a role in altering chemical conditions, such as ocean acidification and deoxygenation, and physical conditions, such as sea level rise and storm surge. These pressures will have potentially significant habitat impacts in embayments, estuaries, and lagoons because if vertical accretion is not matched with sea level rise and storm surge changes, these habitats may be converted to more open water habitat types (SCWRP 2001).

Using the *Open Standards* process, the SWAP 2015 Marine Province regional team identified 20 human-caused potential pressures for the embayments, estuaries, lagoons target. These pressures are identified and defined in Table 5.7-2. In addition to existing pressures identified and described in SWAP 2005, such as overfishing, degradation of marine ecosystems, invasive species, pollution, and human disturbance, the team identified new pressures including climate change.

Table 5.7-2 Potential Pressures Affecting Embayments, Estuaries, Lagoons

Pressure	Definition
Agricultural and Forestry Effluents	Includes runoff from crop and rangelands, dairies and stockyards. Generally high in sediments, nutrients, and pollutants, medium in pathogens. Primarily through watershed inputs.
Airborne Pollutants	Includes particulates, pollutants, pathogens, etc. deposited from the air.
Climate Change	Human generated greenhouse gas (e.g., carbon dioxide, methane) emissions that contribute to climate change, such as released from vehicle exhausts and industrial emissions; includes ocean acidification and deoxygenation, sea level rise, and increased storm surge.
Dams and Water Management/Use	Diversion of watershed and groundwater inputs, including diversions for agriculture and urban use; altered inputs because of dams and levees; controlled inputs (dikes and weirs).
Other Ecosystem Modifications - Modification of Mouth/Channels	Dredging, widening mouth, armoring channels.
Other Ecosystem Modifications - Ocean/Estuary Water Diversion/Control	Jetties, breakwaters at mouth of embayments, estuaries, and inlets; intake pipes for power plants, aquariums, aquaculture facilities, etc.; levee, dikes, and weirs for controlling water flow within estuary (water discharged from power plants and other facilities covered under "Industrial and military effluents - Point Discharges").
Fishing, Harvesting, and Collecting Aquatic Resources	Extraction of marine species and associated indirect impacts; includes scientific collecting.
Garbage and Solid Waste	Includes plastics, discarded food items, household items, etc.
Stormwater – Urban Runoff	Includes runoff from residential and commercial areas, landscaped yards, roads and parking lots, domesticated animal feces; generally low in sediments and nutrients, medium in pollutants, high in pathogens.
Housing and Urban Areas; Commercial and Industrial Areas - Shoreline Development	Current and potential commercial and residential development, as well as agricultural development (e.g., grape production); may create artificial structures.
Industrial and Military Effluents- Hazardous Spills	Oil, gasoline, solvents, etc.
Industrial and Military Effluents, Household Sewage and Urban Wastewater- Point Discharges	Includes discharges from industry, power plants, sewage plants, aquariums and aquaculture facilities; generally medium in sediments and nutrients, high in pollutants and pathogens.
Invasive Plants/Animals	Non-native species directly, either intentionally or unintentionally, brought into the system, rather than movement of species into the system from adjacent areas (e.g., moving in from Mexican waters).
Logging and Wood Harvesting	Removal of timber resulting in erosion, sedimentation, and deposition of particulates into waterways.
Marine and Freshwater Aquaculture	Kelp and other algae, invertebrates, fish pens and aquaculture operations in fresh and marine waters.
Other Ecosystem Modifications- Artificial Structures	Artificial structures currently in place along the shoreline (floating and submerged), including pier pilings, as well as potential for new artificial structures.
Parasites/Pathogens/Diseases	Pathogens introduced from outside (e.g., from feces of native and non-native species) or developing/growing within system.
Recreational Activities	Primarily disturbance of sensitive habitats or species; includes vessel use.
Shipping Lanes - Ballast Water	Water released from vessel storage tanks as they enter coastal waters.

Table 5.7-3 provides an overview of how the ten most commonly identified pressures are linked to stresses for the embayments, estuaries, lagoons target. The six highest priority pressures include:

- climate change;
- dams and water management/use;

- housing and urban areas, commercial and industrial areas (shoreline development);
- agricultural and forestry effluents – agricultural runoff;
- industrial and military effluents – point discharges and hazardous spills; and
- household sewage and urban wastewater - point discharges.

These six highest pressures were followed by three lower-ranked pressures:

- housing and urban development (stormwater – urban runoff);
- other ecosystem modifications - modification of mouth/channels; and
- invasive plants/animals.

Table 5.7-3 Stresses and Pressures for Embayments, Estuaries, Lagoons

Priority Pressures	Climate and Non-Climate Related Factors				Geophysical and Disturbance Regimes	Hydrology and Water Characteristics		Soil and Sediment Characteristics	Ecosystem Conditions and Processes	
	Change in estuarine and oceanic water chemistry and quality[1]	Change in ocean inputs	Change in estuarine and oceanic hydrodynamics[2]	Change in surface area	Change in sediment erosion-deposition regime	Change in runoff and river flow[3]	Change in water chemistry and quality	Change in sediment quality	Change in community structure or composition	Area and extent of community
Agricultural and forestry effluents	X		X		X	X	X	X	X	X
Climate change	X	X	X	X	X	X	X		X	X
Dams and water management/use	X		X	X	X	X	X	X	X	X
Household sewage and urban wastewater*	X		X			X	X	X	X	X
Industrial and military effluents**	X		X			X	X	X	X	X
Invasive plants/animals			X			X			X	X
Modification of mouth/ channels***	X	X	X						X	X
Parasites/pathogens/diseases							X		X	X
Shoreline development****			X	X	X	X	X	X	X	X
Stormwater – urban runoff*****			X			X	X	X	X	X

Note: An X designates that the stress received either a High or Very High rating.
* This includes sewage point discharges.
**This includes hazardous spills, and industrial and military point discharges.
***This is under the pressure "other ecosystem modifications."
**** This is under the pressures "housing and urban areas" and "commercial and industrial areas."
*****This is under the pressure "housing and urban areas."
[1]This includes oceanic and estuarine hypoxia, acidification, and aragonite saturation level.
[2]This includes changes in currents, circulation, upwelling, tidal mixing, waves, and spray patterns.
[3]This includes freshwater inputs into the estuarine and marine systems.

5.7.6 Conservation Strategies

The SWAP 2015 regional team developed goals, conservation strategies, objectives, and conservation actions for addressing specific potential pressures that affect embayments, estuaries, lagoons. First, the overarching goals developed for this target are shared. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. Applicable conservation strategy categories are provided with each of 19 strategies. Following each strategy, the specific objectives are presented along with the pressures that are addressed by the strategy. Some strategies address all pressures, while others are targeted to specific pressures. In addition, related strategies share the types of activities that could be used to implement each strategy described. Table 5.7-4 summarizes the strategies for the embayments, estuaries, lagoons target. Strategies developed by the regional team that fit under the general conservation strategy categories are not listed below.

Embayments, Estuaries, Lagoons

Goals:

- By 2025, in coordination with partners, area of target is increased by at least 5 percent (with at least half of this new area available as buffer for sea level rise).
- By 2025, increase reproductive success of native shorebirds by at least 5 percent, increase native oyster populations by at least 5 percent, and reduce key invasive species populations (those that pose the greatest ecological risk) by at least 5 percent, as indicators of improved community structure in the embayments, estuaries, lagoons ecosystems.
- By 2025, protect at least 5 percent more shorebird habitats to secure high quality embayments, estuaries, lagoons ecosystems.
- By 2025, native seagrass (eelgrass) bed acreage is increased by at least 5 percent. (Will result in an increase in floating vegetation.)
- By 2025, in coordination with partners, surface water flow (both ephemeral and permanent) is increased by at least 5 percent into embayments, estuaries, lagoons.
- By 2025, in coordination with State Water Boards and other partners, improve the water quality of tributaries that flow into embayments, estuaries, lagoons by meeting at least 5 percent of Total Maximum Daily Loads (TMDLs).
- By 2025, in coordination with partners, at least 5 percent of the embayment, estuary, and lagoon water bodies have improved circulation and hydro-connectivity so that key ecological processes are restored. For example, nutrient and other chemical mixings in the water body are functioning better and improved tidal cycle evolutions are experienced throughout the target.

- By 2025, in coordination with State Water Boards and other partners, the water quality standards are met for at least 5 percent of those embayment, estuary, and lagoon water bodies not currently meeting those standards.
- By 2025, in coordination with State Water Boards and other partners, the sediment quality objectives are met for at least 5 percent of those embayment, estuary, and lagoon water bodies not currently meeting those objectives.

Conservation Strategy 1 (Management Planning; Land Use Planning; Partner Engagement; Environmental Review): Improve engagement in decision-making process.

Objective(s):
- Increase capacity by procuring staff and appropriate funding for planning, environmental review, and partnership engagement.
- Increase time spent on internal and external communication and coordination.
- Increase participation in California Environmental Quality Act (CEQA) reviews of project proposals and local coastal plans.
- Review and provide CDFW input on all relevant permits and monitoring programs.
- Develop collaborations with local and state agencies and other relevant partners to address pressures.
- Work with appropriate internal and external groups to integrate efforts to address watershed needs.
- Increase participation at interagency coordination meetings.
- Develop a unit within the CDFW to focus on land-sea interface.
- Develop a standardized approach for reviewing environmental documents (e.g., project proposals, permits, and monitoring plans) and for drafting comments and generating recommendations

Targeted pressure(s): All pressures.

Conservation Strategy 2 (Land Use Planning; Partner Engagement; Environmental Review): Improve implementation of non-structural and structural best management practices (BMPs).

Objective(s):
- Increase review and input on BMP implementation.
- Increase interaction with municipalities to ensure that they are complying with permits.
- Coordinate with partners to reduce storm water/runoff effluents.
- Compile information on user activities and socio-economic data, in support of BMP recommendations.

Targeted pressure(s): All pressures.

Conservation Strategy 3 (Management Planning; Direct Management; Partner Engagement): Improve rapid response capabilities to events that degrade target.

Objective(s):

- Increase capacity to respond to events that degrade target.

Targeted pressure(s): All pressures.

Conservation Strategy 4 (Law and Policy; Partner Engagement): Support development, implementation, and enforcement of effective regulations.

Objective(s):

- Work with CDFW staff to ensure that adopted regulations will be effective at conserving resources.
- Work with legislative liaison to develop regulations that require wetland and shoreline buffers.
- Streamline regulatory process for CDFW staff and other entities to implement invasive species control and eradication work.
- Work with agencies and partners to review coastal maintenance activities including those related to dredging and infrastructure (piers, seawalls) to determine how to effectively incorporate maintenance activities into regulations (e.g., those for MPAs), where needed.
- Support adoption of effective regulations on terminal market for shellfish and aquarium imports.
- Work with agencies and other partners to leverage resources (financial and human) to increase implementation and enforcement of regulations.

Targeted pressure(s): All pressures.

Conservation Strategy 5 (Data Collection and Analysis; Direct Management): Support target monitoring, compile results, and integrate data into management.

Objective(s):

- Assess what data are available within CDFW and from external sources to manage the target.
- Encourage support for physical/chemical monitoring network that includes target (such as the Integrated Ocean Observing System network).
- Provide support for biological monitoring of target, including monitoring of the State MPA network.
- Provide support for compilation and maintenance of data into databases that are readily available to, and easily useable by, managers, as well as the public.
- Provide web access to databases and develop tools for accessing and using data.
- Integrate with socio-economic data collected on resource users, and activities that affect resource and habitat conditions.

Targeted pressure(s): All pressures.

Conservation Strategy 6 (Data Collection and Analysis; Direct Management; Partner Engagement): Encourage research that addresses questions that would improve ability to manage this target.

Objective(s):
- Increase the information available to manage target.
- Increase participation in collaborative partnerships.

Targeted pressure(s): All pressures.

Conservation Strategy 7 (Outreach and Education; Partner Engagement): Improve education and outreach activities.

Objective(s):
- Increase public awareness of major pressures to target and ecosystem services that target provides.
- Increase awareness in intergovernmental forums about how water quality in embayments and estuaries may affect SGCN.
- Increase coordination with partners on education and outreach activities.

Targeted pressure(s): All pressures.

Conservation Strategy 8 (Training and Technical Assistance): Increase training.

Objective(s):
- Provide training to increase staff abilities to achieve goals. Provide training on how to review environmental documents using a standardized approach.
- Provide training on how to evaluate damage from events that degrade the target (e.g., hazardous spills).
- Increase coordination between management and staff on training needs.

Targeted pressure(s): All pressures.

Conservation Strategy 9 (Direct Management; Partnership Engagement): Improve management approaches for fostering the sustainability and resilience of the target.

Objective(s):
- Explore whether a more integrated approach for managing watersheds can build resilience throughout the watershed.
- Examine the effectiveness of the current MPAs within the target to increase the target's sustainability and resilience.

Targeted pressure(s): All pressures.

Conservation Strategy 10 (Data Collection and Analysis; Direct Management; Land Use Planning; Partner Engagement): Work with partners to identify effects on the target of climate change and to develop and implement responses to these effects.

Objective(s):

- Identify the expected effects (from research and models) of climate change on the target's key attributes.
- Work with partners to increase our understanding of the expected effects of climate change on the target (and associated species).
- Incorporate increased understanding of effects into marine resource management.
- Provide guidance to other state agencies on how the key ecological attributes change because of climate change that affect marine resources and how these changes may be best addressed.
- Work with other agencies and organizations to identify and prioritize lands around the target that are important for buffering changes in the target due to sea level rise.

Targeted pressure(s): Climate change.

Conservation Strategy 11 (Data Collection and Analysis; Management Planning): Improve Marine Province's management of resources vulnerable to climate change and ocean acidification.

Objective(s):

- Generate climate vulnerability assessment
- Develop and implement plan (including management actions) to build resilience or decrease vulnerability of sensitive resources to climate change.
- Conduct baseline survey of bivalve species in estuarine habitats.
- Incorporate climate tools into management toolbox.
- Collect data to inform a climate vulnerability assessment on marine mammals listed as SGCNs.

Targeted pressure(s): Climate change.

Conservation Strategy 12 (Management Planning; Environmental Review; Partnership Engagement): Coordinate with local and state relevant agencies on shoreline and water quality management planning.

Objective(s):

- Provide guidance on what should be included in state management planning documents to ensure that the effects of increased anthropogenic greenhouse gases are addressed.
- Improve communication with state and local agencies with shared auspices affecting shoreline and water quality management planning including placement of desalination plants.
- Develop collaborations with local and state agencies to develop BMPs regarding shoreline and water quality management.
- Work with local and state agencies to address issues regarding stormwater runoff and effluents.
- Increase coordination with SWRCB, RWQCBs, and SCCWRP to implement general strategies.
- Develop a climate change vulnerability assessment for marine mammals.

Targeted pressure(s): Climate change; agricultural and forestry effluents (agricultural runoff); stormwater – urban runoff; industrial and military effluents; household sewage and urban wastewater- point discharges.

Conservation Strategy 13 (Economic Incentives; Law and Policy): Support policies and practices that minimize impacts on shoreline and wetlands.

Objective(s):

- Identify, evaluate, and implement incentives that encourage and practices that result in minimal impacts to the target.
- Increase coordination with the Coastal Commission and Coastal Conservancy on policies and potential legislation.

Targeted pressure(s): Housing and urban areas (shoreline development); commercial and industrial areas (shoreline development).

Conservation Strategy 14 (Outreach and Education; Environmental Review): Improve practices to reduce human error.

Objective(s):

- Improve public recreational users' awareness of how to prevent and respond to hazardous spills.
- Improve commercial users' awareness of how to prevent and respond to hazardous spills.
- Coordinate with appropriate regulatory entities to require that an appropriate spill prevention and response plan be developed before proposed permit activities.

Targeted pressure(s): Industrial and military effluents (hazardous spills).

Conservation Strategy 15 (Management Planning; Direct Management): Implement CDFW Aquatic Invasive Species Management Plan.

Objective(s):
- Ensure plan objectives are met.
- Adapt as needed and begin implementation of Aquatic Invasive Species Management Plan.
- Increase content within, and accessibility to, the CDFW invasive species database.
- Create early detection rapid response program for new occurrences of invasive species.
- Conduct eradication and/or control measures for invasive species.
- Support development and implementation of ballast water best management practices.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 16 (Environmental Review; Direct Management; Law and Policy): Streamline processes that address control and eradication of invasive species.

Objective(s):
- Streamline regulatory process for CDFW staff and other entities to implement control and eradication work.
- Provide criteria on how to conduct eradication and/or control measures for invasive species.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 17 (Management Planning; Direct Management): Improve implementation of estuary, lagoon mouth and channel modifications.

Objective(s):
- Participate in development of embayment, estuary, and lagoon management plans.
- Incorporate the existence of MPAs into the planning process.
- Strictly implement existing work windows.

Targeted pressure(s): Other ecosystem modifications - modification of mouth/channels.

Conservation Strategy 18 (Partner Engagement; Land Use Planning; Land Acquisition/Easement/Lease): Encourage protection of lands that reduce runoff (buffers like greenways and gulches).

Objective(s):
- Work with other CDFW regions and other agencies to establish working groups to identify and prioritize lands, like greenways and gulches, which can act as buffers for urban runoff.
- In coordination with working group members, identify and implement efforts to protect highest priority lands.

Targeted pressure(s): Stormwater –urban runoff.

Conservation Strategy 19 (Data Collection and Analysis): Improve understanding of distribution of important pathogens.

Objective(s):

- Conduct comprehensive baseline survey for key pathogens.

Targeted pressure(s): Parasites/pathogens/diseases.

5.7.7 Next Steps for the Marine Province

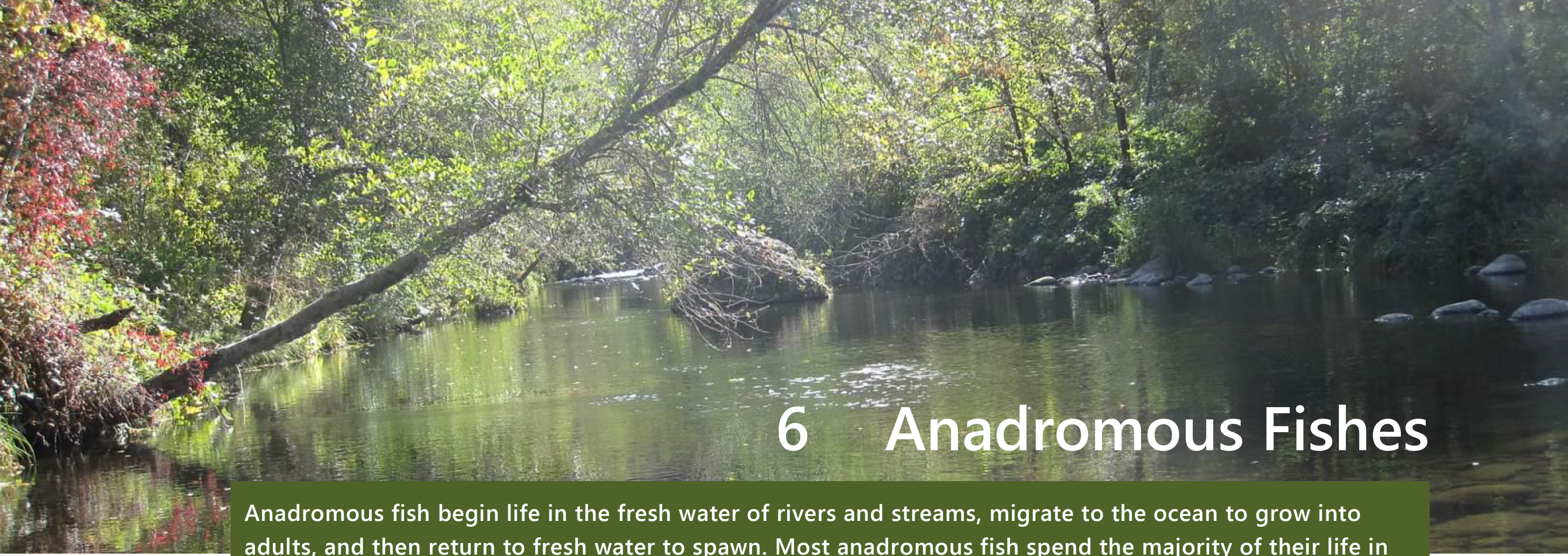
As stated in Section 5.7.1, "Geophysical and Ecological Description of the Province," besides the embayments, estuaries, and lagoons target, the SWAP 2015 regional team for the Marine Province identified five other conservation targets: intertidal zone, nearshore subtidal zone, mid-depth zone, deep zone, offshore rocks; however, these targets were not completed for this update, because less information was available for these targets, they were perceived to have lower vulnerability to climate change impacts than the chosen target; fewer management agencies and/or organizations exist with jurisdiction over these targets than the target chosen; and there was insufficient time to address each target using the in-depth *Open Standards* process. Although specific strategies were not developed for the other targets, many of the general conservation strategies outlined for the embayments, estuaries, lagoons target are also relevant and managers could refer to these in general terms, until more specific information becomes available.

CDFW will complete the other target strategies using the *Open Standards* process after completion of SWAP 2015. Once completed, the strategies can be folded into SWAP 2015 with the amendment process described in Section 7.7, "Review and Revision." Because this process is useful for identifying key priorities and strategies for implementing effective management, CDFW managers responsible for implementing management actions in the Marine Province will use it in an ongoing manner to make updates between 2015 and the next comprehensive SWAP update prior to 2025. In addition to the review and revision process, CDFW is undergoing development of nine sector specific companion plans, as described in Section 1.6, "Companion Plans." One of the sectors is "Marine" and will help to supplement information in this section.

Table 5.7-4 Conservation Targets and Strategies for the Marine Province

Target*	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[2]	Strategy Categories
Embayments Estuaries Lagoons	• By 2025, in coordination with partners, area of target is increased by at least 5% (with half of this new area available as buffer for sea level rise). • By 2025, increase reproductive success of native shorebirds by at least 5%, increase native oyster populations by at least 5%, and reduce key invasive species populations (those that pose the greatest ecological risk) by at least 5%, as indicators of improved community structure in the embayments, estuaries, lagoons ecosystems. • By 2025, protect at least 5% more shorebird habitats to secure high quality embayments, estuaries, lagoons ecosystems. • By 2025, native seagrass (eelgrass) bed acreage is increased by at least 5%. (Will result in an increase in floating vegetation) • By 2025, in coordination with partners, surface water flow (both ephemeral and permanent) is increased by at least 5% into embayments, estuaries, lagoons. • By 2025, in coordination with State Water Boards and other partners, improve the water quality of tributaries that flow into embayments, estuaries, lagoons by meeting at least 5% of the TMDLs. • By 2025, in coordination with partners, at least 5% of the embayment, estuary, and lagoon water bodies improve circulation and hydro-connectivity so that key ecological processes are restored, for example, nutrient and other chemical mixings in the water body are functioning better and improved tidal marsh evolutions are experienced throughout the target. • By 2025, in coordination with State Water Boards and other partners, the water quality standards are met for at least 5% of those embayment, estuary, and lagoon water bodies not currently meeting those standards. • By 2025, in coordination with State Water Boards and other partners, the sediment quality objectives are met for at least 5% of those embayment, estuary, and lagoon water bodies not currently meeting those objectives.	• Area and extent of community • Community structure and composition (e.g., key species population levels, age class structure, biodiversity, endemic diversity, native versus non-native diversity) • Biogenic habitat • Hydrologic characteristics (e.g., flow coming into and out of target) • Quantity of sediment delivered into target (sediment deposition) • Circulation and connectivity within target • Water quality • Sediment quality	• Agricultural and forestry effluents • Airborne pollutants • Climate change • Dams and water management/use • Fishing, harvesting, and collecting aquatic resources • Garbage and solid waste • Household sewage and urban wastewater (urban runoff) • Housing and urban areas, commercial and industrial areas (shoreline development) • Industrial and military effluents (hazardous spills) • Industrial and military effluents, household sewage and urban wastewater (point discharge) • Invasive plants/animals • Logging and wood harvesting • Marine and freshwater aquaculture • Other ecosystem modifications (modifications of mouth/channels, ocean/estuary water diversion/control, artificial structures) • Parasites/pathogens/diseases • Recreational activities • Shipping lanes (ballast water) • Stormwater (urban runoff)	• Data Collection and Analysis • Partner Engagement • Management Planning • Direct Management • Economic Incentives • Environmental Review • Land Acquisition/Easement/Lease • Land Use Planning • Law and Policy • Outreach and Education • Training and Technical Assistance

* Conservation strategies were only developed for the embayments, estuaries, lagoon target. Strategies for other marine conservation targets will be developed in the future. See Appendix H for discussion of Offshore Islands.
[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.
[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.



6 Anadromous Fishes

Anadromous fish begin life in the fresh water of rivers and streams, migrate to the ocean to grow into adults, and then return to fresh water to spawn. Most anadromous fish spend the majority of their life in marine environments and travel great distances between their marine habitat and spawning rivers or streams. Because the geographic ranges of anadromous fish span many of the provinces developed for SWAP 2015, the organization of conservation strategies by hydrologic unit or even province does not adequately address their conservation needs. As such, conservation strategies for anadromous fish have been developed separately, as discussed in this chapter, to capture their full life cycle and geography.

Chapter 6 has been prepared by Kevin Shaffer, CDFW Program Manager, Anadromous Management and Conservation, Fisheries Branch

6.1 Vision

CDFW has a fundamental objective for California's native anadromous fish species and fisheries: to manage and conserve these amazing species and the near-shore, estuary, and river habitats they occupy for their ecological significance, recreation, commercial, and tribal values and for enjoyment by current and future residents and visitors.

This chapter describes California anadromous fishes—Chinook and coho salmon, steelhead and cutthroat trout, green and white sturgeon, eulachon, longfin smelt, and Pacific lamprey. It also discusses their estuarine and freshwater distribution; crucial aspects of their ecology; the pressures they face; and fundamental conservation targets and strategies to protect, enhance, and manage their populations, habitat, and ecological processes.

At the center of CDFW's recommendations and future actions are six core principles. For each species and ecoregion and for the anadromous fish guild and state as a whole, these principles will guide CDFW in its actions and collaborations with federal, state, private, and public partners:

- *Water Conservation* - identifying and implementing water management strategies designed to provide sufficient instream flow quality and quantity to meet suitable fish and habitat needs;
- *Habitat Restoration* - restoring and enhancing physical and water habitat, restoring unimpeded flows, securing sustainable ecological processes, addressing future environmental stresses (sea-level rise, increased water temperature, prolonged drought), and eradication or control of invasive species;
- *Species Recovery* - identifying and implementing actions to recover species until protections under state and/or federal endangered species act listing are no longer warranted;

- *Angling Opportunities* - ensuring the public has appropriate recreational, commercial, and tribal anadromous fisheries harvest opportunities in ocean, estuary, and river waters of the state;
- *Hatchery Management* - improving the science of hatchery aquaculture and management, and ensure hatchery practices maximize fish health and diversity, while minimizing adverse effects on native stocks and river habitat; and
- *Promoting Partnerships* - pursuing inter-state, agency, tribal, private, and academic partnerships and cooperative efforts to conserve and manage California anadromous species.

6.2 Goals and Objectives - Targets and Strategies

Conservation targets pertinent to anadromous fish species are a combination of habitat, fish species, and ecological processes. Targets and strategies are proposed at two scales: statewide and salmonid ecoregional. In each case, the priority targets are limited to three per area, and the priority strategies are limited to three per target. It needs to be noted that the targets and strategies are but a subset of vital needs and actions known for anadromous species. They are a result of knowledge obtained from scientific studies and experience garnered over decades. They are based on the principle that geographic and temporal scales are pivotal to anadromous fish population viability, and that sustaining ecological processes is the central means to recovering and supporting fish populations and fisheries.

In Section 6.6, Challenges to Anadromous Species and Watersheds, both the targets and their strategies are briefly discussed. The listed actions represent CDFW's primary proposals for collaboration and implementation with state and federal agencies, private and non-governmental partners, Native American tribes, and the academic community. They constitute activities for immediate implementation and long-term commitment, and can be implemented at different scales and rates in each salmonid ecoregion, depending on available resources, interest, and necessity.

6.3 Anadromy and Species Diversity in California

California is home to several species of fishes characterized by spending the majority of their lives in estuarine or marine waters and returning to fresh water to spawn. This life-history strategy in fishes is known as anadromy. Native anadromous fishes are represented by jawless lamprey (*Petromyzontidae*) and cartilaginous, bony plated sturgeons (*Acipenseridae*) to the highly migratory salmon and steelhead trout (*Salmonidae*), and the small, short-lived smelts (*Osmeridae*). Some of these are widely recognized and managed for their commercial and sport values, while others are more obscure and seldom seen by the public.

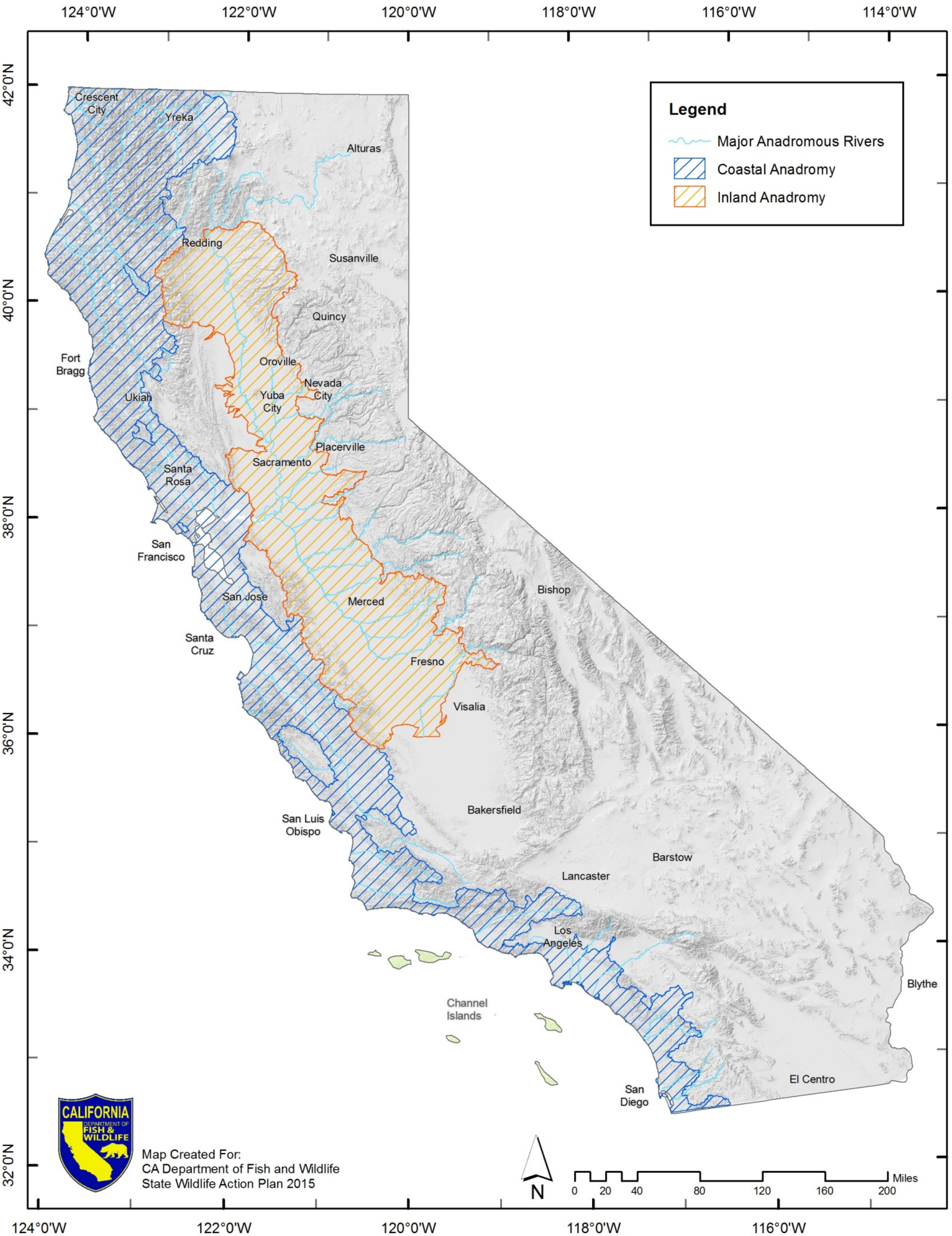
Coho salmon, Matt Elyash, CDFW

Anadromous fishes are widely distributed in California, occurring in coastal watersheds from San Diego to Del Norte counties, the San Francisco Bay system, Sacramento-San Joaquin Delta, and rivers and streams of the Central Valley (Figure 6.3-1). For each of these species, California represents the southern limit of the species range along the west coast of North America. Anadromous species with viable populations occurring in California include two species of salmon (Chinook and coho), two species of trout (steelhead and coastal cutthroat), two species of sturgeon (green and white), two species of smelt (longfin and eulachon), and Pacific lamprey.

Several of the species are separated into unique population assemblages, referred to as Evolutionarily Significant Units (ESU; e.g., salmon and steelhead trout) or Distinct Population Segments (DPS; e.g., sturgeon and eulachon). The status and trend of populations, condition and function of habitat and ecosystem processes, and pressures and limiting factors of these species are determined at the ESU and DPS scale. Such evaluations are used in assessing the need for protection of each species. In California, most ESUs and DPSs are now formally protected by either the California or federal Endangered Species Act (CESA; ESA), or both (Table 6.3-1).

Estuarine and riverine ecosystems across California are utilized differentially by California’s anadromous fishes; however, they all rely on these ecosystems as critical habitat to complete their life history strategy. These ecosystems are vital for egg incubation, juvenile rearing, emigration of young to estuaries or the ocean, and then immigration and spawning of adults (Table 6.3-2). For some species, relatively short periods of time are spent in freshwater (e.g., eulachon, Chinook salmon), while for other species (e.g., Pacific lamprey, steelhead trout), in earlier life stages they spend years in fresh water. The same divergence is seen in estuaries, where salmonids spend vital, relatively limited time in estuaries, and sturgeon and longfin smelt spend a majority of their lives in deltas, bays, and estuaries.

Two species of salmon, Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) spawn and rear in watersheds in the northern half of California (Figure 6.3-2). Chinook salmon live three to six years, most of that time in the ocean. Returning adults are in overlapping groups of a similar age, i.e., cohorts. Coho salmon typically live three to four years and return in distinct cohorts, having little overlap between generations of fish from the same watershed.



Data Source: California Ecoregions (Wild Salmon Center, 2009)
Salmonid ESU and DPS(NOAA Fisheries, 2013)

Figure 6.3-1 Limits of Anadromy in California

Table 6.3-1 Anadromous Fish Species in California and Salmonid Ecoregions

Common Name	Scientific Name	Endangered Species Act Protection		California Salmonid Ecoregions					
		State	Federal	North Coast	North Central Coast	Klamath River	Sacramento-San Joaquin Rivers	South Central Coast	Southern California Coast
CHINOOK SALMON	***Oncorhynchus tshawytscha***			**X**	**X**	**X**	**X**		
Central Valley fall-run ESU							X		
Central Valley late fall-run ESU							X		
Central Valley spring-run ESU		X	X				X		
Central Valley winter-run ESU		X	X				X		
California Coastal ESU			X	X					
Upper Klamath-Trinity Rivers Basin ESU					X	X			
Southern Oregon/Northern California Coastal ESU				X					
COHO SALMON	***Oncorhynchus kisutch***			**X**	**X**	**X**		**X**	
Southern Oregon/Northern California Coasts ESU		X	X	X	X	X			
Central California Coast		X	X		X			X	
CHUM SALMON [1]	***Oncorhynchus keta***								
PINK SALMON [1]	***Oncorhynchus gorbuscha***								
STEELHEAD TROUT	***Oncorhynchus mykiss***			**X**	**X**	**X**	**X**	**X**	**X**
California Central Valley			X				X		
Southern California DPS			X						X
South-Central California DPS			X					X	
Central California Coast DPS			X		X			X	
Northern California					X				
Klamath Mountains Province DPS						X			
COASTAL CUTTHROAT TROUT	***Oncorhynchus clarkii clarkii***			**X**	**X**	**X**			
SOUTHERN GREEN STURGEON DPS	***Acipenser medirostris***		**X**	**X**	**X**	**X**	**X**		
WHITE STURGEON	***Acipenser transmontanus***				**X**	**X**	**X**		
PACIFIC LAMPREY	***Entosphenus tridentatus***			**X**	**X**	**X**	**X**	**X**	**X**
LONGFIN SMELT	***Spirinchus thaleichthys***	**X**	**X**[2]		**X**	**X**	**X**		
EULACHON	***Thaleichthys pacificus***		**X**		**X**	**X**			

1 Incidental to California; with no established populations or consistent occurrence.

2 Warrants protection under the federal Endangered Species Act. However, U.S. Fish and Wildlife Service determined that listing is precluded at this time because of the need to address other higher priority listing actions

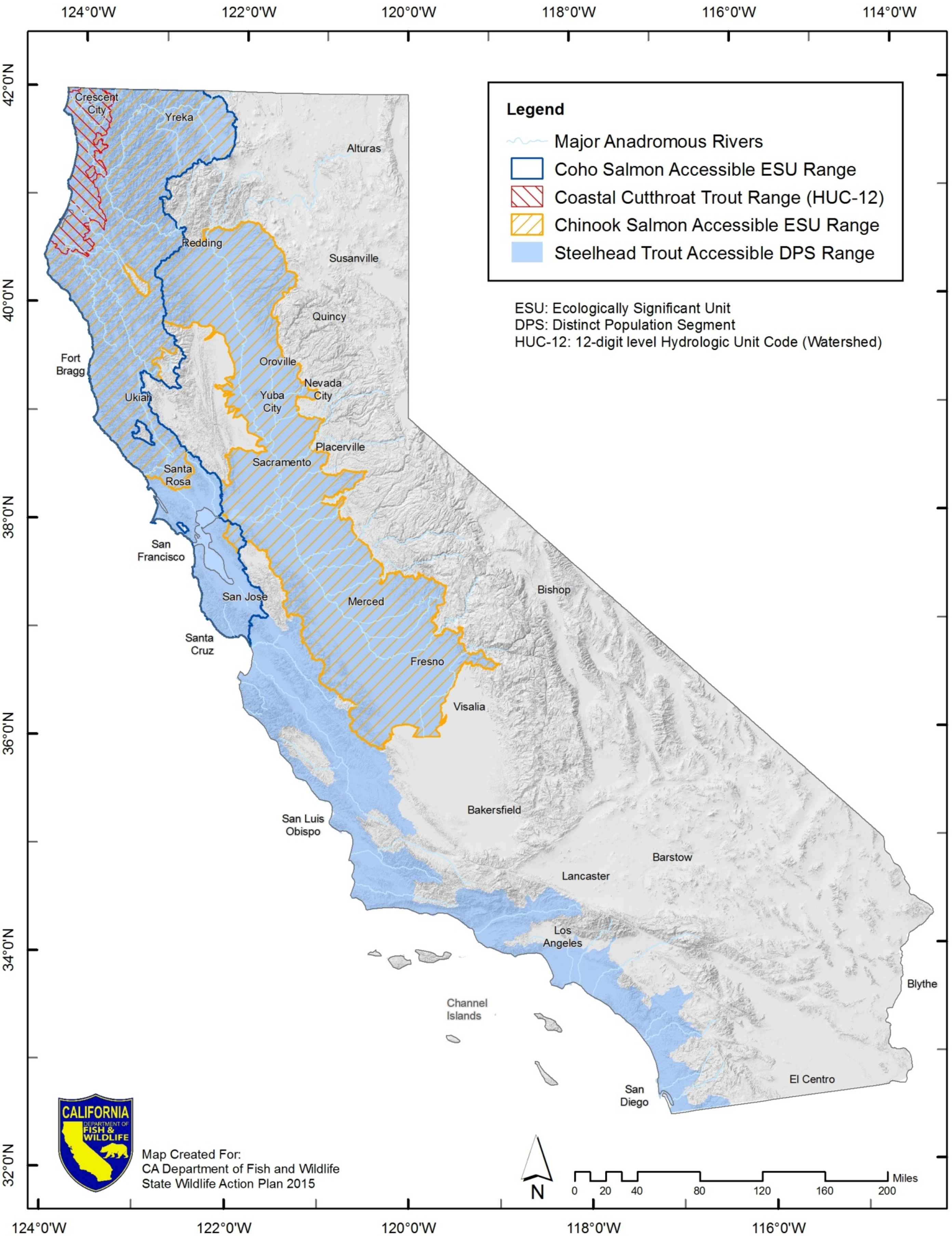
Table 6.3-2 Annual Presence and Use of Freshwater Habitat of Selected Anadromous Fish Species and Runs in Different Major Watershed Drainages in California

Anadromous species, run, and drainage	Life History	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall-run Chinook salmon, Central Valley	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Late fall-run Chinook salmon, Central Valley	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Winter-run Chinook salmon, Central Valley	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Spring-run Chinook salmon, Central Valley	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Steelhead trout, Central Valley	Adult spawning migration												
	Spawning												
	Adult outmigration												
	Egg incubation												
	Rearing												
	Juvenile outmigration												
Coho salmon [generalized for both Evolutionary Significant Units]	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing												
	Juvenile outmigration												
Fall-run Chinook salmon, Klamath-Trinity Rivers Basin [generalized for lower and middle, upper Klamath, Trinity rivers and tributaries]	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Spring-run Chinook salmon, Klamath-Trinity Rivers Basin [generalized for lower and middle Klamath, Trinity rivers and tributaries]	Adult spawning migration												
	Holding to spawn												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Winter-run steelhead trout, Klamath-Trinity Rivers Basin [generalized for lower and middle Klamath, Trinity rivers and tributaries]	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												

Table 6.3-2 Annual Presence and Use of Freshwater Habitat of Selected Anadromous Fish Species and Runs in Different Major Watershed Drainages in California

Anadromous species, run, and drainage	Life History	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coastal cutthroat trout	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
White sturgeon, Central Valley	Adult river spawning												
	Adult presence (delta and bays)												
	Egg incubation												
	Rearing (river, delta, bay)												
	Juvenile outmigration												
Green sturgeon, Sacramento-San Joaquin Rivers	Adult spawning migration												
	Spawning												
	Egg incubation												
	Delta rearing												
	Juvenile outmigration												
Green sturgeon, coastal rivers	Adult spawning migration												
	Spawning												
	Egg incubation												
	Rearing & juvenile outmigration												
Pacific lamprey, coastal rivers	Adult spawning migration												
	Spawning												
	Adult holding												
	Egg incubation												
	Rearing & juvenile outmigration												
Longfin smelt, Sacramento-San Joaquin Bay Delta	Adult and sub-adult occurrence (bay and nearshore)												
	Spawning (delta)												
	Egg incubation (delta)												
	Rearing (larvae)												
	Rearing (juvenile; bay & delta)												
Eulachon	Adult and sub-adult occurrence (bay and nearshore)												
	Adult spawning migration												
	Spawning												
	Egg incubation (delta)												
	Rearing (nearshore)												

Note: Black denotes greatest magnitude with dark grey and light grey indicating moderate and lesser magnitudes, respectively.



Data Sources: Salmond ESU and DPS (NOAA Fisheries 2013); Coastal Cutthroat Trout Range (Coastal Cutthroat Trout Interagency Workgroup (2014)

Figure 6.3-2 Salmonid Distribution

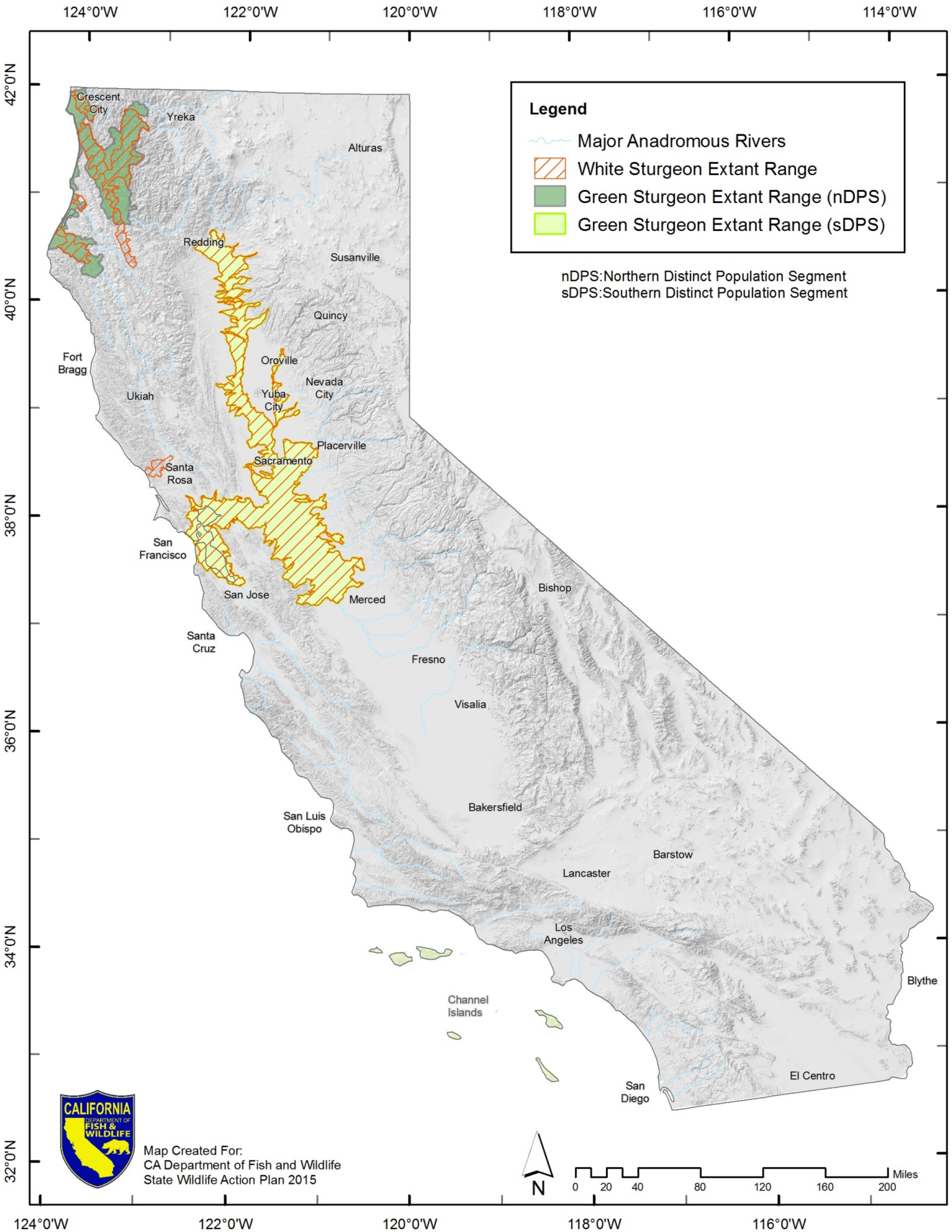
Two ESUs constitute coho salmon and occupy coastal watersheds from San Cruz to Del Norte counties and in the Klamath River, occurring in three salmonid ecoregions (North-Central Coast, North Coast, and Klamath River). Coho salmon in both these ESUs are listed and inland and ocean fisheries for coho salmon are not allowed in California. Chinook salmon are a physically larger and more broadly distributed species, occurring both along the coast and throughout the Central Valley. One ESU along the coast and two in the Central Valley, (i.e., spring and winter-run) are protected. There are ocean, estuary, and inland fisheries for fall-run Chinook salmon in both the Central Valley and Klamath River Ecoregions.

Chinook salmon are divided into seasonal stocks, based upon the time of year that adults return to rivers to spawn. In the Central Valley, three distinct "runs" (fall, winter, and spring) are identified for their evolutionary significance. Late fall-runs are recognized as being an important life strategy but grouped with the fall run ESU. In the Klamath-Trinity Rivers Basin, fall and spring runs are currently recognized life history strategies in a single ESU. There is a coastal ESU of Chinook salmon which occurs along the coast from the Russian River in Sonoma County to Redwood Creek in Humboldt County.

Pink salmon (*O. gorbuscha*) and chum salmon (*O. keta*) periodically occur in streams or rivers in California but are not documented as having viable populations or regular occurrence. Chum and Pink salmon have been documented returning to Blue Creek, Klamath River by the Yurok tribe. Neither species are addressed in this chapter.

There are two species of trout in the state, steelhead trout (*O. mykiss*) and coastal cutthroat (*O. clarkii clarkii*). Unlike salmon, trout adults can spawn more than once. Coastal cutthroat trout have one of the smallest ranges, occurring only in watersheds of the North Coast and the most northern waters of the North-Central Coast Ecoregions. Steelhead trout, on the other hand, have the largest range in California, occurring in all five salmonid ecoregions. Steelhead trout have a particularly complex life history, with fish in each ESU spending variable time in fresh and marine waters. In addition, the steelhead trout are the anadromous form of O. mykiss, and there is a resident form, commonly known as rainbow trout. Individual offspring from either form can assume the life history strategy of the other. Meaning some steelhead trout offspring mature into resident form fish, and some resident form fish offspring mature into the anadromous form. These factors likely contribute to this species having the broadest distribution and range.

Green sturgeon *(Acipenser medirostris*) and white sturgeon (*A. transmontanus*) both occur in coastal waters and watersheds along the North-Central Coast and Klamath River Ecoregions and the Central Valley (Figure 6.3-3). Both species are large (e.g., white sturgeon reaching more than 13 feet (4 meters), weighing more than 1,100 pounds [500 kilograms]) and long-lived (sometimes not reaching sexual maturity after more than a decade). White sturgeon migrate to bays and estuaries, while green sturgeon enter marine waters and may migrate hundreds of miles. White sturgeon are much more common than green sturgeon in the Central Valley and constitute a recreational fishery. Green sturgeon are more common than whites in North Coast rivers and are federally protected.



Data Sources: Fish Species Extant Ranges
(UC Davis Pisces Project, 2014)

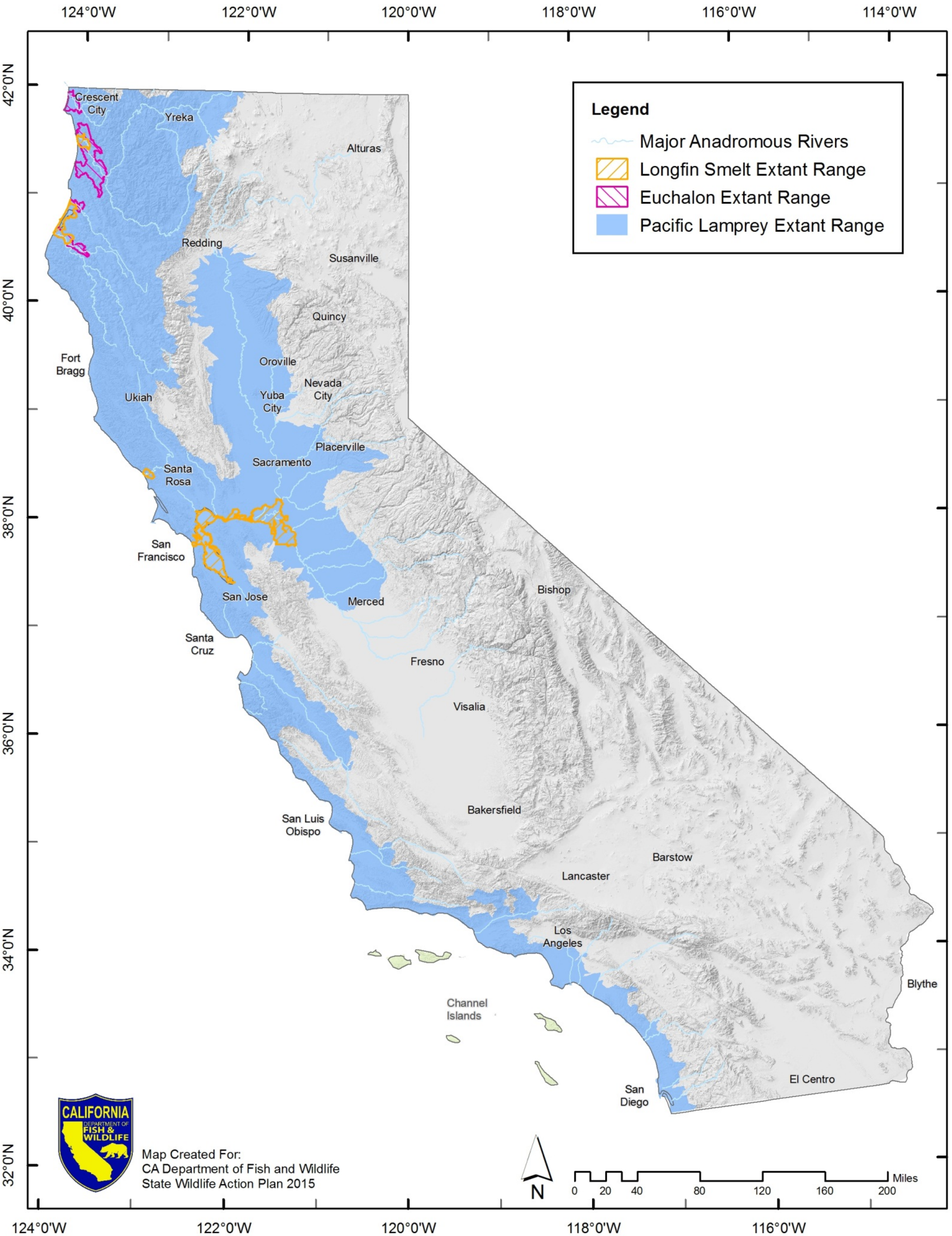
Figure 6.3-3 Sturgeon Distribution

Two species of smelt move from saline water to fresh water and back. Eulachon (*Thaleichthys pacificus*) is truly anadromous, spending one to two years in nearshore, marine waters while spawning in fresh water in the spring. These are the largest smelt in California, averaging 5-10 inches (15-20 cm) and reaching almost 12 inches (30 cm). They occur only along the north coast, known to spawn in the northern most rivers of the North-Central Coast Ecoregion and primarily in the Klamath River (Figure 6.3-4). They were once an important tribal and recreational fishery on the Klamath River. Populations have severely declined since 1990. The species is now federally protected and harvest is not allowed under California sport fishing regulations. Longfin smelt (*Spirinchus thaleichthys*) are smaller, rarely exceeding 5 inches (12 cm). It occurs along a few north coast estuaries and Humboldt Bay, as well as the San Francisco Bay/Sacramento-San Joaquin Delta complex. Longfin rarely enter nearshore, marine waters, although focused sampling for this species is rarely done. Longfin smelt are occasionally caught up and down the coast in the groundfish trawls conducted by National Oceanic and Atmospheric Administration (NOAA) Fisheries. Many one year old longfin smelt leave the San Francisco Bay and go into the ocean during their second summer (Rosenfeld 2007). There is some debate as to whether longfin smelt spawn in fresh water or brackish water, or both.

The last member of California's guild of anadromous fishes is Pacific lamprey (*Entosphenus tridentatus*). It is the member of a phylogenetically ancient group of jawless fishes. Pacific lamprey occur in coastal rivers and streams along the California coast and in the Central Valley (Figure 6.3-4). They are occasionally observed in streams south of Point Conception. Populations are also now land locked in Goose Lake and the Pit River due to construction of rim dams in the middle decades of the 20th century. Little is known about populations in the Central Valley Ecoregion. Pacific lamprey was once common and abundant in larger, northern California rivers, including but not limited to the Eel and Klamath rivers. Adults measure more than half a meter and after spending one to three years in the ocean, they return in spring to spawn in gravels similar to salmon. Juveniles (called ammocetes) live in river substrate for five to seven years and during this time must endure pressures related to gravel scour and sedimentation. This species is considered to be an important component of the food web for opportunistic marine predators and was once significant in tribal culture and diet in the Pacific Northwest, including Northern California.

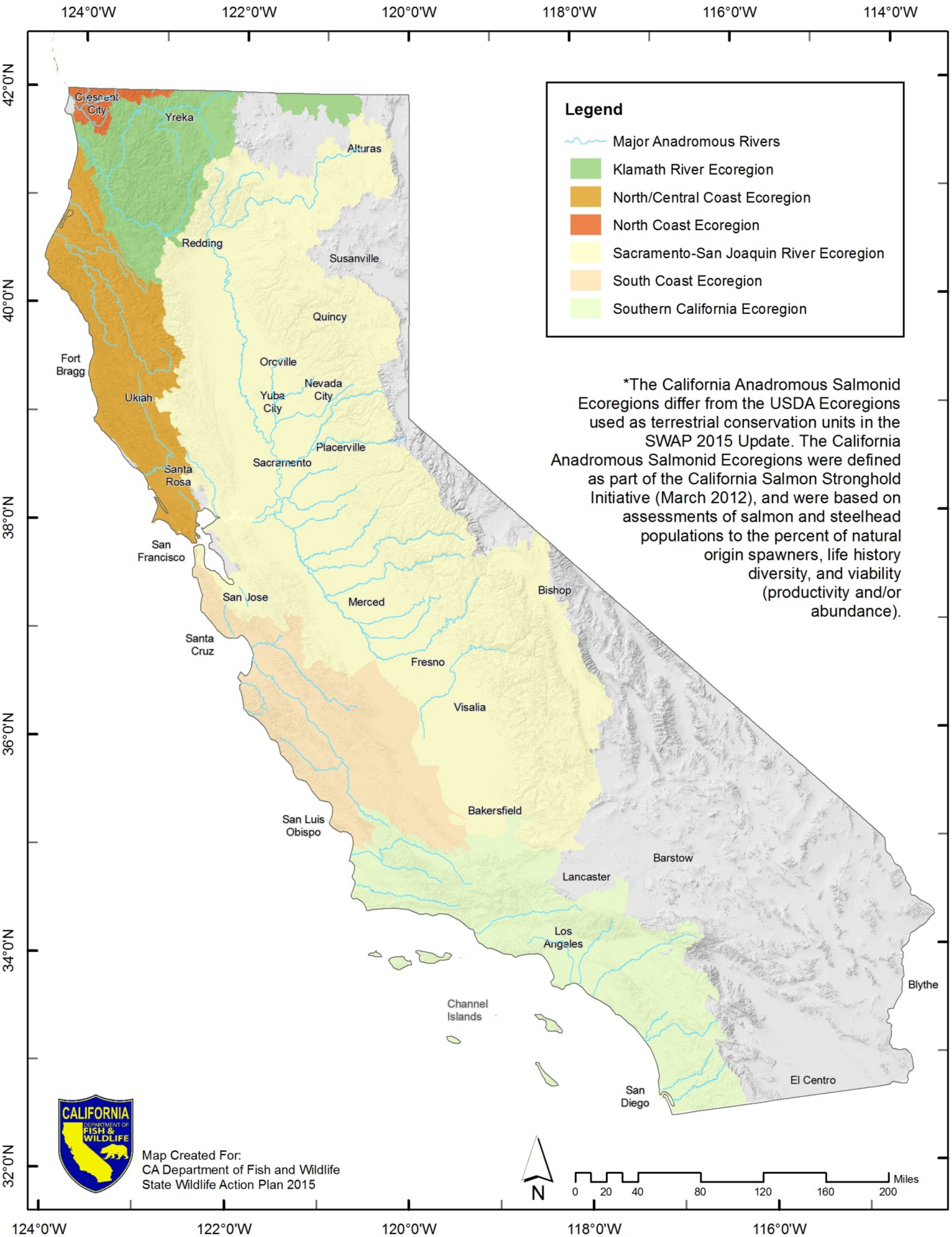
6.4 Salmonid Ecoregions

SWAP 2015 separates California into terrestrial and marine provinces and salmonid ecoregions. For anadromous fish species, the salmonid ecoregion system has been applied. This ecological structure utilizes hydrology, geology, climate, tidal influence, nearshore ocean influence and currents, and limits to anadromy. The analysis was led by the Wild Salmon Center and done in collaboration with federal fisheries agencies, other Pacific state fisheries departments, and conservation groups working to protect anadromous species and watersheds. For anadromous fishes, six salmonid ecoregions exist: South Coast; Southern California, North Central Coast; North Coast, Klamath River; and Sacramento-San Joaquin Rivers Valley (Figure 6.4-1).



Data Sources: Fish Species Extant Ranges
(UC Davis Pisces Project, 2014)

Figure 6.3-4 Smelts and Lamprey Distribution



Data Source: California Ecoregions (Wild Salmon Center, 2009)

Figure 6.4-1 Anadromous Salmonid Ecoregions

Vital ecological processes shape and define ecological function, habitat condition and distribution, biodiversity, and the size and distribution of individual species. Some of the more important processes at the ecosystem level affecting anadromous fishes include hydrology, geomorphology, wood debris delivery, and nutrient cycling. Each of the ecoregions include a different guild of anadromous species. The South Coast Ecoregion is represented by a single species, steelhead trout, while the North Central Coast Ecoregion includes every anadromous species occurring in California. The Central Valley Ecoregion has nearly the biodiversity of the northern coast, and both have the greatest diversity of Chinook salmon and the largest populations of both sturgeon species, Chinook salmon, and longfin smelt.

Steelhead fry, Teri Moore, CDFW

It is important to note that there is a growing body of science and information from habitat restoration disciplines that watersheds may be the minimum scale for which actions need to be taken to recover species, address habitat degradation, re-establish ecological processes, address human interactions, and tackle modifications due to climate change. All of these actions in single watersheds then come together at the ecoregional scale to define ecological health for anadromous species.

6.5 Companion Conservation and Recovery Plans

Because of their dietary, commercial, recreational, tribal, ecologic, and cultural significance, every anadromous species has been the focus of various efforts for conservation, protection, management, and recovery. Some of these efforts, such as Pacific Coast fisheries management, Pacific lamprey conservation, and restoration of salmon and steelhead trout freshwater habitat have and are efforts that span the entire West Coast. Other efforts, such as the Central Valley Improvement Protection Act (CVPIA), California Department of Fish and Game (CDFG) California Coho Salmon Recovery Strategy, and California Water Plan Conservation Strategy are focused plans in California. The National Marine Fisheries Service (NMFS) has developed, or is in the process of developing recovery plans for coastal and Central Valley salmon and steelhead ESUs, and green sturgeon and eulachon DPSs. Since 2013, NMFS has finalized five recovery plans, and three additional plans are in development.

Longfin smelt are protected by CESA, and U.S. Fish and Wildlife Service (USFWS) has released a recovery plan that includes this species. As of 2015, that plan was being updated by USFWS.

The federal CVPIA is a primary mechanism of working to recovery and sustain all anadromous species in the Central Valley. The Anadromous Fish Restoration Program (AFRP), one of the CVPIA’s programs, quantified doubling goals for Chinook salmon to guide restoration planning and implementation. In 2014, federal partners commenced work with CDFW and other partners to develop a strategic decision-making plan to better select and implement projects on behalf of fisheries and water management. CDFW is developing a white sturgeon management plan to both protect the species, and maintain the fishery, in the Central Valley and sits on the federal recovery team developing the recovery plan for green sturgeon in Central Valley rivers and delta, along the north coast, and in the Klamath River Ecoregion.

In 2009, the San Joaquin River Restoration Program commenced. It is a federal-state-private partnership developed to achieve several objectives in the mainstem reach of the San Joaquin River between Friant Dam and the Merced River confluence that benefit salmon and other anadromous fishes. It is meant to recover the mainstem San Joaquin River Chinook salmon river fishery, augment the basin's contribution to the ocean fishery, both re-establish and recover spring-run Chinook salmon [presently extirpated in the basin], maintain and protect river flow, and benefit other anadromous species, such as steelhead trout and sturgeon.

CDFW implements two habitat restoration programs, one dedicated to coastal anadromous salmon and steelhead trout (Fisheries Restoration Grants Program [FRGP]) and one that supports ecosystem restoration, including significant projects for salmon, sturgeon, and longfin smelt (Ecosystem Restoration Program [ERP]). FRGP was founded in 1985 and grants $10-20 million annually in federal and state funds for salmon and steelhead trout recovery. ERP was developed under the joint state-federal CALFED Program in the 1990s. ERP is now implemented by DFW and expends funds to restore ecosystem health and biodiversity in the Sacramento and San Joaquin rivers and Delta.

The Klamath-Trinity Rivers Basin has several conservation and management efforts taking place, including CDFW's Klamath River Fishery Program and federal Trinity River Restoration Program. The Klamath River Basin will also be the center of recovery efforts for eulachon, and NMFS leads the team developing the recovery plan.

Several programs collect and assess fish, habitat, and/or water data to guide management and recovery of anadromous species. Those programs and plans that describe them include:

- White Sturgeon Recreational Angling Report Card Program,
- Steelhead Trout Recreational Angling Report Card Program,
- North Coast Salmon Recreational Angling Report Card Program,
- Salmon Coded-Wire Tagging and Recovery Program,
- CDFW Central Valley Chinook Salmon Escapement Survey projects,
- CDFW San Joaquin River Juvenile Salmon Emigration Assessment project,
- Coastal Anadromous Salmon and Steelhead Trout Monitoring Program,
- Central Valley Steelhead Trout Monitoring Pilot Program,
- CVPIA Anadromous Fisheries Restoration Program,
- Klamath-Trinity Fisheries Program,
- Central Valley/Delta acoustic fish tag array consortium,
- CDFW Bay Delta Sturgeon Study, and
- CDFW Bay Delta smelt survey projects.

In addition to these programs, other state agency and local water districts conduct a myriad of monitoring programs and studies, designed to assess fish population abundance, and habitat quantity/quality, to guide management and recovery of anadromous fish species. CDFW has access to this information as needed through its Scientific Collector's Permit (SCP) program.

6.6 Challenges to Anadromous Species and Watersheds

Each anadromous fish species has limits to its freshwater range where spawning and initial rearing occurs. Figure 6.3-1 illustrates the current limits of anadromy for California's salmonid ecoregions. For some species, adults die after spawning (e.g., salmon), while for other species, adults can spawn multiple times as adults (e.g., steelhead trout, sturgeon). Likewise, rearing of juvenile fish can be relatively short, such as a few months (e.g., Chinook salmon), whereas some juvenile fish spend a year or more in fresh water growing and developing before migrating to the ocean (e.g., sturgeon, Pacific lamprey).

All of these species also have essential habitat and life history requirements in estuaries and bays. White sturgeon and longfin smelt spend a considerable portion of their adult life stage in estuarine waters. Eulachon are never far from estuaries, whether as juveniles or adults, and coho salmon and steelhead trout spend important months in estuaries preparing for adulthood in marine waters. For all species, estuaries are the connecting ecosystem between fresh water and marine migrations.

All anadromous fishes are threatened by the decrease, degradation, fragmentation, and diminished functioning of fresh water and estuarine ecosystems due to massive water development, which has occurred in California over the last 150 years. These effects exist in all six salmonid ecoregions of California, and have resulted in insufficient water flow and poor water quality, as well as disjuncture in timing for one or more life stages that impact species in many watersheds and estuaries statewide.

6.6.1 State Growth and Development, Habitat Loss and Fragmentation

A founding reason for historic and current impacts to habitat and functioning ecosystems is the growth of human populations in California. Expanding communities require increased infrastructure needs, such as transportation corridors and road networks, which have degraded riparian, stream, and estuarine habitat and water quality; contributed to increased stream sedimentation; and created barriers to fish migration. Associated land use practices (e.g., agriculture, forestry, and mining) have damaged, reduced, and fragmented habitat. Human influences, fragmented habitat, and changes in climate and regional hydrologic cycles have also allowed invasive plant and animal species to expand, impacting anadromous fishes through competition, predation, and habitat alteration.

These impacts have occurred in coastal, valley, and mountain ranges of anadromous species. Riverine and estuarine ecosystems have both been affected. Estuaries represent both the conduit between marine and fresh water systems and are vital areas for anadromous fish rearing and development. Manipulation of estuaries and creek mouths has impacted anadromous smelt and salmonid species coast-wide. It is unclear to what extent the changes to estuaries have affected sturgeon and lamprey.

6.6.2 Water Management

The complex life cycle of each anadromous species, and differences in life history strategies between species, result in river and estuary use year-round (Table 6.3-2) by these fish species across California. The most important single factor for fish population health is the hydrologic cycle and management of water releases from reservoirs. Amount and timing of water flow, temperature, and quality are all key factors for successful adult spawning, egg incubation and emergence, juvenile rearing, and seaward migrations.

Competing water needs, water quality degradation, altered hydrology and illegal diversions in many streams, rivers, and estuaries affect habitat quality and quantity, fish behavior, access to rearing and spawning areas, and ecological processes vital for sustainable fish populations. Many rivers and creeks have small to moderate dams and thousands of water diversions exist across the state. There are also a series of large dams on major rivers statewide (e.g., Klamath, Eel, Trinity, Sacramento, Feather, Russian, Mokelumne, Stanislaus, Tuolumne, Merced, San Joaquin, and Carmel rivers). These structures have not only altered hydrology, but have interfered with nutrient cycles, as well as altered wood and sediment transport cycles, which are vital to anadromous species. Perhaps their greatest effect has been creating permanent barriers to historic habitat. There are no statewide calculations for the amount of lost habitat for anadromous salmon, trout, smelt, sturgeon, and Pacific lamprey. A conservative estimate is 50 percent loss. NMFS has estimated that over 75 percent of Central Valley anadromous habitat has been lost for Chinook salmon, steelhead trout, and green sturgeon.

6.6.3 Vulnerability to Climate Change

All natural aquatic ecosystems and native California fish species are vulnerable to the ecological stresses resulting from climate change. Anadromous species may be one of the most vulnerable guilds of aquatic species, because they have complex, diverse life histories dependent on many different habitat types and aquatic communities. Some of the more significant stresses for California’s anadromous fishes due to climate change include:

- changes in upwelling, coastal currents, and warmer marine waters disrupting food supply for sturgeon, smelt, and juvenile salmonids;

- decreased stream flow, habitat connectivity, and water quality during summer months in rivers and estuaries, impacting migration, juvenile fish over-summer rearing, and adult spawning;
- increased and sporadic winter flooding, impacting over-wintering rearing, degrading instream and riparian habitat, and disturbing spawning grounds and incubation of eggs;
- changes in rain- and snow-fall patterns, impacting reservoir water supplies essential for managing species below dams and decreasing snowpack, affecting spring and summer flows; and
- increased and prolonged droughts, decreasing habitat connectivity, increasing mortality in both juvenile and adult populations where water supply and quality reach critical lows. This poses a high risk for species (e.g., winter-run Chinook salmon, eulachon) or populations (e.g., coho salmon south of San Francisco Bay) with limited distribution and low population size.
- proliferation of non-native and invasive species which out-compete native species for food, cover, and spawning areas.

6.7 Anadromous Fish Conservation Targets and Strategies

Anadromous species have been a focus of conservation and management for decades. Since the late 19th century, California's salmon have been the focus of research, management, and protection because of their economic, cultural, and ecologic value. In the late 1980s and early 1990s, all anadromous salmonids became a focus of management and conservation efforts. Since that time, the scientific and resource management communities have commenced efforts to understand, manage, and protect anadromous smelt species, sturgeons, and Pacific lamprey.

Reports and summaries listed at the end of this chapter summarize significant information, analyses, and recommended actions for California's anadromous species, and represent thousands of targets, strategies, activities, and tasks to conserve, manage, and protect these species. They represent the authoritative and scientific foundation for what is known about these species and what actions are needed in future decades. For example, recovery plans and strategies and habitat and natural community conservation plans have planning and implementation schemes of 30-100 years.

Anadromous conservation targets are key species, species guilds, habitat types, or ecological processes essential to future conservation of anadromous species (Table 6.7-1). Species, habitat, and ecological processes were all considered in developing prioritized conservation targets to adequately encapsulate the evolutionary and ecological significance of the species. For each target, three primary strategies are proposed to advance comprehensive conservation and management of each species, associated habitats, and key ecological processes. Anadromous fish biodiversity differs considerably across California's ecoregions (Table 6.3-1). To ensure maximum benefits to all species can be achieved, where species diversity is greatest, single-species targets were not selected.

Table 6.7-1	Conservation Strategies for Anadromous Fish Conservation Targets and Strategies	
Geography	**Conservation Target**	**Conservation Strategy (Implementation by 2025)**
Statewide	In-river spawning and rearing habitat	• Document range and distribution of spawning and rearing habitat; • Enhance and protect key spawning and rearing habitat for each specific anadromous species; and • Promote restoration actions that focus on ecological processes and climate change resilience (e.g., removing barriers to migration, expanding riparian corridors).
	River flow	• Identify annual flow regimes and habitat connectivity necessary for migration, rearing, and spawning of each anadromous species; • Develop water management and conservation plans necessary to conserve anadromous fishes; and • Implement water management and conservation plans.
	Wetland habitat	• Identify current condition of riparian and marsh habitat associated with anadromous species; • Restore marsh and riparian habitat to improve carrying capacity of anadromous fishes; and • Protect key areas necessary to maintain viable populations.
North Coast and North Central Coast	California Anadromous Salmonid Stronghold Watershed Conditions	• Establish collaborative working groups for each Stronghold (Smith, Mattole, and South Fork Eel rivers); • Assess ecological and human conditions that are allowing for healthy fish populations; and • Establish technical, agency, and financial support to maintain and expand ecological and human conditions supporting strong salmon and steelhead populations.
	Coastal estuaries	• Evaluate current condition and estuarine needs for coho salmon, eulachon, Pacific lamprey, and longfin smelt in key estuaries (i.e., Smith, Klamath, and Eel rivers and Humboldt Bay); • Restore and enhance estuary habitat, connectivity, and ecological processes essential for anadromous species; and • Establish estuary function and structure that will allow anadromous migration and be responsive to climate change.
	Russian River Watershed Conditions	• Restore and enhance estuary and river habitat necessary to support viable populations of all listed anadromous fishes (i.e., Chinook salmon, coho salmon, steelhead, green sturgeon); • Develop and implement water management plan to ensure Russian River fisheries and land use are compatible; and • Expand Warm Springs Hatchery complex to function as a potential regional conservation facility for coho salmon and other listed species in the North-Central Domain.
Klamath-Trinity Rivers Basin	Pacific lamprey	• Establish standing committee of local, tribal, State, and federal partners in the Klamath-Trinity Rivers Basin to implement interstate/intertribal 2012 Pacific lamprey conservation agreement; • Implement basin-wide habitat restoration and monitoring programs; and • Secure funding specific for conserving Pacific lamprey in the Klamath/Trinity Rivers Basin.
	Ecological processes	• Evaluate wood debris, gravel, and water cycling and transport mechanisms across the basins; • Establish agreements and practices to ensure adequate ecological processes, habitat quality, and connectivity are maintained to support sustainable anadromous populations across the basins; and • Establish monitoring and evaluation programs to track ecological processes and functioning.

Table 6.7-1 Conservation Strategies for Anadromous Fish Conservation Targets and Strategies

Geography	Conservation Target	Conservation Strategy (Implementation by 2025)
	Listed and at-risk salmonids	• Establish standing inter-organizational team to implement federal and state recovery plans, and continue to support the Trinity River Restoration Plan, and Klamath River Settlement; • Integrate recovery actions with strategic hatchery management (e.g., Iron Gate and Trinity River facilities); and • Integrate sustainable river and tribal fisheries with establishing sustainable, natural populations of salmon and steelhead.
South-Central and Southern California Coasts	Steelhead trout populations	• Establish a robust monitoring program to evaluate steelhead populations, habitat, and ecological processes; • Secure additional funding necessary to pursue essential habitat recovery; and • Determine role of resident populations to recovery and sustainability of anadromous populations.
	Migration barriers	• Remediate most downstream barriers to steelhead entering rivers and streams; • Accelerate planning and remediation of rim dam barriers to key steelhead populations; and • Modify land use practices (e.g., water use, agriculture, recreation, urban and road development) to minimize effects on migration corridors.
	Water management	• In addition to the statewide strategy, identify key streams and locations essential for over-summering juvenile and adult steelhead; • Investigate ability and options to creating water banks for steelhead habitat; and • Update CDFW management and conservation plan to integrate modern water management, including drought and climate change parameters.
Central Valley	Pacific lamprey	• Establish standing committee to implement interstate/intertribal 2012 Pacific lamprey conservation agreement; • Implement habitat restoration and monitoring programs; and • Secure funding specific for conserving Pacific lamprey in the Central Valley.
	Sturgeon	• Establish fisheries management and conservation plans for white and green sturgeon; • Implement habitat restoration and monitoring programs; and • Secure funding specific for conserving sturgeon populations and fisheries in the Central Valley.
	Chinook salmon and steelhead	• Establish biological production goals for each species, coupled with SMART ecological objectives, prioritized restoration actions, focused biotic and abiotic monitoring, and adaptive management planning framework that are developed and overseen by an established standing inter-organizational team to integrate activities of NMFS and CDFW recovery programs, Central Valley Program Improvement Act program, Bay Delta Conservation Plan, San Joaquin River Restoration program, and CDFW fisheries programs to establish sustained salmon and steelhead populations and fisheries; • Revise and integrate hatchery practices of the six facilities in the Central Valley to maximize scientific standards, minimize effects of programs on natural spawning populations and river habitat, and promote healthy fisheries populations; and • Conduct rim dam re-introduction pilot projects on Yuba and Sacramento rivers and evaluate efficacy of expanding rearing and spawning habitats for recovery.

Three strategies are proposed for each statewide or ecological target. The strategies, like their targets, are only a subset of needed actions. Proposed strategies were developed to be broad in both ecological relevance and geographic scope to ensure maximum benefit to the selected targets. Another important feature of each strategy is that it is founded in collaborative implementation.

6.7.1 Statewide

The three targets applicable to all of California are freshwater spawning and rearing habitat, river flow, and wetland habitats. The stresses on these habitats and ecological processes include: (1) habitat fragmentation, loss, and degraded functioning; (2) decreased water supply and quality, altered hydrology, and increased competition for water; and (3) lack of information on the distribution, use, and relative value of spawning and rearing habitat across fish species ranges.

The recommended strategies are meant to restore, connect, and expand habitat; synchronize water management with species needs; and gather information about habitat value and use it to prioritize restoration, enhancement, and protection. SWAP 2015, the Bay Delta Conservation Plan, the Department of Water Resource’s Water Plan and associated Flood and Conservation Plans, and the State Water Resources Control Board and Regional Water Quality Control boards, Water Quality Control plans will be pivotal to the CDFW’s singular and collaborative efforts to integrate water management, and conservation, with anadromous fish restoration.

6.7.2 North Coast and North Central Coast

These ecological regions include every anadromous species occurring in California. This area is also represented by several California Salmonid Strongholds, the most functioning watersheds for particular species (e.g., Smith River for all species, Mattole River for steelhead trout). It also has important estuaries, from the Russian to Smith Rivers, including the Klamath River estuary, a key location for Chinook salmon, Pacific lamprey, and eulachon, and Humboldt Bay, important to salmonids and longfin smelt. The last target is the Russian River, the most southern major river that has Chinook and coho salmon and steelhead trout and is the key watershed for recovery of Central California Coastal coho salmon.

Strategies for these salmonid ecoregions are characterized by understanding how ecological function (i.e., estuaries, entire watersheds) and land use (e.g., in stronghold areas, where fish populations are faring well) are affecting fish populations, and how actions across the area of interest will be implemented to conserve species (e.g., practical support to organizations in stronghold watersheds; restoring estuary function; and maintaining the success of the conservation program at Warm Springs Hatchery).

6.7.3 Klamath-Trinity Rivers Basin

The Klamath-Trinity Rivers Basin represents one of the largest watershed complexes in California, and the Klamath River is one of the longest rivers entering the Pacific Ocean in the lower 48 states. The system is home to populations of salmon important to commercial, recreational, and tribal fisheries, and the largest populations of Pacific lamprey, eulachon, and green sturgeon in California. Lamprey, eulachon, and sturgeon also are important fisheries for tribes in the region.

Targets for this ecoregion include Pacific lamprey, because of its ecological and tribal significance, all anadromous salmonids, because of the multitude of their significance, and ecological processes, because these factors are the basis for the health and biodiversity of the entire ecoregion. For both anadromous salmonids and Pacific lamprey, strategies are targeted on ecoregion-specific groups focused on the conservation of the species. Recovery planning, restoration programs, water settlements, and tribal rights and values demonstrate the worth and strategic value of developing a comprehensive effort to preserve these species. The value of Pacific lamprey is only now being fully appreciated along the entire Pacific Coast of North America, and successful conservation of this species will be founded on success in this ecoregion.

Dams used for water diversion and power generation block salmonid migrations to traditional spawning and juvenile rearing grounds on both the Klamath and Trinity rivers. Mitigation fish hatcheries were built and are operated to compensate for lost salmonid production due to the disruption of fish access to salmonid spawning and rearing habitat above the dams; however, the altered hydrologic regime and dams blocking downstream gravel and wood transport also alter downstream habitat further stressing anadromous fish populations. The significance of improving release flow regimes and wood, gravel, and nutrient cycling is recognized by Klamath and Trinity rivers restoration groups. Actions to improve functional processes related to flow, gravel transport, and riparian function in the affected reaches can benefit all anadromous species in the rivers, tributaries, and Klamath River estuary.

6.7.4 South-Central and Southern California Coasts

The southern, seven coastal counties constitute the southern range of steelhead trout and are represented by two DPSs and the southern extent of Pacific lamprey. Human population size, arid climate, unique geologies, and sporadic rain events currently make these ecoregions a difficult landscape for the species. For these ecoregions, steelhead trout itself is a conservation target. More information is needed to better conserve the species, and the relationship between the anadromous and resident life histories strategies is fundamental to recovering both DPSs. The other two targets represent needs that stem from large urban populations. Water management needs stem from the intense competition for water, alteration of rivers, creeks, lagoons, and estuaries and the unpredictable nature of hydrology annually and perennially. Targeted water strategies and plans across the region will benefit steelhead trout, especially migration corridors, over-summering pools, estuaries, and lagoons. Restoration of estuarine ecosystems and fish barriers will also be key actions that will benefit Pacific lamprey. Because of human communities and infrastructure corridors, many barriers to migration exist close to the ocean entry of most key rivers and creeks. Addressing key barriers and suites of barriers (e.g., the Santa Inez River watershed) will be needed to conserve Southern California and South-Central ecoregion steelhead trout.

6.7.5 Central Valley

The Central Valley is the single-largest catchment basin in California. It is composed of two large river systems, the Sacramento River flowing south in into the Delta and San Joaquin River flowing north into the Delta. The Central Valley once supported the largest runs of naturally spawning Chinook salmon and white sturgeon in the State. The three targets of this huge ecoregion are all species-based- Pacific lamprey, sturgeon, and salmonids. For lamprey, the key needs are to both better understand the species in the ecoregion and develop specific conservation actions for the species. To-date, the species has not been a focus of investigations or actions. For sturgeon, the success of green sturgeon recovery along the Pacific Coast will hinge on conservation in the Sacramento River. Specific actions for restoration and protection of white sturgeon will need to occur to maintain the current fishery and ensure a viable population persists in the Central Valley and Delta.

Strategies for the Chinook salmon and steelhead trout need to be comprehensive. Steelhead trout occur year-round in the ecoregion’s rivers and tributaries and experience various pressures. The Central Valley also has the greatest diversity of life histories for Chinook salmon, and each experience varying pressures. Both species will benefit from improved hatchery management, centered on employing the highest scientific standards and minimizing the influence on naturally spawning populations. For salmonids, water management decisions are a critical and unique conservation concern. In 2014, Shasta Dam operations caused the loss of over 95% of endangered winter-run Chinook salmon, perhaps the entire population of spring-run Chinook salmon below Shasta, and an unknown but likely sizable portion of the commercially-valuable fall-run Chinook salmon below the dam. For this reason, a statewide water management plan should be prepared.

Because major dams exist on most rivers feeding water into the valley floor, this ecoregion needs to be the site of determining the feasibility and efficacy of re-introducing salmon and steelhead trout above rim dams. Presently, the Yuba and Sacramento rivers are intended sites for such, long-term projects. Hatchery and re-introduction efforts will require the collaboration of a large, diverse group of organizations. This same strategy of broad partnerships will be necessary to implement the federal and state recovery and conservation plans completed or in development that will encompass the entire Central Valley within a decade.

6.8 Other Essential Actions

It is clear that conservation of California's anadromous species, their habitats, and their required natural ecological processes will demand a concerted, committed, long-term collaboration; more and better information; and constant educational outreach to the public and leadership in California. CDFW is dedicated to expanding and improving its efforts, to maintaining and enhancing its partnerships, and to exerting its leadership responsibilities to manage and conserve the state's diverse and magnificent anadromous species. This section presents other essential actions to effectively conserve these species.

6.8.1 Unifying Vision

CDFW will develop a comprehensive vision for anadromous fish species that consists of biological goals for each species, and is coupled with the following planning elements:

- ecological objectives that are specific, measurable, achievable, realistic, and time bound (i.e., SMART objectives);
- prioritized restoration actions to guide restoration action priority;
- focused monitoring to update the existing knowledge base; and
- adaptive management framework to ensure progress towards achieving overarching biological goals is being attained, and if not to modify them.

6.8.2 Partnerships, Education, and Outreach

CDFW's partnership and outreach efforts and collaborations will include:

- an improved internet presence, with more information and more frequent updating of species status, conservation efforts, grant fund opportunities, and public involvement opportunities;
- inter-agency outreach and information sharing, such as:
  - Calfish.org, an internet portal for multiple organization data, reports, and contacts on anadromous fishes;
  - PISCES, a new web partnership with the University of California to provide range and distribution information on California's native fishes;
  - partnership with The Nature Conservancy on Salmon Snapshots, an internet site for status and recovery progress of California salmon and steelhead trout;
  - partnership in National Fish Habitat Partnerships, including the Pacific Marine and Estuarine Fish Habitat Partnership, California Fish Passage Forum, and Western Native Trout Initiative, which all address monitoring, assessment, habitat restoration, and public outreach for anadromous species; and

- collaboration with the North American Salmon Stronghold Partnership and Wild Salmon Center to promote watershed partnerships, community support, and habitat enhancement in California's healthiest anadromous watersheds.

6.8.3 Research, Monitoring, and Resource Assessment

Information on fish population status, habitat and water conditions, land use, and outcomes of restoration and resource management actions are essential to conserving anadromous fishes. In addition, continued academic and applied research are vital to understanding less known species (e.g., smelt species along the north coast, Pacific lamprey statewide, and sturgeon statewide), ecological processes (e.g., sea level rise, changes in precipitation patterns, restoration effectiveness), and new conservation priorities (e.g., strategic hatchery management, re-introduction of fish above rim dams).

CDFW and its partners (e.g., University of California and State University research units, NOAA Southwest Fisheries Science Center) will need to expand and improve their collaborations to meet future fish population evaluations and research needs. CDFW has partnered with federal and state agencies, tribes, academic researchers, and private research programs to continue important projects and develop and implement key additional monitoring and assessment programs for population status and trend, restoration efficacy, and ecological functioning. Each existing program will need to be supported and likely expanded in the future, and new programs will need to be developed for some species and some ecoregions.

The following are important existing programs or needed programs central to conserving California's anadromous fishes:

- CDFW Klamath-Trinity River Program and tribal and federal agency monitoring programs- anadromous salmonids, including the Yurok, Karuk, and Hoopa Klamath River Coho Ecology Study, the Lower Klamath River Sub-basin Restoration Plan and the Yurok's Pacific Lamprey monitoring program.
- CDFW-NMFS California Coastal Salmon and Steelhead Monitoring Program;
- Federal Central Valley Anadromous Fisheries Restoration Program- all species (primarily Chinook salmon);
- CDFW San Joaquin River Restoration Program- anadromous salmonids;
- CDFW Delta Investigation and Monitoring Program- smelt and sturgeon species;
- CDFW Ocean Salmon Program;
- Central Valley Steelhead Trout Monitoring Pilot Project- interagency plan to be piloted in 2015 by CDFW;
- Central Valley Chinook Salmon Monitoring Program- interagency plan yet to be implemented;
- Central Valley Sturgeon Monitoring Projects- three integrated pilot projects to be implemented by CDFW, SWFRC, NMFS, and the University of California;

- North Coast Smelt Monitoring- needed for longfin smelt and eulachon in targeted rivers and estuaries on the north-central and north coast ecoregions;
- Pacific Lamprey Monitoring Programs- needed in both the Klamath-Trinity and Central Valley ecoregions;
- CDFW Coded Wire Tagging/Recovery Program – anadromous salmonids; and
- CDFW Hatchery Operation – anadromous salmonids.

7 Integration and Implementation

Integration of SWAP 2015 into California's ecologically, socio-economically, and politically intricate landscape is a complex but needed task. The state's ecology is influenced by natural conditions, both physical and biological, and by human demands. Any effort that attempts to influence this dynamic will require an appreciation of the complexities inherent in balancing the needs of wildlife with the needs of society. This will require an open-minded and innovative approach to explore the full range of potential opportunities beyond those that have been tried in the past.

The SWAP 2015 integration process includes developing more detailed SWAP companion plans, systematically pursuing resources necessary for implementation of conservation strategies, effectively coordinating with CDFW partners, adaptively responding to emerging issues, and rigorously reviewing and revising the plan, as needed over time (the latter of which is required Element 6 of the SWAP). In addition, public participation is an essential part of implementing a successful plan (Element 8).

CDFW has established a SWAP program that uses Miradi and Miradi Share to dynamically adapt the plan as new information becomes available. California's SWAP is not seen as an every-10-year effort. Instead, systems have been put into place for teams to add priority targets, identify stresses and pressures, update strategies and actions, monitor and evaluate target conditions, and share lessons in real time (Element 7).

Federal funding, through the State and Tribal Wildlife Grants (SWG) Program, is provided to states and territories to plan and implement proactive conservation actions to prevent the nation's fish and wildlife from becoming endangered. By preparing and implementing SWAP 2015, California will be eligible for SWG funding for CDFW and conservation partners to restore and actively manage declining wildlife and to prevent species from becoming listed under the state and/or federal Endangered Species Acts. This chapter describes important integration and implementation approaches for SWAP 2015. Monitoring the effectiveness of the conservation strategies is described in the Chapter 8.

7.1 Integration with Other CDFW and Resource Agency Programs

Effectively implementing SWAP 2015 involves integrating recommendations from the SWAP 2005 Evaluation Report (see Section 8.2) and conservation strategies presented in Chapter 5 and Chapter 6, into the spectrum of other conservation programs administered by CDFW and the relevant efforts of other state and federal resource agencies.

The stakeholder-driven process to prepare a Strategic Vision for CDFW based on 2010 legislation (AB 2376, Huffman) requires, among other things, that CDFW and the Fish and Game Commission seek to create, foster, and actively participate in effective partnerships and collaborations with other agencies and stakeholders to achieve shared goals and to better integrate fish and wildlife resource conservation and management with the natural resource management responsibilities of other agencies. Also, CDFW and the Fish and Game Commission are to participate in interagency coordination processes that facilitate consistency and efficiency in review of projects requiring multiple permits. Interagency coordination will include, but not necessarily be limited to, joint state, federal, and local permit review teams that enable early consultation with project applicants and improved sharing of data, information, tools, and science to achieve better alignment of planning, policies, and regulations across agencies.

7.1.1 Integrating SWAP 2015 with Other CDFW Programs and Tools

CDFW conducts habitat management and conservation activities in a wide variety of programs. Integrating the implementation of the SWAP conservation strategies with these existing programs can help achieve successful conservation and management of wildlife. These programs include managing CDFW lands and associated water resources, conservation planning for special-status species and their habitats, mapping and database administration, invasive species control programs, fish hatchery operations, habitat restoration projects, Delta programs, marine protection programs, toxic spill prevention and response, environmental review and permitting, and administration of grants. SWAP 2015 must work with each of these existing programs in implementing statewide wildlife conservation.

Among the most important areas for integration will be preparing, approving, and implementing regional- and landscape-level conservation plans. These include Natural Community Conservation Plans (NCCPs), Habitat Connectivity Planning, the Master Plan for Marine Protected Areas, and individual species management plans. These programs and potential opportunities for SWAP integration are noted below and are also discussed in Chapter 3. Development of coordinated regional conservation strategies, such as NCCPs and habitat linkage planning, is important for preserving ecological integrity of ecosystems. The plans must be well coordinated and implemented by local and regional participants.

- The NCCP program takes a long-term, broad-based, ecosystem approach to planning for the protection and perpetuation of biological diversity, which is completely consistent with the goals of the SWAP. An NCCP identifies and provides for the regional protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activities. The NCCP program is a cooperative effort to protect ecosystems as a whole under the Natural Community Conservation Planning Act of 2003. Early plans were adopted in San Diego County, Orange County, and the Inland Empire counties. Planning efforts are also underway in Butte, Santa Clara, Placer, Yolo, Sutter, and Yuba Counties. There are 23 active NCCPs covering more than 11 million acres in California.
- The California Essential Habitat Connectivity Project, commissioned by CDFW and Caltrans, is intended to guide development of a functional network of connected wildlands essential to the continued support of California's diverse natural communities in the face of development and climate change (CDFG and Caltrans 2010). The project report includes three primary products that are useful to support SWAP wildlife conservation strategies: (1) a statewide Essential Habitat Connectivity Map, (2) information characterizing areas delineated on the map, and (3) guidance for mitigating the fragmenting effects of roads and for developing and implementing local and regional connectivity plans.
- The Master Plan for Marine Protected Areas is a document designed to guide the adoption, implementation, and monitoring of marine protected areas (MPAs; CDFG 2008). In accordance with the Marine Life Protection Act (MLPA), the Master Plan provides guidance on: context for implementing the MLPA goals and objectives; background information on California's marine resources and policies; description of the process for designing alternative MPA proposals; and overviews on the design, management, enforcement, monitoring, and funding of California's MPAs. The Master Plan has been approved by the Fish and Game Commission and is being revised by CDFW in 2015. All study region plans have been completed and implemented. The SWAP 2015 marine conservation strategies will be integrated with the implementation process for the Master Plan, where feasible and appropriate. As a living document, regional updates have been made for each study region after Master Plan completion. Regional updates are located in the appendices and provide more extensive information about specific MPAs, regional management plans, lessons learned, and scientific methodologies for monitoring and evaluation.
- CDFW's Wildlife Investigations Lab (WIL) investigates, monitors, and manages population health issues in California's wildlife. WIL provides expertise, service, training and resources to assist CDFW personnel in assessing wildlife populations, wildlife mortality response, biological sampling, wildlife captures, wildlife rehabilitation, study design, and analyses. WIL's responsibilities have increased to include the statewide investigation of all wildlife mortality events, studies and surveillance of diseases (enzootic and epizootic), wildlife health and condition monitoring, prevention of zoonotic diseases, wildlife rehabilitation, injured and nuisance wildlife, safety training, and investigations of public safety wildlife, such as mountain lions, black bears, coyotes, large non-native carnivores, and deer.

- CDFW implements recovery actions for species, such as captive breeding, population reintroductions, and translocations to re-establish lost populations. (Reintroduction refers to the intentional movement of captive-reared animals into a species' historic range to augment or reestablish wild populations.)

Another critical point of integration for SWAP is in the management of scientific data in resource management databases, maps, and internet sources. Using the *Open Standards for the Practice of Conservation* and the Miradi and Miradi Share software framework, the underlying data supporting the assessment of resource conditions, threats, stresses, and conservation needs are available at the SWAP webpage. These data also need to be integrated with other CDFW geo-referenced databases and mapping. For instance, the website for the Biogeographic Information and Observation System (BIOS) is managed by CDFW (http://bios.dfg.ca.gov) as an interactive, web-based system that allows users to download, print, combine, comment on, or otherwise use the maps, data layers, and other information. In addition, CDFW's Biogeographic Data Branch administers a number of programs involving systematic data collection, analysis, and integration: Conservation Analysis Units (i.e., Areas of Conservation Emphasis, Climate Change Vulnerability Analysis, and California Wildlife Habitat Relationships); California Natural Diversity Database (CNDDB); and Vegetation Classification and Mapping Program (VegCAMP). Sound, integrated management of scientific data will be a key aspect of SWAP implementation.

CDFW's role as a regulatory authority provides it with up-to-date information on the pressures and stresses placed on conservation targets. This role also provides CDFW with the opportunity to integrate, when appropriate, SWAP 2015 goals and strategies into comments on environmental documents and permit terms and conditions. One requirement for the issuance of California Endangered Species Act (CESA) incidental take permits, pursuant to Fish and Game Code (FGC) section 2081, is that the impacts of the taking of state-listed candidate, threatened, or endangered species be fully mitigated. All listed and proposed threatened or endangered species are also Species of Greatest Conservation Need (SGCN); therefore, development of permit conditions of approval and mitigation requirements to meet the full mitigation standard will include consideration of SWAP goals and strategies.

Lake and Streambed Alteration (LSA) Agreements, pursuant to FGC section 1600 et seq., include measures to protect existing fish and wildlife resources when the notified activities may substantially affect these resources. SWAP strategies for relevant resource-related conservation targets will help guide the development of fish and wildlife protection actions in the LSA Agreement process.

CDFW serves as a trustee agency under the California Environmental Quality Act (CEQA) with jurisdiction over the fish and wildlife of the state and, in this role, comments on projects potentially affecting fish and wildlife resources. As such, CDFW often comments and makes recommendations regarding fish and wildlife conservation to CEQA lead agencies and project proponents. Achievement of SWAP conservation outcomes will be considered when developing and providing comments during CEQA reviews of projects affecting conservation targets that are proposed by other lead agencies. In addition, SWAP will be added as a statewide or regional plan to consider when conducting CEQA review of CDFW's own projects.

7.1.2 Integrating SWAP 2015 with Conservation Programs of Other Agencies

Many conservation programs in California are managed by other state and federal agencies. Because SWAP 2015 is a comprehensive plan for wildlife conservation, its integration as input to other agencies' programs creates the opportunity to better coordinate activities for achieving conservation outcomes more efficiently and effectively. Although the full array of relevant conservation programs is too extensive to capture here, this section notes some of the most important ones and the potential role SWAP integration can play.

Wildlife Conservation Board

The Wildlife Conservation Board (WCB) was created by state legislation in 1947 to operate a capital outlay program for wildlife conservation and wildlife-related public recreation; it has since been tasked to also administer other state conservation programs. WCB is an independent board with authority and funding to carry out land acquisition and project development for wildlife conservation (FGC section 1300 et seq.). WCB and CDFW work cooperatively to implement mutual conservation efforts. About one-half of the WCB funding is derived from California bonds authorized by public vote with the remainder coming from other state funds, local matching funds, partner donations, and federal money (WCB 2012).

The primary responsibilities of WCB are to select, authorize, and allocate funds for the purchase of land and waters suitable for recreation purposes and the preservation, protection and restoration of fish and wildlife habitat. WCB can also authorize the construction of facilities for fish and wildlife-related recreational purposes. WCB's functions are carried out through its programs: Land Acquisition, Public Access, Habitat Enhancement and Restoration, Inland Wetlands Conservation, California Riparian Habitat Conservation, Natural Heritage Preservation Tax Credit, Oak Woodland Conservation, Rangeland and Grassland Protection, Forest Conservation, and Ecosystem Restoration on Agricultural Lands (WCB 2014). Because the statutory purpose of the WCB includes conservation of fish and wildlife habitat, and WCB and CDFW work together, SWAP 2015 will continue to inform and guide WCB in its decisions regarding funding of land and water acquisition and habitat enhancement and restoration. SWAP 2015 includes numerous strategies calling for fee title acquisition of lands, acquisition of conservation easements on working landscapes, and acquiring water rights to maintain native fish populations. CDFW will work closely with WCB to implement these strategies.

In 2014, WCB approved approximately $38.5 million in total projects to help protect and restore over 23,955 acres of natural resource lands:

- WCB allocated $26.6 million to complete fee title acquisitions and conservation easement projects on approximately 22,645 acres of land throughout the state.
- Just under $7 million was allocated to enhance or restore 1,310 acres of wildlife habitat including wetlands, riparian, and instream fish habitat.
- Approximately $4.9 million was allocated for the purposes of infrastructure development related to providing wildlife-oriented recreation opportunities and also to upgrade facilities located at several University of California reserves.
- The largest single investment in the first half of 2014 was a $4.5 million allocation for a cooperative project with the State Coastal Conservancy and the County of Los Angeles to acquire 703 acres of land for the protection and restoration of coastal wetlands and watersheds located in Southern California.

  In 2013, WCB approved approximately $50.2 million in total projects to help protect and restore over 17,220 acres of natural resource lands:
- The largest single investment was a $5 million allocation for the restoration of 955 acres of coastal wetlands for the Sears Point Wetland Restoration project in Sonoma County, in cooperation with other government and non-government entities. In addition, WCB allocated a supplemental $9.8 million to restore and enhance an additional 2,901 acres statewide.
- WCB allocated $27.8 million in fee title acquisitions and conservation easement projects on approximately 13,355 acres of land throughout the state.
- Approximately $7.5 million was allocated for the purposes of infrastructure development related to providing wildlife-oriented recreation opportunities and also to upgrade facilities located at several University of California Reserves throughout California.
- The largest single investment in the first quarter of 2013 was a $1.4 million allocation for a cooperative public access improvement project with the San Joaquin River Conservancy at the Lost Lake Park Campground in Fresno County. In addition, WCB allocated an additional $9.2 million to restore and enhance an additional 2,219 acres statewide.
- WCB allocated $16.8 million in fee title acquisitions and conservation easement projects on approximately 13,367 acres of land throughout the state.
- Approximately $2.6 million was allocated for the purposes of infrastructure development related to providing wildlife oriented recreation opportunities and also to upgrade facilities located at several University of California Reserves throughout California.

In the first quarter of 2012, the WCB approved approximately $17 million in total projects to help protect and restore more than 6,700 acres of natural resource lands. In 2011, WCB approved approximately $144 million to help match and assist in funding nearly $320 million in total projects to help protect and restore 160,000 acres of natural resource lands.

WCB serves and works with many partners, including other state agencies, federal agencies and NGOs, including private nonprofit conservation groups and private landowners. WCB recently completed its Strategic Plan (2014) which states that priority projects for funding will be based on, amongst other criteria, project alignment with conservation actions in the Wildlife Action Plan. The plan recognizes and identifies approaches to integrate larger landscape scale conservation efforts into WCB's activities, including climate change adaption; infrastructure mitigation; and integration with federal, local agency, and non-profit conservation initiatives. The Strategic Plan outlines strategies that adhere to legal mandates, but also ensure a transparent, integrated process for ranking and selecting projects across program areas and establishing metrics for measuring, monitoring, and reporting the activities and progress of WCB program areas.

Regional Advance Mitigation Planning

Regional Advance Mitigation Planning (RAMP) was initiated in 2008 by the California Department of Water Resources (DWR) and Caltrans, along with a coalition of resource agencies (including CDFW), nongovernmental organizations, and universities. Although primarily conceptual in nature, it is intended to provide a more comprehensive approach to mitigating biological resource impacts caused by large state infrastructure projects, such as roads and flood control levees. One of the goals will be to implement natural resources protection or restoration as compensatory mitigation before infrastructure projects are constructed, often years in advance. RAMP will enable federal, state, regional, and local representatives to jointly evaluate potential natural resource impacts from infrastructure projects proposed for a region, and at the same time define and implement planned mitigation for those impacts in a manner that contributes to regional conservation priorities. The advance time frame allows strategic mitigation to be implemented and made functional before an infrastructure project's unavoidable impacts occur. Mitigating in advance is intended to allow for more efficient and coordinated project approvals, more certainty to cost estimates, and more effective conservation actions before important land is lost to conversion. SWAP 2015 will be an important source of regional conservation strategies to inform the development of RAMP mitigation actions.

California Water Plan

The California Water Plan, prepared by DWR, provides a collaborative framework for elected officials, agencies, tribes, water and resource managers, businesses, universities, organizations, and the public to make informed decisions about California's water resources. The Water Plan must be updated every five years; the current plan was completed in 2013 (DWR 2013a). It presents the status and trends of California's water-dependent natural resources; water supplies; and agricultural, urban, and environmental water demands. The Water Plan evaluates different combinations of resource management strategies to reduce water demand, increase water supply, reduce flood risk, improve water quality, and enhance environmental and resource stewardship. SWAP 2015 will provide guidance to future Water Plan updates related to conserving freshwater and anadromous fishes, as well as their habitats and the aquatic, wetland, and riparian habitats associated with California's water resources upon which California wildlife also depend.

California Water Action Plan

The California Water Action Plan, released by the Governor in January 2014, is a roadmap for the first five years of the state's journey toward sustainable water management. Implementation during the first year was marked by passage of historic groundwater legislation that will provide much needed tools, financial assistance and technical support to assist regions across the state in achieving sustainable groundwater management at the local level. Additionally, 2014 brought a renewed focus on the importance of reinvesting in our water management systems and watersheds to address the ongoing drought challenges and prepare for future uncertainties. In addition, Proposition 1, the Water Quality, Supply, and Infrastructure Improvement Act of 2014, includes $2.7 billion for public benefits of water storage projects that provide measurable benefits to the Delta ecosystem or its tributaries. The California Water Commission (Commission), through the Water Storage Investment Program, will fund the public benefits of eligible water storage projects. Eligible project types include:

- Groundwater storage projects and groundwater contamination prevention or remediation projects that provide storage benefits.
- Local and regional surface storage projects that improve the operation of water systems in the state and provide public benefits.

SWAP 2015 includes three strategies that describe native fisheries that are in serious peril due to declines in lake water levels that restrict fish movement between lake and stream breeding areas, and increased water temperatures.

Salton Sea Restoration Program

Salton Sea Restoration Program/Species Conservation Habitat Project is led by the California Natural Resources Agency (CNRA). Funding for the project has been appropriated by the California Legislature from Proposition 84. Additional funding is also being sought from WCB. The project is intended to serve as a proof of concept for the restoration of shallow water habitat that currently supports fish and wildlife dependent upon the Salton Sea; this habitat is being lost due to salinity increases and the declining sea elevation. Currently, available funding is approximately $28 million. This is sufficient to fund the construction of 640 acres of the total evaluated and permitted area of the preferred alternative in the Environmental Impact Report/Environmental Impact Statement. CDFW is working cooperatively with local entities to implement the project. The Imperial Irrigation District is providing Construction Management services which include developing the construction bid package and managing the construction. Construction is expected to begin soon after the fall of 2015. Once the project is constructed, CDFW will launch a Monitoring and Adaptive Management program that will help determine if the project is meeting its biological performance goals. Program staff is currently finalizing the draft Monitoring and Adaptive Management Plan. SWAP 2015 will support SWG funding to further our understanding of this complex and threatened habitat.

Central Valley Flood System Conservation Strategy

The Draft Central Valley Flood System Conservation Strategy, prepared by DWR, is an integral part of the Central Valley Flood Protection Plan (CVFPP). It supports the attainment of all CVFPP goals, but focuses on the integration and improvement of ecosystem functions with flood risk reduction projects where feasible. The Conservation Strategy describes the basis for recommending various conservation actions and setting long-term objectives for the Central Valley flood management system as a whole. The purpose of this Conservation Strategy is to provide: (1) a comprehensive, long-term approach for improving riverine and floodplain ecosystems through multi-benefit projects that provide ecological benefits while protecting public safety; (2) a regional programmatic framework for increasing the predictability and cost-effectiveness of permitting, while resulting in more effective and less costly conservation outcomes; and (3) contextual information and tools for use in planning and permitting processes. The integration of specific environmental restoration features with DWR's proposed flood management system improvements is one of the goals of the CVFPP and will also be described further in the 2017 CVFPP update (DWR 2015). Conservation strategies for the Central Valley and Sierra Nevada Province in SWAP 2015 have taken into account the conservation recommendations of the Central Valley Flood System Conservation Strategy by crafting a strategy that addresses common themes with the CVFPP such as enhancement and restoration of ecosystems and habitats, species protection, and habitat management on natural and working landscapes.

California Transportation Plan

The California Transportation Plan (CTP) provides a long-range policy framework to meet our future mobility needs and reduce climate change. The CTP defines goals, performance-based policies, and strategies to achieve our collective vision for California's future statewide, integrated, multimodal transportation system. The plan envisions a sustainable system that improves mobility and enhances our quality of life. The CTP defines performance-based goals, policies, and strategies to achieve our collective vision for California's future statewide, integrated, multimodal transportation system. The CTP is prepared in response to federal and state requirements and is updated every five years. CTP 2025 was approved in 2006 and updated by a 2030 Addendum in 2007. CTP 2040 was initiated in early 2010 with the development of the California Interregional Blueprint (CIB) in response to Senate Bill 391 (Liu 2009).

The CIB is a state-level transportation blueprint that articulates the State's vision for an integrated multimodal transportation system that complements regional transportation plans and land use visions. The CIB provides the foundation for CTP 2040, which will conclude with plan approval by the Secretary of the California State Transportation Agency (CalSTA) in December 2015.The vision of CTP 2040 is a fully integrated, multimodal, sustainable transportation system that supports the three outcomes that define quality of life: prosperous economy, human and environmental health, and social equity.

The CTP 2040 is scheduled for approval by the California State Transportation Agency in December 2015. The Public Draft CTP 2014 was prepared with extensive input and collaboration between Caltrans, its regional partners, and the public. The CTP 2040 references the California Essential Habitat Connectivity Project and Regional Advance Mitigation Planning as a statewide planning tools available to align transportation development with regional wildlife connectivity planning. The CTP 2040 identifies strategies and recommendations to preserve and enhance natural resources with the early integration of environmental considerations into system planning and project scoping (Caltrans 2015).

Fire and Resource Assessment Program

CAL FIRE's Fire and Resource Assessment Program (FRAP) is required by the California legislature to produce periodic assessments of the forests and rangelands of California. These reports have been published every five years since the 1970s. In 2008, the U.S. Farm Bill directed the U.S. Forest Service (USFS) to coordinate with states on forest and rangelands assessments. The first coordinated report for California was completed in 2010 between CAL FIRE and USFS Region 5 (CAL FIRE and USFS 2010). CAL FIRE and USFS Region 5 are preparing the 2015 assessment. Working together with CAL FIRE, CDFW has continued to increase the capacity and effectiveness of its Timberland Conservation Program (TCP) to help conserve forest ecosystems by hiring additional new staff members (currently 33 environmental scientists, managers and administrative staff members), acquiring equipment, providing training, strengthening interagency coordination and reaching out to stakeholders. Under the leadership of the CNRA, CDFW contributed to a framework for developing ecological performance measures to monitor trends in forest ecosystem resilience and recovery from cumulative effects of past forest practices. TCP established a Forest Assessment Technical Working Group to compile and share techniques to evaluate proposed timber operations and potential impacts to public trust values. SWAP 2015 will offer information to the FRAP process, both for the 2015 update and future assessments, for effectively integrating fish and wildlife conservation strategies into forest and rangeland management planning.

California Land Conservancies

California land conservancies have been established through legislation, each with mandates to acquire land and conduct other programs with various conservation missions. For instance, the California Coastal Conservancy was created in 1976 to complement the coastal zone regulatory agencies by working to permanently protect coastal resources and to improve public access. Its jurisdiction spans the entire coastline, coastal watersheds, and the entire nine-county San Francisco Bay encompassing one third of the state and 75 percent of the state's population. The Coastal Conservancy's land conservation work involves land acquisition, restoration and development of regional and site specific restoration and conservation plans. Over the last decade, the Coastal Conservancy expended over $650 million and worked in partnership with others to protect over 400,000 acres of lands and restore 35,000 acres of habitat. The California Tahoe Conservancy was established in 1984 to restore and sustain a balance between the natural and the human environment and between public and private uses at Lake Tahoe. The Sierra Nevada Conservancy, established in 2004, initiates, encourages, and supports efforts that improve the environmental, economic, and social well-being of the Sierra Nevada Region. The Santa Monica Mountains Conservancy was established in 1980 with the mission to strategically buy back, preserve, protect, restore, and enhance treasured pieces of Southern California to form an interlinking system of river parks, open space, and wildlife habitats. Each conservancy is governed by its own mission, mandate, and board. Funding is primarily from voter-approved bond acts and other legislatively authorized budgets. SWAP 2015 provides information, assessments, and strategies that can be instrumental in guiding grant solicitations and awards from these organizations and helping coordinate the land acquisition and resource management efforts of the many state conservancies with the broader CDFW conservation priorities for benefiting the state's fish and wildlife.

Central Valley Project Improvement Act

The 1992 Central Valley Project Improvement Act (CVPIA) amended previous authorizations of the California Central Valley Project (CVP) to include fish and wildlife protection, restoration, enhancement, and mitigation as project purposes having equal priority with irrigations and domestic water supply uses, and power generation. The purpose of the CVPIA is to protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins; to address impacts of the CVP on fish, wildlife, and associated habitats; to improve CVP operational flexibility; to increase water-related benefits provided by the CVP to the state; to contribute to the state's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to achieve a balance among competing demands for use of CVP water. SWAP 2015 has developed strategies in Chapter 5for native fish assemblages and in Chapter 6 for anadromous fish that will help inform fisheries restoration and enhancement projects undertaken through the CVPIA.

National Forest Planning Rule

USFS adopted the 2012 Planning Rule for land management planning for the National Forest System (USFS 2012). The rule was published in the Federal Register on April 9, 2012, and it became effective 30 days following the publication date on May 9, 2012. The USFS has released proposed planning directives as guidance documents that direct implementation of the 2012 planning rule, which include provisions for coordination with state resource agencies (USFS 2013). USFS is seeking to implement an adaptive land management planning process that is inclusive, efficient, collaborative and science-based to promote healthy, resilient, diverse and productive National Forests. The Inyo, Sequoia, and Sierra National Forests in the Sierra Nevada are the three "early adopter" national forests in the Pacific Southwest Region revising their Forest Plans using the 2012 Planning Rule. The revision process involves three stages: assessment of forest resource condition and trends, development of a revised plan, and monitoring the implementation and effectiveness of the plan. Other National Forests in

California will take up revision of their Forest Plans in the future. SWAP 2015 assessment information and conservation strategies will be valuable for National Forests in California to use when updating their Forest Plans in accordance with the Planning Rule, and efforts to coordinate use of common indicators has been a key component of SWAP 2015 integration planning.

Desert Renewable Energy Conservation Plan

The Desert Renewable Energy Conservation Plan (DRECP) is an innovative, landscape-scale renewable energy and conservation planning effort covering more than 22 million acres in the California desert. The DRECP planning area covers private, state, and federal lands in seven counties--Imperial, Inyo, Kern, Los Angeles, Riverside, San Bernardino and San Diego. The multi-phase plan identifies conservation areas, sensitive plant and wildlife species, and a strategy for their management into the future. The DRECP planning process is a unprecedented collaborative effort between the California Energy Commission (CEC), CDFW, the U.S. Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS) also known as the Renewable Energy Action Team.

Landscape Conservation Cooperatives

Landscape Conservation Cooperatives (LCCs) are applied conservation science partnerships coordinated by the U.S. Department of the Interior to better integrate science and management to address climate change and other landscape scale issues. Across the country, 22 LCCs operate in a specific geographic area and form a national network that serves as a management-science partnership. LCCs have two main functions: the first is to provide the science and technical expertise needed to support conservation planning at landscape scales – beyond the reach or resources of any one organization. Through the efforts of in-house staff and science-oriented partners, LCCs are generating the tools, methods, and data managers need to design and deliver conservation using the Strategic Habitat Conservation (SHC) approach. The second function of LCCs is to promote collaboration among their members in defining shared conservation goals. With these goals in mind, partners can identify where and how they will take action, within their own authorities and organizational priorities, to best contribute to the larger conservation effort. Within California, there are five LCCs: the California LCC, which covers the Central Valley, Central Coast, and south coast areas; the North Pacific LCC, which covers the North Coast, Klamath, and Cascade regions; the Great Basin LCC, which covers the Sierra Nevada and Modoc Plateau; and the Desert LCC, which covers the desert areas. SWAP 2015 has been working with LCCs to develop conservation strategies focused on shared priority species and habitats and to share data.

Joint Ventures and Fish Habitat Partnerships

USFWS established policy and provides guidance for the establishment and organization of joint ventures receiving administrative funding. A joint venture is a self-directed partnership of agencies, organizations, corporations, tribes, or individuals that has formally accepted the responsibility of implementing national or international bird conservation plans within a specific geographic area or for a specific taxonomic group, and has received general acceptance in the bird conservation community for such responsibility.

Five Habitat Joint Ventures have been established that overlap California. They are the Central Valley, Intermountain West, Pacific Bird, San Francisco Bay, and Sonoran Joint Ventures. Joint Ventures contribute to conservation of migratory waterfowl and shorebirds in California by funding habitat restoration projects and research.

Similarly, the mission of the National Fish Habitat Action Plan is to protect, restore and enhance the nation's fish and aquatic communities through partnerships that foster fish habitat conservation and improve the quality of life for the American people with the stated goals to protect and maintain intact and healthy aquatic systems; prevent further degradation of fish habitats that have been adversely affected; reverse declines in the quality and quantity of aquatic habitats to improve the overall health of fish and other aquatic organisms; and increase the quality and quantity of fish habitats that support a broad natural diversity of fish and other aquatic species.

Three partnerships have been created that overlap California and include the California Fish Passage Forum, the Pacific Marine and Estuarine Fish Habitat Partnership, and the Desert Fish Habitat Partnership. Chapter 6 describes inter-agency outreach and information sharing between CDFW and these partnerships.

7.2 Companion Plans

In the last phase of SWAP 2015 update process, CDFW is developing nine companion plans that elaborate on shared sector-specific conservation priorities identified between SWAP 2015 and partners involved in companion plan development. Companion plans focus on conservation strategies and activities that can be better undertaken in collaboration with other state and federal agencies, organizations, private landowners and other partners. These prioritized, shared conservation strategies and activities complement SWAP 2015 and expand implementation of conservation strategies beyond CDFW. The benefit of preparing the companion plans is to better leverage limited resources, more effectively achieve conservation outcomes through increased coordination, improve resource and data sharing, and better align planning and policies as a desired outcome of the process. The companion plans are organized by the following focal sectors:

- Agriculture
- Commercial and Recreational Uses
- Energy Development
- Forests and Rangelands
- Land Use Planning
- Transportation Planning
- Tribal Lands
- Water Management
- Marine Resources

Because of the cooperation and teamwork used for their development, companion plans are fostering greater engagement with stakeholders and partners from key sectors for SWAP 2015 implementation. The companion plans are critical for prioritizing effective conservation strategies and activities for the species and habitats addressed in SWAP 2015 and identifying human and financial resources to support implementation. Together, SWAP 2015 and associated companion plans set a context and strategic direction of integrated planning and management efforts that will improve California's habitat and wildlife conservation.

The two main cross-cutting themes coming to light during development of the companion plans are integrated regional planning and climate change.. The three recurring priority strategy categories common among at least five companion plans are data collection and analysis, management planning, and partner engagement. The companion plans will be posted on the California SWAP website (https://www.wildlife.ca.gov/SWAP) when they are available.

7.3 Resources Needed For Conservation Actions

Currently, the conservation actions described in the SWAP are carried out by many CDFW programs. While historically these activities were not specifically implementing the SWAP, the activities can now be considered part of this greater and more comprehensive effort. Additionally, CDFW receives and uses California's annual allocation of SWG funds to accomplish resource assessment and direct management actions for SGCN and their habitat. CDFW staff submit project proposals for review and scoring by a Technical Advisory Committee (TAC) composed of researchers and species experts throughout CDFW. The proposals are scored on a number of factors, including relevance to implementation of SWAP and technical merit. A Management Advisory Committee composed of program managers throughout CDFW reviews TAC results and recommends which projects should be submitted to USFWS for funding consideration.

7.3.1 Funding for Wildlife Conservation

Existing conservation programs and many of the conservation actions recommended in this plan require additional funding. Halting the slide of species toward endangered species status will require new research, expanded conservation planning and management, greatly increased species assessment and monitoring, and major habitat restoration projects. Success or failure to conserve California's wildlife may well hinge on the level of funding dedicated to wildlife conservation and restoration programs over the next few decades.

Increased Demands on Conservation Agencies by Growth and Development

Rapid growth and development, water diversions from creeks and rivers, invasions of non-native species, growth in off-road vehicle recreation, and numerous other activities that affect wildlife have demanded additional efforts of wildlife scientists and conservation managers.

With expanding development, California's unique habitats are shrinking. Maintaining healthy populations of species on fragmented and smaller areas of habitat requires more intensive management, environmental review, conservation planning, monitoring, mitigation project design, and habitat restoration work. Accompanying growth and development is an increasing demand by the public for recreational access to public land, waterways, and ocean resources and greater pressure to develop wildlands that now provide key wildlife habitat, all of which involves more work for state wildlife managers.

Expanding Responsibilities and Demands for Wildlife Conservation

CDFW is the state agency charged with conserving and restoring wildlife and ecosystems, responsibilities that have expanded and become more complex over the last several decades. Responding to the increasing problems affecting species and habitats, state policy-makers have enacted new wildlife conservation and environmental protection mandates. Without a broad-based reliable funding mechanism, CDFW is hard-pressed to implement many of these conservation programs, even at modest levels. Resource assessment, conservation planning, and dozens of tasks necessary to conserve wildlife species at risk are severely underfunded.

The problem of inadequate funding for wildlife conservation has been 40 years in the making. In light of the growing stresses on wildlife, CDFW has appropriately evolved from primarily managing fishing and hunting programs to serving as the public trust steward for all wildlife, habitat, and ecosystems, while continuing to manage fishing and hunting programs. With the enactment of more than 20 conservation programs since 1968, CDFW's wildlife and wildlands stewardship role has expanded dramatically above its statutory and regulatory responsibilities. Many of these measures have mandated major new workloads for CDFW without providing new or sufficient funding and staffing. Lack of funding to perform the required mandates was recognized as one of seven key findings from the SWAP 2005 implementation report (Appendix I).

CDFW's ongoing statutory and regulatory responsibilities include, but are not limited to:

- enforcing and promoting voluntary compliance of fish and game regulations;
- providing hunting and fishing opportunities based on sound science;
- operating 23 hatcheries, stocking almost four million pounds salmon, steelhead, and trout;
- conducting scientific assessments of our fish and wildlife populations;
- developing and implementing strategies to manage wildlife disease and responding to potential outbreaks of disease (e.g., adenovirus, duck viral enteritis, botulism, chronic wasting disease);
- evaluating lands considered for acquisition for benefit of wildlife and fish resources;
- directly managing more than a million acres as wildlife and ecological reserves;
- working with public agencies, landowners and other private interests to develop NCCPs;
- developing and managing numerous partnerships that will establish a comprehensive approach to managing the recently completed network of MPAs under the MLPA;

- protecting vulnerable species through project review, CESA listing and permitting, CEQA, Timber Harvest Plan Review, Mitigation Banking, Climate Change Initiatives (such as Drought Response), and Cap & Trade Carbon Sequestration programs, and LSA Agreements;
- working to control and prevent invasive species infestations;
- managing and restoring wetlands;
- coordinating and integrating CDFW's activities related to water rights, water quality, Federal Energy Regulatory Commission hydroelectric permitting, in-stream flow, Central Valley water operations, and the California Water Plan;
- responding as Lead agency for pollution spill prevention and response through both CDFW's Office of Spill Prevention and Response (OSPR) and inland pollution response;
- advising local governments, various commissions, and working groups regarding biological, technical, and conservation issues;
- working with individuals and government agencies to resolve depredation problems and other wildlife conflicts, an increasing challenge due to growth and development in rural communities and natural areas and expansion of agricultural activities;
- educating the public on fish and wildlife conservation and wildlife public safety issues;
- serving as the principal public contact for wildlife issues in the state; and
- issuing permits and licenses along with public information and education materials.

In addition to ongoing CDFW conservation responsibilities, in recent years, dozens of major new projects and programs have increased demands on CDFW. They include:

- The CDFW Ecosystem Restoration Program (ERP), in coordination with USFWS and National Marine Fisheries Service (NMFS), has finalized a Conservation Strategy for restoration of the Sacramento-San Joaquin Delta, Sacramento Valley and San Joaquin Valley regions. The Conservation Strategy describes ERP goals and conservation priorities for restoration and provides the rationale for potential restoration actions. ERP staff is coordinating with the Delta Science Program, Delta Conservancy, DWR, and other agency staff to ensure consistency of their respective adaptive management efforts with the Delta Plan, and in the development of coordinated Delta-wide restoration monitoring plans, performance measures, and evaluation and reporting programs.
- In 2009, the California Legislature passed the Delta Reform Act, which set in motion new planning efforts to achieve the co-equal goals of water supply reliability and a healthy Delta ecosystem and created two new state agencies, the Delta Stewardship Council (DSC), and the Sacramento-San Joaquin Delta Conservancy (Conservancy). The DSC finalized its comprehensive management plan for the Delta (Delta Plan) on May 17, 2013. The DSC convened its Implementation Committee, made up of state and federal agency directors and regional administrators to foster agency coordination in implementing the Delta Plan. The Final Delta Science Plan was accepted by the DSC on October 25, 2013. CDFW is working closely with the Delta Science Program in developing its Science Action Agenda for the

coming year. The Action Agenda will identify and prioritize science needs to support actions to achieve the co-equal goals of the Delta Plan. The Delta Independent Science Board (ISB) is charged with providing oversight of the scientific research, monitoring and assessment programs that support adaptive management of the Delta through periodic reviews of each of those programs. The ISB is reviewing documents and providing comments to CDFW and the DSC.

- CDFW is engaged in habitat restoration in the Delta in coordination with DWR through the Fish Restoration Program Agreement (FRPA). This program will restore 8,000 acres of intertidal and associated subtidal habitat for Delta smelt and Chinook salmon, including 800 acres of mesohaline habitat for longfin smelt. These restoration actions address restoration specific Reasonable and Prudent Alternatives from the Operation Criteria and Plan Biological Opinions from USFWS and NMFS for State Water Project (SWP) and CVP operations, and CDFW's Longfin Smelt Incidental Take Permit for State Water Project Delta Operations. Restoration projects conducted under FRPA may also be counted as early implementation of BDCP should it be adopted. Two major projects totaling 2000 acres are currently nearing finalization. CDFW and partners are working on a science program to assess the effectiveness of these restoration projects in achieving their objectives of providing habitat and foodweb support for Delta and longfin smelt and Chinook salmon.
- As a primary participant in the Interagency Ecological Program (IEP) for the San Francisco Estuary in partnership with the Delta Science Program, CDFW continues to collaborate with the nine member agencies to conduct extensive research and monitoring to inform real-time decisions on water exports to maintain compliance with ESA and water quality requirements and to identify status and trends and inform long-range export planning. The current drought along with the Biological Opinion Remand process, discussed below, has resulted in additional research and monitoring focused on improving water management decision making. The Management, Analysis and Synthesis Team (MAST) continues to evaluate the latest information collected over the previous year, synthesize it for broader understanding, and make recommendations to the agency directors on focusing the coming year's studies to address key data gaps. This synthesis process is a key component of the Delta Science Plan. This program improves the translation of data into useable information consistent with the recommendations of independent scientists convened by the National Research Council and the Delta Science Program. The MAST's efforts this year have focused on analyzing and synthesizing this data to understand the role of fall habitat in supporting Delta smelt, test and update related conceptual models and support adaptive management options by the U.S. Bureau of Reclamation and others. IEP is finalizing its strategic planning process to establish a clear process for identifying research and monitoring studies that are responsive to management needs and allows for more effective engagement with a broader array of stakeholders in a more inclusive process that draws on a wider range of scientists to help focus the central questions addressed by its research and monitoring program and seek new insights which are integrated with the Delta Science Plan and the Action Agenda.

- The SWP and CVP water operations under existing endangered species authorizations have generally reduced listed species take at the water export facilities. Additionally, over the last several years monitoring of sensitive fish populations in the Delta has shown slight increases for some species. However, despite Delta smelt and longfin smelt both having responded strongly to high Delta flow conditions throughout 2011, producing the highest fall abundance indices in recent years, their abundance has once again shown a decline in 2012 and 2013 to historic lows. The ongoing drought resulting in low river flows and Delta outflow will likely result in continued low abundance levels for native fishes dependent on the Delta and its tributaries. Substantial emphasis continues to be focused on predation as a major stressor in the Delta. Predation is being in part addressed through research, monitoring, outreach to stakeholders and policy development. As part of its settlement of litigation over the effects of striped bass regulations on endangered fish species, the Department and litigants have convened a science team to identify needed research to better understand the effect of predators on salmonids and Delta and longfin smelt in the Delta. One million dollars is available to fund such studies. The 2013 Predation Workshop final report will be used to guide ongoing research.
- CDFW is participating in several phases of the State Water Resources Control Board's (SWRCB) review and update of its Bay-Delta Water Quality Control Plan (Bay-Delta Plan) including making recommendations to (1) revise San Joaquin River flow standards entering the south Delta; (2) revise water quality, flow and Delta operations objectives in the Delta itself; and (3) providing instream flow recommendations for Delta tributary streams. CDFW is recommending improved flow conditions on the San Joaquin River and higher inflows and outflows in the Delta to sustain aquatic species. The SWRCB staff is in the process of revising the substitute environmental document for San Joaquin River flow standards and plan for a release to the public in the fall of 2015. The latest version of San Joaquin River flow standards included a recommendation of 35 percent with the potential to increase to 45 percent with adaptive management. CDFW, other agencies, and NGOs are recommending a higher percentage than the SWRCB staff recommendation and have been participating in meetings with SWRCB staff regarding potential changes to the adaptive management implementation including utilizing biocriteria to aid in decision making. The SWRCB is expected to make a final decision on San Joaquin River flow standards in 2016, at the earliest.
- In addition to San Joaquin River flows, the SWRCB has initiated the Phase 2 of the update to the Bay-Delta Plan. Phase 2 will focused on the following issues: (1) Delta outflow objectives; (2) export/inflow ratio; (3) Delta Cross Channel Gates closures objectives; (4) Suisun Marsh objectives; (5) reverse flow objectives for Old and Middle rivers; (6) floodplain habitat flow objectives; (7) monitoring and special studies; and (8) changes to the program of implementation. The Delta Science Program held two workshops in support of the SWRCB's effort to revise water quality, flow and Delta operations objectives in the Delta. The first workshop was specific to Delta outflows and related stressors and was held in February 2014. The second workshop was specific to interior Delta flows and related stressors and was

held in April 2014. The SWRCB is expected to make a final decision on Phase 2 Delta flow standards and associated objectives in 2016.

- The SWRCB utilized the Delta Science Program to complete an evaluation of methods to develop flow criteria for the Sacramento River and tributaries. The SWRCB plans to release a strategy for establishing flow criteria for Delta tributaries in fall 2015. In addition, CDFW and the SWRCB are coordinating on priority streams that are tributaries to the Delta and have begun the studies for determining the necessary flows. Currently, CDFW is conducting flow studies on lower Butte, Deer, and Mill creeks, all tributaries to the Sacramento River that have habitat for listed anadromous salmonids including spring-run Chinook salmon and steelhead. The studies will result in flow recommendations that CDFW will submit to the SWRCB.
- Marine Protected Area Monitoring and Management: CDFW is responsible for managing California's redesigned MPA network which includes 124 MPAs and 15 special closures, covering approximately 16 percent of the state waters (over nine percent of which is in no-take MPAs). CDFW collaborates with key partners to provide oversight on all aspects of MPA monitoring to inform adaptive management, including developing monitoring plans to apply the statewide MPA monitoring framework, regional baseline monitoring programs, five-year monitoring and management reviews and cost-effective continued monitoring programs based on results from baseline programs. CDFW continues to explore MPA effects on California's fisheries, maintains an interactive spatial marine and coastal data viewer called MarineBIOS and conducts field investigations such as remotely operated vehicle projects. CDFW MPA Outreach Coordination Project continues efforts to enhance public awareness and understanding of California's coastal network of MPAs. These efforts include:
  - collaboration with the California Department of Parks and Recreation (California State Parks) to develop an MPA component for three existing Parks On-line Resources for Teachers and Students (PORTS) programs. PORTS uses video-conference technology and downloadable lesson plans to teach academic content standards. Through this collaboration, CDFW will educate between 10,000-20,000 California K-12 grade-school students about MPAs in the 2014-15 academic year;
  - redesigned and updated guides and brochures for all four of California's regions;
  - collaboration with a variety of partners;
  - participation in the MPA Community Collaboratives; and
  - statewide MPA signage project.

  For additional information on MPAs, please visit http://www.dfg.ca.gov/marine/mpa/; for regional guides and brochures visit http://www.dfg.ca.gov/marine/mpa/mpa_summary.asp.

- Conservation and Mitigation Banking: In January 2013, the Conservation and Mitigation Banking program was established. New FGC sections 1797-1799 authorize CDFW to charge fees to cover reasonable costs for reviewing and approving bank-related documents. The fees support program staffing and contribute to the establishment of conservation and mitigation banks that protect critical fish and wildlife resources while enhancing partnerships with bank sponsors, stakeholders and other federal, state, and local agency partners. With funding and staffing, CDFW is re-engaging in its commitments memorialized in the eight-agency MOU with partner federal and local agencies. https://www.wildlife.ca.gov/Conservation/Planning/Banking.

- Natural Community Conservation Planning: In August, 2013, CDFW issued a NCCP Permit, pursuant to the NCCP Act of 2003 (FGC sections 2800-2835), for the Santa Clara Valley Habitat Plan. An NCCP is a comprehensive, multi-jurisdictional plan that provides for regional habitat and species conservation at an ecosystem level while allowing local land use authorities to better manage growth and development. Upon issuing the NCCP Permit, CDFW can authorize take of certain state listed species and other species of concern, subject to the terms of coverage under the NCCP. The Santa Clara Valley Habitat Plan covers 18 species -- three of which are state listed as threatened or endangered, five of which are California Species of Special Concern, and nine of which are California Rare Plants -- for a 50 year permit term. The plan will permanently conserve 33,205 new acres of land for a Reserve System that will total 46,496 acres. https://www.wildlife.ca.gov/Conservation/Planning/NCCP.
- Enhanced Quagga Mussel Prevention Program: In September 2012, Governor Brown signed AB 2443 into law, which added a new fee to boater registration. The new fee, the Quagga and Zebra Mussel Infestation Prevention Fee, will be used to fund local assistance grants for local water agencies to implement quagga and zebra mussel prevention programs at reservoirs open to the public. This new law directs the California State Parks, Division of Boating and Waterways (DBW) to develop and implement the new local assistance grant program. CDFW has been collaborating with DBW since AB 2443 was first introduced during the 2011/2012 bill cycle and will continue to coordinate with DBW on the development and implementation of the new program.
- Science Institute: CDFW’s Science Institute (SI), codified with the passage of AB 2402 in California’s 2012 legislative session, continues to work on expanding scientific capacity. In late 2012, the SI procured access to an online scientific literature database, addressing at least in part a longstanding unmet need of departmental technical staff. The SI team is also working on the development of policies and practices required by AB 2402, including adoption or formalization of peer review and adaptive management practices and a scientific integrity policy. Future planned efforts of the SI include an updated website to improve availability of current scientific work of the department, data management/stewardship guidelines, a web-based database of technical staff and their skills and program areas, and an internal scientific summit.
- The San Joaquin River Restoration Program (SJRRP) implemented in 2006 with CDFW supporting spring-run Chinook salmon reintroduction as outlined in the NMFS 10(a)1(A), permit application for the Reintroduction of Central Valley spring-run Chinook salmon into the San Joaquin River. DFG carried out monitoring activities and the second year of study on survival rates of juvenile Chinook salmon migrating from Friant dam to the mouth of the Merced River. The Interim Conservation Hatchery facility continues development at the

proposed Conservation Hatchery site at the San Joaquin Fish Hatchery to support salmon experiments and fish reintroduction. The SJRRP received a 2011 Partners in Conservation Award from the U.S. Secretary of the Interior for outstanding conservation, collaboration, cooperation and communication achievements.

Resources Needed for Regional Planning

Constant conflicts between development projects and protection of endangered species have led conservation scientists, stakeholders, and CDFW to recognize the value of regional planning for habitat conservation and protecting biodiversity. The goals of these broader proactive approaches to conservation are to identify and protect key habitats and designate areas more appropriate for development well in advance of planning for individual projects in a region. CDFW serves numerous important functions in these broader conservation efforts, providing:

- biological data on individual species, which is then used to develop multispecies conservation plans, recovery programs, and restoration projects;
- habitat quality and resource assessments, used to identify the most important lands for supporting multiple species;
- planning and design expertise for conservation planning projects;
- design of appropriate mitigation measures for effects of development on natural resources;
- facilitation in bringing diverse stakeholders to the table and assisting them in developing conservation strategies at the local government level; and
- monitoring implementation of conservation plans and mitigation projects to assess the effect and effectiveness of the implementation.

These responsibilities are not in lieu of work at the species level. It is the species-level research and management, and particularly implementation of CESA, which trigger efforts that evolve into the broader conservation planning efforts.

Wildlife Conservation Funding Crisis—Recognized but Not Solved

The fiscal difficulties of CDFW have been repeatedly acknowledged by the Legislature but not solved. The Legislature described the problem in statute in 1978, 1990, and 1992, as noted in the FGC sections below. In addition, FGC sections 711(a) and 711.4 describe funding for nongame fish and wildlife programs, managing lands, and defraying the costs of managing and protecting fish and wildlife trust resources.

FGC Section 710

The Legislature finds and declares that the department has in the past not been properly funded. This lack of funding has prevented proper planning and manpower allocation. The lack of funding has required the department to restrict warden enforcement and to defer essential repairs to fish hatcheries and other facilities. The lack of secure funding for fish and wildlife activities other than sport and commercial fishing and hunting activities has resulted in inadequate non-game fish and wildlife protection programs. (Added to statutes in 1978.)

FGC Section 710.5

The Legislature finds and declares that the department continues to not be properly funded. While revenues have been declining, the department's responsibilities have been expanding into numerous new areas. The existing limitations on the expenditure of department revenues have resulted in its inability to effectively provide all of the programs and activities required under this code and to manage the wildlife resources held in trust by the department for the people of the state. (Added to statutes in 1990.)

FGC Section 710.7

The department continues to face serious funding instability due to revenue declines from traditional user fees and taxes and the addition of new program responsibilities. (Added to statutes in 1992.) The fiscal situation has worsened in recent years. Since 2001, the state budget crisis has compounded the funding challenges at CDFW. Wildlife and marine conservation programs, which are the primary beneficiaries of the limited General Fund dollars, have suffered dramatic budget cuts. General Fund support for CDFW dropped substantially during the recent budget crisis and has just recovered in 2015 to pre-crisis levels although workload and unfunded mandates have increased over this same period of time without concomitant budget augmentations.

FGC Section 711(a)

It is the intent of the Legislature to ensure adequate funding from appropriate sources for the department. To this end, the Legislature finds and declares that:

(1) The costs of nongame fish and wildlife programs shall be provided annually in the Budget Act by appropriating money from the General Fund, through nongame user fees, and sources other than the Fish and Game Preservation Fund to the department for these purposes.

(2) The costs of commercial fishing programs shall be provided out of revenues from commercial fishing taxes, license fees, and other revenues, from reimbursements and federal funds received for commercial fishing programs, and other funds appropriated by the Legislature for this purpose.

(3) The costs of hunting and sportfishing programs shall be provided out of hunting and sportfishing revenues and reimbursements and federal funds received for hunting and sportfishing programs, and other funds appropriated by the Legislature for this purpose. These revenues, reimbursements, and federal funds shall not be used to support commercial fishing programs, free hunting and fishing license programs, or nongame fish and wildlife programs.

(4) The costs of managing lands managed by the department and the costs of wildlife management programs shall be supplemented out of revenues in the Native Species Conservation and Enhancement Account in the Fish and Game Preservation Fund.

(5) Hunting, sportfishing, and sport ocean fishing license fees shall be adjusted annually to an amount equal to that computed pursuant to Section 713. However, a substantial increase in the aggregate of hunting and sportfishing programs shall be reflected by appropriate amendments to the sections of this code that establish the base sport license fee levels. The inflationary index provided in Section 713 may not be used to accommodate a substantial increase in the aggregate of hunting and sportfishing programs.

FGC Section 711.4

(a) The department shall impose and collect a filing fee in the amount prescribed in subdivision (d) to defray the costs of managing and protecting fish and wildlife trust resources, including, but not limited to, consulting with other public agencies, reviewing environmental documents, recommending mitigation measures, developing monitoring requirements for purposes of the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code), consulting pursuant to Section 21104.2 of the Public Resources Code, and other activities protecting those trust resources identified in the review pursuant to the California Environmental Quality Act.

7.3.2 Wildlife Conservation Program Needs

Fishing and hunting programs and related conservation efforts have specific dedicated funding derived from licenses, fees, and taxes on outdoor equipment. The public-trust duties of CDFW and its conservation programs that broadly benefit species, habitats, and ecosystems warrant funding from all Californians. Conservation-related activities that should be supported by broad-based funding may be described within the following four categories:

Science and Planning

- Managing and conducting resource assessment
- Implementing ecological research that supports conservation and management
- Developing regional conservation plans

Wildlife Conservation and Habitat Restoration

- Implementing conservation and recovery plans and projects.
- Designing, implementing, and monitoring habitat restoration projects
- Developing conservation and recovery strategies and plans

Enforcement for Wildlife, Wildlands, and Marine Resources

- Expanding wildlife and marine enforcement staff, salaries, and resources
- Developing an investigator class of wildlife enforcement staff

Wildlife Conservation Education and Service

- Educating the public on wildlife conservation issues
- Providing interpretive information and public services related to outdoor activities

7.3.3 Wildlife Lands Management Needs

State and federal wildlife and land management agencies and some state policy-makers have expressed great concern for the lack of resources for wildlife conservation, restoration, and enforcement on public lands. The needs for operation and maintenance of lands managed by CDFW are discussed below. USFWS, BLM, USFS, the National Park Service, and California State Parks have similar challenges to fund the restoration and management of wildlife areas, parks, and other wildlands. CDFW manages wildlife areas, ecological reserves, and wildlands specifically for the benefit of wildlife and important habitats. These lands are a cross section of California's remarkable natural diversity of animals, plants, habitat types, and ecosystems. Some of the state's finest-quality wildlife habitats are represented in these holdings. But acreage of lands managed by CDFW has quadrupled in the last 35 years, from 250,000 acres in 1980 to over 1.1 million acres today, and funding to manage these lands has not kept pace. Major bond acts and some appropriations have funded acquisition of new lands for wildlife, but there is not a corresponding source of funding to maintain, restore, and manage these lands. Land management entails providing site security, managing public health and safety on the lands, managing wildlife and natural resources, maintaining infrastructure, and managing recreation and other uses.

The consequences of neglecting lands are many:

- An area that is not secure or regularly inspected invites trespass by individuals and livestock and encroachment by such adjoining land uses as agricultural operations and off-road vehicles. Trespassing often involves vandalism and dumping. The result is degradation of the land, and the state is seen as a bad neighbor.
- Without management, wildlife values of the lands are also compromised. The habitat is degraded if invasive species are not controlled, fire is not managed, and ecosystems functions are not maintained.
- Lacking restoration efforts and/or management, many acquired lands do not meet the habitat goals for which they were purchased.
- Many lands have major public-use and education potential that cannot be realized without staff resources.

State wildlife lands have been acquired for specific conservation or recreation goals. Managing lands for their intended purpose requires staff and resources. Depending on the intended purposes of the land and the habitat values, CDFW's Lands and Facilities Branch Program estimates annual land operating management costs for many wildlife areas to range from $16 to $100 per acre. Local agencies estimate land operating and management costs to be significantly higher. In 2005, maintenance, restoration, and management of CDFW's wildlife areas and ecological reserves were supported, on average, at the level of $13 per acre and one staff person per 10,000 acres. Many lands were operated at $1 per acre, with no dedicated staff (CDFW Lands and Facilities Information Sheet).

7.3.4 New Funding Options

California is not unique in its difficulties with establishing an adequate and reliable revenue source for its wildlife conservation department. Numerous other state wildlife departments that have also evolved from fishing and hunting management organizations to expanded conservation organizations are also struggling to secure additional and more reliable funding.

Federal funding accounts for about 12 percent of CDFW's budget. Federal funds are provided through several programs, including the USFWS's programs pursuant to Section 6 of the ESA, the federal SWG Program, programs pursuant to the Sport Fish and Wildlife Restoration Acts, wetlands grant programs of the U.S. Environmental Protection Agency (EPA) and USFWS, and grant programs provided pursuant to the Clean Water Act.

Most state wildlife departments, in addition to receiving federal funding, are funded by a combination of user fees; a few tap into general sales-tax revenues. State wildlife department funding mechanisms include non-consumptive user fees, state lottery revenue, general sales tax, vehicle license plate fees, real estate transfer fees, tax check-offs, and natural resource extraction surcharges.

California's Environmental License Plate Fund Program generates funds for environmental and natural resources departments; however, these funds are usually appropriated to CDFW in lieu of General Fund dollars rather than to augment the base budget. In California, some of the better-funded resource departments and water agencies have funded a CDFW position to ensure certain wildlife-related services are provided. This funding source has been declining in recent years.

The 2014-2015 budget bill was signed on June 20, 2014. CDFW saw an increase of $1.5 million to regulate and enforce unauthorized water diversions and pollution to surface and groundwater as a result of marijuana cultivation. There is also the expansion of an existing per barrel fee on oil to account for crude oil entering in the state via rail, pipeline, and other modes that will fund a program for inland spill prevention and response. California has seen a significant shift in crude oil imports coming in over land rather than by sea. This fee will be collected at the refinery, making the fee equitable across various methods of importation. Currently, OSPR fund sources cover tidally influenced waters only, and cannot be used on inland spills. The budget contains an appropriation of $38.8 million for drought response actions, consistent with State of Emergency proclamations issued by the Governor in January and April. The budget also includes $25 million from Cap-and-Trade Program funds from the California Air Resources Board to implement wetland projects that reduce greenhouse gas emissions.

Arkansas and Missouri have two of the better-funded state wildlife programs. Both of these states have constitutional mandates that devote a percentage of general sales tax dollars to wildlife conservation. In 1976, Missouri enacted a constitutional amendment that raised the sales tax by one-eighth of a cent, generating about $70 million annually for wildlife management and conservation projects. In 1996, Arkansas enacted a similar constitutional amendment, which yields about $20 million annually for wildlife programs.

In 1991, the California Legislative Analyst's Office identified several user or impact fees that have a connection to wildlife and might be assessed to fund CDFW. They are:

- Motor-vehicle and highway impact fees—Vehicles and the highways affect wildlife in several significant ways. Road kills account for substantial mortality of many species, including deer, owls, and snakes. More deer are killed by collisions with vehicles than by hunting. Habitat is eliminated and fragmented by roads and highways. Oil and other chemicals from roads pollute aquatic ecosystems. And invasive species are often introduced along highways. Impact fees could be assessed as an increase in sales tax on vehicles sales, or a flat-rate surcharge could be attached to vehicle registration fees. Assessing an additional $1 per vehicle registration would generate approximately $26 million. Another option is a surtax on vehicle fuels. The California Constitution allows gasoline tax dollars to be used for environmental mitigation related to construction and operation of roads and highways.
- Nonpoint source discharge fees—Pollution from diverse sources runs off into wetlands and aquatic ecosystems. Those who create nonpoint source discharges could be assessed a fee to mitigate wildlife conservation impacts.
- Water use fees—Water diversions from rivers, streams, and the Delta significantly affect fish, amphibians, and aquatic life. To mitigate these effects, the Legislature could impose a water use fee on each acre-foot of water to fund wildlife conservation. A penny per acre-foot would generate about $220,000.
- Wastewater discharge fees—Pollution from industrial point sources degrades fish and aquatic life. Dischargers currently pay a fee that funds the SWRCB's water quality regulatory program.
- Recreational fees or taxes—Currently, only hunting and fishing recreational users pay annual fees for a license. Additional user fees could be assessed for other wildlife-related user activities, including birding, diving, and whale-watching.
- Mining fees—Gravel and open pit mining affects wildlife. For example, gravel mining from streambeds degrades salmon spawning grounds and degrades aquatic habitat. To fund wildlife conservation mitigation, a fee could be charged per volume of material removed. Broad-based fees or taxes, such as a flat-tax surcharge on annual state income tax, a parcel tax or parcel transfer fee, or a percent of sales tax, are in line with the policy that wildlife is a public trust resource and the responsibility of all Californians. If California followed the Missouri and Arkansas examples and enacted a one-eighth of a percent surcharge on sales tax, it would generate about $650 million for wildlife conservation and management of natural resources.

In April 2015, the Governor provided a new dual approach to improving water conveyance and ecosystem health in the Sacramento-San Joaquin Delta through two projects – California WaterFix and California EcoRestore. Habitat restoration actions (30,000 acres of restoration over a five-year period) to support the long-term health of the Sacramento-San Joaquin Delta's native fish and wildlife will be funded by the following:

- Floodplain and tidal/sub-tidal habitat restoration required by existing regulatory frameworks will be funded by state and federal water contractors;
- Wetlands restored for subsidence reversal and carbon management will be supported by the AB 32 Greenhouse Gas Reduction Fund and other sources;
- Various aquatic, riparian, and upland restoration and multi-benefit flood management projects will be supported by Proposition 1 and 1E; and
- Additional projects will be supported by various local and federal partners.

7.4 Coordination with Partners

Effective fish and wildlife conservation necessarily involves collaborative efforts among many partners, including other state agencies, federal agencies, tribes, nongovernmental organizations, local government, universities, landowners, and the private sector. Element 7 of the Eight Required Elements of a SWAP includes "coordinating, to the extent feasible, the development, implementation, review, and revision of the Action Plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats." Ongoing coordination will be a key component of SWAP 2015 implementation.

Key state and federal agencies that have been and/or are expected to be potential partners are listed below.

Key California Agencies with Natural Resource Responsibilities

- California Natural Resources Agency
- Department of Water Resources
- State Water Resources Control Board
- Wildlife Conservation Board
- Department of Forestry and Fire Protection
- Department of Parks and Recreation
- California Energy Commission
- Department of Transportation
- California Environmental Protection Agency
- California Coastal Commission
- State Conservancies (various)

Key Federal Agencies with Natural Resource Responsibilities

- U.S. Fish and Wildlife Service
- Landscape Conservation Cooperative
- National Marine Fisheries Service
- U.S. Forest Service
- Bureau of Land Management
- Bureau of Reclamation
- U.S. Geologic Survey
- Natural Resources Conservation Service
- National Park Service
- Minerals Management Service

7.5 Public Outreach Strategies

Element 8 of the Required Elements of a SWAP requires: "provisions to ensure public participation in the development, revision, and implementation of projects and programs. Congress has affirmed that broad public participation is an essential element of this process." During the preparation of the draft SWAP 2015, thirteen public scoping meetings were held throughout the state between October and December 2013. Over 500 people attended the meetings. Public input was sought to ensure that SWAP 2015 is adequately identifying major conservation issues in California and that the draft conservation strategies are appropriately addressing those impacts. Each meeting highlighted different regional habitats. Outreach materials discussing the various habitats included a PowerPoint presentation, a Fact Sheet handout, and a detailed wall poster for each region describing the conservation goals, sensitive species, environmental stresses, human pressures, and preliminary strategies and activities. The overview PowerPoint and a sample of a regional fact sheet and poster are provided in Appendix J. The matrix of public comments submitted during the scoping process and public review of the draft SWAP 2015 will be posted for public availability on the California SWAP website at https://www.wildlife.ca.gov/SWAP.

7.6 Adaptive Response to Emerging Issues

Natural communities, ecosystems, species population dynamics, and the effects of pressures and stresses on the environment are inherently complex. Wildlife and resource managers often are called upon to implement conservation strategies or actions based upon limited scientific information and considerable uncertainties. Conservation issues may emerge that were not anticipated during or following the preparation of SWAP 2015, or ecosystem and species outcomes may not materialize as expected.

Adaptive management is a key element of implementing effective conservation programs to address emerging issues and unexpected outcomes. CDFW's approach to adaptive management is codified in FGC section 13.5. It reads: "'Adaptive management,' unless otherwise specified in this code, means management that improves the management of biological resources over time by using new information gathered through monitoring, evaluation, and other credible sources as they become available, and adjusts management strategies and practices to assist in meeting conservation and management goals. Under adaptive management, program actions are viewed as tools for learning to inform future actions." Many of the conservation strategies presented in Chapters 4 and 5 include adaptive management procedures embedded in the approach.

As new information becomes available on the status of conservation targets and the effectiveness of conservation strategies, SWAP information will be updated. As described in Chapter 1, the *Open Standards for the Practice of Conservation* was used as the framework for designing strategies for conservation targets. The data supporting SWAP 2015 have been captured using the internet-based *Miradi* and *Miradi Share* software. The intent of this database and internet accessibility is to facilitate the ongoing update and sharing of the SWAP program data, including tracking progress on goals and objectives. A portal to the SWAP 2015 database has been posted at the California SWAP webpage (https://www.wildlife.ca.gov/SWAP).

Conservation actions recommended in SWAP 2015 will be assessed with monitoring to determine the outcome of implementation of the strategies, as described in Chapter 8. In some cases, monitoring of a few environmental variables will be sufficient. In other cases, such as a regional multispecies conservation effort, a major long-term comprehensive monitoring program will be needed. Chapter 8 summarizes current monitoring programs and addresses the steps and considerations needed to design a monitoring program in an adaptive management context. Chapter 8 also provides a process for establishing the monitoring program assessing the effectiveness of each recommended conservation strategy implemented under the SWAP.

7.7 Review and Revision

Element 6 of the SWAP elements required by USFWS directs each state to comprehensively review its plan at least every 10 years. In July 2007, the USFWS and Association of Fish and Wildlife Agencies (AFWA) distributed guidance on the requirements for the review (AFWA and USFWS 2007). AFWA also provided guidance for review and revision in their Best Practices report, including the definition of a comprehensive, major, or minor revision (AFWA 2012). All states must comprehensively review and revise, as needed, their original 2005 SWAPs by October 1, 2015 (or the date specified in their approved plans) and send the updated version and summary documentation to the USFWS.

SWAP 2015 is the required comprehensive review and update of SWAP 2005. The next comprehensive review and update will need to be completed no later than 2025, in accordance with Public Law 106-553 (U. S. Congress 2000). CDFW will continue to follow the USFWS/AFWA 2007 guidance and the 2012 AFWA Best Practices information, unless new information becomes available. Table 1 in the AFWA Best Practices report provides guidance regarding actions that would be helpful when conducting a review and revision to the SWAP (AFWA 2012).

Future comprehensive updates will include the summary documentation that will demonstrate the SWAP was examined and that all of the USFWS required elements are met, including an up-to-date public review process specified in Elements 7 and 8. If no changes are made, CDFW will document and explain why no changes were necessary and what process was used to make that determination. If changes are made, CDFW will provide a summary of the key revisions to USFWS and the public. Public participation will be a key element of future comprehensive reviews and revisions. A comprehensively reviewed SWAP will be republished in its entirety at the time it is submitted to USFWS, and it will be posted on the CDFW SWAP webpage with explanations about the review process and the summaries of key revisions.

In addition to the statutorily required comprehensive review and update every 10 years, ongoing reviews and revisions are part of the cyclical life of any long-term resources management plan and can enhance its relevancy and implementation. Although ongoing review and revision may burden staff resources and conservation partnerships, important changing environmental conditions or resource policies, or the evolution of best management practices, can warrant continuing review and revision as part of adaptive management.

If during the course of implementing SWAP 2015, a significant change occurs that requires revision of two or more elements of the plan, then CDFW will initiate a major revision to the SWAP. For instance, the addition of an SGCN would be a major revision, because it would require the state to substantially address multiple elements (e.g., habitats, threats, and strategies). Similarly, a revision of threat assessments conservation targets (e.g., vegetation types or watersheds) that are essential to conservation of the SGCN would be a major change, because it would likely result in modification and prioritization of conservation strategies. Major revisions do not "restart" the 10-year comprehensive review timeframe. CDFW will include public participation in a major revision process and will document any revisions for both submittal to USFWS and public posting on the CDFW SWAP webpage.

A minor revision, which is defined as changes to a single element, can also be undertaken at any time in coordination with USFWS. CDFW will send USFWS a letter describing the minor revision and post the letter on the CDFW SWAP webpage. Minor revisions are expected to involve narrow changes to the SWAP, such as technical clarifications, elaborations of existing conservation strategies, or the incorporation of new information that does not lead to substantial changes to SGCN, conservation targets, stresses, pressures, or conservation strategies. Because the revisions would be minor, a public participation process would not be needed.

8 Monitoring California's Conservation Strategies

Adaptive management is about continuous learning, not with the objective of finding the perfect final solution to a problem, but to navigate complexities, while keeping a direction toward improved environmental conditions.

Lisen Schultz and Ioan Fazey in Adaptive Management: A Practitioners Guide (Allan and Stankey, ed. 2009)

Natural communities, ecosystems, species population dynamics, and the effects of pressures or conservation actions on the environment are inherently complex. Wildlife and resource managers often need to engage in species or resource management even though scientific information may be incomplete and outcomes of the actions may be uncertain. Adaptive management is essential to implementing effective conservation programs in light of these challenges. Adaptive management of a conservation plan is a process to continually monitor and assess the environment, as well as the effect and effectiveness of conservation strategies, and to adjust the plan when improvement is needed to achieve the desired outcomes.

This chapter presents required Element 5 (monitoring) of the SWAP. The first section describes the statutory basis for how CDFW incorporates adaptive management into conservation planning and resource management. The second section describes the results of an evaluation of the implementation of the SWAP 2005, which were used to inform SWAP 2015. The third section describes the process for monitoring the effect and effectiveness of the conservation strategies included in SWAP 2015.

Monitoring Effects of Extreme Events on Wildlife

A comprehensive monitoring program to detect the response of fish and wildlife to major pressures and stressors involves a multi-level approach. One that includes consistent landscape scale change detection, as well as more intensive or focused research to determine cause and effects and response to management actions. The program must be able to mobilize quickly in order to gather key information of the effects of extreme events on natural communities and SGCN and respond appropriately with necessary conservation actions.

In response to the extreme drought situation in California, Governor Brown declared a Drought State of Emergency on January 17, 2014. Within weeks, CDFW redirected staff to step up efforts to assess the impact of the drought on SGCN and establish plans for priority conservation actions in coordination with conservation partners.

For fish, this included statewide weekly river and fish population monitoring, relocation and rescue prioritization for native species, and focused evaluations of fish at risk in the Central Valley and

Sacramento-San Joaquin Delta. The monitoring and rescue evaluations resulted in a regional focus on native cold water fishes, including species of trout, salmon, and steelhead and enhanced real-time water and fish monitoring in the Sacramento River and Delta. Other fishes (e.g., unarmored three-spine stickleback) and amphibians and wetland reptiles (e.g., western pond turtle) have also been of focus since January 2014. Fisheries management actions have also been employed in conjunction with environmental monitoring and fish relocations and rescues. These include critical habitat restoration projects in the Sacramento River Valley, development of a re-introduction plan for winter-run Chinook salmon in Battle Creek, enhancement and infrastructure improvement of trout and salmon hatcheries statewide, two public grant solicitations for habitat restoration projects to address the current and future droughts, feasibility studies to improve the use of field technology to monitor fishes and water condition (e.g., acoustic, passive integrated transponder [PIT], and satellite tagging and tracking), and two studies to evaluate white and green sturgeon population conditions in the Delta and Sacramento River.

For wildlife, this included assessing SGCN (amphibians, reptiles, birds, and mammals) to determine their relative vulnerability to drought impacts. To do this each species was scored based on three effect-risk categories: annual survival, reproduction, and food production; and three inherent-risk factors: life span, population size, and range size. This resulted in 48 taxa being identified as the most at risk from drought related conditions and an additional 65 taxa that might be at risk in the case of prolonged drought. To help focus attention on areas where management actions may be best employed, increased risk from drought-related pressures were also identified, such as risk from a reduction of agricultural water, risk from increased wildfires, risk from wildlife disease exposure, or reliance on managed wetlands. Examples of initial management actions included wetland management infrastructure improvements on state-managed wildlife areas and expediting the captive breeding program for the critically endangered Amargosa vole by rescuing voles from the rapidly drying marsh at the core of the species population.

8.1 Adaptive Management

The narrative presented in this section is excerpted and adapted from "*Incorporation of Adaptive Management into Conservation Planning and Resources Management*," (CDFW 2014). It is available at https://www.wildlife.ca.gov/Science-Institute.

Pursuant to Fish and Game Code (FGC) section 703.3, resource management decisions by CDFW should incorporate adaptive management to the extent possible. CDFW's intent is to improve the management of biological resources over time by incorporating adaptive management principles and processes, as appropriate, into conservation planning and resource management. This includes:

- designing monitoring, research, and/or assessment studies that are integral to an adaptive management framework;
- improving CDFW's knowledge base by synthesizing new information gathered through monitoring, research, assessment, and credible scientific sources; and
- regularly re-evaluating, based on the best available science, and adjusting, if needed, conservation and management strategies and practices to meet long-term goals.

In September 2012, Governor Jerry Brown signed Assembly Bill 2402 (Statutes of 2012, ch. 559, Sections 1-28) into law, which made a number of changes to the FGC. Among other provisions, the bill makes statements of policy relating to the use of ecosystem-based management, adaptive management, and credible science; and requires establishment of a Science Institute to assist CDFW and the Fish and Game Commission (Commission) in obtaining independent scientific review, advice, and recommendations to help inform their scientific work. Section 12 of the bill (FGC section 715, subdivision [b]) states that the objectives of the Science Institute shall include, but not necessarily be limited to, the following:

- providing independent scientific guidance on the scientific research, monitoring, and assessment programs that support CDFW and the Commission's work with fish and wildlife species and their habitats;
- providing the best available independent scientific information and advice to guide and inform CDFW and Commission decisions;
- promoting and facilitating independent scientific peer review;
- promoting science-based adaptive management; and
- ensuring scientific integrity and transparency in decision-making.

8.1.1 Definitions

Adaptive management is defined under several sections of the FGC and Water Code. These definitions are set out below.

- FGC section 13.5 (General Definitions. Added by Assembly Bill 2402, Statutes of 2012) – "'Adaptive management,' unless otherwise specified in this code, means management that improves the management of biological resources over time by using new information gathered through monitoring, evaluation, and other credible sources as they become available, and adjusts management strategies and practices to assist in meeting conservation and management goals. Under adaptive management, program actions are viewed as tools for learning to inform future actions."
- FGC section 90.1 (Marine Life Definitions) – "'Adaptive management,' in regard to a marine fishery, means a scientific policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that even if they fail, they will provide useful information for future actions. Monitoring and evaluation shall be emphasized so that the interaction of different elements within the system can be better understood."
- FGC section 2852, subdivision (a) (Marine Life Protection Act – Definitions) – "'Adaptive management,' with regard to marine protected areas, means a management policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and monitoring and evaluation shall be emphasized so that the interaction of different elements within marine systems may be better understood."

- FGC section 2805, subdivision (a) (Natural Community Conservation Planning [NCCP] Act – Definitions) – "'Adaptive management' means to use the results of new information gathered through the monitoring program of the plan and from other sources to adjust management strategies and practices to assist in providing for the conservation of covered species."
- Water Code section 85052 (Sacramento-San Joaquin Delta Reform Act of 2009 – Definitions) – "'Adaptive management' means a framework and flexible decision making process for ongoing knowledge acquisition, monitoring, and evaluation leading to continuous improvements in management planning and implementation of a project to achieve specified objectives."

U.S. Fish and Wildlife Service (USFWS) defines adaptive management as a systematic approach for improving resource management by learning from management outcomes. USFWS identifies the key aspects of adaptive management as: (1) helping science managers maintain flexibility in their decisions, knowing that uncertainties exist and provides managers the latitude to change direction; (2) improving understanding of ecological systems to achieve management objectives; and (3) taking action to improve progress towards desired outcomes (Williams et al. 2009).

Requirements of the Fish and Game Code

The NCCP Act (FGC section 2800 et seq.) mandates that all NCCPs integrate adaptive management strategies, in which the results of monitoring, research, and experimental habitat management feed-back into decision-making, mediating uncertainty, and improving the effectiveness of NCCP implementation over time (FGC section 2820, subdivisions [a][2], [8]). NCCP documents must include a description of the plan's comprehensive adaptive management and monitoring program(s). The FGC also includes legislative declarations and requirements concerning the use of adaptive management in conjunction with activities under the Marine Life Protection Act (FGC sections 2853 & 2856), the authorization of the taking of certain species in association with implementation of the Quantification Settlement Agreement (related to overall quantification, settlement, and transfer of various Colorado River water rights) (FGC section 2081.7), and trout management (FGC sections 1726.1, 1728 & 1729). The Marine Life Management Act, FGC sections 7050 to 7090, and specifically 7056(g) states "Fishery management decisions are adaptive and are based on the best available scientific information…" In addition, following the enactment of Assembly Bill 2402, the following definitions and provisions relevant to the conduct of adaptive management were added to FGC:

- FGC section 33 (Credible Science Defined) – "'Credible science' means the best available scientific information that is not overly prescriptive because of the dynamic nature of science, and includes the evaluation principles of relevance, inclusiveness, objectivity, transparency, timeliness, verification, validation, and peer review of information as appropriate. Credible science also recognizes the need for adaptive management, as defined in section 13.5, as scientific knowledge evolves."
- FGC section 43 (Ecosystem-Based Management) – "'Ecosystem-based management' means an environmental management approach relying on credible science, as defined in Section

33, that recognizes the full array of interactions within an ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation."

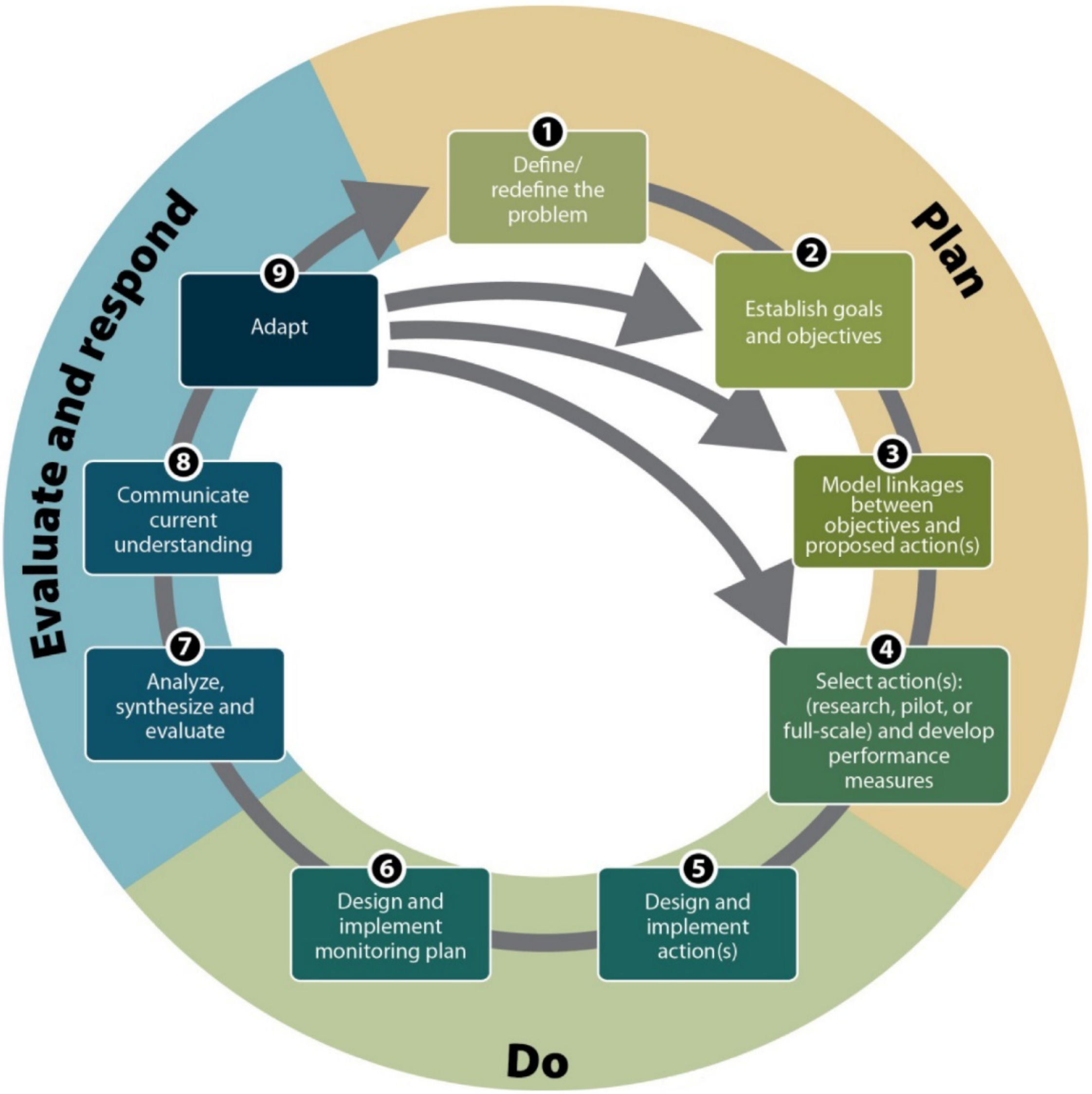
- FGC section 703.3 (Ecosystem-Based Management – Use Required in All Resource Management Decisions) – "It is the policy of the state that the department and commission use ecosystem-based management informed by credible science in all resource management decisions to the extent feasible. It is further the policy of the state that scientific professionals at the department and commission, and all resource management decisions of the department and commission, be governed by a scientific quality assurance and integrity policy, and follow well-established standard protocols of the scientific profession, including, but not limited to, the use of peer review, publication, and science review panels where appropriate. Resource management decisions of the department and commission should also incorporate adaptive management to the extent possible."

Requirements of the Water Code

The Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act) established as overarching state policy the coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem (Public Resources Code section 29702). The Delta Reform Act requires the Delta Stewardship Council to create and adopt a comprehensive and legally-enforceable management plan for the Delta (Delta Plan) to further the coequal goals (Water Code section 85300). Water Code section 85308, subdivision (f) states the Delta Plan must include "a science-based, transparent, and formal adaptive management strategy for ongoing ecosystem restoration and water management decisions." In addition, the Delta Plan must be based on and implemented using best available science (Water Code section 85302, subdivision [g]). The Delta Plan (Policy G P1, Delta Stewardship Council 2013) and its supporting regulations (California Code of Regulations, Title 23. Waters, section 5002) require the use of the best available science and incorporation of adaptive management into ecosystem restoration and water management programs, plans, or projects that are subject to the Delta Plan and regulations. This requirement is satisfied through both of the following: (1) the adaptive management plan for the project must use an approach consistent with the adaptive management framework described in the Delta Plan, and (2) the program, plan, or project must document that there is access to adequate resources to implement the adaptive management process and delineated authority by the entity responsible for implementing the process.

8.1.2 Principles and Processes of Adaptive Management

A rich literature regarding the theory and conduct of adaptive management exists and supports the principles and processes of adaptive management. While differences among the various frameworks exist, they generally contain three broad phases: *Plan*, *Do*, and *Evaluate and Respond* (Delta Stewardship Council 2013). Figure 8.1-1 provides a representative example of the adaptive management process, including the three broad phases and the individual steps within the process.



Source: Delta Plan (Delta Stewardship Council 2013).

Figure 8.1-1 A Three Phase (Nine-Step) Adaptive Management Framework

Adaptive management has become a well-established principle and process within the natural resource management community. An adaptive management approach provides a structured process that allows for taking action under uncertain conditions based on the best available science, and re-evaluating and adjusting decisions as more information is acquired. The structured decision-making process used in adaptive management, involving articulation of objectives, identification of management alternatives, predictions of management consequences, recognition of key uncertainties, and monitoring and evaluating outcomes, is what differentiates it from a trial and error approach (i.e., try something, and if it does not work, try something else) (National Research Council 2004; Williams 2011).

Implementation of adaptive management can be time-consuming and costly, but when it is appropriate and effectively applied, it has the potential to reduce uncertainty associated with management actions, provide long-term cost savings, and improve conservation and management effectiveness (Williams et al. 2009). It is worth noting that despite its intuitive appeal, the application of adaptive management in some circumstances has been less successful than one would expect (Gregory et al. 2006; Walters 2007; Allen and Gunderson 2011). Additionally, not all resource management decisions warrant the use of adaptive management (discussed further below). Nevertheless, the use of adaptive management for managing declining species may be particularly appropriate as adaptive management explicitly acknowledges and attempts to address the uncertainty inherent in managing species where basic biological information and an understanding of appropriate management strategies are often lacking (Fontaine 2011).

Challenges and Lessons Learned

In natural resource programs managed by CDFW, informal adaptive management has been used for decades. These programs typically consist of a resource management decision embedded in a management plan that includes species population objectives (e.g., harvest level recommendations in a timber harvest plan). These programs are supported by long-running population monitoring programs that are used to assess the results of previous management decisions and inform future management decisions.

An example of a well-established CDFW program that relies on adaptive management is the California NCCP Program. Effective conservation through regional habitat conservation plans, such as NCCPs, depends on their ability to confront the challenges of adaptively managing and monitoring complex ecosystems. Assessments of such plans indicate that adaptive management should include opportunistic learning, hypothesis testing, management, monitoring, and directing the results of analysis and assessment back into the program through decision makers (see Atkinson et al. 2004, page 6, for a schematic NCCP/Habitat Conservation Plan adaptive management feedback loop). The adaptive management framework implies an ongoing scientific commitment to the NCCP in perpetuity (Noss et al. 1997). This requires an institutional structure and process that remains flexible and is committed to scientific rigor and quality results (Atkinson et al. 2004).

The practice of building effective adaptive management programs for large-scale, multi-species NCCPs is an endeavor that continues to evolve. NCCPs in California are making real progress in designing adaptive management programs that work. For example, implementing partners of the San Diego Multiple Species Conservation Program (MSCP), through the San Diego Management and Monitoring Program, have demonstrated leadership in scientific collaborations and ecological applications that are informing strategic approaches to reserve management, monitoring, and habitat connectivity enhancement (details about the San Diego Management and Monitoring Program can be found at http://www.sdmmp.com/).

San Diego Multiple Species Conservation Program

The San Diego Multiple Species Conservation Program (MSCP) was approved in 1998 as a collaborative effort between federal, state and local agencies, property owners, development industry, environmental groups and other stakeholders to comprehensively plan for and conserve native habitat, plants, and animals (including threatened and endangered species) throughout southern San Diego County, while accommodating for continued economic development. The MSCP covers approximately 900 square miles within southwestern San Diego County, and is composed of 10 subarea plans.

The MSCP is a Natural Community Conservation Plan (NCCP), a state program which permits the "take" of species that are covered by an NCCP as long as their conservation is provided for thorough ongoing protection, management and monitoring of a reserve system consisting of large, interconnected habitat areas, which are preserved in perpetuity. The MSCP is also a Habitat Conservation Plan (HCP) under the federal Endangered Species Act (ESA). The MSCP was one of the first approved NCCPs, and was part of the original NCCP pilot program established in 1993 to emphasize the conservation of coastal sage scrub habitat in southern California and the many species that use this diminishing habitat, including the federally threatened coastal California gnatcatcher, the cactus wren, and southern western pond turtle.

The MSCP covers 85 species of plants and animals, including three mammals, 27 birds, five reptiles and amphibians, four invertebrates, and 46 plants. Of these, 31 species are listed as endangered or threatened under the ESA and/or California Endangered Species Acts (CESA). NCCPs conserve entire natural communities, thereby benefitting not only sensitive and covered species and preventing future listings, but also supporting a large suite of other species; as such, the MSCP may ultimately result in the protection of habitat for over 1,000 plant species, 380 animals species, and thousands of invertebrate species.

By the end of the 50-year term of the MSCP, over 171,000 acres of natural habitat will be permanently conserved. This reserve system, together with other adjacent reserve systems associated with other NCCPs (such as the San Diego Multiple Habitat Conservation Program, San Diego North and East County MSCPs [currently in preparation], and the Western Riverside County Multi-Species Habitat Conservation Plan), will allow for the regional conservation of covered species, wildlife movement, genetic exchange, and adaptation to changing conditions, including climate change.

SWAP 2005 acknowledged that data used to support the iterative process inherent in adaptive management comes from monitoring the effectiveness of conservation actions directed at species and natural systems. Therefore, monitoring that measures ecosystem condition and response of the ecosystem to both intentional (management actions) and natural perturbations is a critical piece of the adaptive management feedback loop (CDFG 2005). The steps for creating functional and scientifically defensible monitoring and adaptive management programs (Atkinson et al. 2004), as conceptualized and applied in SWAP 2005, are now being applied to conservation strategies under development for SWAP 2015.

Identifying When Adaptive Management Should Be Used

As identified above, certain CDFW activities are mandated by FGC to include an adaptive management program (e.g., FGC sections 2820 and 2856). FGC sections 33, 703.3, and 715 define and promote the use of adaptive management in resource management decisions, to the extent feasible, but do not further define those decisions or provide more specific guidance.

The adaptive management literature cautions that not all resource management decisions/actions are amenable to adaptive management (Gregory et al. 2006; Williams et al. 2009; Allen et al. 2011; Allen and Gunderson 2011; Williams 2011). For example, policy and technical documents prepared by the U.S. Department of Interior (DOI) state that for adaptive management to be operationally appropriate and effective, there must be a mandate to take action in the face of uncertainty, and there must be institutional capacity and commitment to undertake and sustain an adaptive program (Williams et al. 2009). If no decision is necessary, if there is little uncertainty about what management actions to take and what outcome to expect, or if management cannot be adjusted in response to what is learned, non-adaptive management approaches may be appropriate (Williams 2011).

The DOI technical guide (Williams et al. 2009) identifies several considerations for determining whether adaptive management represents a suitable approach to decision-making.

Adaptive management is most applicable when:

- A management decision, involving a choice between alternative actions, needs to be made.
- Decision-making is confounded by uncertainty about potential management impacts.
- The institutional capacity and commitment to undertake and sustain an adaptive program exists. For example, there is institutional support, including adequate and sustainable funding, to implement a monitoring program of sufficient intensity and scope to detect changes in biological response to management actions and to measure progress towards achieving management objectives.
- Stakeholders can be effectively engaged.
- Clear, measureable, and agreed-upon conservation or management goals and objectives can be established.
- Resource relationships and predicted management impacts, along with the associated uncertainties, can be explicitly represented in conceptual and/or quantitative models.
- A monitoring program can be designed to reduce uncertainty and inform decision making, and progress towards achieving the management objectives can be measured.
- Management actions can be adjusted in response to what has been learned (i.e., there are opportunities for iterative decision-making).
- The entire process fits within the appropriate legal framework (i.e., can be conducted in full compliance with applicable laws, regulations, and authorities).

SWAP 2015 uses the *Open Standards for the Practice of Conservation* framework, which is based on the principles of adaptive management.

8.1.3 Implementation of Adaptive Management

Increasing the use of adaptive management processes within CDFW will require a significant commitment to ensure that those charged with implementing adaptive management have the appropriate training, expertise, and resources (e.g., funding). A variety of technical resources is available and can serve as a foundation upon which CDFW can build and maintain the necessary infrastructure to support implementation of adaptive management. The effectiveness measures for the categories of conservation strategies explained in Section 8.3 provides details on how the SWAP intends to incorporate adaptive management into the implementation of the conservation strategies. Indicators were identified for each key ecological attribute to monitor the change in condition of the target over time and as a result of the conservation strategies (see Table 1.5-2 and Section 8.3).

8.2 Monitoring Effectiveness of SWAP 2005 Implementation

As part of developing SWAP 2015, Blue Earth Consultants, LLC (Blue Earth) performed a neutral, third-party, independent evaluation to assess the state's effectiveness in implementing the State and Tribal Wildlife Grant (SWG) Program and SWAP 2005 (Appendix I). The evaluation encompassed a wide range of criteria that measured the progress and effectiveness of SWAP implementation; identified major outcomes, key challenges, and areas for improvement; and, delivered recommendations to inform the development of SWAP 2015 update and its later implementation. The evaluation was critical in that the results is helping CDFW to align conservation efforts with the desired outcomes expressed in SWAP 2015 with high efficacy. This evaluation is part of the adaptive management process of SWAP itself.

Blue Earth undertook five primary activities to inform the evaluation. These activities included:

- developing an evaluation steering committee;
- reviewing documents on the past 81 SWG funded projects;
- interviewing 51 key staff and partners (28 CDFW staff including SWG recipients, five non-governmental organization [NGO] representatives, five non-CDFW government staff, four non-CDFW proposal partners, four SWAP evaluation steering committee members, four private funders, and one tribal member);
- conducting additional web-based research and document review; and
- synthesizing and analyzing gathered information.

8.2.1 Limiting Factors of the Evaluation

Blue Earth identified specific information gaps that affected the effectiveness and completeness of the evaluation. These included:

- lack of clear goals, objectives, metrics to measure progress of implementing conservation actions, and lack of identifying priorities for conservation actions in SWAP 2005;
- challenges differentiating between conservation actions recommended by SWAP 2005 and CDFW day-to-day actions;
- inadequate and inconsistent SWG proposal and reporting documentation;
- lack of awareness of SWAP across CDFW and non-CDFW staff and partners;
- limited connection between funding availability and amount of funds leveraged for SWAP 2005 implementation; and
- lack of explicit descriptions of SWG outcomes in grant documents.

8.2.2 Conservation Action Categories Used for SWAP 2005 Evaluation

SWAP 2005 identified statewide and regional conservation actions based on stressors found at the statewide and regional scales (SWAP 2005 defined "stressors" to mean problems and pressures that may adversely affect wildlife and their habitats). To determine if CDFW achieved specific conservation actions, Blue Earth synthesized both regional and statewide actions into 14 conservation action categories as found below.

- **Policies and Management Actions** includes activities such as facilitating integration of wildlife conservation needs into local or regional land-use planning, developing agricultural and rangeland Best Management Practices (BMPs) protocols that are compatible with ecosystem needs, assisting in the implementation of BMPs on working landscapes, and implementing conservation actions recommended in management plans and policies.
- **Enforcement** includes activities such as increasing funding and staffing (CDFW and non-CDFW agencies) to enforce regulations that protect the environment or prevent negative impacts to natural resources. Please note: Although we include the Enforcement category in our assessment of SWAP 2005 implementation, for SWG analyses, we do not include the Enforcement category because SWG funding cannot be utilized for enforcement activities.
- **Infrastructure, Land-use, and Permitting** includes activities such as permitting agencies, county planners, and land management agencies working together to ensure infrastructure and development projects avoid or minimize negative impacts on native species and habitats.
- **Habitat Conservation and Restoration** involves securing, restoring, or enhancing sensitive wildlife habitats or preserving key habitat linkages. Examples include restoring groundwater levels to support riparian vegetation, as well as protecting and restoring critical habitat linkages that assist wildlife movements or vegetation distribution shifts because of climate change.

- **Species Conservation and Restoration** involves protecting and recovering sensitive species. Examples include the CDFW and other agencies and organizations working together to implement region-wide recovery plans.
- **Coordination, Collaboration, and Stakeholder Engagement** involves partners working together to conserve natural resources and implement recommended conservation actions. Examples include securing co-funding for priority conservation actions, streamlining permitting processes, supporting data sharing, or implementing aligned management plans together to directly protect and restore wildlife and habitats.
- **Addressing Conservation Priorities and Stressors in SWAP 2005** includes efforts to address identified SWAP 2005 recommended conservation action priorities and emerging stressors directly. Examples of SWAP 2005 stressors include Growth and Development, Climate Change, Invasive Species, and Water Management Conflicts. (In SWAP 2015, the conditions described by the term, stressors, are identified by the terms, stresses or pressures.) Examples include coordinated control and eradication of invasive species and implementation of conservation plans that incorporate BMPs for addressing growth and development.
- **Education, Outreach, and Capacity-building** includes offering education on wildlife and habitat conservation, building capacity to implement conservation actions through staff training and new hires, and assisting local agencies and landowners in their planning and implementation of wildlife and habitat conservation efforts. Please note that the SWG program sets limitations on funding activities under this category, meaning only a small portion of SWG funding can be used to address Education, Outreach, and Capacity-building activities.
- **Wildlife Resource Assessment** involves scientific activities, for example, gathering baseline information on species or habitats, and identifying critical wildlife corridors to prioritize activities for habitat connectivity enhancement.
- **Conservation Planning/Plans** involve planning efforts and plans to conserve species, habitats, and ecosystem functions. Examples include development and implementation of regional plans such as HCPs, NCCPs, and species and habitat recovery plans.
- **Funding and Leveraged Funding** includes allocating adequate funding for conservation activities or working together to co-fund and/or leverage funding for shared priority projects to conserve natural resources.
- **Knowledge to Implement SWAP 2005** involves activities performed that increase relevant and applied science and information relevant to effective SWAP 2005 implementation. For example, conducting scientific studies to perform restoration activities and increasing available information for improving management efforts to recover species addressed under SWAP 2005. Many past activities focused on gathering baseline information on wildlife and associated habitats to support development of species and habitat conservation plans. Please note that this category also includes science and information collected through wildlife resource assessments.
- **Monitoring and Evaluation** involves having evaluation processes and tools in place for collecting relevant data and analyzing information to assess and understand trends in

natural resource conditions and effectiveness of SWAP implementation. For example, federal, state, and local agencies continue to collect and evaluate monitoring information to inform conservation action plans and decision-making.

- **Adaptive Management** involves having processes in place for strategically adjusting activities, conservation priorities, expectations, management activities, and decision-making to address SWAP 2005 recommended conservation actions more effectively as new information is acquired. For example, state and federal wildlife agencies and land managers endeavor to choose the most scientifically defensible projections of climate change impacts, identify responses to adapt their program activities, and achieve their program goals based on these adaptations.

Table 8.2-1 shows how these categories of conservation actions from SWAP 2005 correspond to the conservation strategy categories used in SWAP 2015.

Table 8.2-1 Comparison of SWAP 2005 Conservation Actions with SWAP 2015 Categories of Conservation Strategies

SWAP 2005 Conservation Action Categories	SWAP 2015 Strategy Category										
	Direct management	Data collection and analysis	Economic incentives	Environmental review	Land acquisition, easement, lease	Land use planning	Law enforcement, law and policy	Management planning	Outreach and education	Partner engagement	Training and technical assistance
Policies and Management Actions	X			X		X	X	X		X	
Enforcement							X				
Infrastructure, Land-use, and Permitting				X	X	X		X			
Habitat Conservation and Restoration	X				X						
Species Conservation and Restoration	X				X						
Coordination, Collaboration, and Stakeholder Engagement										X	
Addressing Conservation Priorities and Stressors in the SWAP 2005	X	X		X	X	X	X	X	X	X	X
Education, Outreach, and Capacity-building									X		X
Wildlife Resource Assessment		X									
Conservation Planning/Plans						X		X			
Funding and Leveraged Funding			X							X	
Knowledge to Implement SWAP 2005		X		X							
Monitoring and Evaluation		X									
Adaptive Management	X					X		X			

Conservation action categories used in SWAP 2015 can be further grouped into enabling conditions and implementing actions (Table 8.2-2). Enabling conditions include having the resources (human or financial), data, and information to implement conservation actions. Implementing actions are direct activities taken to promote conservation of natural and cultural resources that achieve the desired conservation goals, objectives, and outcomes. Although some conservation action categories may address both enabling conditions and implementation actions, they were grouped based on the category with which they most align.

Table 8.2-2 Classification of Conservation Action Categories in SWAP 2005 as Enabling Conditions or Implementation Actions

Theme	Conservation Action Category
Enabling Conditions	• Coordination, Collaboration, and Stakeholder Engagement • Education, Outreach, and Capacity-building • Wildlife Resource Assessment • Funding and Leveraged Funding • Knowledge to Implement the SWAP 2005
Implementation Actions	• Policies and Management Actions • Enforcement • Infrastructure, Land-use, and Permitting • Habitat Conservation and Restoration • Species Conservation and Restoration • Addressing Conservation Priorities Stressors in the SWAP 2005 under "major wildlife stressors identified by region" (SWAP 2005 stressors) • Conservation Planning/Plans • Monitoring and Evaluation • Adaptive Management

8.2.3 Key Findings of the SWAP 2005 Evaluation

Key findings from the evaluation of SWAP 2005 implementation primarily drew upon interviews and SWG document review. Together, the data collected indicated limited documentation of overall progress and results; however, a majority of interviewees indicated SWAP implementation is making a positive overall impact statewide as well as at the regional level.

Limiting factors (listed in Section 8.2.1) in the evaluation process hindered identification of strong linkages between SWAP implementation, progress, and results. For example, when statewide and regional interviewees described their familiarity with SWAP 2005, less than half of interviewees indicated familiarity with SWAP 2005 and its recommended conservation actions. Of these interviewees, more regional interviewees indicated familiarity with SWAP 2005 and its recommended conservation actions than statewide interviewees. (Statewide interviewees were people who could provide input related to SWAP implementation across the entire state or in more than one SWAP 2005 or CDFW region; regional interviewees were people who understood SWAP issues and implementation at a more localized or SWAP 2005 or CDFW regional scale.)

Key findings of the evaluation include:

- More regional interviewees indicated familiarity with SWAP 2005 and its recommended conservation actions than statewide interviewees.
- A majority of interviewees indicated SWAP implementation is making a positive overall impact at a statewide and regional level.
- Overall progress towards conservation action categories has been limited.
- Interviewees indicated progress made towards the conservation action categories of Habitat Conservation and Restoration; Coordination, Collaboration, and Stakeholder Engagement; and Knowledge to Implement SWAP 2005.
- Forty-five percent of CDFW and non-CDFW interviewees indicated progress in the conservation action categories addressing the theme of Enabling Conditions.
- The most common SWAP 2005 stressor addressed was climate change, followed by growth and land development.
- CDFW staff indicated more progress was made in all 13 categories (excluding Enforcement) than non-CDFW staff, with the most progress made in Conservation Planning/Plans; Coordination, Collaboration, and Stakeholder Engagement; and Habitat Conservation and Restoration.
- Almost 70 percent of the SWAP 2005-recommended conservation actions included Addressing Conservation Priorities and Stressors, but only 44 percent of CDFW staff and 17 percent of non-CDFW staff indicated progress had been made.

Evaluation of the nearly $37 million dollars in SWG funds indicated that state sources matched this federal funding with approximately $19 million. Despite fluctuations in the total federal funding, the state match amount remained relatively consistent across years and grants. Statewide projects received the most funding, while the SWAP 2005 Marine Region received the least funding and grants. The majority of grants focused on mammals and birds, while invertebrates received the least focus.

The evaluation found that implementation of the SWAP from 2005-2014 was successful at developing:

- applied science and research,
- internal and external collaborative efforts,
- existing restoration projects and conservation plans,
- dedicated staff with topical knowledge and expertise, and
- access to federal funding.

The areas of improvement for SWAP implementation were in achieving:

- financial capacity;
- sufficient human capacity;
- clear conservation priorities and objectives;

- clearly articulated vision, mandate, champion, and accountability process;
- streamlined process for SWG application and administration; and
- monitoring metrics to measure progress.

8.2.4 Recommendations from the SWAP 2005 Evaluation

The following recommendations for CDFW for SWAP 2015 development and implementation were developed as a result of the evaluation of SWAP 2005 implementation:

- articulate SWAP 2015 vision, conservation goals, objectives, and metrics to measure progress that will guide future implementation;
- increase, balance, and/or leverage additional state human and financial resources to achieve SWAP goals and objectives;
- develop a SWAP strategic work plan, identify a program home, and assign staff to champion implementation of SWAP strategies;
- monitor and evaluate changes in ecosystem health, stressors, as well as SWAP implementation effectiveness, context, and use in adaptive management;
- strengthen grant administration, application, and reporting processes to improve grant implementation effectiveness;
- improve SWAP recognition to increase buy-in, support, and implementation success; and
- increase and leverage human and financial capacity by fostering coordination and collaboration among agencies and with partners to implement the SWAP.

CDFW is implementing these recommendations in SWAP 2015. By using *the Open Standards for the Practice of Conservation* framework, conservation goals, objectives, and monitoring indicators are clearly articulated and adaptive management is built into the implementation process (see Section 8.3 for specific details). Statewide goals and vision were provided in the Introduction and Vision Chapter. By use of strategic partnerships and implementation of SWAP 2015 through cross-sector companion plans, CDFW will be able to more efficiently work with other agencies and organizations, saving human and financial resources, to achieve SWAP 2015 goals and objectives. A permanent position has been dedicated to SWAP 2015 which will evolve, following approval of the SWAP, from planning to implementation.

Because of the multi-disciplinary focus of the SWAP, which addresses fish, wildlife, plants, and invertebrates species plus terrestrial, freshwater aquatic, and marine habitats, finding a home for SWAP in one of the existing resource branches of CDFW (Fisheries, Wildlife, Water, Habitat Conservation Planning), could possibly limit its implementation in one or more of these key areas over time. SWAP's multi-disciplinary focus may benefit from its assignment to an overarching program with equal access to all resources branches, similar to that of the CDFW's Science Institute. Important duties for the SWAP program during the implementation phase should focus on tracking progress, monitoring and adaptive management, and planning development of new or needed conservations strategies and future revisions. This level of close coordination with CDFW staff and its partners, and SWG funding recipients will keep SWAP 2015 visible, relevant, and improving; while carefully tracking progress in this manner will enhance grant accountability and reporting.

8.3 SWAP 2015 Effectiveness Measure Framework

The following sections highlight effectiveness measures for conservation strategies that apply across all conservation efforts. CDFW has adopted an effectiveness measure framework for SWAP 2015 that is consistent with the *Open Standards for the Practice of Conservation* (http://www.conservationmeasures.org) and has been proposed by the Association of Fish and Wildlife Agencies (AFWA; 2011), consistent with CDFW mandates and the recommendations from the SWAP 2005 evaluation report. The selection of strategies and strategy categories are described in Chapter 4, and the specific conservation strategies for targets are identified in Chapter 5. This framework establishes a standardized and readily accessible monitoring and evaluation process to inform and guide SWAP implementation. Under the effectiveness measure framework, the information gathered through monitoring and evaluation can be used to identify successful strategies that should be continued and shared and also to identify less effective ones that should either be improved or abandoned. The effectiveness measure framework also provides a mechanism for CDFW to report on the status of SWAP implementation to USFWS, conservation partners, and the public.

SWAP 2015 employs three types of monitoring: (1) status monitoring, which tracks conditions of species, ecosystems, and other conservation factors (including negative impacts to ecosystems) over time; (2) effectiveness monitoring, which determines if conservation strategies are having their intended results and to identify ways to improve actions that are less effective (i.e., adaptive management); and (3) effect monitoring, addressing if and how the target conditions are being influenced by implementation of strategies. The effectiveness measure framework promoted by AFWA and adopted for SWAP 2015 brings these three types of monitoring together to (1) attribute changes in ecosystems and species status to the effectiveness of SWAP conservation strategies, and (2) roll up the results of many different strategies into statewide reports.

CDFW is using a "theory of change" to describe how strategies will lead to their ultimate desired outcomes and to measure systematically the effectiveness of the strategies. A limited set of effect and effectiveness measures for each type of strategy are identified to assess progress at key points in the implementation of strategies. CDFW will then collect, analyze, and share data on those measures to show what changes are induced by the strategy, whether or not the strategies are achieving the desired results, why they succeeded or failed or need additional monitoring to determine an outcome, and how implementation of the strategy could be improved over time under different conditions. This process of measuring effect and effectiveness, which is key to adaptive management, required CDFW to integrate monitoring into the design of the strategies themselves. The framework will not only allow CDFW to assess the effectiveness of the individual actions, but also assess and report on the cumulative effectiveness of key strategies across the state.

Teams have identified many conservation strategies to address pressures that affect hundreds of SGCN. Although each province's context is distinct, there are commonalities in the theory of change behind these strategies. For example, teams in one province may be promoting awareness of landowners to minimize the spread of invasive weeds in adjacent riparian areas while in another province teams may be promoting awareness of farmers to use BMPs to prevent run-off into wetlands. Although these two actions take place in different ecosystems, are implemented by different teams, and are aimed at reducing the negative impacts of different pressures on different ecosystems, both strategies involve outreach and education that are designed to raise awareness of a specific audience with the objective of changing their behaviors to help improve ecosystem conditions. These two conservation strategies have been grouped under a SWAP conservation category called "Outreach and Education," and standard effectiveness measures have been developed that allow these measures to be monitored, analyzed, and aggregated for evaluation across the conservation units, provinces, and the state.

For each SWAP conservation target, teams identified key ecological attributes (KEAs), indicators for each KEA to measure the viability of the target, and goals which state the desired result of implementing the SWAP strategies over the next 10 years (see definitions in the text box below). These goals will serve as the ultimate measures of effectiveness of strategies.

SWAP 2015 Categories for Conservation Strategies:

- Data Collection and Analysis
- Partnership Engagement
- Management Planning
- Direct Management
- Economic Incentives
- Environmental Review
- Land Acquisition, Easement, and Lease
- Land Use Planning
- Law and Policy
- Outreach and Education
- Training and Technical Assistance

Using the framework proposed by AFWA (2011) as a guide, CDFW has developed a list of common conservation categories and effectiveness measures. CDFW is using 11 SWAP categories for conservation strategies (see Chapter 4 for more details about these categories) that have been adapted from AFWA and are most commonly implemented under the SWAP. CDFW adapted the theories of change, represented as "results chains," developed by AFWA (2011; http://www.fishwildlife.org/files/Effectiveness-Measures-Report_2011.pdf) and the Conservation Actions and Measures Archetypes Library (CAML; http://www.miradishare.org) as the basis for determining effectiveness measures for each conservation strategy.

Results chains are graphical diagrams that map out a series of causal statements that link short, medium, and long-term results between an action and the ultimate goal related to the viability of the conservation targets. A results chain diagram and associated table are presented for each of the 11 conservation strategy categories (Figures 8.3-1 through 8.3-11). The left side of the results chain identifies the strategy category (shown as a yellow hexagon). From the strategy category, arrows lead to a sequence of anticipated intermediate results (blue rectangle), which are numbered. These numbers correspond to the rows in the associated table. The intermediate results may create the enabling conditions for another conservation strategy category or another strategy category may also support intermediate results (yellow hexagon with green text). Ultimately the strategy and intermediate results lead to a reduction in the pressure(s) (pink rectangle) acting on the conservation target (green oval). The table provides details for the results, objectives, and measures related to the intermediate results displayed in the diagram.

Important Definitions

Conservation Target (or Target): An element of biodiversity at a project site, which can be a species, habitat/ecological system, or ecological process on which a project has chosen to focus.

Goal: A formal statement detailing a desired outcome of a conservation project, such as a desired future status of a target. The scope of a goal is to improve or maintain *key ecological attributes* (defined below).

Indicator: A measurable entity related to a specific information need such as the status of a target/factor, change in a threat, or progress toward an objective. A good indicator meets the criteria of being measurable, precise, consistent, and sensitive.

Intermediate Result: A specific benchmark or milestone that a project is working to achieve en route to accomplishing a final goal or objective (in this case, "intermediate" typically refers to a temporal dimension).

Key Ecological Attribute (KEA): Aspects of a target's biology or ecology that if present, define a healthy target and, if missing or altered, would lead to the outright loss or extreme degradation of that target over time.

Objective: A formal statement detailing a desired outcome of a conservation project, such as reducing the negative impacts of a critical *pressure* (defined below). The scope of an objective is broader than that of a goal because it may address positive impacts not related to ecological entities (such as getting better ecological data or developing conservation plans) that would be important for the project. The set of objectives developed for a conservation project are intended, as a whole, to lead to the achievement of a goal or goals, that is, improvements of key ecological attributes. A good objective meets the criteria of being: results oriented, measurable, time limited, specific, and practical. If the project is well conceptualized and designed, realization of a project's objectives should lead to the fulfillment of the project's goals and ultimately its vision.

Pressure: An anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of targets. Pressures can be positive or negative depending on intensity, timing, and duration.

Project: A set of actions undertaken by a defined group of practitioners – including managers, researchers, community members, or other stakeholders – to achieve defined goals and objectives. The basic unit of conservation work.

Results Chain: A graphical depiction of a project's core assumptions, the logical sequence linking project strategies to one or more targets.

Strategy: A group of actions with a common focus that work together to reduce the negative impacts of pressures, capitalize on opportunities, or restore natural systems. A set of strategies identified under a project is intended, as a whole, to achieve goals, objectives, and other key results addressed under the project.

Stress: A degraded ecological condition of a target that resulted directly or indirectly from the negative impacts of *pressures* defined above (e.g., habitat fragmentation).

See Glossary in Chapter 11 for a complete set of definitions.

8.3.1 Effectiveness Measures - Data Collection and Analysis

The development and implementation of effective conservation strategies require that state natural resource managers and their partners have data available to them that answer specific resource management questions related to conservation targets and to the pressures that affect them. The results chain shown in Figure 8.3-1 outlines the steps to achieve the desired outcome. The critical first step in any data collection initiative is clearly defining the management needs and the questions the data collection and analysis will answer (1). As a result, the researchers address the relevant questions (2). This result will lead to the right data reaching the right people in the right format (3), who then apply it through recommending and implementing a course of action based on the data (4). Applying these practices to a data collection and analysis is anticipated to result in more effective conservation strategies that reduce the negative impacts of pressures and/or stresses (5) and improve or maintain the viability of conservation target(s) (6). Data collected may also be made accessible to others that might need them, and used to make other strategies more effective. Table 8.3-1 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Data Collection and Analysis category.

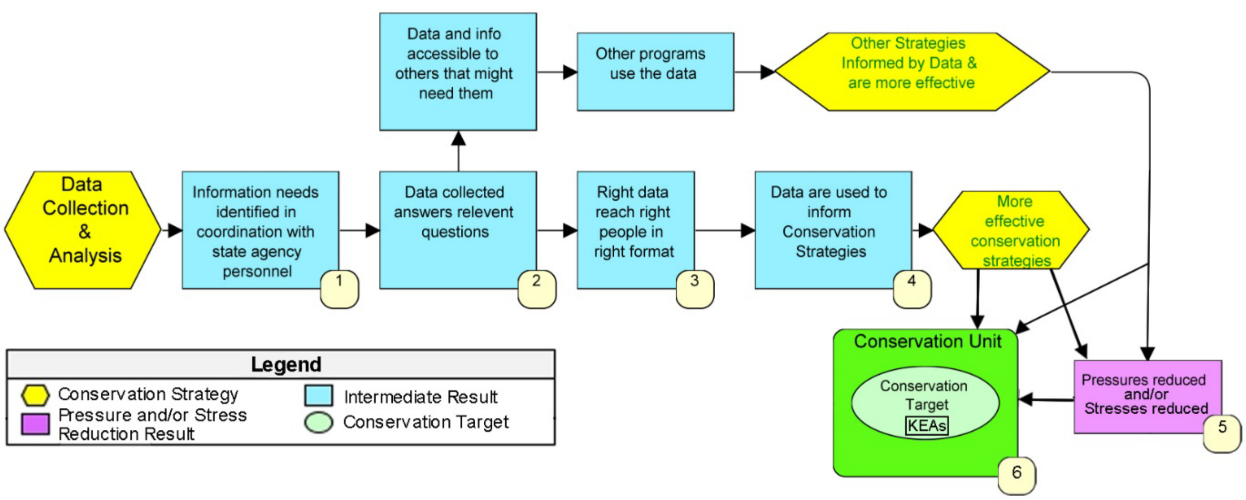


Figure 8.3-1 Results Chain for Data Collection and Analysis

Table 8.3-1 Results, Objectives, and Effectiveness Measures for Data Collection and Analysis

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. Information needs identified in coordination with state agencies	Clear management needs and outcomes that have been identified with input from relevant data users	Qualitative assessment that clear management needs and outcomes have been identified with input from relevant data users	% of data collection and analysis strategies for which objectives are met for information needs identified
2. Data collected answers relevant questions	By the end of the project/grant funding cycle the researcher clearly provides answers to relevant questions on needs identified	Qualitative assessment that the researcher clearly provides answers to relevant questions	% of data collection and analysis strategies for which objectives are met for data answering relevant questions
3. Right data reaches right people in right format	Within X months/years of start of research, appropriate audiences are accessing data	Qualitative assessment that data are reaching relevant audiences (by audience)	% of data collection and analysis strategies for which objectives are met for right data reaching the right people in the right format
4. Data used to inform more effective Conservation Strategies	Within X months/years of the end of the data collection project, recommendations to revise or maintain conservation strategies have been developed	Qualitative assessment that data are being used to inform more effective conservation strategies	% of data collection and analysis strategies for which objectives are met for data used for informing conservation strategies
5. Pressure(s) reduced and/or Stress(es) reduced	Within X years of the data collection, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
6. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-1.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.2 Effectiveness Measures - Partner Engagement

The Partner Engagement Category is a precursor that is intended to lead to the development and implementation of more effective conservation strategies. Shown in Figure 8.3-2, the outcomes that require partnership should be clearly identified as a result of partner engagement strategies (1). Identification of outcomes should result in the partners being identified and contacted (2), and engaged (3). If partners are engaged, then the assumption is that the desired outcomes for the partnership will be achieved (4), which will lead to the development and implementation of more effective conservation strategies. This practice should lead to a reduction in the negative impacts of pressures and/or stresses (5), which would improve the viability of the conservation target(s) (6). Table 8.3-2 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Partner Engagement category.

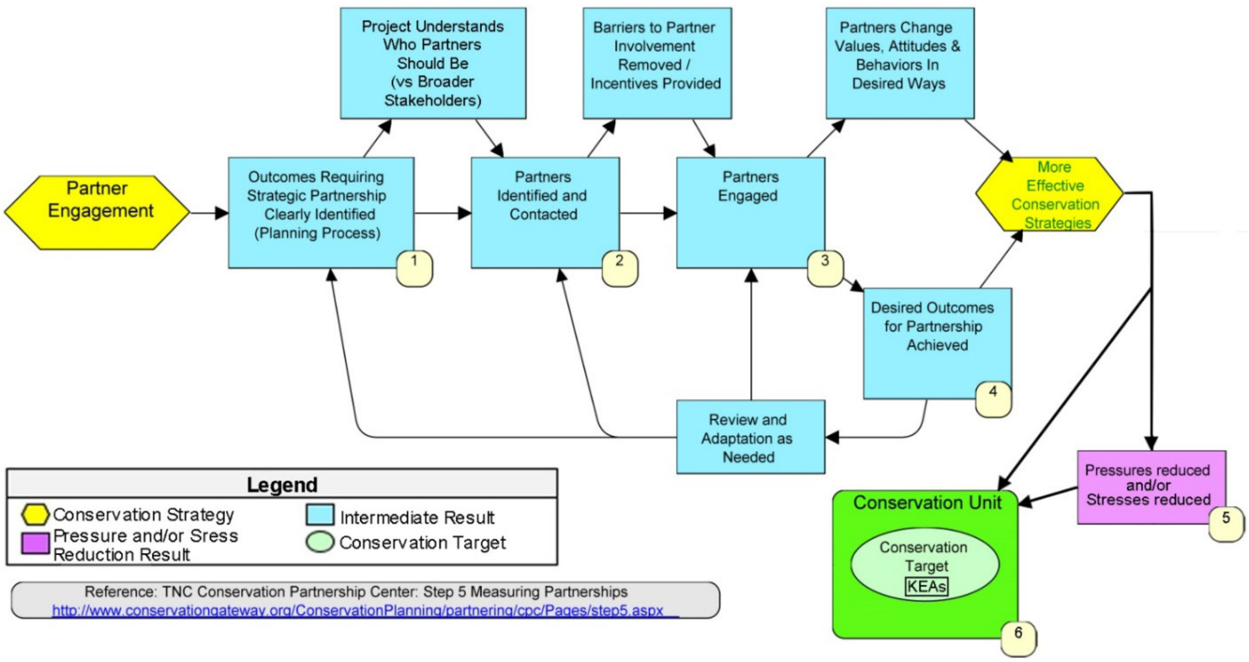


Figure 8.3-2 Results Chain for Partner Engagement

Table 8.3-2	Results, Objectives, and Effectiveness Measures for Partner Engagement		
Result*	**Objective****	**Specific Measure (Indicator)**	**Rolled Up Measure**
1. Outcomes Requiring Strategic Partnership Clearly Identified (Planning Process)	Before partnership is initiated, the outcomes requiring strategic partnership are clearly identified	Qualitative assessment of identification of outcomes for strategic partnership	% of Partner engagement strategies for which objective is met for outcomes identified
2. Partners Identified and Contacted	Before the partnership is initiated, partners are identified and contacted	Qualitative assessment of partners identification	% of Partner Engagement strategies for which objective is met for partners identified
3. Partners Engaged	At initiation of partnerships, the partners are engaged in the right way	Qualitative assessment of partners engaged	% of Partner Engagement strategies for which objective is met for partners engaged
4. Desired Outcomes for Partnership Achieved	At the end of the training, at least X% of trainees demonstrate minimum proficiency in the needed skills	Qualitative assessment of achievement of partnership objectives for more effective Conservation Strategies	% of Partner Engagement strategies for which objective is met for outcomes for more effective Conservation Strategies
5. Pressure(s) reduced and/or Stress(es) reduced	Within X years of the outreach or education, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
6. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-2.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.3 Effectiveness Measures - Management Planning

The results chain for the Management Planning Category describes the outcomes needed for developing management plans for conservation targets that will lead to the development and implementation of more effective conservation strategies (Figure 8.3-3). First, a "compelling" need for management planning should be identified (1) and then, as a result, the key stakeholders should be involved in developing or otherwise supporting the plan (2). As a result, a "complete" management plan is developed (3). A good planning process also considers and evaluates alternative strategies (4). Once the plan is developed, key agencies and stakeholders agree to implement the plan (5), which leads to more effective conservation strategies. If this happens, then the negative impacts of pressures and/or stresses will be reduced (6) leading the improved viability of the conservation target(s) (7). It is also important to monitor the status of the conservation targets and the relevant pressures, as well as the effectiveness of implemented actions to be able to adjust and adapt the plan as needed over time (8). Table 8.3-3 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Management Planning category.

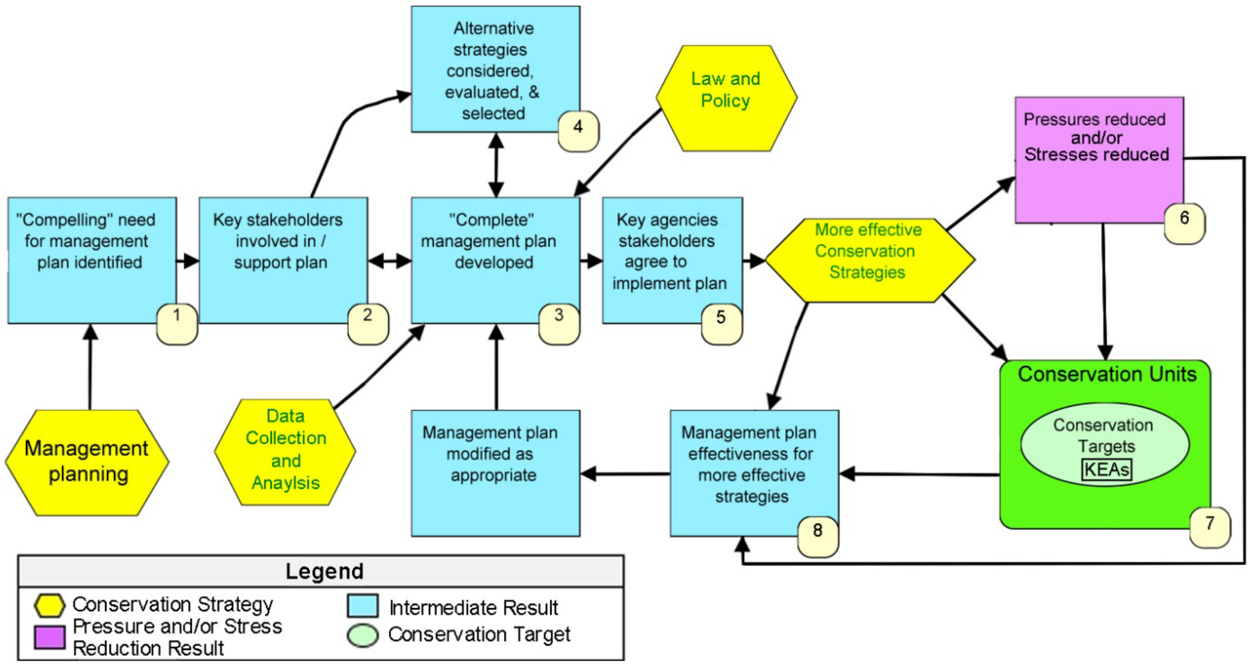


Figure 8.3-3 Results Chain for Management Planning

Table 8.3-3 Results, Objectives, and Effectiveness Measures for Management Planning

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. "Compelling" need for management plan identified	Before the planning work, an analysis of the situation is completed that outlines a "compelling" need for the management plan to meet specific and measurable threat reduction / restoration goals	Qualitative assessment of "compelling" argument developed: why plan is needed to meet specific and measurable threat reduction / restoration goals	% Management planning strategies for which objectives are met for need for plan identified
2. Key stakeholders involved in / support plan	Before drafting the plan, key agencies and other stakeholders are involved in drafting plan and/or supportive of the plan (or at least not hostile)	Qualitative assessment of "Key" stakeholder involvement in the plan	% Management planning strategies for which objectives are met for stakeholder involvement
3. "Complete" management plan developed	"Complete" management plan is developed that includes viability and threats analyses, situation analysis, SMART objectives, strategy recommendations, work plan, budget, and monitoring plan	Qualitative assessment of elements of management plan against standards for "complete" plan	% Management planning strategies for which objectives are met for complete plans developed
4. Alternative strategies considered, evaluated, and selected	Alternative strategies considered, evaluated, and selected based on includes viability and threats analyses, situation analysis, SMART objectives, strategy recommendations, work plan, budget, and monitoring plan	Qualitative assessment of elements of management plan against standards for "complete" plan (3)	% Management planning strategies for which objectives are met for complete plans developed
5. Key agencies / stakeholders agree to implement plan; key agencies / stakeholders actually implement agreed upon actions	Key agencies and other stakeholders receive the plan and agree to implement it in a timely basis	Qualitative assessment of degree to which responsible agencies incorporate plan elements into their own work plans and resource it appropriately	% Management planning strategies for which objectives are met for implementation of plans
6. Pressure(s) reduced and/or stress(es) reduced	Within X months/years of the improved management, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
7. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target
8. Management plan leads to more effectiveness conservation strategies	The plan is evaluated and updated on an ongoing basis on its effectiveness for leading to more effective conservation strategies	Qualitative assessment of appropriate monitoring and evaluation of effectiveness leading to more effective conservation strategies	% Management planning strategies for which objectives are met for plan leading to more effective conservation strategies

* Row numbers correspond to the results chain in Figure 8.3-3.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.4 Effectiveness Measures – Direct Management

Direct management is one of the most common and fundamental conservation strategies used by CDFW to manage ecosystems and their associated SGCN. In some cases before implementing a direct management action, a management plan may need to be completed or management is directed through the Commission process (yellow hexagon in green text, Figure 8.3-4), which has its own results chain (see Management Planning) and will inform the direct management strategy. Ideally, all direct management actions should be implemented, but that is not always possible. Part of the monitoring of implementation includes identifying the percentage of management actions that are being implemented over a predetermined time span. Upon implementation of direct management (1), the negative impacts of pressures will either be reduced or not reduced (2). If the negative impacts of pressures are reduced, then the stresses to the conservation targets will be abated (3). For climate adaptation strategies, this would mean that conservation targets that are sensitive to a climate change exposure would have greater resilience to that exposure, if other pressures that contribute to those stresses are reduced. If the negative impacts of pressures or resulting stresses are not reduced, then adjustments in the management action or in planning will be needed (4). If the negative impacts of pressures and/or resulting stresses are reduced (2 and 3), then the viability of the conservation target(s) is improved or maintained (5). Table 8.3-4 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Direct Management category.

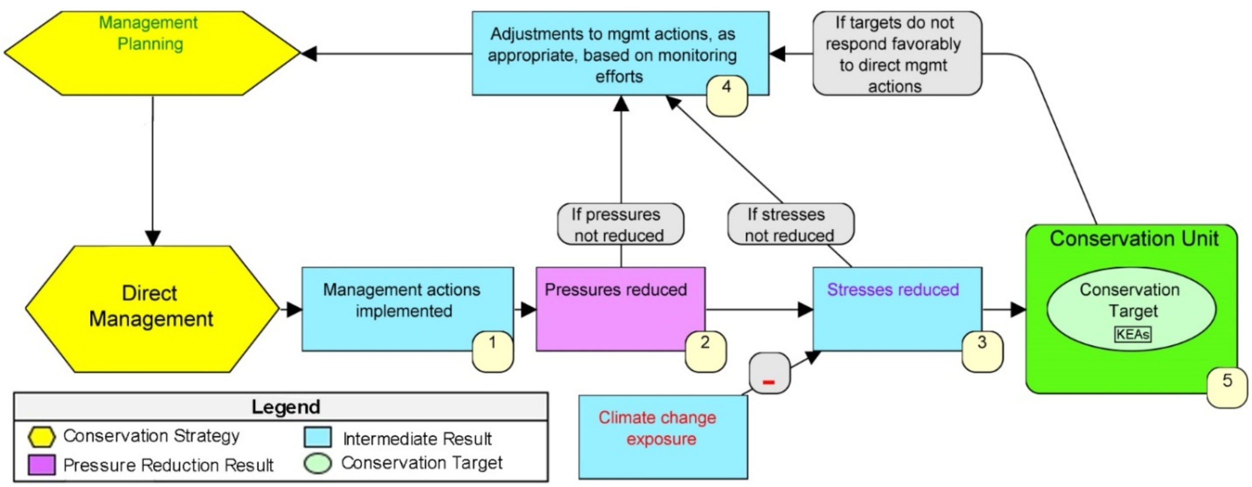


Figure 8.3-4 Results Chain for Direct Management

Table 8.3-4 Results, Objectives, and Effectiveness Measures for Direct Management

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. Management actions implemented	Within X months/years of receiving funding, at least X% of management actions are being implemented as planned	% management actions implemented as planned Progress status of management action	% management actions implemented as planned % management actions that fall into each category of progress status % complete of objectives for management actions implemented
2. Pressure(s) reduced	Within X years of the start of the management action, the desired pressure reduction is seen as a result of the management actions	Area affected by pressure(s) Pressure rating	% change in the area affected by the pressure(s) % pressures that fall into each rating category % complete of objectives for pressure reduction
3. Stress(es) reduced	Within X months/years of implementing direct management actions, the desired stress reduction is seen as a result of the management action	Area affected by the stress(es) Stress rating	% change in the area affected by the stress(es) % of stresses that fall into each rating category % complete of objectives for stress reduction
4. Adjustments to management actions, as appropriate, based on monitoring efforts	If the desired stress reduction is not seen as a result of the management action, then adjustment is made.	Qualitative assessment of adjustment is made to management action as a result of monitoring	N/A
5. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired status of KEA Area with desired status of KEA Viability status of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status % complete of goals for conservation target

* Row numbers correspond to the results chain in Figure 8.3-4.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.5 Effectiveness Measures – Economic Incentives

In the use of economic incentives, it is first expected that a project team would clearly define appropriate incentives for "good" stewardship that is designed to improve the status of conservation targets (Figure 8.3-5). If those are defined, then the next assumption holds that stakeholders or land managers receive those incentives (1). Those incentives can come in a variety of forms, including: compensation for stewardship or loss of income; assistance with efficient compliance with environmental regulations, which can save money and/or time; added value from "good" stewardship (e.g., ability to get certified, attract hunters, attract ecotourists); and technical assistance, which could also help them to apply for money or other incentives programs. Safe harbor agreements are another example of an incentive program in which CDFW and private landowners collaborate to conserve, protect, restore, and enhance listed species and their habitats. Assuming the stakeholders or land managers receive the incentives, then it is expected that they would continue "good" stewardship during the timeframe in which they are receiving the incentive (2). It is intended that the incentive provides the impetus to start or continue good management, but that stakeholders or managers would see benefits in continuing those practices over the longer term (3/4). Table 8.3-5 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Economic Incentives category.

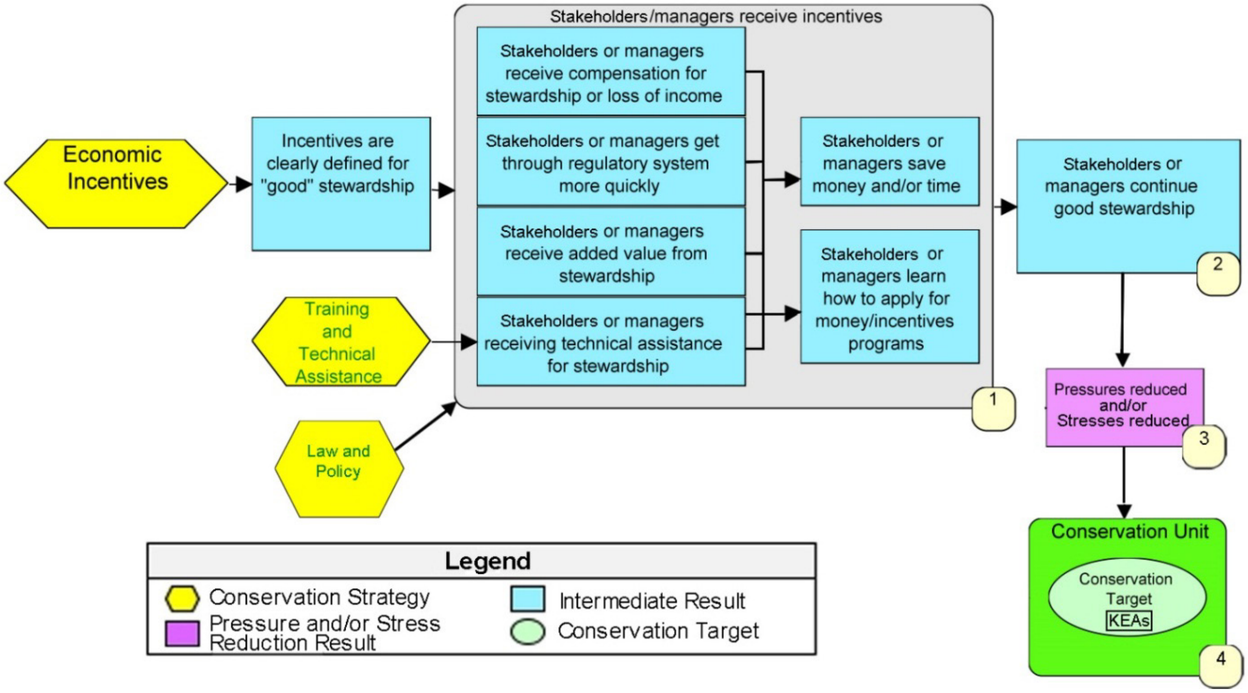


Figure 8.3-5 Results Chain for Economic Incentives

Table 8.3-5	Results, Objectives, and Effectiveness Measures for Economic Incentives		
Result*	**Objective****	**Specific Measure (Indicator)**	**Rolled Up Measure**
1. Stakeholders/ managers receive incentives	Within X timeframe, sufficient incentives are available to get enough stakeholders to participate	% of targeted stakeholders/ managers receiving incentives	% Economic incentive strategies for which objectives are met for incentives received
2. Stakeholders/ managers continue "good" stewardship	Within X timeframe of receiving the incentive, at least 90% of stakeholders/managers are complying with their incentive agreement	% of stakeholders/ managers who are complying with their incentive agreement	% Management planning strategies for which objective are met for "good" stewardship continued
3. Pressure(s) and/or stress(es) reduced	X Within years of receiving the incentive, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
4. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-5.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.6 Effectiveness Measures - Environmental Review

As outlined on the right-hand side of the results chain (Figure 8.3-6), the Environmental Review Category is fundamentally intended to avoid, minimize, or mitigate/compensate for pressures that may adversely affect conservation targets. The Environmental Review Category may be supported by laws and policy strategies that trigger reviews (0). Law and policy strategies have their own results chain. Important elements in this chain include the availability of sufficient staff expertise (1) and information (2) needed to conduct the review. Once the review has been completed (3), the recommendations can be delivered (4). The results chain diverges in the cases of statutory guidance in which the regulatory agency has the authority to require incorporation of recommendations (5a) versus voluntary guidance in which case no regulations require the implementer to comply with the agency recommendations (5b). Finally, if recommendations are incorporated, then the implementers apply the recommendations and modify their development plans or policies as appropriate (6). Monitoring, including evaluation of the effectiveness of how the implementers are applying the recommendations, reporting, and modification of the recommendations, may be needed, as well as verification or enforcement may be needed. If the recommendations are applied then the negative impacts of pressures are reduced or avoided (7), and the viability of the conservation target is improved or maintained (8). Table 8.3-6 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Environmental Review category.

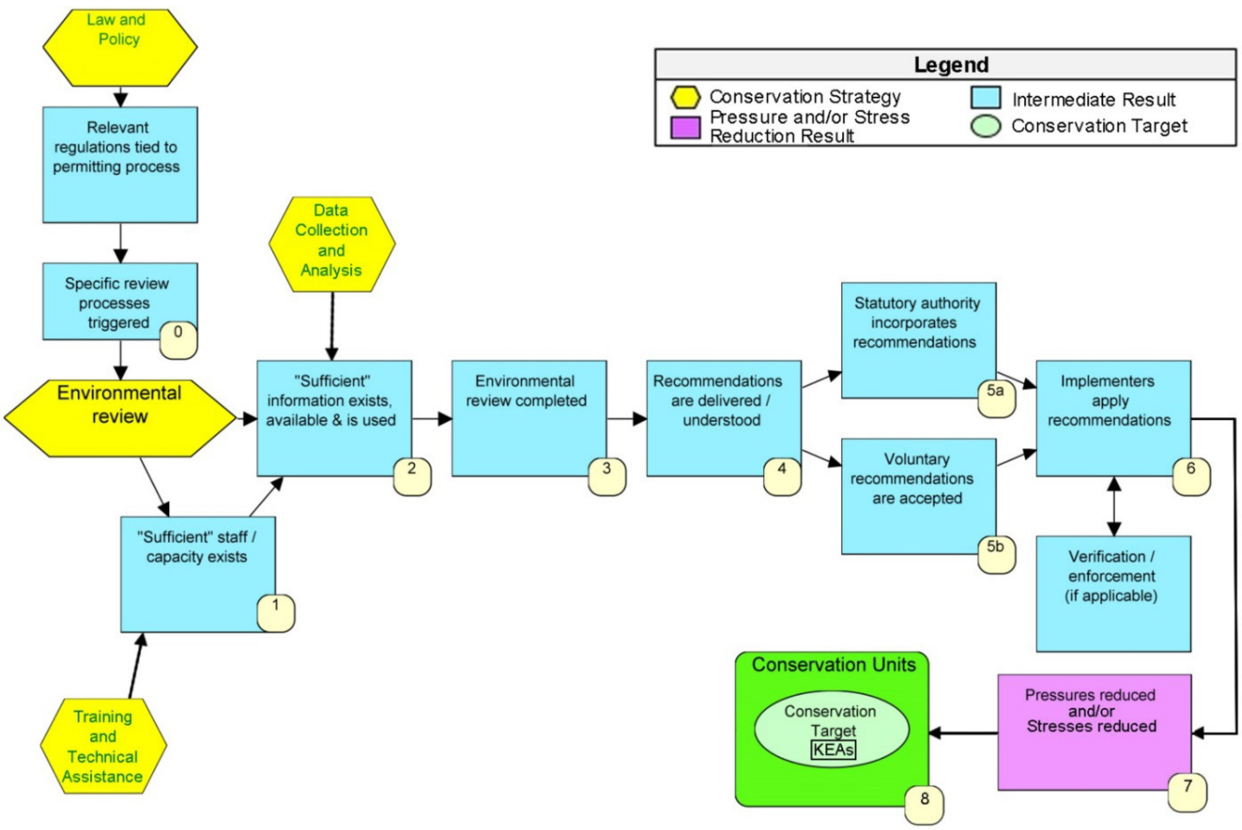


Figure 8.3-6 Results Chain for Environmental Review

Table 8.3-6 Results, Objectives, and Effectiveness Measures for Environmental Review

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. "Sufficient" staff / capacity exists	Following initiation of Environmental Review, reviewers ensure "sufficient staff" or capacity exists in terms of number of staff and the specific skills they possess	Qualitative assessment of available staff / capacity	None
2. "Sufficient" information exists, is available, and is used	Before the review, "sufficient" information about affected species and habitats, potential impacts and sites affected, mitigation/compensation options and alternatives are identified and accessible	Qualitative assessment of availability of information	None
3. Environmental review completed	Review completed within established deadlines that addresses all potential impacts / concerns, and makes recommendations for avoidance, minimization and/or compensation / mitigation as needed	Qualitative assessment of degree to which review is timely, complete, comprehensive	% of Environmental review strategies for which objectives are met for review completed
4. Recommendations are delivered / understood	Following review, recommendations are produced and communicated to the implementer in an appropriate fashion	Qualitative assessment of delivery of recommendations	None
5a. Statutory authority incorporates recommendations	Following the review, relevant permitting entity(ies) or regulatory agency(ies) accept and incorporate recommendations into their review/ permit process and documentation	Qualitative assessment of degree to which recommendations are incorporated into relevant permits and documentation	% of Environmental review strategies for which objectives are met for recommendation incorporated
5b. Voluntary recommendations are accepted	Following review, the project implementers agree to accept all recommendations	Qualitative assessment of degree to which recommendations are accepted by implementer	% of Environmental review strategies for which objectives are met for recommendations accepted
6. Implementers apply recommendations	Following review, the project implementers incorporate all recommendations into project plan or policy	Qualitative assessment of degree to which implementers apply statutory recommendations from the permitting agency into project plan or policy	% of Environmental review strategies for which objectives are met for recommendations applied
7. Pressure(s) and/or stress(es) reduced	Within X years of the environmental review, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
8. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-6.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.7 Effectiveness Measures - Land Acquisition, Easement, or Lease

As outlined in the results chain (Figure 8.3-7), the success of the conservation strategies in the Land Acquisition, Easement, or Lease Category depends on securing sufficient funds for the initial property transaction (1), identifying land or water with high conservation values (2), and then purchasing, leasing, or obtaining an easement for the prioritized lands or water rights (3). The agency then needs to develop a management and monitoring plan (4) and allocate funds to implement it (5). The agency next needs to implement management and monitoring work (6) to mitigating the negative impacts of pressures and/or stresses on the land (7). If the site or water is leased, over time the landowners need to renew the lease or convert to a more permanent form of protection (8a). If the site or water is placed under easement, the easement needs to stay in compliance (8b). If the negative impacts of pressures and/or stresses are reduced (7), then the viability of the conservation target(s) is improved or maintained (9). Table 8.3-7 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Land Acquisition, Easement, or Lease category.

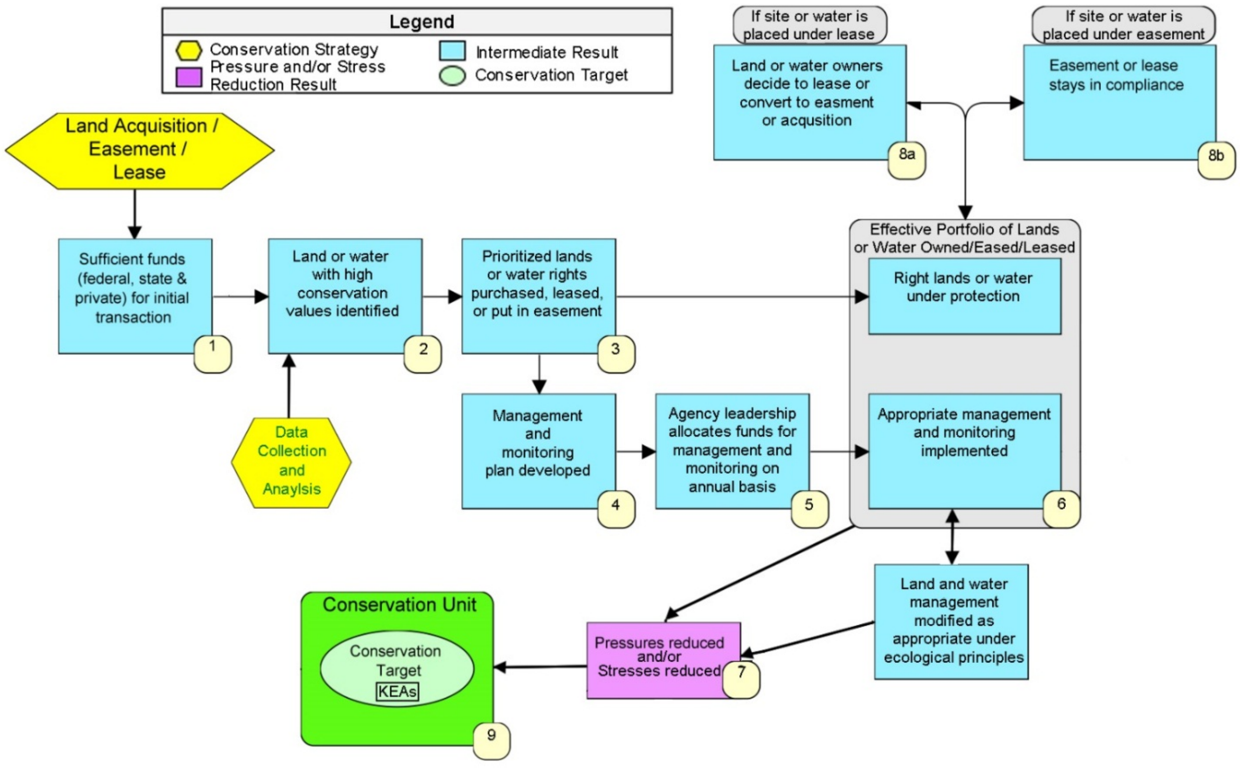


Figure 8.3-7 Results Chain for Land Acquisition, Easement, or Lease

Table 8.3-7 Results, Objectives, and Effectiveness Measures for Land Acquisition, Easement, or Lease

Results*	Objectives**	Effectiveness Measure (Indicator)	Roll-up measure
1. Sufficient funds are obtained for initial transaction	By (date), sufficient funds are obtained	Qualitative assessment of sufficient funds obtained	% of strategies for which objective is met for planned acquisitions/ easements/ leases receiving sufficient funds
2. Priority lands or waters with high conservation value(s) are identified	Within X months of obtaining funds, priority site(s)/water are identified	Qualitative assessment of prioritization	None
3. Priority lands or water rights are purchased, leased, or put in an easement	Within X months of obtaining funds, priority site(s)/water purchased, leased, or put in an easement	Qualitative assessment of lease renewal or conversion to easement or acquisition	% of strategies for which objective is met for prioritized land purchased, leased, or put into easement
4. Management and monitoring plan is developed	Within X month of transaction, management and monitoring plans are developed	Qualitative assessment of a management and monitoring plan that outlines steps required leading to desired conservation results	% of strategies for which objective is met for acquisitions/easements/leases that have management plans
5. Agency leadership allocates funds for management and monitoring on an annual basis	Within X months of transaction, agency allocates funds for management and monitoring	Qualitative assessment of adequate funding requested for management and monitoring annually	% of strategies for which objective is met for acquisitions/easements/leases that are managed annually
6. Appropriate management and monitoring implemented	At each annual review, property management is consistent with management plan	Qualitative assessment of appropriate property management per year	% of strategies for which objective is met for management actions implemented and for acquisitions/easements/leases
7. Pressure(s) and/or stress(es) reduced	Within X years of the start of the management action, the desired pressure reduction is seen as a result of the management actions	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s)and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
8a. Landowners decide to renew lease or convert to easement or acquisition	At the time of lease renewal, landowner decides to either: a) renew lease; b) convert least to easement; or c) offer leased land up for acquisition	Qualitative assessment of lease renewal or conversion to easement or acquisition	% of strategies for which objective is met for protected lands at the time of renewal that are: a) renewed; b) converted from lease to easement or c) converted to acquisition
8b. Easement or lease stays in compliance	At each annual review, easement or lease is shown to be compliant	Qualitative assessment of that lease is in compliance	% of strategies for which objective is met for acquisitions/easements/leases that are in compliance
9. Viability of conservation target improved	<u>Goal:</u> By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-7.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.8 Effectiveness Measures – Land Use Planning

As outlined in Figure 8.3-8, the Land Use Planning Category involves understanding the decision-making process and identifying a mechanism to inform decisions (1). It may also involve using data collection and analysis to identify wildlife needs and habitat priorities within the various political jurisdictions (2). Sufficient funds and resources must be available (2a). It is intended that these results will lead to approved land use plans that are consistent with input (3). If this happens as anticipated, it is expected that the land use plan is implemented consistent with input (4). If this happens, then the negative impacts of pressures will be reduced (5). If the negative impacts of pressures are reduced, then the stresses to the conservation target(s) will be abated (6). If other negative impacts of pressures or resulting stresses are not reduced, then adjustments in the land use planning actions will be needed (7). If negative impacts of pressures and/or resulting stresses are reduced (5 and 6), then the viability of the conservation target(s) is improved or maintained (8). Table 8.3-8 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Land Use Planning category.

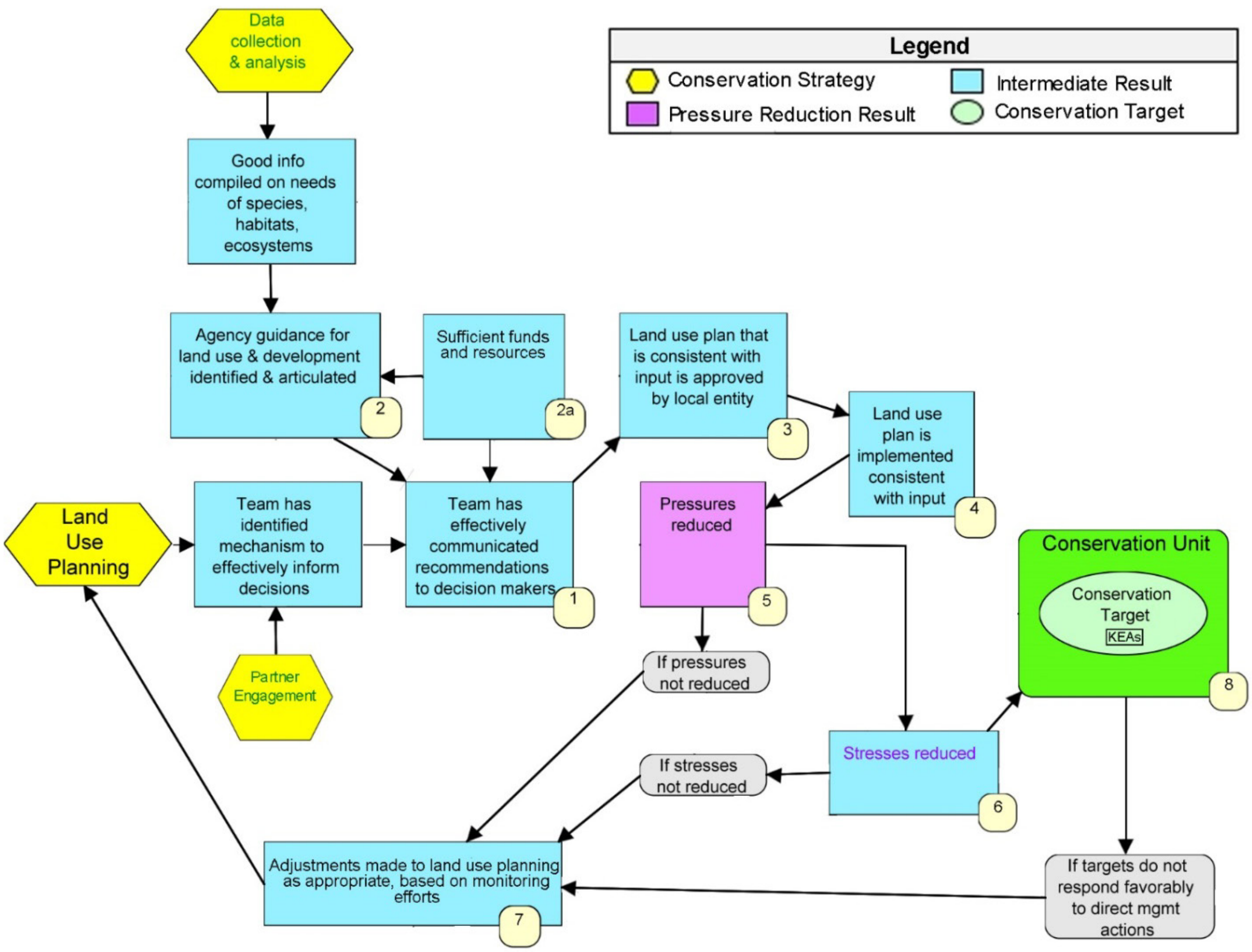


Figure 8.3-8 Results Chain for Land Use Planning

Table 8.3-8 Results, Objectives, and Effectiveness Measures for Land Use Planning

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. Team has identified mechanism to effectively inform decisions	Within X months/years of starting the land use planning initiative, there is a strategy in place for how to most effectively inform key decision makers	Qualitative assessment that a strategy is in place for how to most effectively inform key decision makers	% of Land Use Planning strategies for which objectives are met for evidence of a strategy in place for how to most effectively inform key decision makers
2. Agency guidance for land use & development identified & articulated	Within X months/years of starting the land use planning initiative, agency land use planning guidance is based on information resources describing the needs of species, habitats, and ecosystems, as well as identified priority places	Qualitative assessment that agency guidance is based on information resources describing the needs of species, habitats, and ecosystems, as well as identified priority places	% of land use planning strategies for which objectives are met for evidence that agency guidance is based on information resources describing the needs of species, habitats, and ecosystems, as well as identified priority places (% of each category identified)
2a. Sufficient funds and resources are available for data collection and land use planning to occur	By (date), sufficient funds are obtained	Qualitative assessment of sufficient funds obtained	% of strategies for which objective is met for land use planning receiving sufficient funds
3. Land use plan that is consistent with input are approved by local entity	Within X months/years of starting the land use planning initiative, key decision makers incorporate X% of recommendations into approved land use plan	% of recommendations incorporated into land use planning decisions	% of Land Use Planning strategies for which objectives are met for incorporating recommendations into land use planning decisions
4. Land use plan is implemented consistent with input	At each annual review, plan is implemented consistent with input	% of plan recommendations implemented consistent with input	% of Land Use Planning strategies for which objectives are met for recommendation being implemented consistent with input
5. Pressure(s) reduced	Within X years of the land use planning, the desired pressure reduction is seen	Area affected by pressure(s) Pressure rating	% change in the area affected by the pressure(s) % pressures that fall into each rating category % complete of objectives for pressure reduction
6. Stress(es) reduced	Within X months/years of implementing direct management actions, the desired stress reduction is seen as a result of the management action	Area affected by the stress(es) Stress rating	% change in the area affected by the stress(es) % of stresses that fall into each rating category % complete of objectives for stress reduction
7. Adjustments to land use plans, as appropriate, based on monitoring efforts	If the desired stress reduction is not seen as a result of the management action, then adjustment is made.	Qualitative assessment of adjustment is made to management action as a result of monitoring	N/A
8. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-8.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.9 Effectiveness Measures – Law and Policy

Table 8.3-9 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Law and Policy Category. The first step in any Law and Policy strategy, besides requiring substantial political and constituent support, is to gather input from appropriate agencies and/or stakeholders (1). As a result, the law or policy being approved will be consistent with agency and/or stakeholder input (2). This result will lead to the law or policy effectively being enforced (3), which results in improved compliance (4). Through improved legislation, regulations, policy, and enforcement, the negative impacts of pressures and stresses on conservation target(s) will be reduced (5) and improve or maintain the viability of conservation target(s) (6). Table 8.3-9 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Law, and Policy category.

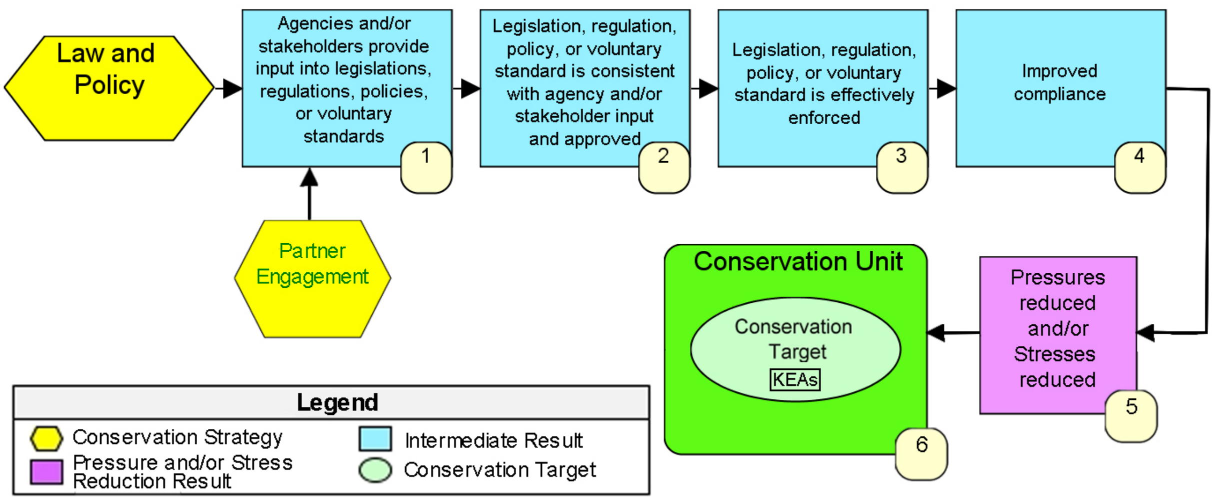


Figure 8.3-9 Results Chain for Law and Policy

Table 8.3-9 Results, Objectives, and Effectiveness Measures for Law and Policy

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. Agencies and/or stakeholders provide input into legislation, regulations, policy, or voluntary standards	Within X timeframe, input from relevant agencies and/or stakeholders is received	Qualitative assessment that clear input has been received on legislation, regulation, policy, or voluntary standard	None
2. Legislation, regulation, policy, or voluntary standard is consistent with agency and/or stakeholder input and approved	Within X month/years of improved knowledge, policies, laws, and regulations are improved and approved	Qualitative assessment of improvement in the specific policy and law	% law and policy strategies for which objectives are met for improvement in the policies or law
3. Legislation, regulation, policy, or voluntary standard is effectively enforced	Within X month/years of improved capacity, there an increase in the number of enforcement actions under the policy/law	% increase in the number of enforcement actions under the specific policy/law	% law and policy strategies for which objectives are met for improved enforcement
4. Improved compliance	Within X month/years of improved enforcement, there is improved compliance	% decrease in the rate of infringements	% law and policy strategies for which objectives are met for improved compliance
5. Pressure(s) and/or stress(es) reduced	Within X months/years of the improved compliance, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
6. Viability of conservation target improved	<u>Goal:</u> By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-9.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.10 Effectiveness Measures – Outreach and Education

This category involves providing information and materials to key resource users, with the expectation that they will use that information and material to adopt or reinforce behaviors supportive of SGCN and their habitats. As outlined in Figure 8.3-10, the start of any outreach initiative involves clarity about the target audience, messages they need to hear, and the most appropriate method of reaching them (1). The remainder of the chain follows a typical "knowledge-attitudes-practices" model for behavior change or reinforcement. If the audience receives the message (2), then the first expectation is that they will have the desired knowledge, attitudes, and values (3). This will, in turn, lead them to adopt or continue a practice that is consistent with the message (4). The practice should lead to a reduction in the negative impacts of pressures and/or stresses (5), which would improve the viability of the conservation target(s) (6). Table 8.3-10 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Outreach and Education category.

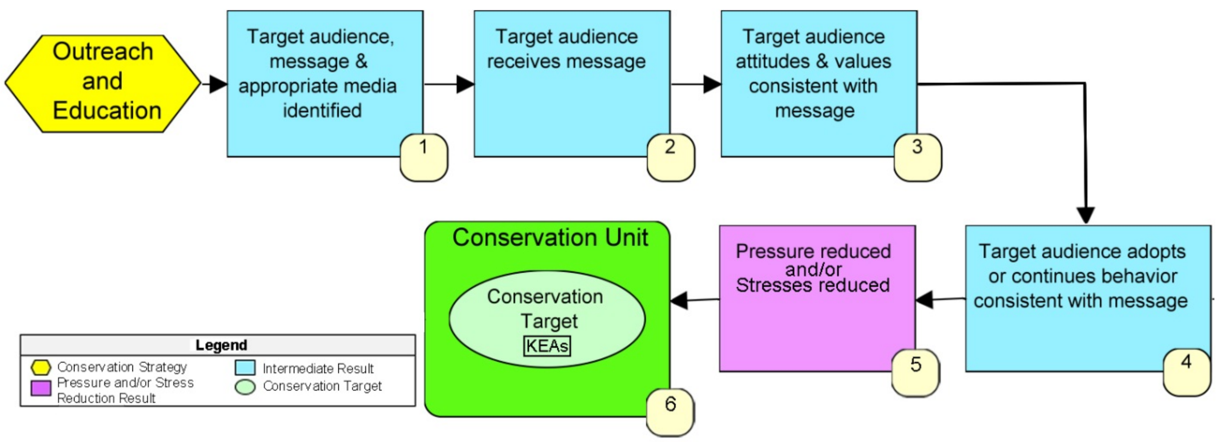


Figure 8.3-10 Results Chain for Outreach and Education

Table 8.3-10 Results, Objectives, and Effectiveness Measures for Outreach and Education

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. Target audience, message, and appropriate media identified	Before outreach or education is initiated, the target audience, message, and appropriate media are identified	Qualitative assessment of target audience, message, and appropriate media identified	N/A
2. Target audience receives message	Within X months/years of campaign, at least X% of target audience receives the message	% of target audience that receives message	% of Outreach and Education strategies for which objectives were met for target audience receives message
3. Target audience adopts attitudes and values consistent with message	Within X months/years of campaign, there is an increase from X% to Y% in target audience desired attitudes & values	% of target audience that has desired attitudes & values	% of Outreach and Education strategies for which objectives were met for target audience attitudes/values
4. Target audience adopts or continues behavior consistent with message	Within X months/years of start of campaign, there is an increase from X% to Y% in the amount of target audience that has adopted or continued the desired behavior	% of target audience that has adopted or continued desired behavior	% of Outreach and Education strategies for which objectives were met for target audience behavior
5. Pressure(s) and/or stress(es) reduced	Within X years of the outreach or education, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
6. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

* Row numbers correspond to the results chain in Figure 8.3-10.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

8.3.11 Effectiveness Measures – Training and Technical Assistance

The Training and Technical Assistance Category is defined as efforts to develop the skills for professionals, key stakeholders, or others to create and implement more effective conservation strategies. As shown in Figure 8.3-11, before developing and conducting the training sessions, a justification or compelling argument for training must be created, and specific skills to be delivered and audiences to receive these must be identified (1). Once these are determined, the curricula can be selected from existing sources or newly developed, and suitable trainers must be identified (2). Once the training itself takes place (3), trainees must demonstrate learning of the new skills (4) and then ultimately apply these skills (5) to development and implementation of more effective conservation strategies. As depicted in the Technical Assistance (TA) results chain, technical assistance follows a similar pattern to training, but focused more on solving immediate problems and practical skills delivery "on the ground" rather than developing capacity. First, a justification or compelling argument for technical assistance must be created, and specific skills to be delivered and audiences to receive these must be identified (1^+). Once these are determined, the modality and providers must be identified (2^+) before the technical assistance takes place (3^+). Once the technical assistance takes place, trainees must demonstrate learning of the new skills (4) and then ultimately apply these skills (5) to development and implementation of more effective conservation strategies. This practice should lead to a reduction in the negative impacts of the pressure (6), which would improve the viability of the conservation target (7). Table 8.3-11 lists the desired results of implementation, objectives, and indicators for the conservation strategies in the Training and Technical Assistance category.

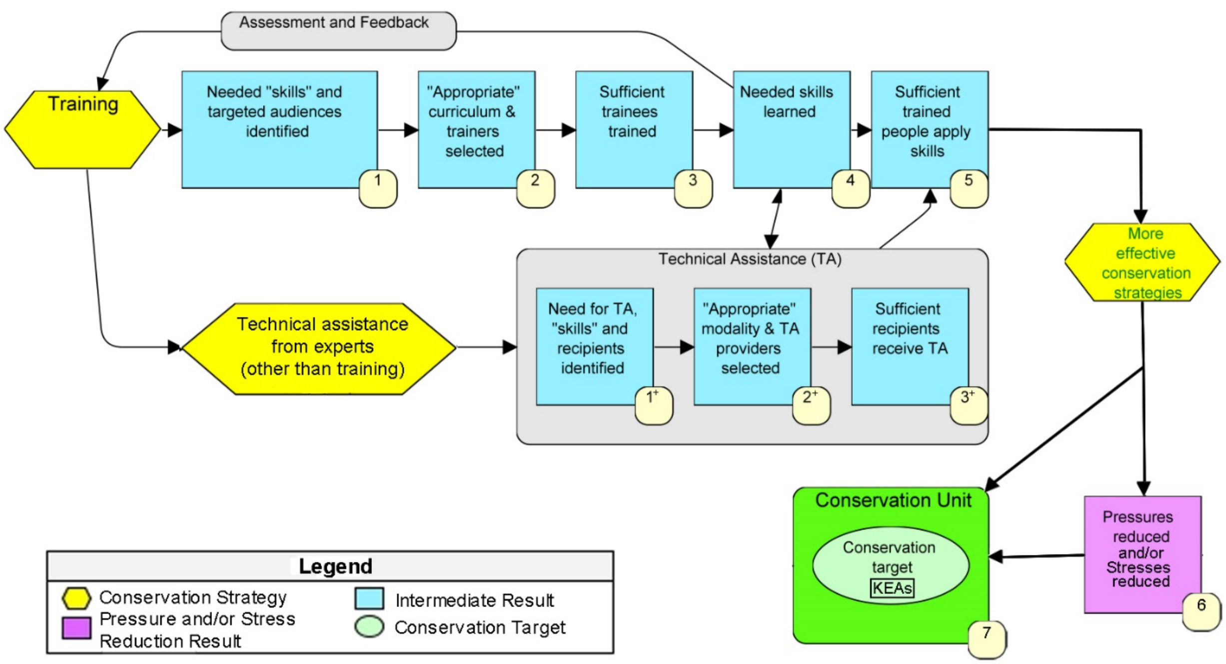


Figure 8.3-11 Results Chain for Training and Technical Assistance

Table 8.3-11 Results, Objectives, and Effectiveness Measures for Training and Technical Assistance

Result*	Objective**	Specific Measure (Indicator)	Rolled Up Measure
1. Needed "skills" and targeted audiences identified	Before training is initiated, a compelling argument is laid out for specific "skills" needed by specific targeted individuals who will reduce threats / do restoration	Qualitative assessment of "compelling" argument development, appropriate needs / skills to solve a pressing pressure reduction or restoration problem, and appropriate audience identified	% of Training & Technical Assistance strategies for which objective is met for needed skills and target audience
2. "Appropriate" curriculum selected and trainers selected	Before the training is initiated, an "appropriate" curriculum is selected or developed for the audience's learning style including delivery method, location, timing, examples and "appropriate" trainers are selected.	Qualitative assessment of "appropriate" curriculum development and trainers selected	% of Training & Technical Assistance strategies for which objective is met for curriculum and trainers selected
3. Sufficient trainees trained	At the end of the training period, X% of targeted individuals have attended required number of training modules	% of targeted audience trained	% of Training & Technical Assistance strategies for which objective is met for sufficient trainees trained
4. Needed skills learned	At the end of the training, at least X% of trainees demonstrate minimum proficiency in the needed skills	% of trainees demonstrating proficiencies	% of Training & Technical Assistance strategies for which objective is met for needed skills learned
5. Sufficient trained people apply skills	Within X months of the training, X% of trainees successfully apply their new skills at least once to appropriate problems Within X months of the end of the training, there are sufficient numbers of trained individuals to meet the pressure reduction / system restoration needs who are actively applying their skills	% of trained individuals applying skills % increase in capacity of people with skills	% of Training & Technical Assistance strategies for which objective is met for sufficient trained people applying skills
6. Pressure(s) and/or Stress(es) reduced	Within X years of the training or TA, the desired pressure and/or stress reduction is seen	Area affected by pressure(s) Pressure rating Area affected by the stress(es) Stress rating	% change in the area affected by the pressure(s) and/or stress(es) % pressures and/or stresses that fall into each rating category % complete of objectives for pressure and/or stress reduction
7. Viability of conservation target improved	Goal: By 2025, KEA has [desired condition] By 2025, area with desired condition of KEA has increased at least X% By 2025, desired condition of KEA is met (desired viability rating)	Desired condition of KEA Area with desired condition of KEA Viability rating of target	% change in the area with the desired status of KEAs % Conservation Targets showing improved viability status according to rating % complete of goals for the Conservation Target

Table 8.3-11 Results, Objectives, and Effectiveness Measures for Training and Technical Assistance			
Result*	**Objective****	**Specific Measure (Indicator)**	**Rolled Up Measure**
1+. Need for TA, "skills" and recipients identified	Before TA is initiated, a compelling argument is laid out for specific "skills" (skills, knowledge, advice) needed by specific targeted individuals that are needed to reduce pressures / do restoration	Qualitative assessment of "compelling" argument developed, appropriate needs / skills to solve a pressing threat reduction or restoration problem, and appropriate recipients identified	% of Training & Technical Assistance strategies for which objective is met for need for TA, "skills" and recipients identified
2+. "Appropriate" modality selected and TA providers selected	Before the TA is initiated, an "appropriate" modality is selected and TA provider(s) are selected	Qualitative assessment of "appropriate" modality selection and trainers selection	% of Training & Technical Assistance strategies objective is met for "appropriate" modality selected and TA providers selected
3+ Sufficient recipients receive TA	At the end of the TA period, X individuals have received needed TA	% of targeted recipients receiving TA	% of Training & Technical Assistance strategies for which objective is met for sufficient recipients receive TA

* Row numbers correspond to the results chain in Figure 8.3-11.
**The "X"s used to describe objectives indicate placeholders where specific numbers are to be developed for individual result chains and provide a template for the specific regional strategies.

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CDOF. See California Department of Finance.

CEC. See California Energy Commission.

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11 Glossary

Most terms in this section originate from the glossary in the Conservation Measures Partnership's (CMP) *Open Standards for the Practice of Conservation* (Version 2.0). These definitions are based on current usage by many CMP members, other conservation organizations, and planners in other disciplines. Some terms have been added or refined to clarify how CDFW uses them. Underlined entries are defined elsewhere in the glossary.

action: synonymous with task.

activity: a task needed to implement a strategy, and to achieve the objectives and the desirable outcomes of the strategy.

adaptive management: the incorporation of a formal learning process into conservation action. Specifically, it is the integration of project design, management, and monitoring, to provide a framework to systematically test assumptions, promote learning, and supply timely information for management decisions.

alluvium: clay, silt, sand, gravel, or similar detrital material deposited by flowing water

anadromous: refers to fish species that spend most of their lives in the ocean but migrate to freshwater rivers and streams to spawn.

anthropogenically created aquatic features: various human-made features that incidentally support native fish and/or amphibians including agricultural drainage ditches, irrigation canals, roadside ditches, flood control basins, borrow pits, railroad berms, golf course ponds, cattle stock ponds, and duck club ponds. These features were not created with the intent of providing fish or amphibian habitat.

animal unit month (AUM): the amount of forage needed by an "animal unit" (AU) grazing for one month. The animal unit in turn is defined as one mature 1,000-pound cow and calf, one horse, five sheep, or one steer.

anthropogenic: resulting from the influence of humans on nature.

aquatic: growing, living in, or frequenting fresh water, usually open water; compare with wetland.

aquatic refuge: a natural, human-modified, or constructed watercourse/waterbody that is specifically managed or created for the recovery/restoration/conservation of at-risk native aquatic species.

aquifer: an underground reservoir of water.

assumption: A project’s core assumptions are the logical sequences linking project strategies to one or more targets as reflected in a results chain diagram. Other assumptions are related to factors that can positively or negatively affect project performance – see also risk factor.

audit: an assessment of a project or program in relation to an external set of criteria such as generally accepted accounting principles, sustainable harvest principles, or the standards outlined in this document. Compare to evaluation.

bay: a body of water connected to an ocean or lake, formed by an indentation of the shoreline.

benthic: living on or near the bottom of a body of water.

bioaccumulation: the uptake and concentration of chemicals by living systems.

biodiversity: the full array of living things.

biodiversity target: a synonym for conservation target.

biological diversity: the variety of life over some spatial unit, used to describe all aspects of the broadly diverse forms into which organisms have evolved, especially including species richness, ecosystem complexity, and genetic variation.

biomes: areas on the earth with similar climate, plants, and animals, classified according to the predominant vegetation and characterized by adaptations of organisms to that particular environment.

bioregion: an area that includes a rational ecological community with characteristic physical (climate, geology), biological (vegetation, animal), and environmental conditions.

browse: 1. tender shoots, twigs, and leaves of trees and shrubs and grass that are available and acceptable to grazing animals (see also forage); 2. to feed on browse, graze.

California Legacy Project: an initiative that involves a broad range of government agencies and citizen organizations working together to develop a suite of tools and maps to help Californians make important decisions about conserving and protecting the state's working lands and natural resources.

California Wildlife Habitat Relationships System (CWHR): an information system and predictive model for California's wildlife containing range maps and habitat relationship information on all of the state's regularly occurring amphibians, reptiles, birds, and mammals.

canopy: the cover provided by a layer of vegetation, such as overstory trees in a forest.

cavity nesting: a type of bird species that nests in holes (cavities) in trees. They are divided into two groups. Primary cavity nesters excavate their own holes in trees and snags, while secondary cavity nesters are dependent upon natural cavities or abandoned sites excavated by primary cavity nesters.

cienega: water-saturated and poorly drained wetland areas associated with perennial spring and seep systems in isolated arid basins of the southwest. Cienega habitats are unique to the desert west and are rapidly disappearing.

clearcutting: a silvicultural method in which all trees in a designated area are removed in one operation.

climate change adaptive capacity: a measure of the ability of a system or species to respond to climate change with minimal disruption. Adaptive capacity is an intrinsic characteristic of a system, but even for systems with relatively high adaptive capacity, landscape context (e.g. location within the broader landscape, habitat patch size, proximity to range limit) may affect the ability of a system to realize this adaptive capacity.

climate change vulnerability: refers to the degree to which an ecological system, habitat, or individual species is likely to be negatively affected as a result of changes in climate and often dependent on factors such as exposure, sensitivity, and adaptive capacity.

climate exposure: a measure of the direction, magnitude, and variability of a change in climate and the associated effects of a system, habitat, or species is likely to experience. Examples of climate change exposure include the following:

- changes in CO_2 concentrations;
- changes in temperature and precipitation (averages, extremes, or timing);
- sea level rise;
- change in the frequency/intensity of disturbance events (e.g., fire, flooding events, droughts); and
- changes in hydrology (e.g., groundwater tables, runoff and river flow)

climate sensitivity: a measure of whether and how a system or species is intrinsically tolerant to changes in climate or dependent on a particular climate regime such that changes in climate would adversely affect the condition of the target. In other words, for a sensitive target, a change in exposure generates a stress on a key ecological attribute of the target. Examples of sensitivities at the habitat-level (here defined by dominant vegetation) include the following:

- dependence on particular temperature or moisture conditions;
- dependence on a particular disturbance regime (e.g., fire, flooding events, drought) or on a lack of disturbance;
- sensitivity to changes in CO2 concentration; and
- dependence on timing of abiotic phenological events (e.g., snow melt, peak spring flows, etc.).

commensal: having benefit for one member of a two-species association but neither positive nor negative effect on the other.

Community of Practice: a group of practitioners who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.

competition: occurs when two or more organisms have the potential for using the same resource. Competition may be between individuals of the same species or between two or more different species.

conceptual model: a diagram that represents relationships between key factors that are believed to impact or lead to one or more conservation targets. A good model should link the conservation targets to pressures, opportunities, stakeholders, and intervention points (factors – pressures, opportunities, or targets – in a conceptual model where a team can develop strategies that will influence those factors). It should also indicate which factors are most important to monitor.

conifer: trees belonging to the order Gymnospermae, comprising a wide range of trees that are mostly evergreens. Conifers bear cones and have needle-shaped or scalelike leaves. In the wood products industry, the term "softwoods" refers to conifers.

conservation: the use of natural resources in ways such that they may remain viable for future generations. Compare with preservation.

conservation bank: privately or publicly owned land that is permanently protected and managed for its natural resource values. A conservation bank operator may sell habitat credits to developers who need to satisfy legal requirements for mitigating environmental impacts of development projects. Conservation banks must be approved by such wildlife agencies as CDFW and USFWS.

conservation target: an element of biodiversity at a project site, which can be a species, habitat/ecological system, or ecological process on which a project has chosen to focus. Synonymous with biodiversity target.

conservation unit: a spatial unit in which the conservation objects called targets were selected, their conditions analyzed and the conservation strategies developed. There are three types of conservation units; terrestrial, aquatic, and marine. Terrestrial units consist of ecoregional areas called "section" defined by USDA (http://www.fs.fed.us/rm/ecoregions/). Aquatic units are watersheds defined by USGS as HUC4 (http://water.usgs.gov/GIS/huc.html). Marine units are adopted from the Marine protection Area defined under the Marine Life Protection Act (MLPA) (http://www.dfg.ca.gov/marine/mpa/mpa_summary.asp).

contributing factor: a behind the scene socio-economic factor that contributes to produce pressures.

critical pressure: pressure that have been prioritized as being the most important to address.

distribution: the pattern of occurrences for a species or habitat throughout the state; generally more precise than range.

disturbance regime: the characteristic pattern of natural- or human-caused events that disrupts the current physical and biological conditions of an area, such as floods, fires, storms, and human activity.

down logs: trees, limbs, or trunks that have fallen and are at least 10 feet long and at least 10 inches in diameter as measured on the large end.

driver: a synonym for factor.

ecological integrity: the degree to which the components (types of species, soil, etc.), structures (arrangement of components), and processes (flows of energy and nutrients) of an ecosystem or natural community are present and functioning intact. Lands with high ecological integrity generally have not been subjected to significant human influences or disruption of natural processes, such as fire, floods, or nutrient and hydrological cycling.

Ecological Reserve: designation given to certain lands owned or managed by CDFW as a way of regulating appropriate use. This designation is usually reserved for land with special status plants, animals, or vegetation types. Compare with Wildlife Area.

ecosystem: a natural unit defined by both its living and non-living components; a balanced system for the exchange of nutrients and energy. Compare with habitat.

ecosystem function: the operational role of ecosystem components, structure, and processes.

ecosystem health: the degree to which a biological community and its nonliving environmental surroundings function within a normal range of variability; the capacity to maintain ecosystems structures, functions, and capabilities to provide for human need.

ecosystem processes: the flow or cycling of energy, materials, and nutrients through space and time.

ecosystem services: the beneficial outcomes for the natural environment or for people that result from ecosystem functions. Some examples of ecosystem services are support of the food chain, harvesting of animals or plants, clean water, or scenic views. For an ecosystem to provide services to humans, some interaction with, or at least some appreciation by humans, is required.

ecosystem structure: spatial distribution or pattern of ecosystem components.

enabling condition: a broad or high-level opportunity within a situation analysis. For example, the legal or policy framework within a country.

endangered species: any species, including subspecies or qualifying distinct population segment, which is in danger of extinction throughout all or a significant portion of its range.

endemic: found only in a specified geographic region.

endemism: a measure of distribution for those taxa that are found only in one specific area, such as one region or the state itself. A region of high endemism has many taxa restricted to it.

estuary: an area in which salt water from the ocean mixes with flowing fresh water, usually at the wide mouth of a river.

evaluation: an assessment of a project or program in relation to its own previously stated goals and objectives. See monitoring and compare to audit.

evolutionarily significant unit (ESU): refers to a genetically distinct population segment of a species. An ESU is protected under the federal Endangered Species Act, which defines species to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife, which interbreeds when mature."

excessive livestock grazing: livestock grazing at a frequency or intensity that causes degradation of native plant communities, reduces habitat values for native wildlife species, degrades aquatic or other ecosystems, or impairs ecosystem functions. (The term "overgrazing" has a different meaning; it is usually used in referring to the productivity of the forage crop and range condition).

exotic species: a species of plant or animal introduced from another country or geographic region outside its natural range; non-native.

extinct: refers to a plant or animal or vegetation type that no longer exists anywhere.

extirpated: refers to a plant or animal or vegetation type that has been locally eliminated but is not extinct.

factor: a generic term for an element of a conceptual model including pressures, opportunities, and associated stakeholders. It is often advantageous to use this generic term since many factors – for example tourism – could be both a threat and an opportunity.

fauna: refers to all of the animal taxa in a given area.

fen: low land covered wholly or partly with water.

fire frequency: a broad measure of the rate of fire occurrence in a particular area.

fire regime: a measure of the general pattern of fire frequency and severity typical to a particular area or type of landscape.

flagship species: popular species that appeal to the general public and have interesting or notable features that make them suitable for communicating conservation concerns.

flora: refers to all of the plant taxa in a given area.

fluvial: pertaining to rivers.

focal species: species determined to be important by SWAP regional teams and expected to benefit from implementation of conservation strategies, but may not meet a criterion to be considered Species of Greatest Conservation Need.

forage: browse and herbage that is available and acceptable to grazing animals(see also browse).

forb: a broad-leaved herb, such as clover, as distinguished from a grass or a woody plant.

forest health: capacity of a forest for renewal, for recovery from a wide range of disturbances, and for retention of ecological function, while meeting the current and future needs of people for desired levels of values, uses, products, and services.

forest structure: the horizontal and vertical distribution of components of a forest stand, including height, diameter, crown layers, and stems of trees, shrubs, herbaceous understory, and down woods' debris.

fragmentation: the process by which a contiguous land cover, vegetative community, or habitat is broken into smaller patches within a mosaic of other forms of land use/land cover; e.g., islands of an older forest age class immersed within areas of younger-aged forest, or patches of oak woodlands surrounded by housing development.

fyke: a long bag fishing net kept open by hoops.

Gap Analysis Program (GAP): It identifies gaps between land areas that are rich in biodiversity and areas that are managed for conservation.

genus: the level of biological classification above species. Closely related species belong to the same genus.

geographic information system (GIS): an organized assembly of people, data, techniques, computers, and programs for acquiring, analyzing, storing, retrieving, and displaying spatial information about the real world.

goal: a formal statement detailing a desired outcome of a conservation project, such as a desired future status of a target. The scope of a goal is to improve or maintain key ecological attributes. A good goal meets the criteria of being linked to targets, impact oriented, measurable, time limited, and specific.

grazing permit: land lease offering written permission to graze a specific number, kind, and class of livestock for a specified defined allotment.

habitat: where a given plant or animal species meets its requirements for food, cover, and water in both space and time. May or may not coincide with a single macrogroup, i.e., vegetated condition or aquatic condition. Compare with ecosystem.

habitat quality: the capacity of a habitat to support a species.

herbaceous: having characteristics of an herb; i.e., a nonwoody stem such as forbs, grasses, and ferns, or the nonwoody tissues of a branch or stem.

hybridization: refers here to the crossbreeding of two animals or plants of different species or subspecies.

impact: the desired future state of a conservation target. A goal is a formal statement of the desired impact.

impaired: condition of the quality of an ecosystem or habitat that has been adversely affected for a specific use by contamination or pollution.

indicator: a measurable entity related to a specific information need such as the status of a target/factor, change in a threat, or progress toward an objective. A good indicator meets the criteria of being: measurable, precise, consistent, and sensitive.

information need: something that a project team and/or other people must know about a project. The basis for designing a monitoring plan.

Inland Empire: Riverside and San Bernardino Counties in Southern California.

intermediate result: a specific benchmark or milestone that a project is working to achieve en route to accomplishing a final goal or objective (in this case, "intermediate" typically refers to a temporal dimension).

introduced: refers to any species intentionally or accidentally transported and released into an environment outside its native range.

invasive: an introduced species which spreads rapidly once established and has the potential to cause environmental or economic harm. Not all introduced species are invasive.

invertebrate: an animal without an internal skeleton. Examples are insects, spiders, clams, shrimp, and snails.

key ecological attribute (KEA): aspects of a target's biology or ecology that, if present, define a healthy target and, if missing or altered, would lead to the outright loss or extreme degradation of the target over time.

key intervention point: a factor in a conceptual model where you could develop a strategy to ultimately improve the conservation status of one or more targets.

keystone species: a species whose loss from an ecosystem would cause a greater than average change in other species populations or ecosystem processes and whose continued well-being is vital for the functioning of a whole community.

lagoon: a shallow body of water separated from a larger body of water by barrier islands or reefs.

land cover: predominant vegetation life forms, natural features, or land uses of an area.

landscape: the traits, patterns, and structure of a specific geographic area, including its biological composition, its physical environment, and its anthropogenic or social patterns. An area where interacting ecosystems are grouped and repeated in similar form.

late succession forest: stands of dominant and predominant trees with open, moderate, or dense canopy, often with multiple canopies, and at least 20 acres in size. Characteristics include large decadent trees, snags, and large down logs.

late successional: the latter developmental stages of a plant community where vegetation structures are in a stable state and slow to change, reflective of increased age.

learning questions: questions that define what you want to learn based on the implementation of your project. Learning questions drive the identification of information needs, and thus, your monitoring plan.

listed: general term used for a taxon protected under the federal Endangered Species Act, the California Endangered Species Act, or the California Native Plant Protection Act.

logical framework: often abbreviated as logframe. A matrix that results from a logical framework analysis that is used to display a project's goals, objectives, and indicators in tabular form, showing the logic of the project.

macrogroup: the fifth level in the National Vegetation Classification natural vegetation hierarchy, in which each vegetation unit is defined by a group of plant communities with a common set of growth forms and many diagnostic plant taxa, including many character taxa of the dominant growth forms, preferentially sharing a broadly similar geographic region and regional climate, and disturbance.

mesic: neither wet (hydric) nor dry (xeric); intermediate in moisture, without extremes.

metapopulation: a group of populations, usually of the same species, that exist at the same time but in different places.

method: a specific technique used to collect data to measure an indicator. A good method should meet the criteria of accurate, reliable, cost-effective, feasible, and appropriate.

migrate; migratory: referring to animals that travel seasonally. Migrations may be local or over long distances.

monitoring: the periodic collection and evaluation of data relative to stated project goals and objectives. Many people often also refer to this process as monitoring and evaluation (abbreviated M&E).

monitoring plan: the plan for monitoring a project. It includes information needs, indicators, and methods, spatial scale and locations, timeframe, and roles and responsibilities for collecting data.

morphology: the form and structure of organisms.

native: naturally occurring in a specified geographic region.

natural community: general term often used synonymously with habitat or vegetation type.

NatureServe: a non-profit conservation organization that hosts a network of natural heritage programs providing information about rare and endangered species and threatened ecosystems.

non-native species: see exotic species.

nonpoint: pollution whose source cannot be ascertained, including runoff from storm water and agricultural, range, and forestry operations, as well as dust and air pollution that contaminate waterbodies.

objective: A formal statement detailing a desired outcome of a conservation project, such as reducing the negative impacts of a critical pressure. The scope of an objective is broader than that of a goal because it may address positive impacts not related to ecological entities (such as getting better ecological data or developing conservation plans) that would be important for the project. The set of objectives developed for a conservation project are intended, as a whole, to lead to the achievement of a goal or goals, that is, improvements of key ecological attributes. A good objective meets the criteria of being: results oriented, measurable, time limited, specific, and practical. If the project is well conceptualized and designed, realization of a project's objectives should lead to the fulfillment of the project's goals and ultimately its vision. Compare to vision and goal.

old growth forest: a stand or stands of forest trees that exhibit large tree sizes, relatively old age, and decay characteristics common with over-mature trees.

operational plan: a plan that includes analyses of: funding required; human capacity and skills and other non-financial resources required; risk assessment and mitigation; and estimate of project lifespan and exit strategy.

opportunity: a factor identified in an analysis of the project situation that potentially has a positive effect on one or more targets, either directly or indirectly. Often an entry point for conservation actions. For example, "demand for sustainably harvested timber." In some senses, the opposite of a threat.

outcome: the desired future state of a threat or opportunity factor. An objective is a formal statement of the desired outcome.

overdraft: the pumping of water from a groundwater basin or aquifer in excess of the supply flowing into the basin; results in a depletion or "mining" of the groundwater in the basin.

overstory: the uppermost canopy (treetops) in a stand of trees.

Pacific Flyway: the westernmost migratory bird flyway in North America, which begins in Alaska and runs south through California. It consists of several parallel routes linked together by several branches and follows the coast of North America and the valleys of the major mountain ranges.

pelagic: living on the open ocean rather than coastal or inland bodies of water.

piscivore: an animal whose primary food source is fish.

plant alliance: a level of classification for vegetation types generally based upon the dominant plant species in the uppermost or dominant layer of vegetation.

plant association: a level of classification for vegetation types below plant alliance and defined by the most characteristic species associated with a plant alliance. Many plant associations may be nested within a single plant alliance, just like many species may be nested within a single genus.

population: the number of individuals of a particular taxon in a defined area.

practitioners: all people involved in designing, managing, and monitoring conservation projects and programs.

predation: the act of killing and eating other animals.

prescribed fire: a deliberate burn of wildland fuels in either their natural or modified setting and under specific environmental conditions that allow the fire to be confined to a predetermined area and intensity to attain a planned resource management objective.

preservation: generally, the nonuse of natural resources. Compare with conservation.

pressure: an anthropogenic (human-induced) or natural driver that could result in changing the ecological conditions of the target. Pressures can be positive or negative depending on intensity, timing, and duration. Negative or positive, the influence of a pressure to the target is likely to be significant.

private land: lands not publicly owned, including private conservancy lands.

program: a group of projects which together aim to achieve a common broad vision. In the interest of simplicity, this document uses the term "project" to represent both projects and programs since these standards of practice are designed to apply equally well to both.

project: a set of actions undertaken by a defined group of practitioners – including managers, researchers, community members, or other stakeholders – to achieve defined goals and objectives. The basic unit of conservation work. Compare with program.

project area: the place where the biodiversity of interest to the project is located. It can include one or more "conservation areas" or "areas of biodiversity significance" as identified through ecoregional assessments. Note that in some cases, project actions may take place outside of the defined project area.

project scope: individual ecoregion or watershed will serve as the basis for developing strategies and actions within the project area.

project team: a specific core group of practitioners who are responsible for designing, implementing, and monitoring a project. This group can include managers, stakeholders, researchers, operations staff, and other key implementers.

province: a regional unit defined under SWAP 2015 that is made out of several nearby conservation units.

public: lands owned by local, state, or federal government or special districts.

Ramsar Convention: an international treaty providing the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

range: the maximum geographic extent of a taxon or habitat; does not imply that suitable conditions exist throughout the defined limits. Compare with distribution.

rangelands: any expanse of land not fertilized, cultivated, or irrigated that is suitable and predominately used for grazing domestic livestock and wildlife.

rare: one of several special status listing designations in state law; it applies only to plants. Under California law, a plant is rare when, although it is not in immediate danger of extinction, it occurs in such low numbers that it may become endangered if its environment worsens. The word rare is also commonly applied to non-listed plants and animals whose populations are low in number and therefore at risk.

rarity: a measure of sensitivity for those taxa that have special status due to very limited distribution, low population levels, or immediate threat. An area high in rarity has many taxa that meet this definition.

recruitment: the influx of new members into a population by reproduction or immigration.

redd: nesting site for salmonids and other fish.

refugia: areas where species can take refuge during times of climatic upheaval or biological stress. Places of past refugium are sometimes areas that still harbor high biological diversity.

regime: a regular pattern of occurrence or action.

resident: refers to animal taxa that remain in a given location throughout the year.

result: the desired future state of a target or factor. Results include impacts which are linked to targets and outcomes which are linked to threats and opportunities.

results chain: a graphical depiction of a project's core assumption, the logical sequence linking project strategies to one or more targets. In scientific terms, it lays out hypothesized relationships.

richness: a measure of diversity; the total number of plant taxa, animal species, or vegetation types in a given area.

riparian: relating to rivers or streams.

riprap: gabions, stones, blocks of concrete, or other protective covering material of like nature deposited upon river and stream beds and banks, lake, tidal, or other shores to prevent erosion and scour by water flow, wave, or other movement.

risk factor: a condition under which the project is expected to function, but which can cause problems for the project. Often, a condition over which the project has no direct control. Killer risks are those that when not overcome, will completely stop the project from achieving its goals and objectives.

salmonids: collective term for a family of fish that includes salmon and trout.

scope: the broad geographic or thematic focus of a program or project. The State of California will serve as the broad geographic or thematic scope for the program which consists of a group of projects, which together aim to achieve a common broad vision.

sensitive species: plant and animal species for which population viability is a concern.

seral: a series of stages in community transformation during ecological succession

silviculture: generally, the science and art of cultivating forest crops.

snags: standing dead trees with a minimum diameter of 10 inches and a height of 10 feet.

spawn: the eggs and sperm released or deposited, usually into water, by aquatic animals. As a verb, spawn refers to the process of releasing the eggs and sperm, also called spawning. Most aquatic animals, apart from aquatic mammals, reproduce through a process of spawning.

Special Animals List: a list compiled by CDFW containing threatened, endangered, and unlisted, but sensitive or declining, vertebrate and invertebrate taxa; taxa on this list are included in the California Natural Diversity Database.

species at risk: candidate, threatened, or endangered species pursuant to state and federal Endangered Species Acts, and species of special concern.

Species of Greatest Conservation Need (SGCN): all state and federally listed and candidate species, species for which there is a conservation concern, i.e., Species of Special Concern, or species identified as being highly vulnerable to climate change.

Species of Special Concern (SSC): an administrative designation given to animals that were not listed under the federal Endangered Species Act or the California Endangered Species Act at the time of designation but are declining at a rate that could, and sometimes does, result in listing.

stakeholder: any individual, group, or institution that has a vested interest in the natural resources of the project area and/or that potentially will be affected by project activities and have something to gain or lose if conditions change or stay the same. Stakeholders are all those who need to be considered in achieving project goals and whose participation and support are crucial to its success.

strategic plan: the overall plan for a project. A complete strategic plan includes descriptions of a project's scope, vision, and targets; an analysis of project situation, an action plan, a monitoring plan, and an operational plan.

strategy: a group of actions with a common focus that work together to reduce the negative impacts of pressures, capitalize on opportunities, or restore natural systems. A set of strategies identified under a project is intended, as a whole, to achieve goals, objectives, and other key results addressed under the project.

stress: a degraded ecological condition of a target that resulted directly or indirectly from negative impacts of pressures defined above (e.g., habitat fragmentation).

substrate: the base or material on which an organism lives; subsoil.

succession: the gradual transformation of one ecological community to another, either in response to an environmental change or induced by the organisms themselves.

successional stage: a particular state of ecological development.

tailwater: irrigation runoff water from agriculture.

take: to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.

target: see conservation target.

task: a specific action in a work plan required to implement activities, a monitoring plan, or other components of a strategic plan.

taxa: plural of taxon.

taxon: the name that is applied to a group in biological classification, for example, species, subspecies, variety, or evolutionarily significant unit (ESU). The plural is taxa.

threat: see pressure.

threatened species: any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

threatened: one of several special status listing designations of plant and animal taxa. Under the California and federal Endangered Species Acts, threatened refers to a taxon that is likely to become endangered in the foreseeable future. The word threatened is also commonly applied to non-listed taxa in danger of extinction.

total maximum daily load (TMDL): a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, as well as an estimation of the percentage originating from each pollution source. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for state-designated purposes. The calculation must also account for seasonal variation in water quality.

turbidity: reduced water clarity resulting from the presence of suspended matter.

umbrella species: a species whose conservation protects a wide range of co-existing species in the same habitat, which may be lesser-known and difficult to protect otherwise.

understory: the trees and other woody species growing under a relatively continuous cover of branches and foliage formed by the overstory trees.

uneven-aged: a silvicultural system in which individual trees originate at different times and result in a forest with trees of many ages and sizes.

upland: referring to species, habitats, or vegetation types in non-flooded or non-saturated areas.

vegetation type: a named category of plant community or vegetation defined on the basis of shared floristic and/or physiognomic characteristics that distinguish it from other kinds of plant communities or vegetation. This term can refer to units in any level of the National Vegetation Classification hierarchy.

vernal pools: seasonal wetlands that form in depressions on the soil surface above a water-restricting layer of soil or rock. Plant and animal taxa endemic to vernal pools are those which can adapt to a unique cycle of flooding, temporary ponding, and drying.

vertebrate: an animal with an internal skeleton. Examples are birds, mammals, reptiles, amphibians, and fish.

viable: able to persist over time; self-sustaining.

vision: a description of the desired state or ultimate condition that a project is working to achieve. A complete vision can include a description of the biodiversity of the site and/or a map of the project area as well as a summary vision statement.

vision statement: a brief summary of the project's vision. A good vision statement meets the criteria of being relatively general, visionary, and brief.

watershed: defined here as the area of land that catches rain and snow and drains or seeps into a marsh, stream, river, lake, or groundwater.

wetland: a general term referring to the transitional zone between aquatic and upland areas. Some wetlands are flooded or saturated only during certain seasons of the year. Vernal pools are one example of a seasonal wetland.

wildfire: any fire occurring on undeveloped land; the term specifies a fire occurring on a wildland area that does not meet management objectives and thus requires a suppression response. Wildland fire protection agencies use this term generally to indicate a vegetation fire. Wildfire often replaces such terms as forest fire, brush fire, range fire, and grass fire.

wildlands: collective term for public or private lands largely undeveloped and in their natural state.

wildlife: all species of free-ranging animals, including but not limited to mammals, birds, fishes, reptiles, amphibians, and invertebrates.

Wildlife Area: designation given to certain lands owned or managed CDFW as a way of regulating appropriate use. This designation is usually given to land with potential for multiple wildlife-dependent public uses such as waterfowl hunting, fishing, or wildlife viewing. Compare with Ecological Reserve.

woody debris: fallen dead wood or large branches. Woody debris is an important source of nutrients and habitat as well as a source of fuel for fire.

work plan: a short-term schedule for implementing an action, monitoring, or operational plan. Work plans typically list tasks required, who will be responsible for each task, when each task will need to be undertaken, and how much money and other resources will be required.

xeric: dry or desert-like.

zooplankton: minute, often microscopic, animal life that drift or swim in water bodies such as the ocean.