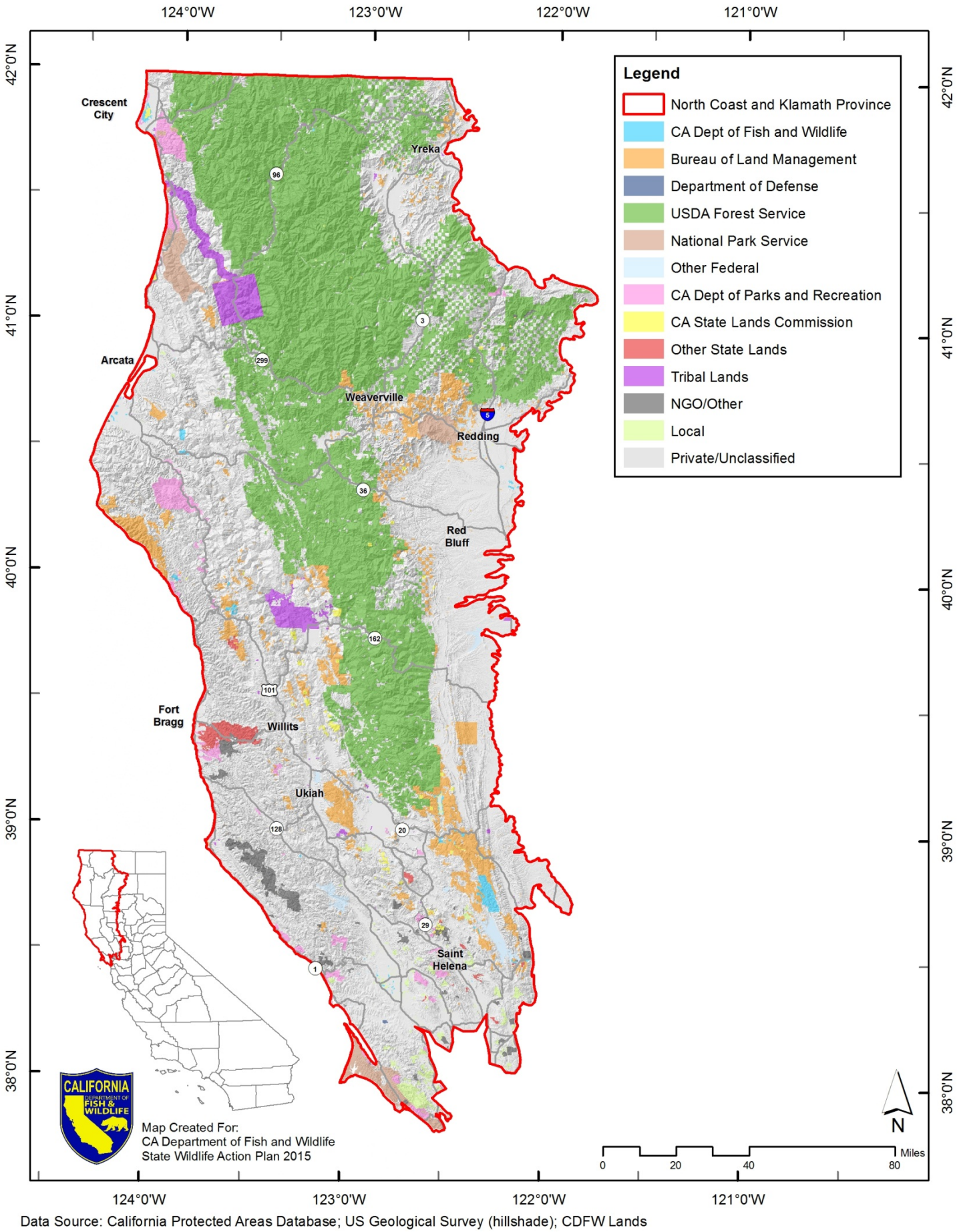
5.1 North Coast and Klamath Province

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. Some water is diverted from the westward flowing Trinity River system eastward 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

Dave Feliz, CDFW

River systems draining the province's Coast Ranges include the Eel, Russian, Mattole, Navarro, Smith, Mad, and Gualala rivers. Because the Coast Range is composed of soft, easily eroded soils, these rivers have carved more extensive riparian habitats and also carry high sediment loads. 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, Humboldt Bay, the mouth of the Eel River, Bodega Bay, and Tomales Bay (Page and Shuford 2000).

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, 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. Additionally, 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. Finally, 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, like coho salmon, steelhead, cutthroat trout, and sturgeon, coastal fish like the coast range sculpin, and inland fish such as the Klamath tui chub.

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.

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–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, coast cutthroat trout, green and white sturgeon, and Pacific lamprey. 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; 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.

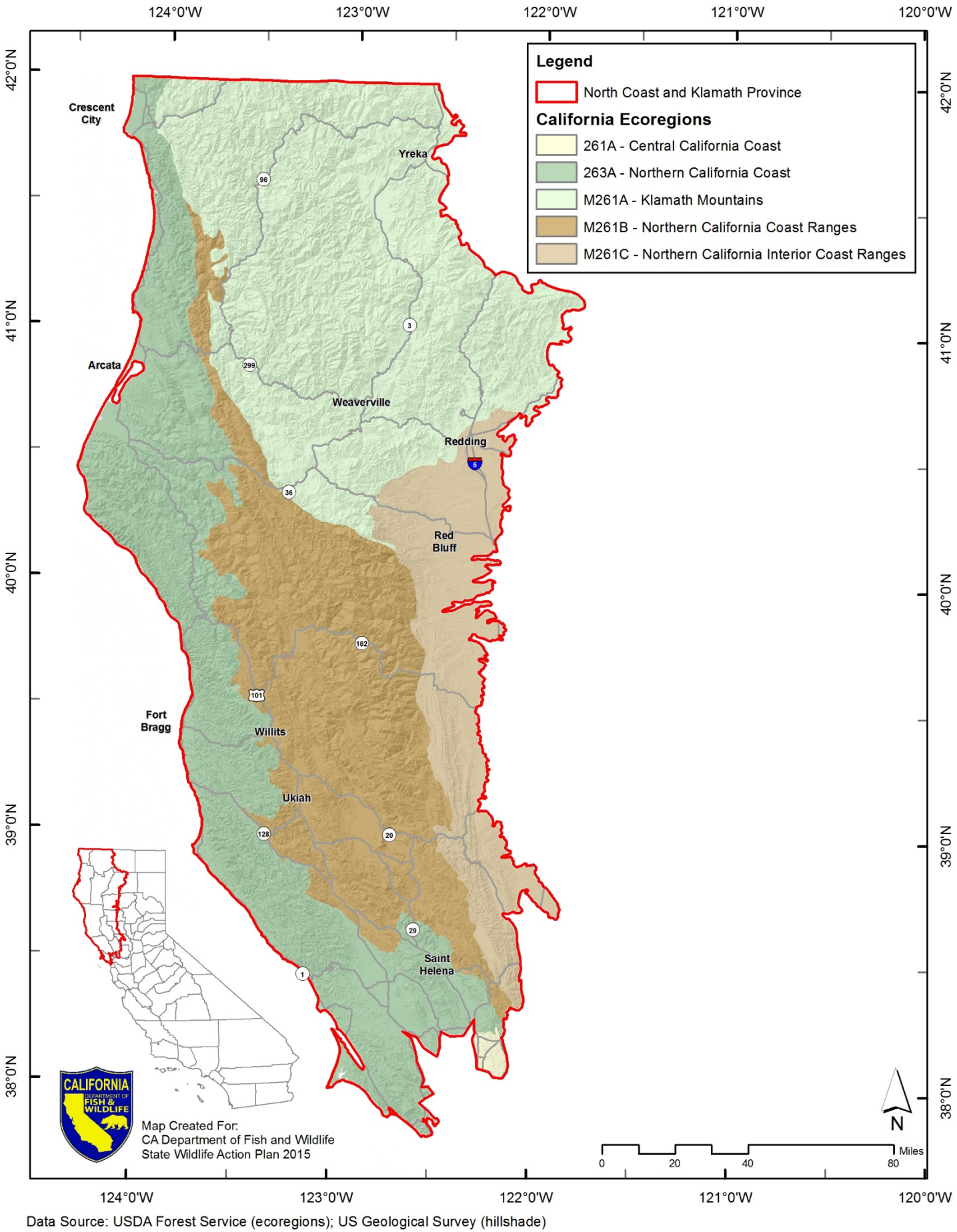
The province's rivers support one-third of the state's Chinook salmon, most of the state's coho salmon and steelhead, and all of the coastal cutthroat trout (California State Lands Commission 1993). Other native fresh water fish, like the Lost River sucker and shortnose sucker, have also experienced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

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).

Thirteen conservation targets were selected in this province as important plant communities and native freshwater aquatic species assemblages for conservation planning within the conservation units. Figure 5.1-4 shows the distribution of the plant communities within the province. These communities include: alpine vegetation, American southwest riparian forest and woodland, California foothill and valley forests and woodlands, fen (peatlands), freshwater marsh, montane upland deciduous scrub, 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.

The selected targets for each of the conservation units in the North Coast and Klamath Province are summarized in Table 5.1-1.



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

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

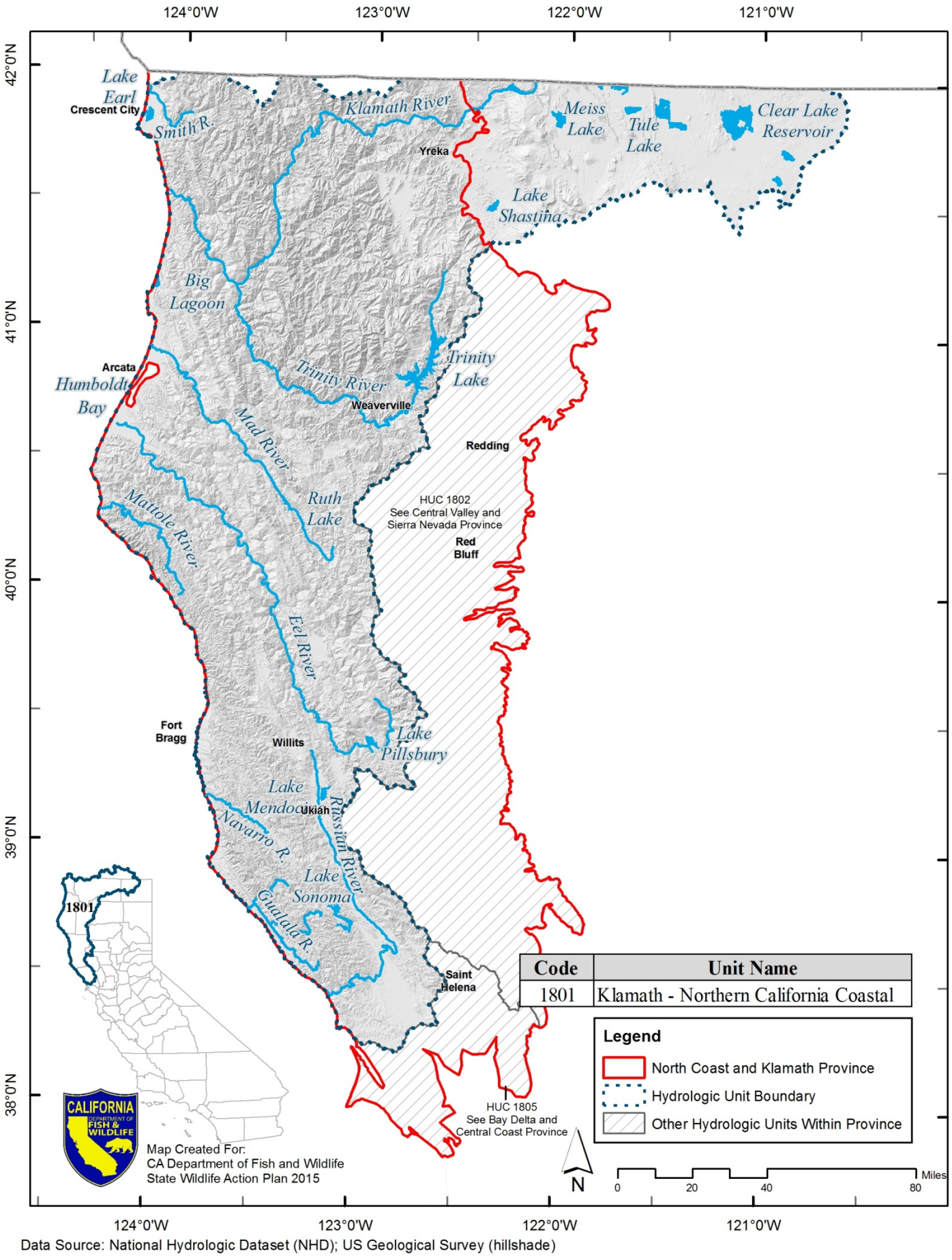


Figure 5.1-3 Hydrologic Units of the North Coast and Klamath Province

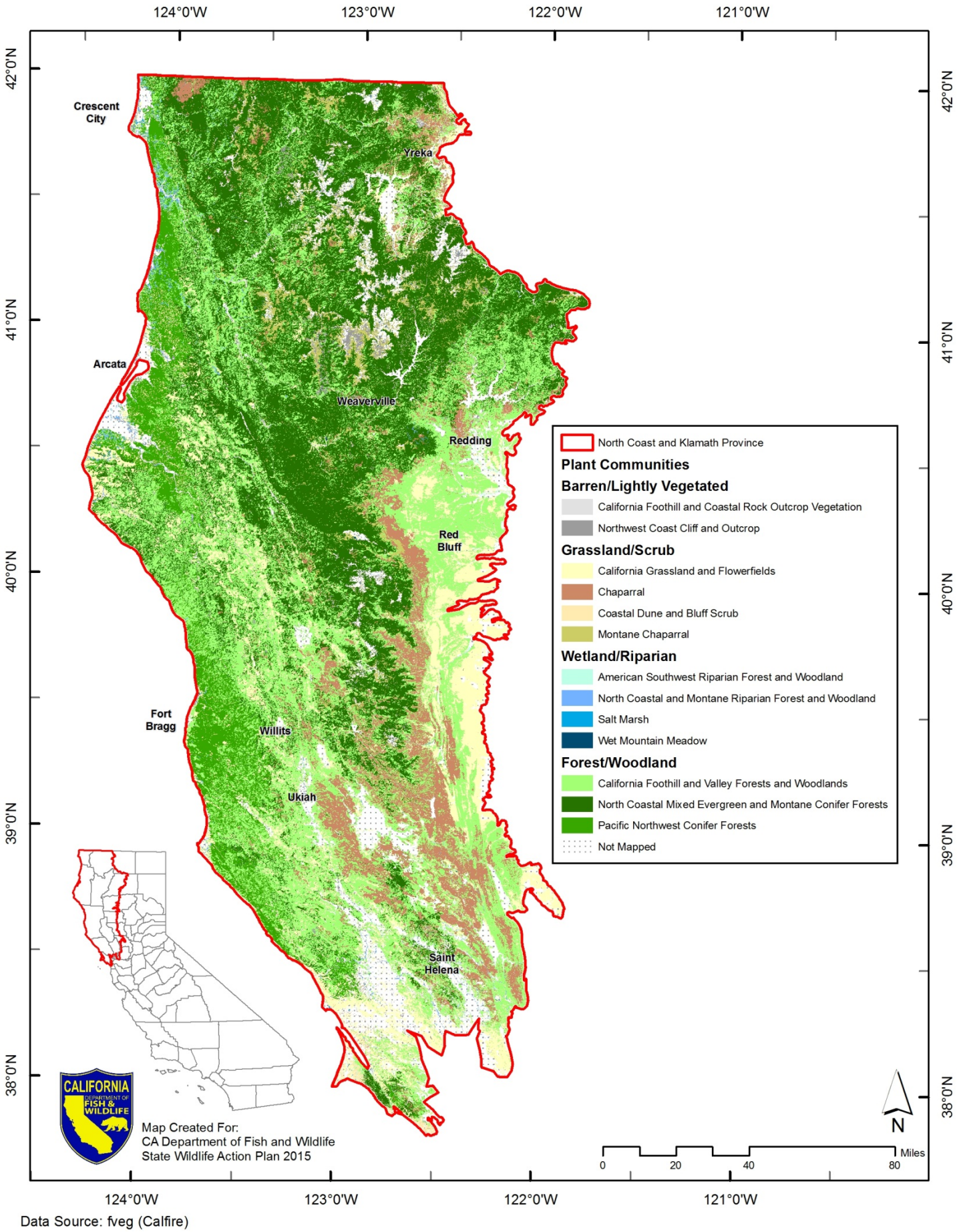


Figure 5.1-4 Plant Communities of the North Coast and Klamath Province

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	American Southwest Riparian Forest and Woodland	Found in valleys bordered by sloping alluvial fans, slightly dissected terraces, lower foothills, and coastal plains. Associated with low velocity flows, flood plains, and gentle topography. Most stands of this macrogroup occur below 4000 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. Summer coastal fog and marine air flows inland have a great influence on the habitat. Most stands are found in permanently moist settings or riparian settings where sub-surface water is available year-round. Upper canopy layer dominated by Fremont cottonwood, black and red willow, and California sycamore. Other species include arroyo willow, narrow-leaf willow. Typical understory shrub layer plants include wild grape, wild rose, California blackberry, blue elderberry, poison oak, and buttonbrush and spice bush.	valley-foothill riparian
		Pacific Northwestern 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

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 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	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
		American Southwest Riparian Forest and Woodland	See description under Northern California Coast Ecoregion.	valley-foothill riparian
		North Coastal and Montane Riparian Forest and Woodland	See description under Northern California Coast Ecoregion.	montane riparian
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,

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	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
		North Coastal and Montane Riparian Forest and Woodland	See description under Northern California Coast Ecoregion.	montane riparian
		Fen (Peatlands)	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	Montane chaparral

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
			oak trees such as Ponderosa pine, canyon oak and live oak may occur in sparse stands or as scattered individuals within the chaparral type.	
		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
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, 13 amphibians 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 (and resident) ▪ 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 ▪ Northern leopard frog ▪ Red-bellied newt ▪ Pacific 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 - 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;
- age class heterogeneity; and
    - hydrologic regime.

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

Key Ecological Attributes	Conservation Unit and Target																
	Northern California Coast				Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
	American Southwest Riparian Forest and Woodland	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	American Southwest Riparian Forest and Woodland	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Peatlands)	Montane Upland Deciduous Scrub	North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains)	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	X
Fire regime							X	X		X	X	X	X	X	X	X	
Connectivity among communities and ecosystems	X	X	X		X	X			X		X			X			
Successional dynamics	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Community structure and composition																	
Key species population levels		X						X									X
Structural diversity				X			X										
Diversity									X								
Native versus non-native diversity								X		X		X	X		X	X	X
Age class heterogeneity	X		X		X	X	X	X			X			X			
Hydrological regime	X		X	X	X	X				X		X	X		X	X	
Soil and sediment deposition regime				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–Klamath'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–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–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. Not all of the focal species meet the criteria to be considered Species of Greatest Conservation Need (SGCN). The criteria used to determine SGCN are described in Section 2.4 and the complete list of SGCN for California is presented in Appendix C. Table 5.1-3 lists the focal species for each conservation unit and target within the North Coast and Klamath Province. SGCN are indicated with an asterisk.

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[1]															
		Northern California Coast				Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath							Klamath-Northern California Coastal HUC 1801
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	American Southwest Riparian Forest and Woodland	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Peatlands)	Montane Upland Deciduous Scrub	North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains)	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
California freshwater shrimp*	*Syncaris pacifica*																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[1]															
		Northern California Coast				Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath							Klamath-Northern California Coastal HUC 1801
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	American Southwest Riparian Forest and Woodland	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Peatlands)	Montane Upland Deciduous Scrub	North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains)	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
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* (and resident)	*Oncorhynchus clarkii clarkii*																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
Tidewater goby*	*Eucyclogobius newberryi*																X
Reticulate sculpin*	*Cottus perplexus*																X
Amphibians																	
California tiger salamander*	*Ambystoma californiense*								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[1]															
		Northern California Coast				Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath							Klamath-Northern California Coastal HUC 1801
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	American Southwest Riparian Forest and Woodland	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Peatlands)	Montane Upland Deciduous Scrub	North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains)	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
Southern torrent salamander*	*Rhyacotriton variegatus*	X		X	X	X	X				X		X	X		X	X	X
Red-bellied newt*	*Taricha rivularis*	X		X	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	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	X	X											
Siskiyou Mountains salamander*	*Plethodon stormi*												X		X			
Coastal tailed frog*	*Ascaphus truei*	X		X	X			X			X		X	X		X	X	X
Western spadefoot toad*	*Spea hammondii*								X									
Northern leopard frog*	*Lithobates pipiens*																	X
Northern red-legged frog*	*Rana aurora*		X								X		X	X		X	X	X
Foothill yellow-legged frog*	*Rana boylii*	X		X		X	X											X
Cascades frog*	*Rana cascadae*										X		X	X		X	X	X
California red-legged frog*	*Rana draytonii*		X						X									X
Oregon spotted frog*	*Rana pretiosa*																	X
Reptiles																		
Northern western pond turtle*	*Actinemys marmorata*	X	X	X		X	X		X									X
Western skink	*Plestiodon skiltonianus*								X									
Forest sharp-tailed snake*	*Contia longicauda*	X		X	X													
Ring-necked snake	*Diadophis punctatus*								X									

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

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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															
California condor*	*Gymnogyps californianus*							X										
Osprey	*Pandion haliaetus*				X			X	X									
Northern goshawk*	*Accipiter gentilis*	X		X	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									
Bald eagle*	*Haliaeetus leucocephalus*								X									
Short-eared owl*	*Asio flammeus*		X															
Long-eared owl*	*Asio otus*	X		X		X	X		X			X						
Burrowing owl*	*Athene cunicularia*								X			X						
Northern spotted owl*	*Strix occidentalis caurina*	X		X		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									
Olive-sided flycatcher*	*Contopus cooperi*				X			X			X		X	X		X	X	
Willow flycatcher*	*Empidonax traillii*	X	X								X		X	X		X	X	
Hutton's vireo	*Vireo huttoni*								X									

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Purple martin*	*Progne subis*	X	X	X	X	X	X				X		X	X		X	X	
Bank swallow*	*Riparia riparia*	X		X		X	X				X		X	X		X	X	
Marsh wren	*Cistothorus palustris*		X															
Saltmarsh common yellowthroat/San Francisco common yellowthroat*	*Geothlypis trichas sinuosa*	X	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		X	X											
Pallid bat*	*Antrozous pallidus*								X									
Townsend's big-eared bat*	*Corynorhinus townsendii*	X		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		X	X	
Fringed myotis (bat)*	*Myotis thysanodes*	X		X		X	X											
Long-legged myotis (bat)*	*Myotis volans*	X		X		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	X	X										

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Northern flying squirrel	*Glaucomys sabrinus*				X			X							X			
San Joaquin pocket mouse*	*Perognathus inornatus inornatus*								X									
North American beaver	*Castor canadensis*	X	X	X		X	X											
Sonoma tree vole*	*Arborimus pomo*				X													
White-footed vole	*Arborimus albipes*	X		X		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									
Pacific marten*	*Martes caurina (=americana)*	X		X	X	X	X	X		X	X		X	X	X	X	X	
Humboldt marten*	*Martes caurina [=americana] humboldtensis*	X		X		X	X											
American badger	*Taxidea taxus*								X			X						
Fisher - West Coast DPS*	*Pekania [=Martes] pennanti*	X		X	X	X	X	X							X			
River otter	*Lontra canadensis*		X						X									
Western spotted skunk	*Spilogale gracilis*				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.

* 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 caused by pressures, anthropogenic (human-induced) or natural drivers that could result in impacts to the target by changing the ecological conditions. Pressures can be positive or negative depending on intensity, timing, and duration. The pressures identified as affecting the viability of conservation targets in the North Coast and Klamath Province are summarized in Table 5.1-4. The most commonly addressed pressures identified for the province (i.e., those that affect several targets) are discussed below. The relationship between the stresses and pressures are unique for each conservation target and are identified in Section 5.1.6.

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

Pressure	Conservation Units																
	Northern California Coast				Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
	American Southwest Riparian Forest and Woodland	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	American Southwest Riparian Forest and Woodland	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Peatlands)	Montane Upland Deciduous Scrub	North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains)	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
Annual and perennial non-timber crops	X	X	X		X	X											X
Avalanches				X													
Climate change							X		X								
Commercial and industrial uses									X								
Dams and water management/use	X		X		X	X											X
Fire suppression				X			X	X		X	X	X	X	X	X	X	X
Fishing and harvesting aquatic resources																	X
Garbage and solid waste																	X
Housing and urban areas	X	X	X		X	X					X						X

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Pressure	Conservation Units																
	Northern California Coast				Northern California Coast Ranges			Northern California Interior Coast Ranges	Klamath								Klamath-Northern California Coastal HUC 1801
	American Southwest Riparian Forest and Woodland	Freshwater Marsh	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Conifer Forests	American Southwest Riparian Forest and Woodland	North Coastal and Montane Riparian Forest and Woodland	Pacific Northwest Subalpine Forest	California Foothill and Valley Forests and Woodlands	Alpine Vegetation	Fen (Peatlands)	Montane Upland Deciduous Scrub	North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains)	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
Household sewage and urban wastewater																	X
Introduced genetic material				X													X
Invasive plants/animals	X	X	X	X	X	X		X	X	X		X	X		X	X	X
Industrial and military effluents																	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
Marine and freshwater aquaculture																	X
Mining and quarrying																	X
Parasites/ pathogens/ diseases				X			X							X			X
Renewable energy																	X
Roads and railroads				X													X
Recreation activities							X	X	X								
Wood and pulp plantations				X													
Other ecosystem modifications		X															

Most Commonly Addressed Pressures in the North Coast and Klamath Province

- Annual and Perennial Non-Timber Crops
- Dams and Water Management/Use
- Housing and Urban Areas
- Invasive Plants/Animals
- Fire and Fire Suppression
- Livestock, Farming, and Ranching
- Logging and Wood Harvesting

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 such benefits of natural flooding regimes 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 salmon, 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, where more than 90 percent of the historical tidal marshlands have been lost. 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 dam construction deplete the flows of river systems in the province, sometimes resulting in rivers completely drying up. 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

Water diversion and 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. In this province, 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 appeared to verify these results. These 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 endangered salmonid species, including one of the most important populations of coho salmon. 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 cold water streams that would no longer support cold-water fishes such as trout. 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 proposed Endangered Species Act protection for West Coast populations of the Pacific fisher because of a number of recent deaths link 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 ArcGIS, 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 County, 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 comprised 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 Mendcino Counties. Shasta and Lake Counties had over a million plants seized. Much like a game of Whac-A-Mole, when one farm is found, another one pops us 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– 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 River 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 these are not legal.

Dams and diversions reduce the amount of water in province's 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 warm water fishes such as large-mouth 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, 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 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–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 Plant/Animals

As in other provinces, invasive species present a noteworthy threat to the provinces 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.

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.

The greatest invasive threats to the integrity of north coast redwood forests results from the pathogen that causes Sudden Oak Death (SOD; *Phytophthora ramorum*), and the invasion of Jubata grass (*Cortaderia jubata*) and Selloana grass (*Cortaderia selloana*). Tanoak (*Lithocarpus densiflorus*) 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 promises to bring a profound and essentially permanent change to the coast redwood landscape. Jubata grass and Selloana grass have begun to surface 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 noxious 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 exotic 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 only 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 waterway 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 standard decontamination protocol is being implemented to prevent spread by recreational users.

Even 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, however, are present in freshwater streams within southern part of the province in the North Coast Range and Northern California Interior Coast Range ecoregion: Mendocino, Sonoma, Marin, Napa, Yolo, and Solano Counties (CISR 2011). Only two northern counties, Shasta and Del Norte, have records within their borders. New Zealand mudsnails are established in the Mad-Redwood, Lower Klamath, Tomales-Drake's Bay drainages, the Russian, Garcia, and Napa Rivers, and Putah Creek within the province. 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, Utah) trout 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). There are also no known natural enemies such as predators, parasites, and pathogens in California. Because there are no feasible eradication technologies, the first line of defense against New Zealand mud snail is containment. 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.

Non-native fish species like the largemouth and smallmouth bass, yellow perch, sunfish, black and white crappies, yellow perch, brown and brook trouts, catfish and bullhead are present in waters throughout this province. Yellow perch, brown and brook trouts, and Sacramento pikeminnow are some of those that negatively impact SGCNs within the province. Yellow perch compete with trout and are believed to prey upon juvenile salmonids, while brown and brook trouts aggressively out compete native trout species. Brook trout are present in many of the cold water 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, The 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 in the future, more waters may see an increase in warm-water centrarchid fish populations such as sunfish and crappies and a decrease in cold-water 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 Hutton, 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 North Coast and Klamath Province, bullfrogs are currently a threat to inland sensitive species of frogs like the Cascades frog, California red-legged frog and fish such as the endangered Coho salmon upon which they prey. With the simplification of rivers and streams from levees and dams, restoration for endangered Coho salmon has focused on off-channel habitat creation important for juvenile survival and production. Unfortunately, these newly created channels and slow moving waters are perfect bullfrog habitat and become invaded shortly after creation (Van Hutton, pers. comm., 2015) where juveniles become bullfrog prey (Garwood et al. 2010; Jancowski and Orchard 2013). In addition, 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).

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).

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. 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. 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–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. Forestry Service (USFS) and U.S. Bureau of Land Management (BLM).

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 provide shade, bank stabilization, and wood delivery needed for channel forming elements and nutrients to rivers and streams.

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–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 (including the Big, Gualala, Russian, Navarro, Mattole, Eel, Mad, Scott, and Trinity rivers and Redwood Creek) 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 2002).

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 depend on unfragmented forest interior habitats.

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

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, causing 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 ten conservation targets in the North Coast and Klamath Province. The goals for each target are listed below. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the pressures intended to be reduced by implementing the strategies. When specific actions have been identified for the strategies, they are also listed. Tables 5.1-5 through 5.1-14 show the relationships between the stresses and the pressures for each target. Table 5.1-15 summarizes conservation strategies for the province.

Target: American Southwest Riparian Forest and Woodland; 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 with native species 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): Conduct outreach and education.

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), and local/federal agencies.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 to would deter water diversion from streams and creeks that impacts riparian vegetation and 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.

Intended pressure(s) reduced: Livestock, farming, and ranching, housing and urban areas.

Conservation action(s):

- Coordinate with National Resource Conservation Service (NRCS).

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.

Intended pressure(s) reduced: 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, and cities.

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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 American Southwest Riparian Forest and Woodland; North Coastal and Montane Riparian Forest and Woodland				
Priority pressures	Stresses			
	Changes in hydrology and water characteristics	Ecosystem changes		
	Change in water levels and hydroperiod	Change in spatial distribution of habitat types	Changes community structure or composition	Changes succession processes and ecosystem development
Annual and perennial non-timber crops	X	X	X	
Dams and water management/use	X	X	X	X
Housing and urban areas		X		
Invasive plants/animals		X	X	
Livestock, farming, and ranching		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 with native species 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 2015, 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.

Intended pressure(s) reduced: 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.

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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: Livestock, farming, and ranching; annual and perennial non-timber crops.

Table 5.1-6 Stresses and Pressures for Freshwater Marsh

Priority pressures	Stresses					
	Changes in soil characteristics	Changes in hydrology and water characteristics	Ecosystem changes			
	Change in soil moisture	Change in water levels and hydroperiod	Change in spatial distribution of habitat types	Changes community structure or composition	Changes succession processes and ecosystem development	Habitat fragmentation
Annual and perennial non-timber crops	X		X	X	X	
Housing and urban areas				X		X
Invasive plants/animals			X	X	X	
Livestock, farming, and ranching			X	X	X	X
Other ecosystem modifications				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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 techniques such as irradiation through active management and control (i.e., treating disturbed soil to prevent establishment of invasive species).

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

*Intended pressure(s) reduced***:** 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.

Intended pressure(s) reduced: 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 NRCS, The Nature Conservancy (TNC), and others for joint advocacy.

Objective(s):

- Influence management of federal lands with partnerships.

Intended pressure(s) reduced: Parasites/pathogens/diseases; logging and wood harvesting.

Conservation action(s):

- Advocate for appropriate grazing practices.
- Review existing ranching and grazing BMPs.
- Partner and advocate for reducing rodenticide use.
- Work with NRCS, BLM, and USFS to modify BMPs as needed.
- Incorporate BMPs into CEQA comment letters.
- Identify key private land owners to whom outreach is directed.
- Advocate prescribed burns.
- Advocate for post burn weed control.

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.

Intended pressure(s) reduced: Introduced genetic material; invasive plants/animals.

Table 5.1-7 Stresses and Pressures for Pacific Northwest Conifer Forest

Priority pressures	Stresses					
	Changes in geophysical and disturbance regime		Ecosystem changes			
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in spatial distribution of habitat types	Changes community structure or composition	Changes succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents					X	
Avalanches/landslides			X			
Fire and fire suppression		X				
Introduced genetic material				X		
Invasive plants/animals				X		
Livestock, farming, and ranching				X		
Logging and wood harvesting	X				X	X
Parasites/pathogens/diseases				X		
Roads and railroads						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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 month, 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: Fire and fire suppression.

Conservation Strategy 7 (Partner Engagement): Establish partnership to co-monitor target vegetation on state and federally managed lands.

Objective(s):

- By 2025, a mutually agreed upon partnership and monitoring strategy is developed and monitoring is implemented.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: Climate change.

Conservation Strategy 9 (Training and Technical Assistance): Provide science based application and tools. 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.

Intended pressure(s) reduced: Livestock, farming, and ranching; invasive plants/animals.

Table 5.1-8 Stresses and Pressures for Pacific Northwest Subalpine Forest

Priority pressures	Stresses								
	Climate factors					Ecosystem changes			
	Change in spring average temperature	Change in natural fire regime	Change in snow pack	Change in snow cover period	Change in soil moisture	Change in spatial distribution of habitat types	Changes community structure or composition	Changes succession processes and ecosystem development	Change in biotic interactions (altered community dynamics)
Climate change	X	X	X	X	X	X	X	X	X
Fire and fire suppression		X							
Parasites/pathogens/diseases									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 dominance 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).

Intended pressure(s) reduced: Fire and fire suppression; livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 2 (Direct Management): Conduct controlled burns on CDFW lands.

Objective(s):

- Conduct ecologically sound controlled burns on the CDFW lands**.**

Intended pressure(s) reduced: Fire and fire suppression.

Conservation Strategy 3 (Direct Management and Outreach and Education): Conduct demonstration management of successful BMPs.

Objective(s):

- Provide public demonstrations of successful BMPs and scientifically document environmental change from BMP implementation.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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):

- Introduce landowners and allotment leasees to BMPs for grazing.
- Inform public of incentive programs available to them.
- Educate recreation-focused landowners on wildlife BMP's.
- Grazing fees will be used to provide funding for recreation use).
- Keep CDFW staff current on relevant science such as restoration techniques and science.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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				
	Changes in geophysical and disturbance regimes	Changes in soil characteristics	Ecosystem changes		
	Changes in natural fire regime	Changes in soil moisture	Changes community structure or composition	Changes succession processes and ecosystem development	Change in biotic interactions (altered community dynamics
Fire and fire suppression	X		X	X	X
Invasive plants/animals	X	X	X	X	X
Livestock, farming, and ranching		X	X		
Recreational activities	X				X

Debra Hamilton, CDFW

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).

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.
- 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.

Intended pressure(s) reduced: Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):

- Add BMPs for assisting vegetation shift from impending climate change.

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).

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 factors								Ecosystem changes		
	Change in spring average temperature	Change in CO_2 levels	Change in summer average temperature	Change in temperature extremes	Change in soil temperature	Change in snow pack	Change in snow cover period	Change in soil moisture	Change in spatial distribution of habitat types	Changes 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
Invasive plants/animals										X	
Livestock, farming, and ranching										X	
Recreational activities										X	

Target: Fen (Peatlands); North Coastal and Montane Riparian Forest and Woodland (Klamath Mountains); Subalpine Aspen Forests and Pine Woodlands (Meadows); Western Upland Grasslands; Wet Mountain Meadow

Goals:

- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with native species 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.

Intended pressure(s) reduced: Fire and fire suppression.

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.

Intended pressure(s) reduced: 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.

*Intended pressure(s) reduced***:** 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 (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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: Fire and fire suppression; logging and wood harvesting.

Table 5.1-11 Stresses and Pressures for Fen (Peatlands), North Coastal and Montane Riparian Forest and Woodland, Subalpine Aspen Forests and Pine Woodlands, Western Upland Grasslands, Wet Mountain Meadow

Priority pressures	Stresses							
	Climate factors	Change in geophysical and disturbance regime	Change in hydrology and water characteristics		Ecosystem changes			
	Change in spring average precipitation	Change in natural fire regime	Change in groundwater tables	Change in water levels and hydroperiod	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Changes community structure or composition	Habitat fragmentation
Fire and fire suppression		X				X	X	
Invasive plants/animals					X		X	X
Logging and wood harvesting			X	X				X

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.

Objective(s):

- Delineate mature forests.
- Increase and understand wildlife use of restored mature forests.

Intended pressure(s) reduced: Fire and fire suppression.

Patricia Bratcher, CDFW

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.

Intended pressure(s) reduced: 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.)

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.
- Agencies and landowners jointly implement projects that benefit wildlife.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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		
	Changes in geophysical and disturbance regimes	Ecosystem changes	
	Changes in natural fire regime	Changes community structure or composition	Habitat fragmentation
Fire and fire suppression	X	X	X
Logging and wood harvesting	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 and increase wildlife use of restored aspen meadows from 2015 levels.
- By 2025, aspen community have responded to management actions.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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						
	Changes in geophysical and disturbance regimes	Changes in soil characteristics	Changes in hydrology and water characteristics	Ecosystem changes			
	Changes in natural fire regime	Changes in soil moisture	Change in groundwater tables	Change in spatial distribution of habitat types	Changes community structure or composition	Changes 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: 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).

Intended pressure(s) reduced: 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 (Category: Outreach and Education): Provide outreach and education. Outreach efforts targeted to specific groups, communities, resource users, policy makers, stakeholders and/or the public to improve awareness and change knowledge, attitudes, and behaviors. 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: Housing and urban areas.

Conservation action(s):

- Make recommendations to local agencies to establish minimum buffer width.
- Redesignate 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.

Intended pressure(s) reduced: 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 code1600 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.

Intended pressure(s) reduced: 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.

Intended pressure(s) reduced: 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 5.1-14 Stresses and Pressures for Native Aquatic Species Assemblages/Communities

Priority pressures	Stresses											
	Changes in geophysical and disturbance regimes	Changes in soil characteristics	Changes in hydrology and water characteristics						Ecosystem changes			
	Changes in sediment erosion-deposition regime	Change in pollutants	Change in runoff and river flow	Changes in water temperature	Changes in water chemistry	Changes in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded	Changes in nutrients	Change in spatial distribution of habitat types	Changes community structure or composition	Changes 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
Dams and water management/use	X		X	X		X			X	X		X
Fire and fire suppression	X	X	X	X			X		X	X		X
Fishing and harvesting aquatic resources		X								X		
Garbage and solid waste												
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			X			X		X		
Introduced genetic material										X		
Invasive plants/animals										X		
Livestock, farming, and ranching	X	X	X	X		X			X	X		X
Logging and wood harvesting	X		X	X					X	X	X	X
Marine and freshwater aquaculture										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

Table 5.1-15 Conservation Targets and Strategies for the North Coast and Klamath Province

Target	Goals	Key Ecological Attributes (KEAs)	Pressures[1]	Strategy Categories
American Southwest Riparian Forest and Woodland 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 with native species 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) has increased by at least 5% from 2015 acres/miles.	▪ Area and extent of community ▪ Connectivity among communities and ecosystems ▪ Successional dynamics ▪ Age class heterogeneity ▪ Hydrological regime	▪ Annual and perennial non-timber crops ▪ Dams and water management/use ▪ Invasive plants/animals ▪ Housing and urban areas ▪ Livestock farming and ranching	▪ Partner Engagement ▪ Management Planning ▪ Direct Management ▪ Land Acquisition/ Easement/ Lease ▪ Law and Policy ▪ Outreach and Education
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 with native species 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 2015, 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 ▪ Key species population levels ▪ Surface water flow regime	▪ Annual and perennial non-timber crops ▪ Housing and urban areas ▪ Invasive plants/animals ▪ Livestock farming and ranching ▪ Other ecosystem modifications	▪ Management Planning ▪ Economic Incentives ▪ Land Acquisition/ Easement/ Lease ▪ Law and Policy ▪ 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 ▪ Structural diversity ▪ Hydrological regime ▪ Soil and sediment deposition regime	▪ Agricultural and forestry effluents ▪ Avalanches ▪ 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 ▪ Partner Engagement ▪ Management Planning ▪ Direct Management ▪ Outreach and Education ▪ Training and Technical Assistance

Table 5.1-15 Conservation Targets and Strategies for the North Coast and Klamath Province (continued)

Target	Goals	Key Ecological Attributes (KEAs)	Pressures[1]	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 ▪ Structural diversity ▪ Age class heterogeneity	▪ Climate change ▪ Fire and fire suppression ▪ Parasites/pathogens/diseases ▪ Recreational activities	▪ Data Collection and Analysis ▪ Partner Engagement ▪ Management Planning ▪ Direct Management ▪ Economic Incentives ▪ Environmental Review ▪ Land Use Planning ▪ 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 ▪ Key species population levels ▪ Native versus non-native diversity ▪ Age class heterogeneity ▪ Soil and sediment deposition regime	▪ Fire and fire suppression ▪ Invasive plants/animals ▪ Livestock farming and ranching ▪ Recreational activities	▪ Partner Engagement ▪ Direct Management ▪ Economic Incentives ▪ Land Acquisition/ Easement/ Lease ▪ 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 ▪ Connectivity among communities and ecosystems ▪ Diversity	▪ Climate Change ▪ Commercial and industrial areas ▪ Invasive plants/animals ▪ Livestock farming and ranching ▪ Recreational activities	▪ Data Collection and Analysis ▪ Partner Engagement ▪ Management Planning ▪ Direct Management ▪ Economic Incentives ▪ Outreach and Education ▪ Training and Technical Assistance
Fen (Peatlands) North Coastal and Montane Riparian Forest and Woodland Subalpine Aspen Forests and Pine Woodlands Western Upland Grasslands, Wet Mountain Meadow	▪ By 2025, acres of habitat are increased by at least 5% from 2015 acres. ▪ By 2025, acres with native species 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 ▪ Native versus non-native diversity ▪ Hydrological regime	▪ Fire and fire suppression ▪ Invasive plants/animals ▪ Logging and wood harvesting	▪ Data Collection and Analysis ▪ Partner Engagement ▪ Direct Management ▪ Environmental Review ▪ Law and Policy ▪ Outreach and Education
Subalpine Aspen Forests and Pine Woodlands	▪ 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 ▪ Age class heterogeneity ▪ Soil and sediment deposition regime	▪ Fire and fire suppression ▪ Logging and wood harvesting ▪ Parasites/pathogens/diseases	▪ Data Collection and Analysis ▪ Partner Engagement ▪ Direct Management ▪ Environmental Review ▪ Law and Policy ▪ Outreach and Education

Table 5.1-15 Conservation Targets and Strategies for the North Coast and Klamath Province (continued)

Target	Goals	Key Ecological Attributes (KEAs)	Pressures[1]	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 ▪ Age class heterogeneity	▪ Housing and urban areas ▪ Logging and wood harvesting ▪ Fire and fire suppression	▪ Data Collection and Analysis ▪ Partner Engagement ▪ Direct Management ▪ Environmental Review ▪ Law and Policy ▪ Outreach and Education
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, population of key species 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 ▪ Key species population levels ▪ Native versus non-native diversity ▪ Soil 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 ▪ Dams and water management/use ▪ Fire and fire suppression ▪ Garbage and solid waste ▪ Household sewage and urban waste water ▪ Housing and urban areas ▪ Fishing and harvesting aquatic resources ▪ Livestock farming and ranching ▪ Industrial and military effluents ▪ Introduced genetic material ▪ Invasive plants/animals ▪ 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] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.