Delta Conservation Framework

PARTNERSHIPS AND PLANNING TOOLS FOR 2050

Vision for a Delta in Common

California Department of Fish & Wildlife

California Department of Fish & Wildlife

REPORT AUTHORS

Christina Sloop, PhD

Brooke Jacobs, PhD

Randi Logsdon

Carl Wilcox

STAFF CONTRIBUTORS

Bjarni Serup

Brandon Amrhein

Cindy Hensley

PRODUCTION CREDITS

Editor: Ariel Rubissow Okamoto

Design: Darren Campeau

Maps: Diane Mastalir, CDFW

Illustrations: Afsoon Razavi

This report was produced by the California Department of Fish & Wildlife, December 2018.

Cite as
Sloop, Christina, Brooke Jacobs, Randi Logsdon, and Carl Wilcox. 2018. *Delta Conservation Framework – A Delta in Common*, California Department of Fish and Wildlife, Sacramento, CA

http://wildlife.ca.gov/DeltaConservationFramework

For more information please contact us at dcf@wildlife.ca.gov

Publication date: Version 12/31/18

Table of Contents

Delta Conservation Framework and Appendices

www.wildlife.ca.gov/conservation/watersheds/dcf

YOUR GUIDE TO THE DELTA CONSERVATION FRAMEWORK

HOW IT'S ORGANIZED

Executive Summary

EACH SECTION HAS THREE USEFUL PARTS

1. **Framework Explained**
   Goals, strategies, rationale, context
2. **On-the-ground, Site Specific Examples**
   Existing regional partnerships and plannning efforts in conservation opportunity regions throughout the Delta.
3. **All-in-One Reference Guides**
   Quick reference summaries of related plans, programs, tools, and checklists that can help landowners, partners, and stakeholders begin to understand and navigate the complexities of conservation work in the Delta.

SECTION I
Vision
Background, Purpose

SECTION II
Community Integration
GOALS A • B • C

SECTION III
Ecosystem Function
GOAL D

SECTION IV
Conservation Based in Science
GOAL E

SECTION V
Permitting, Funding
GOALS F • G

SECTION VI
Path Forward, Partnerships, Processes & Tools
Regional Conservation Strategies

MORE DETAILS
Bay-Delta Conservation Plan
Conservation Opportunity Regions
Species Recovery Briefs
Grants
Endnotes
and much more

Appendices

Illustration: Afsoon Rozavi

Delta Conservation Framework

Partnerships and Planning Tools for 2050

Developing a framework for planning and implementing conservation in a dynamic place with close ties to native biodiversity, California history, agriculture, and statewide economies is a challenging task. Add to that consideration of the myriad existing plans and conservation initiatives that apply to California's Delta, and the task boggles the mind. Then consider the perils and uncertainties presented by climate change and the task becomes a very tall order.

This document, called the *Delta Conservation Framework*, is the product of three years of work (2016-2018) led by the California Department of Fish and Wildlife and developed in partnership with Delta stakeholders. These stakeholders included federal, state, and local government representatives, conservation practitioners, non-profit organizations, landowners, residents, and business owners.

Three primary sets of resources guided development of the Framework:

1. Feedback from a series of public workshops held in 2016
2. Prior plans focused on the people and ecosystems of the Delta
3. Best available science on ecosystem processes in the Delta

From this foundation emerged seven conservation goals, 26 strategies to reach those goals, 200 pages of details, seven appendices, and a 30-year vision for a healthier Delta for both humans and wildlife: the *Delta Conservation Framework*.

VISION 2050

In 2050, the Delta is composed of resilient natural and managed ecosystems situated within a mosaic of towns and agricultural landscapes, where people prosper and healthy wildlife communities thrive.

Hopes for the Delta Expressed by Various Stakeholders in 2016 Workshops

- **MULTI-BENEFIT OUTCOMES:** In 2050, the Delta is a network of multiple-use landscapes where agricultural productivity, economic vitality, and ecosystem conservation are achieved in a manner that mutually supports the needs of people and wildlife.
- **CONSIDERATION OF LANDSCAPE DYNAMICS:** In 2050, the Delta is recognized as part of a greater system that functions within the context of California's largest watersheds.
- **HEALTHY, RESILIENT ECOSYSTEMS:** In 2050, the Delta has healthy, resilient ecosystems with the capacity to adapt through time to impacts associated with climate change, sea level rise, and other environmental uncertainties.
- **COLLABORATION:** In 2050, state, federal, and local government agencies collaborate with each other and Delta stakeholders to achieve multi-benefit outcomes where possible.
- **DECISIONS BASED ON SCIENCE:** In 2050, policy decisions and desired conservation outcomes are informed and evaluated through coordinated Delta science endeavors.
- **LOCAL SUPPORT:** In 2050, Delta residents promote the management of healthy ecosystems as the basis of a healthy and economically thriving Delta region.
- **LOCAL BENEFITS:** In 2050, Delta residents and visitors actively enjoy the region's unique cultural and natural resource values through wildlife-friendly agricultural practices, tourism, outdoor recreation, and environmental education activities for all ages.
- **RELIABLE LOCAL WATER:** In 2050, effective integrated water management in the Delta promotes good water quality and a reliable water supply for users in the Delta.
- **MULTI-BENEFIT FLOOD MANAGEMENT:** In 2050, the Delta's flood management system provides both improved flood protection and increased habitat value for fish and wildlife, where possible.

History of the Push to Reframe Delta Conservation

The California Water Code recognizes the Delta as "the most valuable ecosystem on the west coast of North America and South America." However, over the last century, the wildlife habitats and ecosystem services that the Delta provides have been impacted by environmental degradation, land use conversions, and economic shifts. Efforts to protect, enhance and restore the Delta's natural riches and ecosystem services are ongoing. Indeed large-scale conservation of Delta aquatic and terrestrial habitats is called for in a wide variety of California state laws, mandates, plans, mitigation requirements, and initiatives, many of which are the result of decades-long debates, and reports based on scientific research.

The origins of the *Delta Conservation Framework* derive from changes in Delta conservation and water policies between 2006 and 2016. In 2006, Delta planning agencies began crafting the *Bay Delta Conservation Plan* (BDCP), intending to provide a comprehensive tool for planning and permitting conservation projects and new water conveyance infrastructure. The resulting 2013 BDCP public draft contained measures to protect 54 sensitive native species and specific actions to protect and restore habitat in the Delta. The BDCP also contained plans to add three new water intakes along the Sacramento River to divert water for the state and federal water projects. In spring 2015, the Brown administration announced a shift from the BDCP to two parallel but separate programs: California WaterFix, to pursue water supply infrastructure; and California EcoRestore, to implement focused restoration in the Delta.

Since then, the California Department of Fish and Wildlife (CDFW) has continued to work to maintain and increase the momentum of conservation planning and implementation that began with the BDCP. To this end, CDFW started a new initiative in 2016 called the *Delta Conservation Framework.* The department began by holding a series of meetings with its state partners to present the new initiative, gather feedback, and hear perspectives. The group collectively acknowledged two key points: 1) the need for a new approach to conservation planning after the BDCP and 2) the need to bring Delta stakeholders into the planning process early. Two years later, the result is the 200-page *Delta Conservation Framework* described in this executive summary.

Outside the variety of scientific resources, planning tools, and regional partnerships brought together under the umbrella of this new 30-year Framework, the strongest current state guidelines for overarching conservation and management of Delta aquatic and terrestrial ecosystems are the 2009 Delta Reform Act and subsequent 2013 *Delta Plan*, the 2014 *California Water Action Plan* as well as the 2006-2013 work to draft the *Bay Delta Conservation Plan* described above. Additionally, in 2016, the San Francisco Estuary Institute completed the last of three important reports establishing a strong foundation of science on the Delta's historical ecology, transformation by humans, and future restoration prospects: *A Delta Renewed*. The latter is an important science basis for the *Delta Conservation Framework*.

What is not in the *Delta Conservation Framework*, however, are any conservation actions associated with changing flows into or through the Delta. Nor are there any acreage targets or maps showing where conservation should occur. Instead, the Framework offers a guide for how best to plan and implement conservation.

In the coming decades, this planning context for Delta conservation will be challenged by substantial additional changes to the region due to climate change. While California has long experienced droughts, floods, wildfires, and other climate-driven events, recent extremes and accelerated climate change clearly derive from human activities such as the burning of fossil fuels. As a result, Delta managers and residents must prepare for sea level rise, extreme droughts, and storms with associated flooding. These events will influence the evolution of the Delta landscape, ecosystems, and economy far into the future.

What is the Delta?

The Delta, once a vast freshwater marsh, drains the watersheds of California's Sacramento and the San Joaquin Rivers. Combined with Suisun Marsh, this inland reach of the San Francisco Estuary spans six counties and 1,300 square miles of land and water. Nearly half of California's surface water unites in the Delta, flowing through hundreds of miles of interconnected waterways west to San Francisco Bay. Ecologically rich and diverse prior to European settlement, the Delta is now largely a center for agricultural operations interspersed with small towns and communities, and bordered by larger cities including Stockton and West Sacramento. A vast levee system protects over 400,000 acres of high-quality farmland, communities, and municipalities that are situated within the historic Delta floodplain.

The Delta plays a crucial role supporting California's economic vitality as a central component of the state's water supply infrastructure and contributor to the state's substantial agricultural productivity. Statewide, more than 3 million acres of prime irrigated farmland and two-thirds of the state's population depend on the Delta watershed for some portion of their water supply. The Delta is also home to a growing population of more than 550,000 people. Delta communities are primarily concentrated in the large and expanding cities around its fringes.

Framework Goals & Strategies

The *Delta Conservation Framework*'s goals and strategies, used collaboratively, offer pathways to realizing the vision of the Delta as a place where people prosper and wildlife communities thrive by 2050.

Goals A, B and C underscore a growing recognition of the role people and communities must play as partners in conservation. Public agencies, restoration practitioners, and scientists can all benefit from working in collaborative partnerships with Delta residents, landowners, farmers, tribes and nongovernmental organizations, at the local and regional levels, to plan conservation projects. The intention of these partnerships is to overcome the current climate of guardedness and move toward sustained communication and collaboration. Mutual respect for, and a commitment to, evaluating challenges and opportunities together is essential to the success of conservation.

Goal D highlights the importance of conserving Delta ecosystems and ecological processes and functions, and is founded on a landscape-scale approach that directly aligns with recommendations in *A Delta Renewed*. Delta ecosystems have degraded substantially over time, and continue to do so, because of a host of factors including land use changes, poor water quality, reduced sediment supply, and invasive species. Populations of native fish and wildlife species have seriously declined in the past decade. The Delta's capacity to supply ecosystem services, drinking and irrigation water, and agricultural livelihoods to its residents and the state, while also sustaining its native fish and wildlife, continues to decrease. The novel, much altered, current Delta ecosystem is weak and climate change will exacerbate its weaknesses. Any conservation effort must embrace the importance of scale and ecosystem function to be resilient.

Framework Goals

People: Communicating, engaging, educating

- GOAL A: Ensure that regular communication among stakeholders and socioeconomic considerations are integrated into all Delta conservation initiatives.
- GOAL B: Support and expand existing public outreach efforts advancing Delta conservation.
- GOAL C: Develop multi-benefit conservation and land management strategies and plans that balance environmental and human needs.

Ecosystem: Making science-based decisions

- GOAL D: Conserve Delta ecosystems and their ecological processes and functions to benefit society and wildlife, and to enhance resilience to climate change.
- GOAL E: Evaluate conservation progress and address climate change stressors and other drivers of change by implementing the science strategies and priorities of the Delta Science Program and Interagency Ecological Program, the adaptive management program for Biological Opinions related to state and federal water project operations, and adaptive management recommendations emerging from interagency integration teams.

Permits & Funds: Thinking ahead collectively

- GOAL F: Improve resource agency and regulatory capacity for permitting Delta conservation projects.
- GOAL G: Optimize use of existing short-term funding and support current and new mechanisms to secure long-term funding for continued conservation implementation and management.

Delta landscapes are a mixture of water, farms, wildlife habitats, and small towns. Photo: Amber Manfree

Goal E highlights pre-existing and ongoing scientific research and adaptive management efforts necessary to successfully implement conservation in the Delta. Understanding the complexities, and reverberating impacts on the use of the Delta by both people and native species, requires collaborative multi-interest science, long-term monitoring, and adaptive management based on this research and monitoring. Without science-based conservation practices that support rapid responses to crises and provide long-lasting solutions, Delta conservation may not be successful in the long term.

Goals F and G recognize that there are major challenges to the timely and cost-effective implementation of conservation projects in the Delta related to permitting and funding. Even the most seasoned engineers, resource managers, biologists, and advocates for conservation projects struggle with the complexity and cost of moving projects through planning, permitting, compliance, and construction. The Framework offers strategies and tools for how facilitate permitting and funding for conservation.

Each section of the *Delta Conservation Framework* includes three parts: a description of goals and strategies; on-the-ground examples of regional-scale conservation planning efforts already underway; and reference guides introducing readers to the many existing plans and programs in the Delta, as well as useful tools, checklists, and models. The Framework also provides the basics on Delta science enterprise and adaptive management efforts. One section summarizes the most current landscape-scale science on how to implement conservation to support ecosystem function. Other sections provide an invaluable counterpart, describing how farm fields, pastures, and working lands can contribute to ecosystem health and conservation. By pulling it all together in one place, and by identifying all the latest policy, regulatory, science, and management resources available, the document is much more than another plan on the shelf.

An Emphasis on Regional Approaches

A strong thread throughout the *Delta Conservation Framework* is to focus on "regions" that make sense in terms of landscapes, watersheds, ecosystems, human history, or communities as an organizing principle for conservation work in the future.

The Framework references a number of different kinds of "regional" approaches:

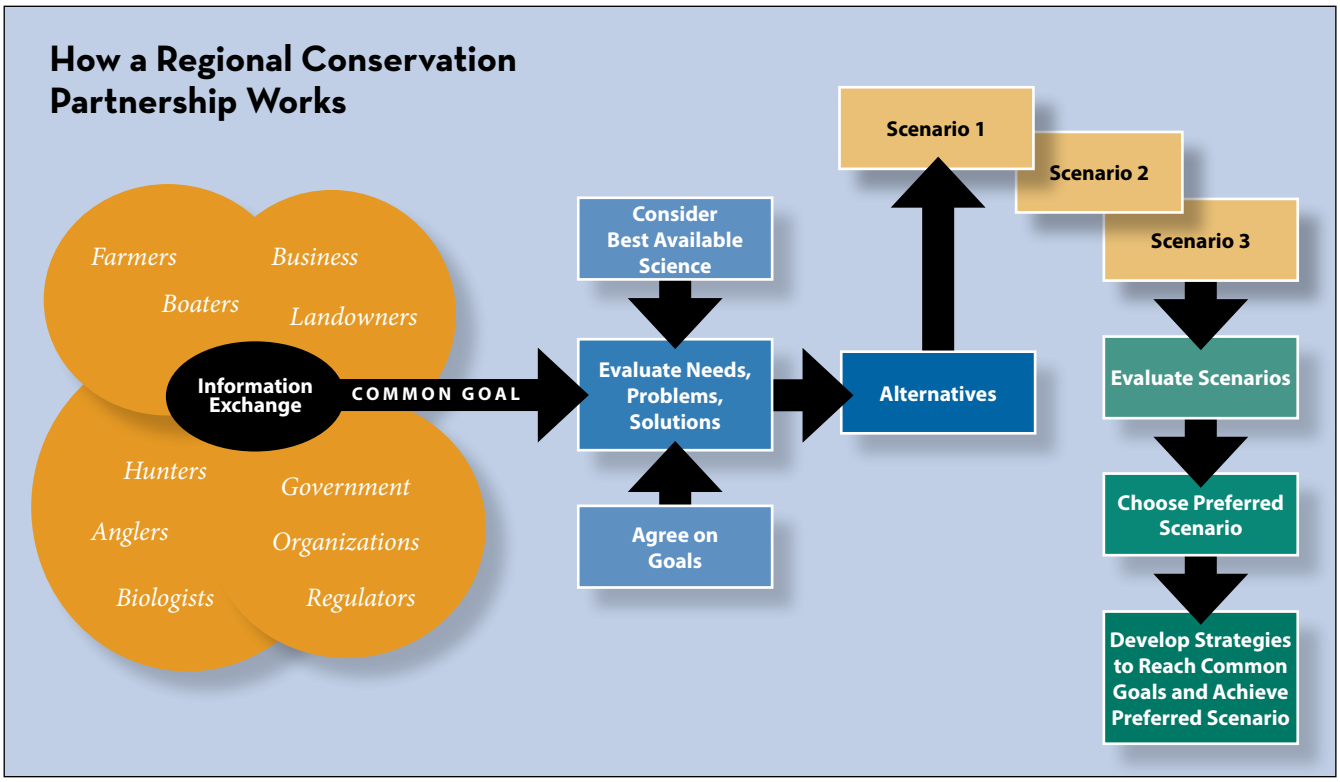
- **Regional Conservation Partnerships** made up of diverse interests, public and private, that work together to achieve landscape level goals;
- **Regional Conservation Strategies** developed by regional partnerships that map out how conservation goals might be achieved in the regions with an eye toward fitting the regional pieces together across a larger landscape picture;
- **Conservation Opportunity Regions** roughly identified by Delta stakeholders where promising opportunities for major conservation and restoration successes exist;
- **Regional Conservation Investment Strategy** (RCIS), a California Department of Fish and Wildlife program offering a structure for analysis, assessment, scenario-planning, investment and mitigation to regions interested in developing nonbinding, voluntary conservation and habitat enhancement actions around focal species and habitats (see also Section V).*

Of the above, the "regional conservation strategy" is a central organizing idea for implementation of the *Delta Conservation Framework*. A regional strategy might be an existing plan, such as the *Suisun Marsh Habitat Restoration and Management Plan*, or may be the result of a new effort.

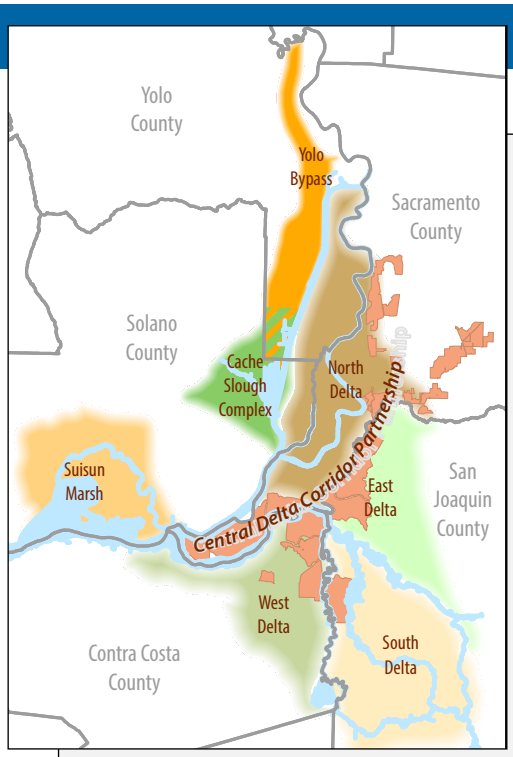
The main idea is to develop non-regulatory, long-term, broadly-supported regional conservation action plans. These would be developed collaboratively by regional planning partnerships comprised of public agencies, Delta community stakeholders, representatives of existing regional partnerships and tribes, other interest groups, scientists, restoration practitioners, non-governmental organizations, and interested citizens.

The resulting strategies or plans would focus on public lands or collaborations with willing private landowners in a given "conservation opportunity" region. The Framework identifies seven conservation opportunity regions of the Delta that include public lands, existing conservation lands, or existing planning partnerships (see map next page). This sub-regional division of the Delta, derived from stakeholder discussions during the 2016 *Delta Conservation Framework* public workshops, reflects variation in local land use, communities, ecosystem types, and public lands.

Each resulting regional conservation strategy would tailor a set of conservation objectives, specific actions, and an adaptive management framework to the needs of each sub- region. To achieve multiple, landscape scale benefits, however, these strategies would also be aligned with the overarching goals and strategies of the *Delta Conservation Framework.**



** While the core ideas of regional partnerships, strategies, and conservation opportunity regions presented here are the foundation of the Framework, they appear largely without capitalization throughout these pages to underscore an intent of inclusivity and collaboration.*



Delta Conservation Projects and Opportunity Regions

Yolo County
Sacramento County
Solano County
Contra Costa County
San Joaquin County
Alameda County
West Sacramento
Yolo Bypass
Yolo Bypass and Cache Slough Complex
Sacramento Deep Water Ship Channel
Freeport
Clarksburg
Elk Grove
Hood
Stone Lakes NWR
Courtland
Cache Slough
Cache Slough Complex
North Delta
Cosumnes River Preserve
Walnut Grove
Thornton
McCormack Williamson Tract
Ryde
Sacramento R.
Rio Vista
Isleton
Fairfield
Suisun Marsh
Staten Island
Bouldin Island
East Delta
Lodi
Decker Island Wildlife Area
Twitchell Island
Webb Tract
Benicia
Sherman Island
Sherman Lake
Franks Tract
Winter Island
Pittsburg
Dutch Slough
Martinez
Oakley
Holland Tract
Antioch
Bacon Island
San Joaquin R.
Stockton
Brentwood
West Delta
Discovery Bay
Byron
South Delta
Lathrop
Mountain House
Tracy
Conservation Projects
Farmland in Delta Region
Central Delta Corridor Parcels
COR Areas
0 5 10 Miles
N

Source: CDFW, 2018

Building on Existing Plans and Partnerships

Any evaluation of conservation opportunities in the Delta requires consideration of the many existing planning documents, programs, and related regulatory requirements. The *Delta Conservation Framework* does not supersede these individual planning efforts, but instead connects and integrates them into the larger landscape-scale perspective. It also suggests them as important references for consideration as part of ongoing or future regional conservation strategies and individual projects. To make this integration more transparent, the Framework provides summarized guides to related plans and programs.

The tricolored blackbird, a threatened species with diminishing habitat in the Delta. Photo: Matt Elyash, CDFW

Current Major Initiatives Aligned with the Delta Conservation Framework

Agricultural Lands Stewardship Framework and Toolkit: A working group launched by the Department of Water Resources in 2014 to develop a list of strategies to provide project proponents and those affected by proposed conservation projects with an integrated and collaborative approach to address protecting and changing uses of agricultural land.

California Department of Fish and Wildlife Grant Solicitation Guidelines: Draft 2018 Proposition 1 solicitation guidelines make it a priority to fund the development of regional planning partnerships and to facilitate the collaborative development of regional conservation strategies or plans in the Delta.

Central Delta Corridor Partnership: A partnership launched in 2017 to coordinate planning and restoration on a network of roughly 50,000 acres of publicly-owned or funded lands in the central Delta.

Delta Plan Interagency Implementation Committee: A committee established in 2013 to facilitate *Delta Plan* implementation through increased coordination and integration among local, state and federal agency participants. The committee has encouraged the development of programmatic permitting tools for conservation projects.

Delta Science Program Social Science Task Force: The Delta Science Program is coordinating a Social Science Task Force tasked with developing a strategic plan to strengthen and integrate social sciences into the science, management, and policy landscape of the Delta. Composed of individuals with a diverse set of expertise in the social sciences, the task force's key goal will be to develop a set of recommendations that can be acted upon by the Delta science community.

Franks Tract Feasibility Study: A study led by the California Department of Fish and Wildlife aimed at restoring portions of Frank's Tract to tidal marsh. This effort solicited feedback from local residents, boaters, and anglers and includes a locally proposed design.

Yolo Bypass Cache Slough Partnership: A partnership of representatives from local, state, federal agencies who signed a memorandum of understanding to oversee collaborative implementation of conservation in this region, all before initiation of the Framework in 2016.

Additional Important Regional Plans & Partnerships

Central Valley Joint Venture Implementation Plan, outlines objectives for Central Valley habitats that support shorebirds, waterbirds, and riparian songbirds.

Delta Working Landscapes Program, coordinated through the Delta Protection Commission, provides examples of what wildlife friendly agriculture and wetland restoration measures private landowners could adopt on larger scales throughout the Delta.

Habitat Conservation Plans & Natural Community Conservation Plans: The *Delta Conservation Framework* defers to the species and acreage targets outlined in HCPs and NCCPs, or relevant Conservation Strategies, where they overlap with the Delta planning region. These include: the East Alameda Conservation Strategy; the East Contra Costa County HCP/NCCP; the South Sacramento HCP/NCCP; the Solano Multispecies HCP; the San Joaquin County Multi-Species HCP and Open Space Plan; and the Yolo HCP/NCCP.

Migratory Bird Conservation Partnership – comprised of Audubon California, Point Blue Conservation Science, and the Nature Conservancy – works with a broad array of partners to develop multi-benefit conservation solutions for birds, wildlife, and human communities to address issues concerning bird habitat and biological needs.

Nature Conservancy BirdReturns, a pilot project combining crowd-sourced data, hard science and economic incentives, provides pop-up habitats for birds on rice fields in the Sacramento Valley.

North Delta Habitat Arc, a reconciled ecosystem strategy, creates an arc of habitats connected by the Sacramento River to benefit native fish and other wildlife.

***Suisun Marsh Habitat Management, Preservation and Restoration Plan*,** established in 2013, provides a structure for conservation planning and implementation in the Suisun Marsh region.

Permitting, Funding & Planning Tools – The Implementation Questions

Whether it's restoring a few acres of wetland or planting riparian vegetation on levees or removing invasive weeds, most conservation projects on Delta landscapes, let alone infrastructure upgrades, require permissions and permits from government regulators.

Myriad regulations reflect federal, state, regional and local goals for environmental quality, wildlife protection, public safety, land use, and other areas of public interest and common good. Faced with the many layers of regulatory oversight governing Delta projects – not to mention sometimes conflicting definitions and directives –even the most seasoned practitioners struggle with the complexity and cost of moving projects through planning, permitting, compliance, and construction. By the time projects are approved and shovel-ready, the dollars and equipment required to do the job may have already evaporated.

The *Delta Conservation Framework*, as an overarching framework for coordinating large-scale conservation, recognizes that these are major challenges to the timely and cost-effective implementation of conservation projects in the Delta. The Framework offers strategies and solutions for how to facilitate permitting and funding for conservation, as well as how to develop conservation plans on project, local and regional scales with the Framework in mind.

Permitting Strategies

The Framework recommends supporting and increasing the capacity of regulatory agencies to review and approve conservation projects. It also supports the development of easily accessible online resources to explain permitting guidelines and requirements clearly, as well as the development of more regional and programmatic permitting frameworks for the Delta. The Framework also includes various examples of how to tackle permitting challenges.

Funding Strategies

The Framework explores both short-term and long-term funding challenges. It underscores the need to shift from the parcel-by-parcel, project-by-project thinking that pervades short term funding models to landscape scale, regionwide, longer-term models. It also advocates for the development of more long term funding opportunities for Delta conservation and adaptive management, ranging from direct budget allocations and environmental trust funds to emerging carbon markets.

Planning Scales – Regional or Individual

The Framework recognizes two approaches to future conservation. The first approach is to continue, or form, independently facilitated, multi-stakeholder regional partnerships in each suggested conservation opportunity region. These partnerships would then work together to develop recommendations and project lists relevant to their region. The second approach allows for individual project implementation in areas without an established regional partnership.

Planning Tools

The Framework describes a number of well-established planning tools to aid decision-making by regional partnerships and individual project proponents. These include: the Open Standards for the Practice of Conservation; scenario planning; and structured decision-making. These tools are specifically designed to bring unconscious prejudices to the surface, tackle complexity, move through uncertainty, weigh alternatives, consider trade offs and arrive at priority conservation actions and strategies.

The Path Forward – A More Resilient Delta in 2050

The path toward more ecologically functional Delta ecosystems within a thriving Delta community remains controversial. Despite mitigation requirements for infrastructure projects and the state and federal water projects, and a long history of public investment in Delta ecosystems through bond funds, few projects have been initiated and managed over the long term. Implementing conservation in the Delta will continue to stall unless Delta stakeholders are willing to work collaboratively, knowing they may have to be open to considering and accepting tradeoffs. If no solutions can be found, Delta ecosystem conservation will remain on hold, or occur in a piecemeal fashion. In the meantime, Delta ecosystems and their important services to humans and wildlife will continue to decline.

Multi-benefit projects that float all boats may seem like an impossible dream. But in reality, what local landowners, hunters, farmers, anglers, and boaters want may not be that far off from what species need to survive and what public infrastructure projects need to provide the greatest good for the lowest price. Every interest – both human and wild – faces the common uncertainty of drought, fire, earthquakes, and political change. There is an equally common reverence, however, for the Delta landscape and a desire to renew the riches of the past in the future.

The *Delta Conservation Framework* is an invitation to all interested stakeholders to come to the table. It is a call to continue the work of improving ecosystem health, supporting and recovering Delta wildlife, and growing the science capacity to learn from conservation actions. It is a warning of the urgency of facing the challenges of climate change, drought, and flooding head on.

Find your place, your region, your partners, review the goals and tools provided in the *Delta Conservation Framework*, and set out to make positive progress.

It's up to each and every one of us to build the conservation commons of the future within the unique landscape, and among the unique people, that comprise the Delta.

Photo: Bassmaster Elite, CDFW

What Does the Framework Mean to Me?

- **For farmers** – ideas and support for wildlife friendly agriculture, and a seat at the conservation planning table.
- **For landowners** – opportunities to participate in bottom-up conservation planning, and affirmation that conservation goals focus on public lands first.
- **For residents** –ideas for how your way of life may be preserved, and protected from floods and climate change.
- **For policymakers** – a concrete glimpse of how multi-benefit projects and regional conservation partnerships can optimize conservation spending.
- **For scientists** – briefs on the most current recommendations, science initiatives, and adaptive management programs designed to nurture species resilience and ecosystem processes.
- **For birders, hunters, and anglers** – avenues for protecting and improving the habitats, migration routes, and food supplies of the Delta's fish, birds, and wildlife.
- **For boaters** – improved access to Delta waterways due to conservation activities that often support invasive weed management.
- **For regulators** – a call to consider common delta guidelines and regional permits, and support for these efficiencies. Opportunities to shift away from time-consuming project-by-project approvals to more landscape scale conservation.
- **For conservation and resource managers** – Pathways for going beyond single species management, a way to work together at larger scales, and a guide to navigate permitting.
- **For you** – a way to fit in with all of the above and cherish your Delta.

The *Delta Conservation Framework* Online
wildlife.ca.gov/DeltaConservationFramework

The California Department of Fish and Wildlife acknowledges and appreciates the support of the Sacramento-San Joaquin Delta Conservancy beginning with the 2016 public workshops. The Delta Conservancy facilitated communication with Delta stakeholders through the use of its Delta interests contact list, funding for professional facilitation services, and engagement in each of the public workshops.

The Delta Conservation Framework.
California Department of Fish and Wildlife
Publication Date: Version 12/31/18

Authors: Christina Sloop, Brooke Jacobs, Randi Logsdon, Carl Wilcox
Editor: Ariel Rubissow Okamoto
Graphic Design: Darren Campeau
Illustrations: Afsoon Razavi
Maps: Diane Mastalir, CDFW

For more information please contact us at dcf@wildlife.ca.gov

SECTION 1

A Common Framework for Building a Resilient Delta

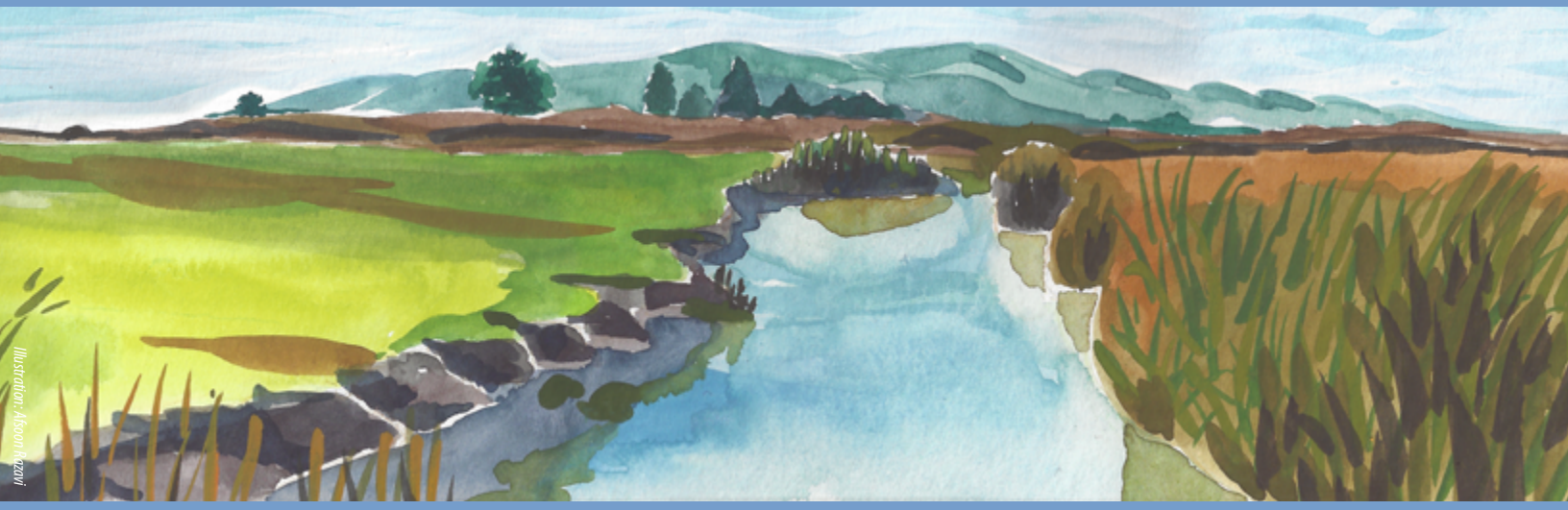


Illustration: Alyson Rozov

KEY TERMS

- **COEQUAL GOALS** - As mandated by the Delta Reform Act of 2009, coequal goals means the "two goals of providing a more reliable water supply for California, and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place." (CA Water Code §85054) Additionally, Water Code Section §85021 states that it is the Policy of the State to "reduce reliance on the Delta in meeting California's future water supply needs."
- **CONSERVATION** is defined as the protection, enhancement, and restoration of ecological function of Delta ecosystems.
- **DELTA STAKEHOLDERS** are residents, landowners, farmers, and businesses situated in the Delta; the public, including citizens who rely on the Delta for water supply or for recreational uses; beneficiaries up- and downstream of the estuary; restoration practitioners; local, state and federal agencies; non-government organizations; Native American tribes; academic institutions; private entities; and policy-makers.
- **DELTA COMMUNITY** refers to the residents, landowners, farmers, and businesses situated in the Delta.
- **DELTA** refers to the Sacramento-San Joaquin Delta as defined in Water Code §85058, Suisun Marsh and Bay, and the northern Yolo Bypass. This "Delta" area includes the principal conservation opportunity regions described in Section VI and Appendix 2. Areas immediately adjacent to the "Delta" comprise the supplementary conservation opportunity regions to be considered in long-term planning.
- **ECOSYSTEM SERVICES** are "the direct and indirect contributions of ecosystems to human well-being. They support directly or indirectly our survival and quality of life." Ecosystem services can be categorized into four main types: provisioning, regulating, habitat and cultural services.
- **WILDLIFE** refers to all native plant and vertebrate and invertebrate animal species that inhabit the Delta as permanent residents or during part of their migratory life cycle.

The Delta Conservation Framework *footnote and endnote references can all be found in Appendix 1 online by section.*

Introduction

The 2018 *Delta Conservation Framework* provides a new, integrated, toolbox and guide to landscape-scale planning and implementation of conservation projects in the Sacramento-San Joaquin Delta, Suisun Marsh, and the Yolo Bypass (collectively, the "Delta").

The Framework was developed by the California Department of Fish and Wildlife as part of a three-year collaborative stakeholder process founded on openness, listening, and direct engagement by public agencies with landowners and stakeholders. The resulting vision for 2050 is of a Delta composed of resilient natural and managed ecosystems situated within a mosaic of towns and agricultural landscapes, where people prosper and healthy wildlife communities thrive. Beyond this vision, the Framework presents seven specific conservation goals, 26 strategies to reach those goals, 200 pages of details, and seven appendices.

The process that resulted in this *Delta Conservation Framework* involved stakeholders in a collaborative approach to conservation planning at a pivotal time for Delta science and policymaking. This pivotal time followed a period of changes in Delta conservation and water policies between 2006 and 2016 that are summarized as follows, in order to provide context for development of the Framework.

In 2006, Delta planners and agencies began crafting a *Bay Delta Conservation Plan* (BDCP), intending to provide a comprehensive tool for planning and permitting conservation projects and new water conveyance infrastructure. The resulting 2013 BDCP public draft[1,2,3] contained measures to protect 54 sensitive native species and specific actions to protect and restore habitat in the Delta. The BDCP also contained plans to add three new water intakes along the Sacramento River to divert water for the state and federal water projects. In spring 2015, the Brown administration announced a shift from the BDCP to California WaterFix[4] and EcoRestore.[5] These two new parallel but separate programs were initiated to pursue water supply infrastructure and implement more focused restoration in the Delta respectively.

To maintain the momentum of conservation planning and implementation that had begun in the BDCP over the long term, the California Department of Fish and Wildlife started a new initiative called the *Delta Conservation Framework* in 2016. The Department held a series of meetings with its state partners to present the new initiative, gather feedback, and hear perspectives. The group collectively acknowledged two key points: 1) the need for a new approach to conservation planning after the BDCP and 2) the need to bring Delta stakeholders into the planning process early.

In June 2016, the California Department of Fish and Wildlife held an initial public workshop to have the same conversation with a wider stakeholder audience. In this meeting participants expressed many

Framework Goals

People: Communicating, engaging, educating

- GOAL A: Ensure that regular communication among stakeholders and socioeconomic considerations are integrated into all Delta conservation initiatives.
- GOAL B: Support and expand existing public outreach efforts advancing Delta conservation.
- GOAL C: Develop multi-benefit conservation and land management strategies and plans that balance environmental and human needs.

Ecosystem: Making science-based decisions

- GOAL D: Conserve Delta ecosystems and their ecological processes and functions to benefit society and wildlife, and to enhance resilience to climate change.
- GOAL E: Evaluate conservation progress and address climate change stressors and other drivers of change by implementing the science strategies and priorities of the Delta Science Program and Interagency Ecological Program, the adaptive management program for Biological Opinions related to state and federal water project operations, and adaptive management recommendations emerging from interagency integration teams.

Permits & Funds: Thinking ahead collectively

- GOAL F: Improve resource agency and regulatory capacity for permitting Delta conservation projects.
- GOAL G: Optimize use of existing short-term funding and support current and new mechanisms to secure long-term funding for continued conservation implementation and management.

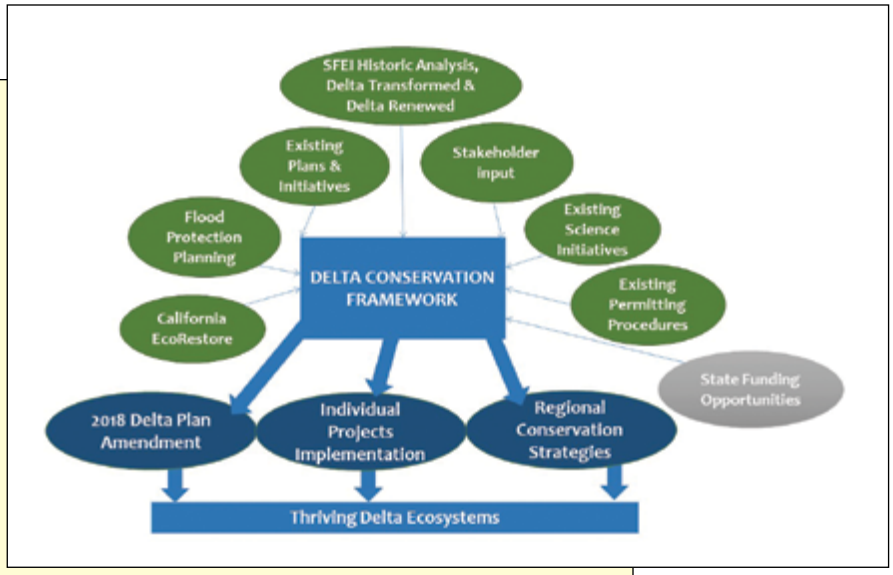


Figure 1.1: The Delta Conservation Framework offers a nexus and guide for diverse planning initiatives and perspectives in the Delta region.

concerns about the myriad past and present Delta conservation planning efforts. They also made some general, overarching suggestions for improvements:

- Bring together the confusing array of existing Delta planning efforts, instead of creating yet another plan to sit on the shelf.
- Focus conservation efforts on public lands first.
- Acknowledge agriculture as the primary land use and way of life in the Delta in any conversation about conservation planning.
- Include stakeholders in the conservation planning process early and often.
- Plan for conservation on a regional scale to better embrace the size and diversity of the Delta.

In response to this initial meeting, the California Department of Fish and Wildlife launched a series of six monthly public workshops. At these workshops, participants from diverse public and private interests reviewed and discussed draft portions of the document. The Department encouraged participants to offer new perspectives and suggest revisions, and then used this input to build the core components of the 2017 Public Draft *Delta Conservation Framework*. After releasing the 2017 Public Draft, the Department solicited more feedback through comment letters, individual stakeholder meetings, and two additional public workshops. The resulting public and final drafts offer an integrated vision and guide for regional conservation planning in the Delta.

Each section of the *Delta Conservation Framework* includes three parts: a description of goals and strategies; on-the-ground examples of regional-scale conservation planning efforts already underway; and reference guides introducing readers to the many existing plans and programs in the Delta, as well as to useful tools, checklists, and models. The Framework also provides the basics on Delta science enterprise[6,7,8,9,10,11] and adaptive management[12,13] efforts to help conservation practitioners learn about ongoing efforts and put them in a broader context.[14,15] As an example, a section on the San Francisco Estuary Institute's *A Delta Renewed* — which serves as the Framework's scientific foundation — summarizes the most current landscape-scale science on how to implement conservation to support ecosystem function. Other sections provide an invaluable counterpart, describing how farmfields, pastures, and working lands can contribute to ecosystem health and conservation. By pulling it all together in one place, and by identifying all the latest policy, regulatory, science, and management resources available, the document is much more than another plan on the shelf: it's a strategic, stakeholder-informed pathway to a healthy and prosperous Delta in 2050.

Although the *Delta Conservation Framework* was initiated as a conservation planning effort in response to the pivot away from the BDCP, what emerged at the end of the public participation and feedback process looks very different from the BDCP. For example, the Framework does not contain acreage targets. Nor does it provide detailed maps showing where conservation should occur. Instead, it is a guide for how best to plan and implement conservation.

In terms of the broader planning and policy context, the *Delta Conservation Framework* supports achieving the ecosystem goals of the Delta Reform Act and the Delta Stewardship Council's *Delta Plan*.[17] In June of 2015, the Delta Stewardship Council identified the need to amend the *Delta Plan* to address the shift from the BDCP to California Waterfix and EcoRestore. During the development of the *Delta Conservation Framework*, the Delta Stewardship Council initiated an amendment to Chapter 4 of the *Delta Plan*, Protect, Restore, and Enhance the Delta Ecosystem.

While the Council goes through the amendment process, and while many other plans and programs continue to evolve and adapt to changing circumstances, the Framework is intended to serve as a valuable reference and resource. If the Framework's conservation goals and strategies are pursued

by all Delta stakeholders, and if stakeholders embrace and champion the kind of multi-objective, regional scale projects that optimize benefits, the vision of a healthy Delta for all in 2050 could become reality.

Setting

The Delta, once a vast freshwater marsh, drains the watersheds of California's Sacramento and the San Joaquin Rivers. Combined with Suisun Marsh, this inland reach of the San Francisco Estuary spans six counties and 1,300 square miles of land and water.[17] Nearly half of California's surface water unites in the Delta, flowing through hundreds of miles of interconnected waterways west to San Francisco Bay. Ecologically rich and diverse prior to European settlement, the Delta is now largely a center for agricultural operations interspersed with small towns and communities.

The Delta plays a crucial role supporting California's economic vitality as a central component of the state's water supply infrastructure and contributor to the state's substantial agricultural productivity.[18] It is also home to a growing population of more than 550,000 people. Delta communities are primarily concentrated in the large cities around its fringes, but they are also expanding into the Delta's non-urban areas, such as Discovery Bay, the River Islands near Lathrop, and Hotchkiss tract in Oakley.[18,19] Statewide, more than three million acres of prime irrigated farmland and two-thirds of the state's population depend on the Delta watershed for some portion of their water supply.[20] Water flowing through the Delta provides a critical base for most of the state's economic output.[21] A vast levee system protects 400,600 acres of high-quality farmland, communities, and municipalities that occur within the historic Delta floodplain.

Although the California Water Code recognizes the Delta as "the most valuable ecosystem on the west coast of North and South America", the wildlife habitats and ecosystem services[21,22] that the Delta provides have been impacted by environmental degradation, land use conversions, and economic shifts. In the coming decades the Delta is expected to undergo substantial additional changes due to climate change. While California has long experienced droughts, floods, wildfires, and other climate-driven events, recent extremes and accelerated climate change derive from human activities such as the burning of fossil fuels.[23] As a result, the Delta must prepare for sea level rise, extreme droughts, and storms with associated flooding.[23] These events will influence the evolution of the Delta landscape far into the future.[3,14,17,18,20,23,24,25] Over the short and long term, these impending changes could impact land use and affect Delta ecosystems, agricultural operations, communities, and the Delta economy. [18,20,23,24]

Workers sort apples, part of the Delta's thriving agriculture related industries. Photo courtesy Delta Protection Commission

Planning History

Large-scale conservation of Delta aquatic and terrestrial habitats is called for in a wide variety of California state laws, mandates, plans, mitigation requirements, and initiatives, many of which are the result of decades-long debates, and efforts based on scientific research.[20,26,27,28,29,30,31,32,33,34]

Numerous government agencies, non-governmental organizations, academic institutions, private entities, policy-makers, landowners, and citizens are involved in these conservation, stewardship, and science activities.

> *"The Legislature finds and declares that the Sacramento-San Joaquin Delta, referred to as the Delta in this division, is a critically important natural resource for California and the nation. It serves Californians concurrently as both the hub of the California water system and the most valuable estuary and wetland ecosystem on the west coast of North and South America."(California Water Code, §85002).*

The strongest current state guidelines for overarching conservation and management of Delta aquatic and terrestrial ecosystems are the 2009 Delta Reform Act and subsequent 2013 *Delta Plan*, the 2014 *California Water Action Plan* (CWAP)[20] as well as the work that went into the 2006-2013 *Bay Delta Conservation Plan* (BDCP)[1] that in 2015 resulted in the separation of water supply management and resource conservation programs into California Water Fix[2] and California Eco-Restore.[3] The two recent state planning resources developed in parallel. Additionally, in 2016, the San Francisco Estuary Institute issued three important reports including *A Delta Renewed*, an important science basis for the Framework.[16,32,33]

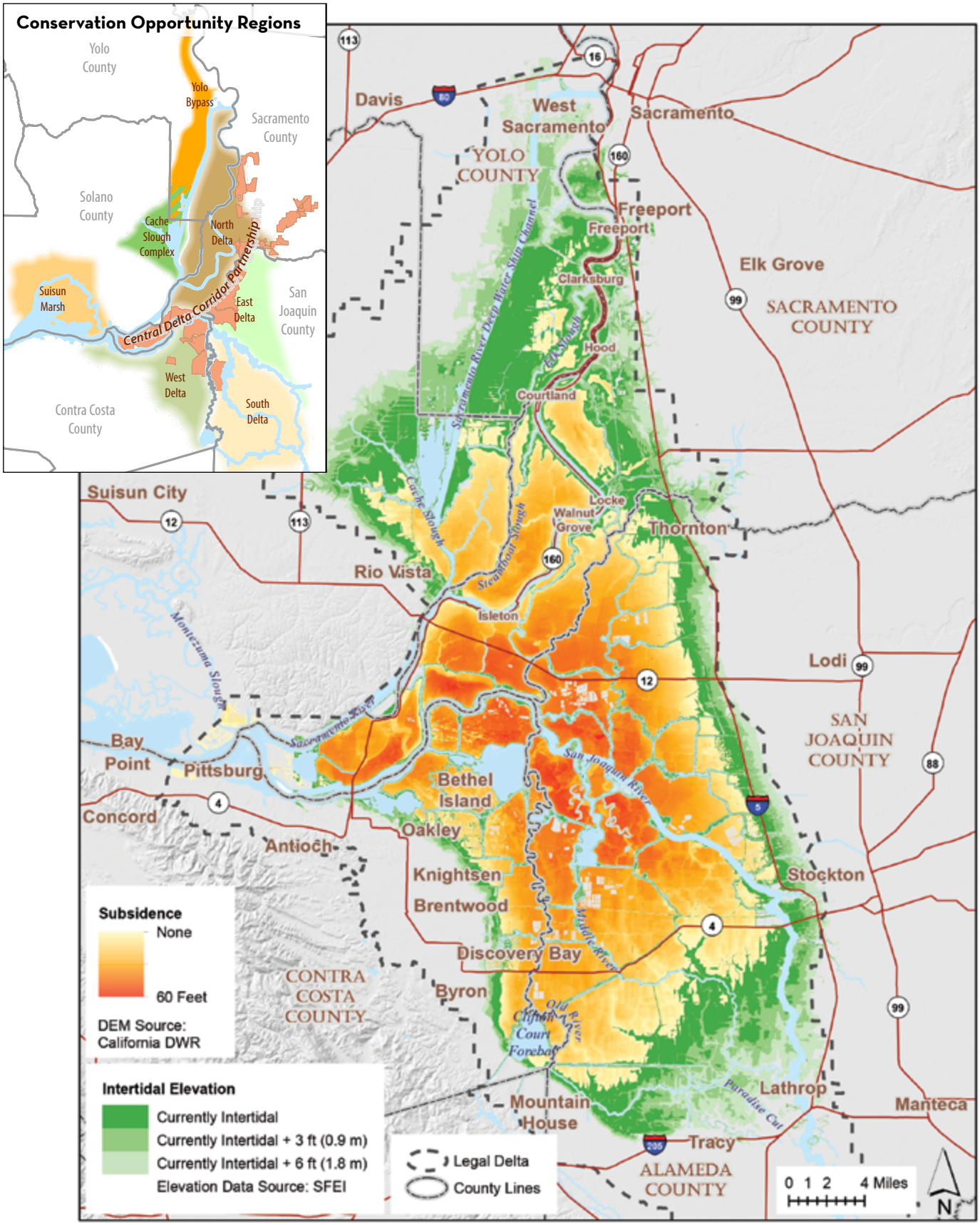
The *Delta Conservation Framework* does not include conservation actions associated with changing flows into or through the Delta. Although the magnitude, timing, and pattern of flow through the Delta are vital factors driving ecosystem function, conservation actions to address flows are championed in parallel efforts to the Framework. These parallel efforts include the update to the *Bay Delta Water Quality Control Plan* by the State Water Resources Control Board, implementation of the current Biological Opinions[25] on the operations of the State Water Project and Central Valley Project, the re-initiation of consultation on these biological opinions, and incidental take authorizations for the operations of the state water project issued by the California Department of Fish and Wildlife. Collectively, they seek to understand the role of flow in the Delta in supporting ecosystem function and, if needed, place regulatory restrictions on water project operations to minimize the effects on listed species and their habitats.

The information integrated and compiled in the *Delta Conservation Framework* is also needed to protect, restore, and improve the function of Delta ecosystems to support native communities of fish and wildlife, particularly populations of special status species.

Photo: Christina Sloop

Regulatory History Timeline

- 1992 – DELTA PROTECTION ACT states that "The Delta is a natural resource of statewide, national, and international significance, containing irreplaceable resources. It is the policy of the State to recognize, preserve, and protect those resources of the Delta for the use and enjoyment of current and future generations, in a manner that protects and enhances the unique values of the Delta as an evolving place (PRC §29701-2)."
- 1992 – DELTA PROTECTION COMMISSION was established by the Delta Protection Act as a forum for Delta residents to participate in decisions to recognize and enhance the unique cultural, recreational, and agricultural resources of the Delta (PRC §29703.5(a)).
- 1994 – CALFED BAY-DELTA COORDINATION PROGRAM (CALFED) was created to resolve some of the challenging issues affecting Delta ecosystems and wildlife, following a decade of disputes between the State of California, the federal government, agricultural interests, environmental groups, and municipal water services.
- 2006 – BAY DELTA CONSERVATION PLAN (BDCP) was initiated by the Department of Water Resources and the Bureau of Reclamation as a permitting framework for the construction of new Delta water conveyance through a combined 50-year Habitat Conservation Plan and Natural Community Conservation Plan spanning the Delta, Yolo Bypass, and Suisun Marsh.
- 2006 – DELTA VISION BLUE RIBBON TASK FORCE superseded CALFED, laying the groundwork for the Legislature to craft the 2009 Delta Reform Act.
- 2009 – DELTA REFORM ACT includes a package of bills that defined regulatory accountability in the Delta for implementation of conservation measures, as well as measures for water conservation, groundwater monitoring, enforcement to prevent illegal water diversions, and a bond measure to provide needed funding (California Water Code §85054).
- 2009 – DELTA STEWARDSHIP COUNCIL was established by the Delta Reform Act to advance the Delta Reform Act's coequal goals and to develop and oversee implementation of the Delta Plan, a long-term sustainable management plan for the region founded on those goals in the context of the "Delta as an evolving place." The Council is supported by the Delta Independent Science Board and the Delta Plan Interagency Implementation Committee.
- 2009 – SACRAMENTO-SAN JOAQUIN DELTA CONSERVANCY was established by the Delta Reform Act as the state agency responsible for implementing ecosystem restoration in the Delta and supporting efforts that advance both environmental protection and the economic well-being of Delta residents.
- 2013 – DELTA PLAN was unanimously adopted by the Delta Stewardship Council. It is guided by best available science and founded on cooperation and coordination among federal, state and local agencies.
- 2014 – CALIFORNIA WATER ACTION PLAN highlights overarching goals for "Reliability, Restoration, and Resilience," and outlines ten main actions that include: "Achieve the coequal goals for the Delta, protect and restore important ecosystems, increase flood protection, increase operational and regulatory efficiency, and identify sustainable and integrated financing opportunities."
- 2015 – CALIFORNIA WATERFIX was launched in lieu of the BDCP to realize new Delta water conveyance infrastructure under ESA Section 7 and the California Endangered Species Act.
- 2015 – CALIFORNIA ECORESTORE was launched in lieu of BDCP conservation measures as a new Natural Resources Agency led initiative to swiftly implement conservation projects in the Delta, Yolo Bypass, and Suisun Marsh.



Primary challenges to conservation in the Delta remain land subsidence behind levees, flood protection, and rising sea levels and extreme precipitation events related to climate change. Conservation lands offer important buffers for Delta communities and farmlands. INSET: The Delta Conservation Framework focuses on improving public lands first (Central Delta Corridor) to benefit the ecosystem and wildlife. The Framework also identifies conservation opportunity regions where it hopes to support regional partnerships and multi-benefit, public private collaborations for a healthier Delta.

Source: CDFW, 2018

Photo courtesy Delta Protection Commission.

Vision for Delta 2050

Despite substantial efforts to plan conservation in the Delta, many challenges to ecological resilience and function remain. Over the next three decades, efforts to restore the Delta ecosystem will occur in an ever-changing social, ecological, and regulatory environment influenced by economic shifts and climate change effects, such as sea level rise.[7,9,14,35,36] Human uses of, and impacts on, the Delta are central to considerations of how the landscape functions now and into the future.[19]

In 2050, the Delta is composed of resilient natural and managed ecosystems situated within a mosaic of towns and agricultural landscapes, where people prosper and healthy wildlife communities thrive.

As cornerstones for the success of Delta conservation and lasting multi-benefit solutions, Delta stakeholders developed a 30-year vision and set of guiding principles for collaboration and mutual respect during a series of Delta Conservation Framework public workshops in 2016. This vision will be achieved by all Delta stakeholders, local, state and federal, as they align future conservation efforts with the seven overarching goals established in the Framework.

What do stakeholders hope to see as the results of the framework and vision?

- MULTI-BENEFIT OUTCOMES: In 2050, the Delta is a network of multiple-use landscapes where agricultural productivity, economic vitality, and ecosystem conservation are achieved in a manner that mutually supports the needs of people and wildlife.
- CONSIDERATION OF LANDSCAPE DYNAMICS: In 2050, the Delta is recognized as part of a greater system that functions within the context of California's largest watersheds.
- HEALTHY, RESILIENT ECOSYSTEMS: In 2050, the Delta has healthy, resilient ecosystems with the capacity to adapt through time to impacts associated with climate change, sea level rise, and other environmental uncertainties.
- COLLABORATION: In 2050, state, federal, and local government agencies collaborate with each other and Delta stakeholders to achieve multi-benefit outcomes where possible.
- DECISIONS BASED ON SCIENCE: In 2050, policy decisions and desired conservation outcomes are informed and evaluated through coordinated Delta science endeavors.
- LOCAL SUPPORT: In 2050, Delta residents promote the management of healthy ecosystems as the basis of a healthy and economically thriving Delta region.
- LOCAL BENEFITS: In 2050, Delta residents and visitors actively enjoy the region's unique cultural and natural resource values through wildlife-friendly agricultural practices, tourism, low-impact outdoor recreation, and environmental education activities for all ages.
- RELIABLE LOCAL WATER: In 2050, effective integrated water management in the Delta promotes good water quality and a reliable water supply for users in the Delta.
- MULTI-BENEFIT FLOOD MANAGEMENT: In 2050, the Delta's flood management system provides both improved flood protection and increased habitat value for fish and wildlife, where possible.

Foundations of the Framework

The Framework is based on a 2050 vision, guiding principles, and a three-year effort to integrate public input, science, and existing plans into a cohesive framework for conservation planning.

Input from the Delta Stakeholder Community

Stakeholders from a variety of sectors and interests, including local Delta community members, play a key role in the successful planning and implementation of conservation-oriented programs and projects. Their involvement is especially important when reconciling the complex, often multi-dimensional, human and environmental uses of Delta landscapes and waterways.

During a series of six workshops in 2016, stakeholders from local, state, and federal agencies, water contractors, non-governmental organizations, environmental consulting firms, reclamation districts, universities, private businesses, and local residents raised important issues for consideration in developing a common vision and an integrated conservation approach for Delta ecosystems (see also Section II and Appendix 4).

Overall, workshop participants emphasized the importance of agriculture as the Delta's economic engine and the need to involve Delta community members when planning, implementing, and managing conservation actions.

The participation of Delta community members in the 2016 workshop series was limited until a local champion got involved to spread the word and share a sense of urgency. Reasons for the initial lack of local turn out included work demands, lack of trust in the process based on past experiences, an unfavorable attitude toward conservation, or insufficient outreach and communication about the workshops in local newspapers and at community gathering spots.

In general, participating stakeholders established that Delta conservation would move forward most successfully by focusing on lands currently under public ownership or on lands managed under specified conservation easements owned by non-governmental organizations, businesses, or private citizens. They also emphasized the importance of preserving local tax bases, adequately funding long-term management of public lands, and avoiding additional regulations and negative impacts on agriculture. Stakeholders supported a focus on multi-benefit solutions, including financial incentives for wildlife-friendly farming practices,[37,38] long-term agricultural conservation easements with willing Delta landowners,[37] or other incentives.

During the workshops, Delta local stakeholders also emphasized the importance of a "bottom-up" approach, where conservation projects are developed at a regional level with local support that ensures resident landowner participation in conservation planning and implementation. They agreed that applying good-neighbor practices to avoid negative impacts on agriculture and other neighboring land uses[37] would go a long way toward obtaining local support and

The California Department of Fish and Wildlife asked for early community feedback from residents of Bethel Island on a proposed design for a tidal marsh restoration project for Delta smelt habitat on Franks Tract. The community responded with their own counter proposal. Such exchanges, early in planning timelines, are critical to achieving conservation in collaboration with Delta communities. Photo: Christina Sloop

successfully implementing Delta conservation. Stakeholders also called for a balance of publicly accessible and "wild" conservation lands, to allow restricted or seasonal recreational access to some areas, while protecting sensitive wildlife areas from disturbance. There was also overall recognition that strong levees are beneficial to everyone.

In terms of conservation goals, workshop participants supported a greater focus on improving ecological processes to restore ecosystem function[16] and going beyond emphasis on single species conservation under federal and state endangered species laws and regulations (Federal Endangered Species Act (ESA)/California ESA (CESA)), to improve wildlife habitat and connectivity. This expanded approach would benefit wildlife and help recover declining populations of special status species. Specifically, participants favored a landscape conservation approach tied to locally driven project planning and implementation that builds on, or integrates, existing regional planning efforts. Stakeholders also recognized the need to make the conservation permitting process more efficient to expedite implementation and reduce costs.

One take home was the need for conservation proponents to take responsibility over the long term for achieving desired conservation outcomes. To be effective, such efforts will require not only regular evaluations of conservation performance on the basis of predefined goals, but also regular communication of successes and failures to stakeholders.

The *Delta Conservation Framework* integrates many of these stakeholder concerns and suggestions into its goals and strategies (see Section II).

Considering Existing Plans

Any evaluation of conservation opportunities in the Delta requires consideration of the many existing planning documents and programs. Those plans and programs considered in the development of this *Delta Conservation Framework*, and descriptions of how they align with the Framework, are detailed in the Guide to Related and Aligned Plans and Programs at the end of this section (see pp. 30-37). The *Delta Conservation Framework* does not supersede these individual planning efforts, but instead connects and integrates them into the larger landscape-scale perspective. It suggests them as important references for consideration as part of ongoing or future regional conservation strategies and individual projects. In particular, in locations where regional conservation strategies overlap with regionally-focused planning efforts, such as Habitat Conservation Plans and Natural Community Conservation Plans (HCPs and NCCPs), regional goals, strategies, and objectives should tie in with those in the pre-existing plans. Appendix 6 provides summaries of the existing plans that should be considered by regional conservation partnerships in regional conservation strategy planning, and by individual conservation practitioners in project planning, and it offers further insight into how these plans relate to the *Delta Conservation Framework* (see also p. 45 for a discussion of the various "regional" strategies, partnerships, and plans terminology).

Framing Conservation Goals

The *Delta Conservation Framework*'s goals and strategies, used collaboratively, offer pathways to realizing the vision of the Delta as a place where people prosper and healthy wildlife communities thrive by 2050. In sections II-V the Framework suggests strategies for communication, planning, funding, and permitting conservation that could be used to achieve each goal over the coming decades. Some of the goals and strategies, such as Goal E, highlight pre-existing and ongoing efforts to successfully implement conservation in the Delta that should be used as resources moving forward. Other goals, such as Goals F and G, highlight the need to consider new approaches to implementing conservation. Still others, such as Goals A-C, underscore a growing recognition of the role people and communities must play as partners in conservation.

Delta Conservation Framework at a Glance

SHARED VISION AND OVERARCHING GOALS ON HOW TO ACHIEVE DELTA CONSERVATION

- Serves as a high-level Delta conservation guidance document for all stakeholders engaged in conservation planning, and for the collaborative development of focused regional conservation strategies that link to the system-wide goals outlined in this document.

SUPPORT FOR GOALS OF THE DELTA REFORM ACT AND CALIFORNIA WATER ACTION PLAN

- Encourages collaborative approaches through stakeholder partnerships and development of regional conservation strategies to inform the amendment of the ecosystem elements of the *Delta Plan* and implement *California Water Action Plan* Action 3. Recommends goal-based strategies to improve integrative conservation planning by Delta stakeholders that emphasize multi-benefit outcomes where possible.

PARTNERSHIP APPROACH FOR COLLABORATIVE ENGAGEMENT

- Establishes a goal and strategies for actively engaging landowners, federal, state, and local government agencies, regional partnerships, non-governmental organizations, and other relevant stakeholders to advance ecosystem conservation goals and strategies collaboratively on both landscape and regional scales, while ensuring consistency with existing conservation initiatives.

EDUCATION AND OUTREACH ABOUT THE IMPORTANCE OF A HEALTHY DELTA AT LOCAL, STATE, AND NATIONAL LEVELS

- Offers strategies for promoting public education and outreach about the Delta to improve public understanding of its economic, cultural, and environmental importance and to garner far-reaching support for its health and related socioeconomic sustainability. This is in direct alignment with the public trust doctrine outlined in the Delta Reform Act.

STRATEGIES AND OBJECTIVES FOR POTENTIAL SOLUTIONS TO KNOWN DELTA CONSERVATION CHALLENGES

- Offers strategies to address challenges, including the effective integration of community and conservation goals; regulatory conflicts, permitting, and funding barriers hindering conservation project implementation; and needed resources for the long-term maintenance and management of Delta projects.

FLOOD PROTECTION PLANNING LINKS

- Connects with flood protection planning through the emphasis on approaches for conservation that consider multi-benefit outcomes, as outlined in the 2016 *Central Valley Flood Protection Plan Conservation Strategy* and North Delta Program.

PRIORITIES FOR STATE AND OTHER FUNDING

- Directly informs grant solicitation language for some state funding programs, helps guide distribution of other available conservation support, and serves as a basis for future funding for long-term Delta conservation, including national, state, regional, and private sources.

GUIDANCE FOR THE COORDINATION OF COLLABORATIVE REGIONAL CONSERVATION STRATEGIES

- Provides a framework for coordinated implementation and management to build on early conservation successes and to guide collaborative future planning, implementation, and long-term management activities.

Photo: Rick Lewis

NATIONAL MODEL

Restoration Plan for Florida Everglades Mirrors Delta Approach

Everglades. Photo courtesy National Park Service.

Although located 2,500 miles away and in a markedly different ecosystem, Florida's Everglades nevertheless face similar challenges, and offer a useful parallel, to the Delta.

The Everglades — a wide, slow-moving swath of wetland dubbed "the river of grass" — is one of the largest wetland ecosystems in the world, covering nearly 18,000 square miles in southern Florida. It is now the focus of an extensive and historically significant watershed restoration program to mitigate the damage done by more than two centuries of redirecting estuarine water for flood control and other human uses. This ongoing and largely successful restoration program is tackling many of the same problems, and coming to many similar conclusions about best solutions, as California's *Delta Conservation Framework.*

"Success for the human systems will be to maintain or improve current levels of water supply and flood protection in a rapidly growing human population in south Florida, consistent with the goals of the Plan for the natural system."

"Success for the natural system will be to recover and sustain those essential hydrological and biological characteristics that both defined the original pre-drainage greater Everglades and made it unique among the world's wetlands. These defining characteristics include the great extent of naturally interconnected and interrelated wetlands, sheet flow, extremely low levels of nutrients in freshwater wetlands, high levels of estuarine productivity, and the great resilience of the plant community mosaics and abundance of many of the native wetland animals."

Vision, Comprehensive Everglades Restoration Plan, USACE 2003

NATIONAL MODEL CONTINUED

Plan Overview

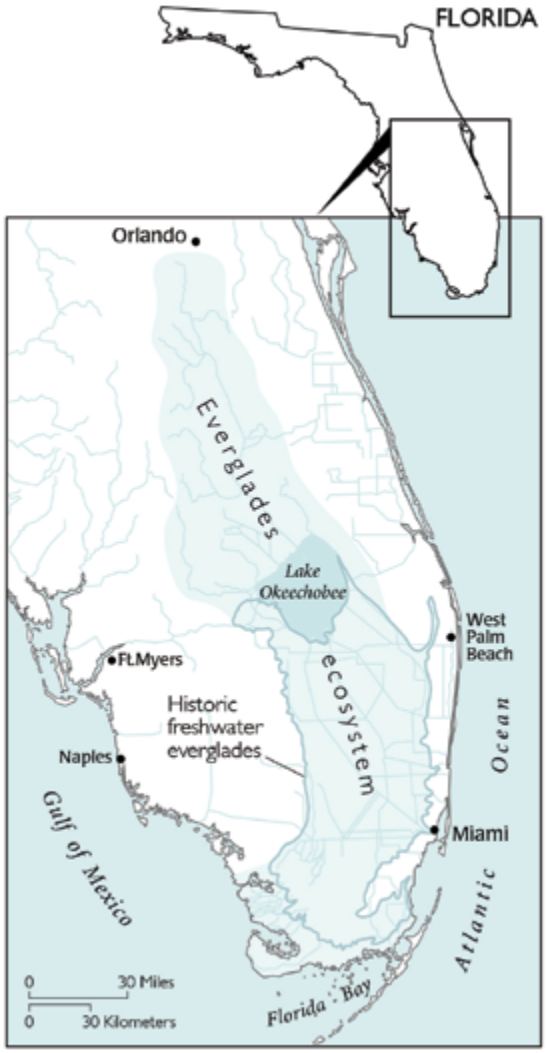
Similar to the *Delta Plan*'s coequal goals, the main objectives of the *Comprehensive Everglades Restoration Plan* (CERP) are "getting the right amount of water of the right quality to the right places at the right time" and "to find the correct balance among the flow types throughout all regions to ensure a healthy and sustainable natural and human environment." Everglades restoration goals include recovery of freshwater flows into the estuaries, restoring the ecosystem processes that once supported diverse wetland habitats, and providing resiliency to changing conditions.[1,2,3] This focus further includes making recommendations for structural or operational modifications to the existing water project to restore important functions and services of the Everglades and south Florida ecosystem while also planning for agricultural and urban water needs and flood protection for the next 50 years.

The Plan is founded on an adaptive management program as a basis for continually improving the design, operation, and performance over time. Maximizing operational flexibility is considered to be an essential strategy for meeting the natural and human system performance goals of the Plan.

Human and Natural System Integration

The CERP's greatest strength is that it integrates natural and human objectives into a single design, and brings together an array of public interests into a common strategy for the future of south Florida.

Although the future Everglades ecosystem will not recreate historic conditions, because it will be smaller than the pre-drainage system, planned restoration is intended to recover these defining characteristics and create a new Everglades that behaves functionally as a wild



Source: CERP

Everglades system rather than as a set of managed, disconnected wetlands.

Like the *Delta Conservation Framework*, the CERP acknowledges both human and natural demands on a rich estuarine system, and the need to sustain both as functional systems far into the future. In the Delta Framework's case however, (the DCF has no flow- or water supply- management actions), the human dimension is more related to the Delta's agricultural legacy.

Direct Community Involvement

In both the Delta and Everglades, planning is based on an open collaborative process with interdisciplinary, cross-sector, and public outreach and engagement. The lead agencies of the CERP—the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD)—are leading one of the largest conservation partnerships in the world. This multi-stakeholder partnership is composed of tribes and federal, state, and local government agencies, as well as private and environmental interests including the fishing community; business organizations; local community groups; environmental organizations; the agricultural community; homeowners; and other members of the public who are concerned about the health of the Everglades, including recreation groups and the sugar industry.[1,4,5]

Community participation has been an important component of restoration in the Everglades. Community members have been engaged in the planning and ecosystem restoration process through public workshops and volunteer opportunities, in part as a result of a 2010 Clean Water Fund survey that resulted in recommendations to improve public outreach and participation.

Development of the *Delta Conservation Framework* has involved similar community surveys, stakeholder outreach, and resulting emphasis on collaborative planning.

Multiple-Benefit Management and Public Lands

Both the Delta and the Everglades are made up of a patchwork of public and private lands owned by various entities and managed to achieve a variety of goals (though there may be more public land in the Everglades system). The greater Everglades ecosystem contains four national park units, 16 national wildlife refuges, and over one million acres of public lands managed by the water district. These lands support recreation, public use, and conservation of natural resources. As such, individual CERP projects may have one or more multi-benefit objectives, including:

1. Restoring wetlands and watersheds and reestablishing flows to maintain ecosystem connectivity
2. Improving flood protection
3. Sustaining existing and future water supply, while increasing water storage capacity
4. Improving the water quality and timing of discharges into estuaries, lakes, wild and scenic rivers and managing water conservation areas for municipal, agricultural, and recreational uses.

Electrofishing research in the Everglades. Photo: Larry Perez, courtesy National Park Service

NATIONAL MODEL CONTINUED

Examples of multi-benefit approaches to the Everglades restoration efforts with characteristics similar to some of those referenced in the *Delta Conservation Framework* include:

- A Master Recreation Plan, included in CERP, under which regional plans and projects evaluate and address compatibility between recreation and restoration and incorporate workshop participants' feedback on recreation needs into the regional plans.[5]
- A community outreach program, developed by USACE, including a quarterly newsletter, to inform the public of project planning meetings and to educate and engage young adults and children.[6]
- The *Invasive Exotic Species Strategic Action Framework* (South Florida Ecosystem Restoration Task Force 2015), which engages partner agencies and the public in managing the impacts of invasive species on ecosystems, native and special status species, cultural values, recreational opportunities, and economic interests that affect the entire state of Florida.[7]

Environmental Overview

As in the Sacramento-San Joaquin River Delta in California, humans reclaimed a large acreage of the Everglades wetlands for farming and development starting before 1900. Infrastructure changes to support urban development and agriculture reduced freshwater flow through the estuaries, and the vast Everglades wetland ecosystem ultimately shrank to half its original size as a result. Encompassing Lake Okeechobee and its tributary areas, the Everglades ecosystem includes the roughly 40- to 50-mile-wide, 130-mile-long wetland mosaic that once extended continuously from Lake Okeechobee to the southern tip of the Florida peninsula at Florida Bay.[8] A large canal developed for flood control transformed the meandering Kissimmee River into a straight, deep channel that caused catastrophic damage to floodplain habitats and water quality, severely affecting several fish and wildlife species and reducing ecosystem services to humans.

Conservation Focused on Restoring Ecosystem Function

Even in their diminished states, the ecosystems on both coasts provide innumerable ecological services. The Everglades contains a mosaic of wetlands, freshwater ponds, prairies, and forested uplands that support rich communities of plants and wildlife. In 1994, Congress passed the Everglades Forever Act to reverse the decline in water quality and ecosystem health which led to the development of the CERP, an overarching framework for restoration projects with objectives to recover freshwater flows into the estuaries; restore the ecosystem processes that once supported diverse wetland habitats; improve water quality; and provide resiliency to changing conditions.

Florida panther. Photo courtesy Everglades National Park Service

Estuaries and coastal areas in the Everglades receive either too little or too much water, causing fluctuations in salinity that affect the health of ecosystems. By capturing, storing, cleaning, and redistributing water, the CERP addresses this challenge to restore freshwater flows to the estuary while still providing for the needs of the public. CERP projects are:

- rehydrating coastal wetlands by distributing freshwater to the estuary over a broad area, instead of through individual drainage canals
- capturing runoff and excess water to reduce harmful discharges to the estuary during wet periods and provide water during dry periods
- improving water quality to reduce salinity and nutrient impacts on the estuary; removing flow and connectivity barriers
- reestablishing underground aquifers

These landscape-scale projects are already restoring habitats for native plants, fish, wading birds, shorebirds, and waterfowl. Although invasive species, heavy rains, drought, and other challenges continue to degrade the ecosystems in the Everglades, restoration has helped with recovery. Imperiled Everglades species, such as the federally endangered Florida panther, and declining native fish populations, including largemouth bass, Everglades pygmy sunfish, and other species of sunfish, have benefitted from CERP actions.

Science Informing Everglades Restoration Efforts

Restoration efforts in the Everglades combine the best available scientific and technical information with policy, management, and public opinion. Congress established the South Florida Ecosystem Restoration Task Force to coordinate the development of policies, strategies, plans, programs, and projects that address restoration and protection of the South Florida ecosystem. One of the Task Force advisory bodies is the Science Coordination Group, including senior managers and scientists, which supports efforts to coordinate the scientific aspects of restoration with management decisions. A multiagency collaboration of scientists and resource specialists (The Restoration Coordination and Verification program, or RECOVER) provides scientific and technical information to incorporate into the CERP effort.

RECOVER develops five-year plans to ensure project design, construction, operations, and adaptive management incorporate the latest updates in science. The five-year plans establish tasks and make recommendations for changes to goals or targets, decision-making processes, and communication. Regular RECOVER meetings evaluate and refine conceptual models.

The *Delta Conservation Framework* is also based on best available science, science-based adaptive management, and monitoring and tracking of conservation outcomes based on goals and objectives. Many layers of multiagency science, research, and collaboration underly the Framework.

QUICK LINKS

Comprehensive Everglades Restoration Plan[3]
https://www.saj.usace.army.mil/Portals/44/docs/Environmental/Report%20to%20Congress/2015CERPReportCongressDRAFT.pdf

Kissimmee River[7]
www.sfwmd.gov/our-work/kissimmee-river

Comprehensive Everglades Restoration Plan (CERP)[3]
http://141.232.10.32/pm/recover/recover.aspx

Everglades Restoration[1]
www.evergladesrestoration.gov

Restoration Coordination and Verification five-year plan[9]
https://evergladesrestoration.gov/content/scg/minutes/2017meetings/012317/RECOVER_5-yr.pdf

Western Everglades Restoration Project [10]
www.sfwmd.gov/sites/default/files/documents/jtf_western_glades_planning.pdf

United States Geological Survey [8]
https://pubs.usgs.gov/circ/circ1182/pdf/12Everglades.pdf

GUIDE TO RELATED & ALIGNED PLANS & PROGRAMS

Bay Delta Conservation Plan Public Draft

This plan was initiated in 2006 as a permitting framework for the construction of proposed Delta water conveyance improvements through a combined 50-year habitat conservation plan (HCP/NCCP) spanning the Delta, Yolo Bypass, and Suisun Marsh. A draft was completed in 2013, but in April 2015, the Brown administration announced a change in the permitting approach for new Delta water conveyance infrastructure, shifting state efforts away from the BDCP. Conservation measures presented in the 2013 Public Draft of the BDCP were intended to restore a more naturally functioning Delta ecosystem, contribute to the recovery of covered species through establishing a large Delta reserve system, and establish a secure and reliable Delta water supply for human use while managing flows to protect and support life history requirements of special status fish. The draft BDCP offers a wealth of information useful to inform future planning and development of Regional Conservation Strategies. The *Delta Conservation Framework* goals and strategies reflect many of the BDCP conservation measures targeted to improve Delta ecosystem function to benefit fish, wildlife, and natural communities. However, the *Delta Conservation Framework* does not offer direct acreage targets beyond those already established through existing planning documents, nor does it address the issue of providing a secure and reliable water supply for human use. For more details of how the *Delta Conservation Framework* incorporates elements of the BDCP, please refer to Table III.1 in Appendix 3.

Endangered Delta smelt. Photo: DWR

California State Parks Recreation Proposal for the Sacramento-San Joaquin Delta

This 2011 proposal provides recommendations for the improvement or expansion of California State Parks' four Delta recreation areas and six other state parks on the edge of the Delta and Suisun Marsh, and for connecting them with destinations inside the Delta and Suisun Marsh region. It outlines opportunities to create four new state parks for the region, and suggests ways to improve recreational use of wildlife habitat areas, publicly owned levees, scenic highways, state recreational trails, and other public lands. It also includes suggestions for coordination of recreation and tourism efforts. The proposal suggests a network of recreation areas — including parks, resorts, boating facilities, historic communities, agricultural-tourism attractions, and other visitor-oriented places that are connected by scenic driving routes, boating trails, or bicycling and hiking trails. The proposal highlights existing recreation assets as well as new recreation opportunities. These may include flood-control efforts, pipelines and canals, and restoring large wildlife habitat areas, especially at the six potential "restoration opportunity areas" mapped in the recreation proposal.

Partnerships among agencies, businesses, and nonprofit groups would help advance such multi-benefit outcomes and reveal the region to more visitors under this proposal. Co-benefit recreation opportunities are integrated into *Delta Conservation Framework* Goal C, "Develop multi-benefit focused conservation and land management solutions to balance environmental and human needs."

California State Wildlife Action Plan

The 2015 update to this strategic conservation plan (the "SWAP") developed by California Department of Fish and Wildlife provides a blueprint for sustaining the integrity of California ecosystems.

SWAP 2015 articulates conservation priorities for implementation by 2025, with a goal of desired conditions to be attained and sustainability improved within 50 years. The following goals summarize the SWAP priorities and provide a framework for complementary tier-down regional goals and objectives aimed at: 1) enhancing the abundance and richness of species and ecosystems, 2) enhancing the quality of ecosystem conditions; and 3) enhancing ecosystem functions and processes. Supported by 12 subgoals, these statewide goals represent the overarching desired outcomes of integrated implementation.

SWAP 2015 highlights the Delta as part of the Bay Delta Conservation Unit, within the Bay Delta and Central Coast Province, and identifies target ecosystems and species of greatest conservation need.

The SWAP also highlights pressures in the Delta that make it a prime region for conservation. Targets and conservation strategies were developed by reviewing and synthesizing other planning efforts for more specific guidance, including the BDCP, *Delta Plan*, and other planning documents described in this appendix. However, regional conservation partnerships and project proponents should consult the SWAP when planning projects for or within target ecosystems and are strongly advised to consult the SWAP if applying for federal funding through the State Wildlife Grant or Endangered Species Act Section 6 program.

Species Recovery Briefs can be found in Appendix 5 online.

See Quick Links p.37 to access above plans and programs.

California Water Action Plan

Concerns regarding declines in the Delta's wildlife species, the resilience of Delta levees to significant seismic events, and the Delta's vulnerability to floods and the effects of sea level rise are the focus of the 2014 *California Water Action Plan* (CWAP). This plan outlines ten main actions for achieving reliable and resilient water systems and restoring the most important California ecosystems. The CWAP recognizes the social and political complexities around Delta issues yet states that "the status quo in the Delta is unacceptable and it would be irresponsible to wait for further degradation or a natural disaster before taking action".

Relevant CWAP actions include:

- Action 3: Achieve the coequal goals for the Delta
- Action 4: Protect and restore important ecosystems
- Action 8: Increase flood protection
- Action 9: Increase operational and regulatory efficiency

Implementation of the *Delta Conservation Framework* will serve to further the above actions in the future, with several overarching long-term goals with strategies that address these CWAP actions. These include strategies aimed at:

- Reestablishing or improving Delta ecosystem function (GOAL D; Section III);
- Optimizing connectivity, functional food webs, management of harmful invasive species, and low-impact human use of conservation areas to reduce negative effects on sensitive wildlife (GOAL D; Section III);
- Levee maintenance and flood management practices that also afford additional or improved habitat, and advancing agency land management processes and procedures (GOAL C; Section II);
- Climate adaptation and adaptive management in Delta conservation and community planning going forward (GOAL E; Section III);
- Improving permitting procedures (GOAL F, Section V);
- Securing funding support (GOAL G, Section V).

Central Valley Flood Protection Plan and Conservation Strategy 2017

This plan (the CVFPP) serves as a guide to the state's participation in managing flood risk and prioritizing investments in areas protected by the State Plan of Flood Control (SPFC). The CVFPP recognizes that flood risks, water supplies, and functioning Central Valley ecosystems are interconnected, with actions in one area influencing the other areas.

The 2017 update contributes to a programmatic vision for flood system improvements over time in accordance with the requirements of the Flood Protection Act of 2008. The non-regulatory companion, CVFPP Conservation Strategy, is an integral part of the CVFPP that focuses on the improvement of ecosystem functions. The CVFPP planning area includes the *Delta Conservation Framework* Conservation Opportunity Regions; see section VI and Appendix 2. Planning partnerships and individual project proponents should look to the CVFPP for specific guidance on conservation of fluvial, riparian, and floodplain ecosystems in the context of flood protection activities.

The CVFPP Conservation Strategy goals directly overlap with Goal C, Strategy C1 of the *Delta Conservation Framework*. Other goals and strategies also overlap regarding river and floodplain conservation with a focus on:

- Multi-benefit projects that combine flood risk reduction with ecological benefits, environmental improvements, and agricultural stewardship (*Delta Conservation Framework* Goal C, Strategies C1, C2, C4, C5, C6);
- Promoting natural dynamic hydrologic and geomorphic processes underlying ecosystem function (*Delta Conservation Framework* Goal D, Strategy D1);
- Contributing to the recovery of special status species in riverine and floodplain habitats (*Delta Conservation Framework* Goal D, Strategies D1, D2, D3, D4, D5);
- Increased predictability and cost effectiveness of permitting processes as related to multi-benefit projects (*Delta Conservation Framework* Goal F); and
- Goals and measurable objectives for progress evaluation within an adaptive management framework (*Delta Conservation Framework* Goal E).

Delta Economic Sustainability Plan

To inform the Delta Stewardship Council's policies concerning the socioeconomic sustainability of the Delta region, the 2009 Delta Reform Act required the Delta Protection Commission to prepare an *Economic Sustainability Plan* (ESP) for the Delta region. The ESP, adopted in January 2012 (Public Resources Code §29759), includes recommendations on levees, public safety, and updates to the Department of Water Resources flood management plan, to inform local government general plans and economic efforts affecting Delta agriculture and infrastructure. It also provides options for Delta Legacy Communities to encourage recreation and tourism investments in the Delta to maintain and enhance economic prosperity, particularly if there are declines in agriculture. As a key finding, the ESP emphasizes water quality, water supply, and the ability to divert water in the Delta as essential drivers for the sustainability of habitat and ecosystem improvement, agriculture, tourism, and recreation in the Delta. The ESP is being updated with the most current information on recreation, agriculture, tourism, business development, and more. This ESP update and available Community Action Plans will be critical resources to inform regional conservation partnership planning processes and help integrate Delta conservation practices with the human dimension going forward. Planning partner-

To skip these references go to p. 39

GUIDE TO RELATED & ALIGNED PLANS & PROGRAMS - CONTINUED

ships and individual project proponents should look to the updated ESP and Community Action Plans for specific guidance on how Delta socioeconomic aspects relate to conservation in a given region.

The Delta Plan

First released in 2013 when state and federal agencies were working toward a habitat conservation planning approach with the 50-year *Bay-Delta Conservation Plan* (see p.30 and Appendix 3), the *Delta Plan* outlines policies and recommendations to provide a more reliable water supply for California; preserve and improve Delta ecosystems; protect and enhance "Delta as an evolving place"; improve water quality; and reduce risk to people, property, and state interests. It further highlights funding needs and options for *Delta Plan* implementation. Associated white paper publications also provide guidance on adaptive management, performance measures, a levee investment strategy, and a long-term strategy for dredged sediment reuse.

Delta Landscapes Project Report Series, SFEI

This series of reports (2012-2016) informs landscape-scale conservation of the Sacramento-San Joaquin Delta ecosystem. Funded by the California Department of Fish and Wildlife Ecosystem Restoration Grants Program, the project includes the Delta historical ecology investigation outlining how Delta ecosystems functioned prior to the California Gold Rush and subsequent landscape-level changes in the early 1800s. Two successive reports utilized the resulting historical baseline to evaluate and describe how the Delta was altered over time (*A Delta Transformed*) and how it might be improved in the future to better support resilient populations of native wildlife (*A Delta Renewed: A Guide to Science-Based Ecological Restoration in the Sacramento-San Joaquin Delta*).

The *Delta Conservation Framework* goals and strategies related to ecosystem function as part of a landscape-level perspective (in particular for Goal D) are directly based on information provided in the Delta Landscapes Project report series (see Section IV for more information). Regional conservation partnerships and individual project proponents should look to the Delta Landscapes Project report series for detailed maps, historical context and how Delta function has changed, and for recommendations on conservation practices to support ecological functions in the Delta going forward (see also SFEI p. 132).

Ecosystem and Species Recovery Plans and Conservation Strategies

Recovery plans have been drafted by a variety of agencies and organizations for state and federally listed species and habitats; these are summarized below. For federally listed species, the National Marine Fisheries Service and US Fish and Wildlife Service have developed ecosystem-level recovery plans for tidal marsh, vernal pool, and Antioch Dunes ecosystems, and for upland species of the San Joaquin Valley. Plans for individual species include those for California tiger salamander (draft), giant garter snake, California red-legged frog, Least Bell's vireo (draft), California least tern, Central Valley salmon/steelhead, Delta smelt, Sacramento splittail, longfin smelt, green sturgeon, Chinook salmon, and Sacramento perch. State-listed species' plans are generally written by experts—examples include plans prepared for bank swallow, Swainson's hawk, and tricolored blackbird. A draft conservation strategy for greater sandhill crane is in process, but has not yet been released. Some recovery strategies are incorporated in conservation plans for specific ecosystems, such as for riparian bird.

Goal D, Strategy D3 of the *Delta Conservation Framework*, "Create conditions conducive to meeting the goals in existing species recovery plans to maintain or improve the distribution and abundance of listed species supported by Delta ecosystems," refers to the existing recovery goals described above. Other strategies under Goal D focus on optimizing connectivity, ecosystem function to support food webs, control and management of harmful invasive species, and minimizing adverse effects from human disturbance.

Photo: Amber Manfree

See Quick Links p.37 to access above plans and programs.

ERP Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta, Sacramento Valley and San Joaquin Valley Regions

This serves as the conceptual framework to guide the multi-agency Environmental Restoration Program (ERP), including development of conservation priorities and processes to identify and implement restoration opportunities and monitoring to guide and improve their success, in the Sacramento-San Joaquin Delta, the Sacramento Valley, and San Joaquin Valley regions. The ERP approach for ecosystem restoration is focused mainly on aquatic habitats and species in the Delta and the Sacramento and San Joaquin Valley regions.

The ERP Conservation Strategy describes goals and conservation priorities for Stage 2 of the CALFED Bay-Delta Program. The ERP implementing agencies — consisting of CDFW, USFWS, and National Oceanic and Atmospheric Administration Fisheries Service — will use the ERP Conservation Strategy as a guide until 2030.

The vision and goals of the *Delta Conservation Framework* directly integrate what is presented in the ERP Conservation Strategy, while providing an additional link to the Delta community and specific focus on implementation of Delta conservation. regional conservation partnerships and individual project proponents should look to the ERP Conservation Strategy for details on aquatic habitat descriptions, stressors, and related goals and conservation priorities.

Habitat Conservation Plans/ Natural Community Conservation Plans

The *Delta Conservation Framework* defers to the species and acreage targets outlined in Habitat Conservation Plans (HCPs), Natural Community Conservation Plans (NCCPs), or relevant Conservation Strategies, where they overlap with the Delta planning region. Here, we provide short overviews of HCP or NCCP initiatives within the Delta primary or secondary planning zones. The *Delta Conservation Framework* recommends that regional conservation partnerships integrate these goals and targets in conservation plans.

EAST ALAMEDA COUNTY CONSERVATION STRATEGY (EACCS)

The EACCS is not an HCP or NCCP; however, it is a framework intended to protect, enhance, and restore natural resources. A final draft was released in October 2010. The purpose of the EACCS is to preserve endangered and other special-status species and their habitats through a shared vision for long-term habitat protection in East Alameda County. The EACCS establishes guiding biological principles for conducting conservation in the county by assessing East Alameda County areas for their conservation value. Recommendations include working with willing landowners to implement long-term conservation stewardship efforts that will offset impacts from local land use, transportation, or other infrastructure projects. Only the most northeastern tip of Alameda County overlaps with the legal Delta, which is conservation zone 7 (CZ7) in the EACCS. This area contains a small amount of grassland and alkali meadows with ponds, while the remainder is agricultural. Special-status species that occur or historically occurred in CZ7 include San Joaquin kit fox, California red-legged frog, and California tiger salamander.

EAST CONTRA COSTA COUNTY HCP/NCCP

This is an approved 30-year HCP/NCCP, released in 2006 and developed, in part, to address indirect and cumulative impacts to terrestrial species from development supported by increases in water supply provided by the Contra Costa Water District. While the HCP/NCCP plan area includes land within the legal Delta, the focus of the plan is primarily on grasslands, riparian, and other upland habitats and the terrestrial species dependent on these ecosystems. However, some natural community level goals include preserving and restoring wetlands. Most of the investments in land acquisition and habitat improvements are focused outside of the legal Delta. Key restoration priorities in the Delta include the Dutch Slough/Big Break area, lower Marsh Creek, and lower Kellogg Creek. Projects within the Delta would help to achieve the plan's species-level goals for giant garter snake, tricolored blackbird, Swainson's hawk, and western pond turtle. The HCP/NCCP does not cover fish species, including salmonids, and the impact on fish is addressed through separate consultation and permitting.

SOUTH SACRAMENTO HCP

Currently under development, with a working draft released in 2010, the primary focus of the South Sacramento HCP is to protect vernal pool and other upland habitats that are being diminished by vineyards and development, but it also protects wetland and riparian habitats and agriculture. The plan covers several special status terrestrial species that also inhabit the Delta, such as Swainson's hawk, tricolored blackbird, sandhill crane, giant garter snake, Valley elderberry longhorn beetle, western pond turtle, white-tailed kite, California tiger salamander, and western burrowing owl. The geographic scope of this HCP includes a small portion of the Sacramento-San Joaquin Delta in Sacramento County, extending from about the Stone Lakes National Wildlife Refuge in the north (and up to Florin Road in Sacramento) to Tyler Island in the south. The westernmost boundary of the plan

To skip these references go to p. 39

GUIDE TO RELATED & ALIGNED PLANS & PROGRAMS - CONTINUED

area is the Sacramento River. Portions of the Plan Area are included in the *Delta Conservation Framework*'s secondary planning zone, where habitat could become important for species such as sandhill crane and giant garter snake as sea levels rise and other future conditions render legal Delta habitat less suitable. Reserve areas adjacent to the Delta could also provide stepping-stone connectivity between Delta wildlife populations and populations to the east. This HCP does not address aquatic species, as they have historically been covered by U.S. Army Corps of Engineers' (USACE) 404 permits and CDFW Streambed Alteration Agreements. Programmatic permits that may be incorporated into the HCP are developed by Sacramento County in collaboration with the USACE, U.S. Environmental Protection Agency, and CDFW.

SOLANO MULTISPECIES HCP (MSHCP)

The Solano MSHCP is still in development, with a final administrative draft updated in October 2012. This HCP will promote conservation of biodiversity and preservation of covered species and their habitats in relation to urban development, flood control, and infrastructure improvement activities. Federally- and state-listed fish species and other species of concern on lands within the Delta will be included in the HCP as covered species. These include many of the species also covered by the *Bay Delta Conservation Plan.* Natural communities to be protected include grasslands and vernal pools, riparian and stream habitats, and marshes. The plan area includes all of Solano County and a small portion of Yolo County, overlapping the Delta primarily in Suisun Marsh and the vicinity of Cache and Lindsey sloughs.

SAN JOAQUIN COUNTY MULTI-SPECIES HABITAT CONSERVATION AND OPEN SPACE PLAN (SJMSCP)

Approved in 2001, this HCP was developed to provide guidelines for preserving agriculture and protecting species in the context of conserving open space and protecting it from conversion to other land uses. The geographic scope includes all lands within the legal Delta that overlap with San Joaquin County, as well as secondary zones to the east and southwest of the Delta. The purpose of the plan is to balance the need to conserve open space and special status species with the region's agricultural economy and landowner property rights. The SJMSCP is a 50-year plan covering 97 special status plant, fish, and wildlife species in 52 vegetative communities. The covered species in the Delta are mostly the same species covered by the BDCP and some species not included in the BDCP, such as bank swallow.

YOLO HCP/NCCP

A second administrative draft of the Yolo county-wide HCP/NCCP, which is under development, was released in 2015. This plan will address the conservation of 70-80 species in five habitat types: wetland, riparian, oak woodland, grassland, and agricultural lands. It will not address aquatic species; however, project-specific mitigation will be developed for projects affecting aquatic resources. Yolo County only overlaps the Delta in the Yolo Bypass and the area between the Sacramento Deep Water Ship Channel and the Sacramento River. However, there are numerous special status species that inhabit this area, including valley elderberry longhorn beetle, giant garter snake, Swainson's hawk, western burrowing owl, and tricolored blackbird; there was even a sighting of least Bell's vireo.

Human Use of Restored and Naturalized Delta Landscapes

This one-year study explored the California Delta from an integrative human-environment perspective. It offers a holistic integration of multiple goals and land use agendas using a landscape planning approach. Released in 2016, the report advances a reconciliation approach, which seeks synergies between ecosystem needs and the desires of those who live, work, and play in the Delta, both now and in the future. Recommendations include the need for a significant shift in the way restored Delta landscapes are conceptualized and considered in planning, policy, and design efforts and advocating for an approach in which human presence is understood as integral to these landscapes. This will require integration of a multitude of values — economic, ecological, scientific, and recreational — and will make restorative efforts more realistic and effective. However, reconciling human uses with restoration objectives will also require a more holistic type of stewardship. Implementing adaptive management efforts is therefore a further recommendation, combined with adequate resources for support.

Many of the recommendations in this report are also integrated into the *Delta Conservation Framework* overarching goals, and they were also voiced and captured during the 2016 stakeholder workshop process (see Appendix 4). In particular, Goals A-C address human integration into Delta conservation processes and the heightening of national, state, and even local awareness of Delta values and culture.

See Quick Links p.37 to access above plans and programs.

San Francisco Estuary Comprehensive Conservation and Management Plan

Known as the CCMP or *Estuary Blueprint*, this 2016 plan incorporates input from more than 70 organizations that reached collaborative agreement on four long-term goals to be achieved by 2050, plus 32 actions to be taken prior to 2021. The aim is to protect, restore, and sustain the San Francisco Estuary including the Delta and San Francisco Bay.

The overarching goals of the *Delta Conservation Framework* entirely or in part align with the four long-term CCMP goals to: 1) Sustain and improve the Estuary's habitats and living resources (Goals C-D); 2) Bolster the resilience of Estuary ecosystems, shorelines, and communities to climate change (Goals D-E); 3) Improve water quality and increase the quantity of fresh water available to the Estuary (Goal C - water quality; overall freshwater flow quantities are not addressed by the *Delta Conservation Framework*); and 4) Champion the Estuary (Goals A-B, and F-G).

In the lower Estuary, biologists and shoreline planners are experimenting with human-engineered oyster reefs that can improve water quality, enhance habitats for estuarine species, and protect nearby communities from storm surge and sea level rise. Such living shorelines are an important element in the Estuary Blueprint. Photo: Kathy Boyer

The *Delta Conservation Framework* goals also align with the CCMP action priorities to: improve our understanding and monitoring of how watersheds support aquatic resources and to connect the management of streams, rivers, and downstream habitats; to protect and grow a healthy mosaic of habitat types along shorelines and riparian banks; maintain ecosystem function and bolster food webs, connections between habitats, and the movement of fresh water and sediments through the Estuary; support ecological adaptations to rising sea levels through natural infrastructure (wetlands, horizontal levees, buffering habitats); encouraging water conservation, recycling, and regional planning to increase supply without diverting more from fish to cities; keep addressing pollution challenges; persist in finding solutions to climate challenges, including wetland related carbon sequestration and other solutions for improved and resilient land use practices; and make strides in informing and integrating the public in planning and implementation activities.

While the *Delta Conservation Framework* only addresses the CCMP goals and priority actions within the upstream portion of the Estuary, the short- and long-term effects of implementation through regional conservation partnerships will extend downstream and out into the Pacific ocean; and perhaps will address upstream conditions as sea level rises and salinity and other effects felt in the Bay reach further into the Delta. Therefore, a sustained and improved connection among efforts in the upstream (Delta) and downstream (Bay) regions of the Estuary will become increasingly important.

The Suisun Marsh Habitat Management, Preservation, and Restoration Plan

This comprehensive, 30-year plan (the SMP) addresses habitats and ecological processes, public and private land use, levee system integrity, and water quality through tidal restoration and managed wetland activities. The SMP's purpose is to create an acceptable balance between protection and enhancement of managed wetlands and the restoration and protection of tidal wetlands. The SMP was developed by and is overseen by the Suisun principal agencies: the U.S. Fish and Wildlife Service; U.S. Department of Interior, Bureau of Reclamation; California Department of Fish and Wildlife; Department of Water Resources; National Marine Fisheries Services; Suisun Resource Conservation District; and the Delta Stewardship Council (successor to the CALFED Bay-Delta Program).

The objectives of the SMP are to preserve and enhance the quality and diversity of the Suisun Marsh aquatic and wildlife habitats and to assure retention of upland areas adjacent to the marsh in uses compatible with its protection.

These objectives are integrated within *Delta Conservation Framework* Goal C, Strategy C2 "Support sustainable wildlife-friendly agriculture to provide additional wildlife and migratory bird habitats," and Goal D, strategies D1-D2, "Restore, enhance, and manage ecosystem processes Delta-wide to improve function and life history support for native and migratory wildlife, and to build ecological resilience," and "Conduct technical analyses within groups such as regional conservation partnerships to coordinate, identify, and prioritize available geographic areas for conservation and climate adaptation."

For implementation of projects in Suisun Marsh, individual project proponents should work closely with the Suisun Resource Conservation District and the San Francisco Bay Conservation and Development Commission.

To skip these references go to p. 39

GUIDE TO RELATED & ALIGNED PLANS & PROGRAMS - CONTINUED

Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary

The California State Water Resources Control Board (State Water Board) put out this plan in 2006 (the *Bay-Delta Plan*), which focuses on beneficial uses to be protected and water quality control measures needed to afford sound protection of these uses in the watershed. The plan is implemented through water rights and other measures. The State Water Board administers water rights in the Bay-Delta watershed and is currently in the process of updating the *Bay-Delta Plan* and flow objectives for priority tributaries to the Delta to protect watershed beneficial uses. The first phase updates San Joaquin River flow and southern Delta water quality requirements, followed by other comprehensive changes to protect beneficial uses not addressed in Phase 1 (e.g., Delta outflows, Sacramento River inflows, Suisun Marsh salinity, Delta Cross Channel gate closure, export limits, reverse flows). Additional phases involve changes to water rights and other measures to implement changes to Phases 1 and 2, as well as developing and implementing flow objectives for priority Delta tributaries outside of the *Bay-Delta Plan* updates.

The *Delta Conservation Framework* addresses water quality challenges and solutions only in the context of conservation project planning and implementation and so defers to the *Bay-Delta Plan* for addressing the more comprehensive requirements for Delta-wide water quality improvements.

Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan

Prepared jointly by the Department of Water Resources and Bureau of Reclamation in 2012, the *Yolo Bypass Salmonid Habitat Restoration and Fish Passage Draft Implementation Plan* addresses two specific Reasonable and Prudent Alternative (RPA) actions in the National Marine Fisheries Service state and federal water project Biological Opinion for the recovery of endangered salmonid species, focused on increased seasonal inundation and fish passage in the Yolo Bypass:

RPA Action I.6.1: Restoration of floodplain rearing habitat, through the increase of seasonal inundation within the lower Sacramento River basin; and

RPA Action I.7: Reduce migratory delays and loss of salmon, steelhead, and sturgeon, through the modification of Fremont Weir and other structures of the Yolo Bypass.

Flooding in approximately 80 percent of years, the Yolo Bypass offers many characteristics of historic floodplain habitat favorable to various fish species. Flood protection is the primary function of the Yolo Bypass, with managed agricultural activities in most of the area during the dry season. At present, a number of Yolo Bypass focused restoration projects are being planned and implemented through the California EcoRestore initiative.

The associated Yolo Bypass Cache Slough Partnership, convened in 2016, also provides a vehicle for local governments to be involved in planning and decision making. Made up of 15 local, state, and federal agencies, the Partnership's purpose is to improve executive-level interagency coordination. The policy-level Partnership emphasizes the importance of achieving across-the-board improvements in habitat, flood protection, agricultural sustainability, recreation, and other public values. This foundational acknowledgement has set the stage for improved trust between stakeholders, a key ingredient in successful efforts of this scale.

See Quick Links p.37 to access above plans and programs.

QUICK LINKS

See Appendix I for full references and end notes

Bank Swallow Technical Advisory Committee (2013)
https://www.sacramentoriver.org/bans/index.php?id=recovery

Bay Delta Conservation Plan Public Draft (BDCP 2013)
http://baydeltaconservationplan.com/EnvironmentalReview/EnvironmentalReview/2013-2014PublicReview/2013PublicReview-DraftBDCP.aspx Accessed 6/2/16.

California EcoRestore projects (CNRA 2017)
http://resources.ca.gov/ecorestore/california-ecorestore-projects/
Accessed: August 24, 2017.

California State Parks Recreation Proposal for the Sacramento-San Joaquin Delta
www.parks.ca.gov/?page_id=26677

California State Wildlife Action Plan (CDFW 2015 update)
www.wildlife.ca.gov/swap/final

California Water Action Plan (CDFA and CalEPA 2014)
http://resources.ca.gov/docs/california_water_action_plan/Final_California_Water_Action_Plan.pdf

California Water Action Plan Update (CNRA, CDFA and CalEPA 2016)
http://resources.ca.gov/docs/california_water_action_plan/Final_California_Water_Action_Plan.pdf

Central Valley Flood Protection Plan: Public Draft (DWR 2011, 2012)
www.water.ca.gov/cvfmp/docs/2012_CVFPP_FullDocumentHighRes_20111230.pdf

Central Valley Flood Protection Plan Conservation Strategy (DWR 2016), Sacramento, CA
https://water.ca.gov/Programs/Flood-Management/Flood-Planning-and-Studies/Conservation-Strategy
Accessed: August 24, 2017

ERP Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta, Sacramento Valley and San Joquin Valley Regions (CDFW2014)
https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=31232&inline
Accessed December 29, 2015

The Delta Plan: Ensuring a reliable water supply for California, a healthy Delta ecosystem, and a place of enduring value (Delta Stewardship Council 2013)
http://deltacouncil.ca.gov/delta-plan-0
Accessed: June 23, 2016

Conservation Plan for the Tricolored Blackbird (Kester 2007)
www.fws.gov/migratorybirds/pdf/management/focal-species/TricoloredBlackbird.pdf

Conservation Strategy for Swainson's Hawks in California
www.swainsonshawk.org/Images/Conservation%20Plan%2009%20final.pdf

Delta Economic Sustainability Plan
http://delta.ca.gov/regional_economy/economic_sustainability/

A Delta Renewed: A guide to science-based ecological restoration in the Sacramento-San Joaquin Delta (SFEI 2016)
www.sfei.org/sites/default/files/project/SFEI_DeltaRenewed_102616_lowres.pdf
Accessed January 25, 2017

A Delta Transformed: ecological functions, spatial metrics, and landscape change in the Sacramento-San Joaquin Delta (SFEI 2014)
www.sfei.org/documents/delta-transformed-ecological-functions-spatial-metrics-and-landscape-change-sacramento-san
Accessed: January 26, 2016

East Alameda County Conservation Strategy (EACCS 2010)
www.eastalco-conservation.org/documents.html
Accessed: June 29, 2016

East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan (ECCCHC 2006)
www.co.contra-costa.ca.us/depart/cd/water/HCP/documents.html
Accessed: December 22, 2011

Estuary Blueprint, San Francisco Estuary Comprehensive Conservation and Management Plan (SFEP 2016)
www.sfestuary.org/ccmp/

Human Use of Restored and Naturalized Delta Landscapes (Milligan-Kraus-Polk 2016)
https://watershed.ucdavis.edu/files/biblio/Human%20Use%20Report_for%20screen%20viewing%20%28spreads%29.compressed.pdf

Restoring the Sacramento-San Joaquin Delta Ecosystem (CNRA 2015)
http://resources.ca.gov/docs/ecorestore/ECO_FS_Overview.pdf

Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon and California Central Valley steelhead (NMFS 2014)
www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/california_central_valley/california_central_valley_recovery_plan_documents.html

Suisun Marsh Habitat Management, Preservation, and Restoration Plan (USBR, USFWS and CDFG 2013)
www.wildlife.ca.gov/Regions/3/Suisun-Marsh

The Riparian Bird Conservation Plan (Point Blue, California Chapter of Partners in Flight 2016)
www.prbo.org/calpif/pdfs/riparian_v-2.pdf

San Joaquin Multispecies Habitat Conservation and Open Space Plan (SJMSCP 2000)
www.sjcog.org/DocumentCenter/View/5

Solano Multispecies Habitat Conservation Plan (draft Solano County Water Agency 2012)
www.scwa2.com/water-supply/habitat/solano-multispecies-habitat-conservation-plan

South Sacramento Habitat Conservation Plan
www.southsachcp.com

Water quality control plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB 2006)
www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/2006wqcp/

Yolo Bypass salmonid habitat restoration and fish passage implementation plan (DWR and Reclamation (2012)
www.water.ca.gov/fishpassage/docs/yolo2.pdf
Accessed: 6/3/16.

Yolo Habitat Conservation Plan and Natural Community Conservation Plan (draft 2015)
www.yolohabitatconservancy.org/documents

Your Project, Your Ideas, Your Partners?

SECTION II

Integrating Delta Community with Conservation

Illustration: Alison Kazovi

KEY TERMS

- **DELTA AS PLACE** - The concept of "Delta as Place" emerged from the 2007 Delta Vision Blue Ribbon Task Force process[1] and connects to the language in the Delta Reform Act of achieving the coequal goals "in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place" (California Water Code §85054).[2]
- **LANDSCAPE-SCALE BENEFITS** – The larger the scale of the planning context for conservation, the greater the potential benefits for the ecosystem. Projects planned on a "landscape scale," beyond individual parcels, can multiply benefits for fish and wildlife. Connecting individual projects across a landscape over the long term can yield bigger returns.
- **MULTI-BENEFIT PROJECTS** – Multiple benefits projects balance environmental and human needs either at the project scale, or the landscape scale to result in a variety of beneficial outcomes. As long as projects contribute to multiple benefits in the larger landscape context, not all have to result in multiple benefits at the project scale. Examples include: wildlife-friendly farming, multi-use floodplains that provide flood protection and agricultural fields with annual crops that provide habitat, and low-impact outdoor recreation in conservation areas.
- **WILDLIFE-FRIENDLY FARMING** endeavors to integrate conservation and agricultural production to benefit wildlife and conserve biodiversity on land that is used to produce food, crops, livestock, and other commodities.
- **HABITAT EXCHANGES** are voluntary programs that use habitat credit markets and financial returns for landowners to encourage willing landowners to provide wildlife habitat. The Central Valley Habitat Exchange aims to generate a future where landowners are rewarded for sustainable management and restoration activities that result in measurable environmental improvements. Improvements include healthier streams, resilient floodplains and riparian corridors that translate into more jobs and support benefits for farmers who "grow" habitat.

The Delta Conservation Framework footnote and endnote references can all be found in Appendix 1 online by section.

Introduction

There is growing recognition that for conservation practices to be successful they must be reconciled with the needs of Delta community members, tribes, and all Californians.[1]

Looking back, early examples show that this is possible.[2] Native Californians have lived in the Delta region sustainably for at least 6,000 years. Traditional resource management, such as fire management in the Great Valley, has been shown to increase habitat quality and species diversity, reduce evapotranspiration losses, attenuate peak flood flows, prolong stream flows, and increase production of culturally significant resources.

Over time, use of the Delta has intensified, however. As the Delta's population grows, as demand for fresh water and agricultural products continues, and as habitat for birds, fish, and wildlife shrinks, finding ways to do more with less for the benefit of all is becoming an urgent priority for residents and resource managers alike.

Today, the Delta is at a crossroads. In the last two hundred years, reclamation and agricultural development rapidly transformed the Delta from a natural landscape laced with rivers and marshes into a highly developed patchwork of levees, channels, farms, fields, towns and water conveyance systems. Over the next hundred years — faced with pressure to change the water conveyance system,[3] subsidence, weakening levees, endangered species, rising sea levels, and new climate extremes — the Delta must change rapidly again.

Restoring ecological processes will nurture ecosystem resilience in the face of future changes and will ensure continued and improved ecosystem services to local Delta communities and agriculture. This includes, but is not limited to open space; opportunities for hunting, fishing, boating, and other recreation that also promote tourism; clean water and fertile soils; subsidence reversal; carbon sequestration; crop pollination; biodiversity; and flood control. (See also Key Terms p.14)

This section of the *Delta Conservation Framework* highlights the need for a more comprehensive, public facing approach to conservation. It explores three specific goals designed to ensure that all stakeholder perspectives – whether business, community, recreational or resource management — are included when planning and implementing conservation in the Delta.

Goal A focuses on stakeholder communication and integration with regional planning partnerships.

Goal B focuses on outreach campaigns to local, statewide, and national audiences.

Goal C focuses on how the integration of conservation goals and existing science and planning can help achieve multi-benefit outcomes for Delta ecosystems and local communities.

While these are important foundational goals for the *Delta Conservation Framework*, it is important to acknowledge that solutions intended to benefit both the Delta ecosystem and local communities may not always result in equal benefits. Solutions, at one point or another, will inevitably include disadvantages, or even losses, for some stakeholders.[4,5,6,7] Recognizing the potential for unequal benefits must be a first step in any effort to gain the trust and cooperation of stakeholders.

Riverfront agricultural facility near Clarksburg in the heart of the Delta. Photo courtesy Delta Protection Commission

Public Feedback from 2016 Workshops

As described in Section I, efforts to engage stakeholders early in the *Delta Conservation Framework* planning process, and to start to develop a mutual understanding of common goals, included a series of public workshops in 2016. The workshops revealed that many Delta farmers, business owners, and residents feel that they have gotten the "short end of the stick" in the past, in terms of being given meaningful opportunities to share their views and contribute to the conservation and water planning going on all around them. In some cases, participants attended the 2016 workshops to avoid a potential negative effect on their lands or livelihoods. In other cases, participants were motivated by their desire to undo some of the degradation of Delta ecosystems caused by humans over the past century.

Participants in the 2016 workshops expressed particular concern about the possible impact of conservation on agriculture and Delta counties and communities. Many of these concerns pertain to the economic impacts of converting productive agricultural farmlands to wildlife habitats, floodplains, or other landscapes with benefits to ecosystem health. Concerns expressed about such conversions included the loss of a local tax base for Delta counties, and associated decreases in agricultural processing, labor, and equipment sales.

Workshop participants also expressed concerns about being subject to constraints on agricultural operations that might result from the presence of sensitive species on or near private property; the spread of invasive species onto their properties from nearby conservation areas, or vice versa; drainage and seepage from restoration or levee setback sites onto agricultural lands, or vice versa; and other unintended but potential impacts associated with implementation and management of conservation lands, and, in some instances, with public access to conservation lands.

Although it is possible to plan conservation projects with minimal impacts and multiple benefits, the degree of agricultural and community benefit from conservation will likely vary within the Delta and over time. Partnerships, projects and strategies developed through the *Delta Conservation Framework* will emphasize appropriate solutions with long term benefits for all stakeholders whenever possible. They will also focus conservation efforts on public lands first, and on providing lasting support and incentives for private landowners willing to engage in conservation.

Delta communities clearly also recognize that conservation can have positive impacts on their environment and the fish, wildlife, and waterways many rely on for tourism, hunting, fishing, boating, and quality of life. The way of life, and the quality of life, in the Delta are fundamentally supported by functional ecosystems. The ecosystem services provided by conservation efforts benefit all those that are part of the ecosystem, not just salmon, smelt, cranes and otters, but also women, men and children. As such, conservation projects that have small-scale impacts on agriculture should be considered in light of the potential direct and indirect larger, landscape-scale, benefits of ecosystem conservation to society. Ultimately restoring ecosystem processes via conservation may contribute more to local and statewide economies than maintaining marginal agricultural lands in perpetuity. The *Delta Conservation Framework* seeks to provide a framework for making these kinds of decisions with real consideration for the rich context of the Delta – people, place, and wildlife. It is imperative that all stakeholders get a chance to collaborate in conservation planning efforts and help make "all boats float" in the Delta in the long term.

Walnut Grove ice cream joint. Photo: Amber Manfree

Pear festival in Courtland. Farm festivals in the Delta offer a nexus between tourism, community, and stewardship. Photo courtesy Delta Protection Commission

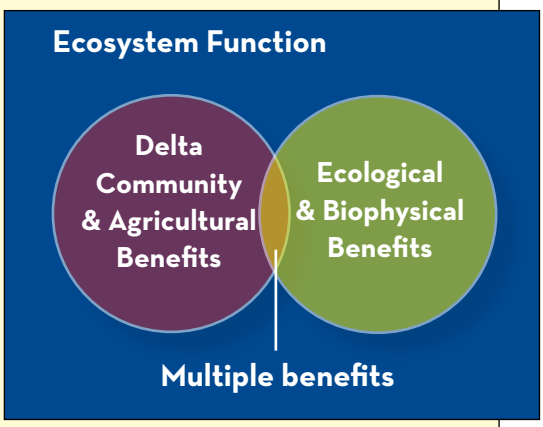
Delta as an Evolving Place

As mentioned above, in order for conservation to succeed it must occur in a context – such as the *Delta Conservation Framework* — that acknowledges the importance of an evolving place and the people who live there.

The phrase "Delta as Place" emerged from the 2007 Delta Vision Blue Ribbon Task Force process.[8,9] "Delta as Place" acknowledges that the Delta is a place for people, homes, and businesses, filled with history, cultural richness and diversity, as well as that the Delta is a critical hub for water distribution in California and an important ecosystem.[10]

The phrase connects to language in the Delta Reform Act directing that the state's co-equal goals of a reliable water supply and healthy ecosystem be achieved "in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place" (California Water Code §85054). This language calls for consideration of the human dimension in ecosystem conservation. The *Delta Plan*, in turn, articulates a number of ways to achieve this reconciliation of human uses and protection of the Delta ecosystem in the future.[10,11] The Plan also outlines regulatory policies, recommendations, and performance measures that track progress toward this end.[10]

Participants in the 2016 *Delta Conservation Framework* workshops described "Delta as Place" as a local feeling and great love for the Delta as a home, rooted in a multi-generational linkage to the land and in a way of life founded on farming and land management. They also recognized, however, that these strong ties to the landscape and its history may impart a reluctance to embrace change, especially if change is initiated from outside of local communities. Those Delta community members who participated in the 2016 workshops expressed concern that their lifestyle could cease to exist, or drastically change, if state agencies manage more land in the Delta and displace farms, orchards, pastures, and people. Participants also expressed concern that conversion and restoration of agricultural lands to habitat, or other state purposes, could adversely affect water quality and availability and also increase regulatory restrictions on their agricultural activities.



Stakeholder input suggests that research into potential socioeconomic effects, and acknowledgement of local concerns, needs to inform ongoing planning and implementation of conservation projects to be successful. Addressing local concerns may also help to achieve buy-in for long-term solutions.[12,13,14,15,16]

For example, as Delta conditions evolve over time due to climate change or changes in markets, which could both affect which crops are grown, some loss of agriculture could be balanced by improved long-term economic sustainability or other benefits.

Other entities and initiatives are now furthering the preservation of "Delta as place," and inform the *Delta Conservation Framework*. For example, Chapter 5 of the *Delta Plan*, Protect and Enhance the Unique Cultural, Recreational, Natural Resource, and Agricultural Values of the California Delta as an Evolving Place, describes the cultural values that make the Delta a unique place and outlines a series of five core strategies to protect and enhance those values. These core strategies include designating the Delta as a special place in state and national registries, maintaining Delta agriculture, encouraging recreation and tourism, sustaining a healthy and diverse Delta economy, and developing plans to protect Delta lands communities.

In addition to the strategies outlined in Chapter 5 of the *Delta Plan*, the Delta as Place Interagency work group was established by the Delta Protection Commission to implement related *Delta Plan* policies and recommendations and to advance Delta values. Some of this work involves coordinating activities across federal, state, and local agencies to promote Delta agricultural sustainability, culture, economic development, energy and transportation infrastructure, recreation, and subsidence reversal/carbon markets.[9] Recent work group actions include several initiatives: Community Action Planning, Delta Narratives, a Delta Awareness Campaign, a Delta Leadership Program, and a proposal for a federal designation of the Delta as a National Heritage Area.[9] This kind of heritage area is defined as "a region designated by the United States Congress, where natural, cultural, historical, and recreational resources combine to form a cohesive, nationally-distinctive landscape arising from patterns of human activity shaped by geography."[9]

If community attitudes and conservation planning are to evolve as the Delta evolves, and as what defines the "Delta as place" evolves, the region requires a more inclusive and adaptive long-term planning process. Many stakeholders, including government agencies, are rooted in the status quo. With so much change ahead, however, preparing for the future now, using the forward-thinking collaborative effort including representation of the various interests proposed by the *Delta Conservation Framework*, is in everyone's best interest.

"If there isn't community buy-in on restoration projects then they're often seen as an imposition rather than a type of amenity for the community. Those projects that have a good connection with the local community really increase their rate of success, because you have those communities looking out for those projects. If restoration is imposed, it plays itself out where it can get sabotaged, and there isn't support for it. I think most of the scientific community is aware of this now. I'm not sure we have a set of best practices yet. But I think they will have to come to light through trial and error."

BRETT MILLIGAN, UC DAVIS [1]

BENEFITS OF CONSERVATION TO DELTA COMMUNITIES

- Control of invasive aquatic vegetation in both conservation areas and adjacent agricultural and recreational waterways and marinas
- Climate change mitigation, adaptation, resiliency
- Removal of submerged debris and abandoned vessels in or near conservation sites
- Discouragement of unsanctioned activities, such as illegal dumping, poaching, unauthorized camping
- Installation and management of water gates, screens, and barriers for the benefit of fisheries and irrigation systems
- Improvement of water quality
- Beneficial reuse of dredge material in restoration of tidal wetlands (e.g., subsided lands or flooded islands or land-side of levees)
- Improvement of fishing access from levees and public conservation staging areas; enhanced wildlife viewing destinations accessible from boats (e.g., Calhoun Cut Ecological Reserve)
- Direct public access in certain conservation areas
- Enhanced tourism subsidizing local Delta businesses
- Improvement of air quality and scenic value from the planting of trees
- Public stewardship

A Regional Approach to Conservation

A strong thread throughout the *Delta Conservation Framework* is to focus on "regions" that make sense in terms of landscapes, watersheds, ecosystems, human history, or communities as an organizing principle for conservation work in the future.

The Framework references a number of different kinds of "regional" approaches:

- **Regional Conservation Partnerships** made up of diverse interests, public and private, that work together to achieve landscape level goals;
- **Regional Conservation Strategies** developed by regional partnerships that map out how conservation goals might be achieved in the regions with an eye toward fitting the regional pieces together across a larger landscape picture;
- **Conservation Opportunity Regions** roughly identified by Delta stakeholders where promising opportunities for major conservation and restoration successes exist (see maps pp. 20 & 170);
- **Regional Conservation Investment Strategy** (RCIS), a California Department of Fish and Wildlife program offering a structure for analysis, assessment, scenario-planning, investment and mitigation to regions interested in developing nonbinding, voluntary conservation and habitat enhancement actions around focal species and habitats (see also Section V).*

Of the above, the "regional conservation strategy" is a central organizing idea for implementation of the *Delta Conservation Framework*. A regional strategy might be an existing plan, such as the *Suisun Marsh Habitat Restoration and Management Plan*, or a new plan. The main idea is to develop non-regulatory, long-term, broadly supported regional conservation action plans. These would be developed collaboratively by a regional planning partnership comprised of public agencies.

Each regional conservation strategy would be aligned with the overarching goals and strategies of the *Delta Conservation Framework* while tailoring a set of conservation objectives, specific actions, and an adaptive management framework to the needs of a given region.

The Framework also suggests a process for integrated scenario planning to support existing and new regional partnerships in the development of regional conservation strategies. Through this process, regions can select a priority scenario representing the most favorable multiple benefit outcomes for implementation (see Section VI).

** While the core ideas of regional partnerships, strategies, and conservation opportunity regions presented here are the foundation of the Framework, they appear largely without capitalization throughout these pages to underscore an intent of inclusivity and collaboration.*

Regional scale planning enables the Yolo Bypass to be used for multiple benefits, including farming and habitat, and protects nearby Sacramento from flooding (such as this January 2017 event). Photo: Carson Jeffres

Framework in Depth: Goal A

Integrate Stakeholder Communication in Conservation Practice

Public agencies, restoration practitioners, and scientists can all benefit from working in collaborative partnerships with Delta residents, landowners, farmers, tribes and nongovernmental organizations, at the local and regional levels, to plan conservation projects.[1,10,11,13,14] The intention of these partnerships is to overcome the current climate of guardedness and move toward sustained communication and collaboration. Mutual respect for, and a commitment to, evaluating challenges and opportunities together is essential to the success of conservation. Delta ecosystem function could be greatly improved through support for multi-benefit projects.[1,8,10]

Collaborative Regional Partnerships

Strategy A1 under Goal A of the *Delta Conservation Framework* encourages the development of collaborative regional partnerships among public and private stakeholders to inform conservation planning. The work of such partnerships is to develop and implement regional conservation strategies within subregions of the Delta, using scenario-planning and decision-making approaches like those outlined in Section VI. These strategies should explore the most appropriate conservation scenario solutions for their sub-region, and consider local ecosystems, land uses, and needs of Delta communities in the process. As regional conservation strategies are developed, they should they not focus on adopting specific conservation measures from the *Bay Delta Conservation Plan* (see p. 30); they should, however, consider existing acreage targets detailed in regulatory and compliance plans.

As described above, stakeholder input from the 2016 workshops identified both existing regional partnerships and subregions of the Delta (subsequently referred to as conservation opportunity regions) where it makes sense to expand conservation efforts, support existing and new collaborative partnerships, and undertake strategic conservation planning.

The Framework also emphasizes the importance of executive level coordination and facilitation of habitat restoration in the Delta. A combination of such support and independent advisors can help overcome institutional hurdles related to project permitting, long-term management, and project implementation.

Local entities with strong ties to agriculture, such as farm bureaus or leaders within local agricultural communities, could also serve as liaisons to ensure the use of good-neighbor practices consistent with Department of Water Resources' (DWR) Agricultural and Land Stewardship Workgroup strategies[17] (see pp. 48 & 75). These regional liaisons would also ensure that any new priorities emerging from socio-economic studies supporting project planning and implementation be addressed. Regional conservation opportunity areas are featured within each Framework section and include the Suisun Marsh, Yolo Bypass, Cache Slough Complex, Central Delta Corridor, West Delta, South Delta, and North Delta (see pp. 63, 90, 121, 149, & 175).

The *Delta Conservation Framework* also suggests that easily accessible web tools and content be made available to support regional conservation partnerships. These resources could include existing conservation planning tools such as the Open Standards of the Practice of Conservation[18] and web links to current agency webpages, including CDFW, DWR, the Delta Conservancy, the Delta Protection Commission, the Delta Stewardship Council, and the Good Neighbor Checklist prepared by DWR[17] (see Table 2.2, p. 75). Websites and online forums (e.g., blogs, email list serves) should be designed to facilitate early and consistent communication among all Delta stakeholders. Physical mailings, published announcements, and posted flyers could also be used to inform potentially interested Delta community stakeholders about conservation-related meetings within each Delta region.

Major existing and emerging conservation efforts that are building blocks within the *Delta Conservation Framework* include:

- The *Suisun Marsh Habitat Management, Preservation and Restoration Plan*, established in 2013 to provide a structure for conservation planning and implementation in the Suisun Marsh region.
- The *Central Valley Joint Venture Implementation Plan* that outlines objectives for Central Valley habitats that support waterfowl, shorebirds, waterbirds, and riparian songbirds.[19]
- The Yolo Bypass-Cache Slough Complex Planning effort, which includes the Yolo Bypass-Cache Slough Partnership, the Corridor Management Framework, and the Yolo Bypass Working Group, that serve as a conduit for successful conservation planning and management in the Yolo Bypass-Cache Slough region.


Illustration: Alyson Razzini

GOAL A

Ensure that regular communication among stakeholders and socioeconomic considerations are integrated into all Delta conservation initiatives.

STRATEGY A1

Maintain and expand communication among diverse individuals, organizations, and agencies with a stake in conservation planning.

- Use existing collaborative regional partnerships and regular coordinated forums to plan, implement, and manage conservation; evaluate progress; and engage in adaptive management.
- Foster new regional partnerships in areas without existing partnerships.
- Support the use of existing tools (such as best practice checklists, science based project design recommendations, and online scenario-building and decision-making methods) to engage stakeholders when planning or developing regional conservation strategies.

STRATEGY A2

Align conservation practices with best practices that support Delta agriculture and communities.

- Consider the Department of Water Resources' Agricultural and Land Stewardship Workgroup strategies, as well as socioeconomic and natural resource management. research (existing, ongoing, or new), in the planning of regional conservation strategies.
- Identify local experts in land use and agriculture as points of contact for individual projects and regional planning efforts.
- Consider relevant findings from socioeconomic research in conversation planning.
- Update conservation practices as ecosystem and stakeholder needs evolve and change.

- The Central Corridor Partnership, which is a regionally focused effort of public landowners and owners of publicly funded lands along the Central Delta Corridor with the goal to develop a regional strategy with coordinated conservation efforts.
- The North Delta Habitat Arc, a reconciled ecosystem strategy that creates an arc of habitats connected by the Sacramento River to benefit native fish and other wildlife.
- The Migratory Bird Conservation Partnership, comprised of three of California's top organizations for bird conservation: Audubon California, Point Blue Conservation Science, and The Nature Conservancy, working with a broad array of partners to develop multi-benefit conservation solutions for birds, wildlife, and human communities to address issues concerning birds' habitat and biological needs.
- The Nature Conservancy's BirdReturns, a pilot project combining crowd-sourced data, hard science and economic incentives to provide pop-up habitats for birds on rice fields in the Sacramento Valley. There is interest and potential to expand this effort to the Delta.
- The Delta Working Landscapes Program, coordinated through the Delta Protection Commission, is providing examples of what wildlife friendly agriculture and wetland restoration measures private landowners could adopt on larger scales throughout the Delta.[23,24]

See Guide to Supporting Partnerships and Programs on p. 70.

FRAMEWORK IN DEPTH: GOAL A CONTINUED

Agriculture, Land Stewardship and Conservation

Strategy A2 under Goal A of the *Delta Conservation Framework* suggests ways to align conservation practices with agriculture and land stewardship. Local landowners are concerned that conservation projects will take valuable agricultural land out of production, as well as spread invasive species, provide mosquito habitat, impact water supply, increase the risks of drainage and seepage problems, and draw scrutiny from regulatory agencies if listed species move onto their lands. Some participants in the 2016 stakeholder workshops felt that public agencies generally do not manage their lands well, and have insufficient staffing and funding for long-term monitoring and maintenance. They suggested that public agencies focus on finding solutions to improve land management and consider stewardship practices that incorporate agriculture (see also Goal C, Strategy C4).

Several solutions were proposed to address potential conflicts between conservation projects and local community goals. These included incorporating stakeholders' perspectives in conservation planning and implementation processes; using good- neighbor practices when managing conservation lands over the long term; and offering financial, regulatory, or other incentives to compensate landowners for their participation in conservation.

As described under Strategy A1, the *Delta Conservation Framework* suggests that conservation partnerships, state agencies, local agencies, and project proponents should consider the 2014 Department of Water Resources Agricultural and Land Stewardship Workgroup strategies (DWR-ALS)[17] to minimize potential impacts of conservation projects on agricultural lands. The DWR-ALS strategies contain specific tools that balance the needs of agriculture and conservation. They also provide an outline for assessing the ecosystem benefits of a given project, while ensuring that local landowners can achieve or maintain agricultural and economic viability in the surrounding region.

During conservation planning efforts, effective coordination among agricultural practitioners (or their local representatives), local planners, conservation planners, and other stakeholders is essential to ensure that potential impacts to agricultural lands and the environment can be recognized promptly and evaluated.[20,21] Farmers and landowners should be involved in planning from the start. Assistance and incentives for farmers and landowners to engage in conservation partnerships are also essential. Because landowners and farmers are often busy managing their own lands, the DWR-ALS strategies[17] suggest the use of public advisors for government projects aimed at conservation. The advisor could serve as a point of contact for agricultural interests in a region, help inform farmers and landowners about ongoing conservation planning processes and advocate for funding to provide incentives to farmers willing to use wildlife-friendly farming practices.

More information on DWR-ALS and Delta Working Landscapes can be found in the Guide to Related Partnerships and Programs on pp. 74-75.

Workers in a Delta field. Photo courtesy DWR-PJH

CONSERVATION ACTIONS WITH SOCIOECONOMIC BENEFITS

- Encourage more farms to adopt wildlife-friendly agricultural practices based on successful examples in the Delta, such as sandhill crane habitat on Staten Island.
- Construct new flood bypasses, or improve existing bypasses, to provide habitat and improve flood protections; for example, in Yolo Bypass and McCormack-Williamson Tract-Cosumnes (north and central Delta) and Paradise Cut (south Delta).
- Conduct restoration on already flooded islands like Frank's Tract to reestablish habitat for listed species, according to the Delta Smelt Resiliency Strategy, before converting productive agricultural land.[37,38]
- Focus restoration efforts on the mid-channel berms or islands that are in danger of being lost, before converting productive agricultural land, as a wide variety of species are dependent on those types of habitats, including Delta smelt, Chinook salmon, Sacramento splittail, western pond turtle, and Mason's lilaeopsis.
- Encourage the growth of native vegetation on the waterside of Delta levees, where appropriate, to provide habitat for aquatic and semi-aquatic species and provide recreational and tourism benefits.[40]
- In some areas, instead of planning restoration across large swaths of land, enhance existing habitat in smaller restoration areas by improving natural slough structure using dredge and fill material in strategic locations, increasing the variability of flows and water residence times, and creating more natural channel margins along existing sloughs and waterways by establishing native plants. Examples include Twitchell Island and Southport.
- Restore historic floodplains to provide ecosystem benefits onsite and in the Delta to enhance, for example, sediment transport and food web support and to improve system-wide flood management

Source: Adopted from Delta Protection Commission 2012.

Framework in Depth: Goal B

Educate the Public about Delta Cultural and Ecological Values

Most Californians who live and work outside the Delta have little sense of it as a unique place with a rich agricultural and recreational history, or don't understand how Delta ecosystems support local and statewide economies through water supply and other ecosystem services. Some only drive through the Delta on major highways with little notion of "where it begins and where it ends."[9] The *Delta Conservation Framework* recommends that statewide and national Delta education initiatives work in concert with the ongoing Delta Awareness Campaign[9] to close this awareness gap. These efforts should work to explain the Delta's historical legacy and economic importance to the public and decision-makers, as well as the urgency of improving its degraded natural areas and novel ecosystems (see Key Terms p. 108) so that they can better support Delta residents and native wildlife. Accordingly, 2016 workshop participants developed a public education goal and related strategies aimed at integrating recognition of the "Delta as an evolving place" with information about the importance of ecosystem conservation. The effort should build on existing education and outreach initiatives and target national, state, and local audiences.

Delta Public Education

Strategy B1 under Goal B of the *Delta Conservation Framework* suggests the importance of a well-coordinated, widely accessible local education program that heightens public awareness of, and support for, conservation and restoration activities. This increased awareness will foster ongoing local collaboration in conservation planning and increase appreciation for the direct and indirect contributions of ecosystems to people's well-being and quality of life. For example, the ecosystem services provided by conservation — including maintained or expanded areas for boating, fishing, and hunting — benefit both Delta residents and visitors. Increased awareness will also highlight how integrating activities that support conservation with those that support communities and local economies through the *Delta Conservation Framework* can increase benefits to both. Engaging the local community in conservation related discussions should be an ongoing priority.

The *Delta Conservation Framework* supports working with the several organizations already engaged in similar activities including: the Delta Regional Foundation, Delta Conservancy, Delta Protection Commission, and Water Education Foundation. One result of these kinds of education efforts has been the Delta Heritage Area Initiative. This initiative will define an area with specific boundaries within which projects and resources are focused to preserve the human heritage of the Delta.[9] Other educational initiatives have been the non-profit Delta Regional Foundation's Delta Leadership Program and the Delta FOREVER art show, presented at California State University, Sacramento, in March of 2016.[22,23]

Strategy B2 under Goal B focuses on educating audiences outside the region — across the State of California and the nation — about the Delta. In 2013, the Delta Protection Commission and the Delta Conservancy joined forces in response to a statewide survey that showed that 78 percent of voters had never heard of the Delta. In a two-stage effort they initiated a Delta Awareness Campaign to help educate Californians

FRAMEWORK IN DEPTH: GOAL B CONTINUED

Illustration, Afsoon Razavi

Goal B

Support and expand existing public outreach efforts advancing Delta conservation.

STRATEGY B1

Promote and update existing local and regional public education programs to broaden scope, audience, and messaging about future conservation challenges.

- Include educational curricula for all ages integrating agriculture, Delta communities, and ecosystem conservation across large landscapes and regional scales.
- Incorporate education about impending changes to ecosystem services and essential agricultural, wildlife, fish, water, and other common Delta resources from climate change.

STRATEGY B2

Continue support for the implementation and expansion of existing outreach campaigns to statewide and national audiences about the importance of both the Delta and multi-benefit conservation outcomes.

about the Delta as a historic, cultural, recreational, and ecological treasure of the State.[9] This Delta branding effort – led by the Commission — supported tourism research, identified promising market opportunities in the Delta, and commissioned logos and brand standards for the Great California Delta Trail and the proposed Delta National Heritage Area.[9] The second phase, led by the Conservancy, is creating a Delta-focused web presence linked to Visit California,[24] which will provide a more comprehensive overview of the Delta's cultural, recreational, historical, ecological, and agricultural tourism opportunities to potential visitors.

The *Delta Conservation Framework* also supports a public outreach theme suggested by 2016 workshop participants: "Where does your water come from?" Campaigns answering this question will help inform people throughout California and the U.S. about the Delta as a major source of water and ecosystem services for the fifth largest world economy.[22]

The *Delta Conservation Framework* also suggests that the Delta's existing outreach and branding programs be expanded to promote an appreciation for the unique ecosystems and wildlife in the Delta, as well as of impending changes to this unique place associated with climate change, rising sea levels, and extreme weather and precipitation events. Public support will also help fuel future conservation funding initiatives.[25]

Framework in Depth: Goal C

Seek Multiple Benefits to Float all Boats

When stakeholders and conservationists are able to collaborate, they can identify multi-benefit projects that simultaneously improve ecosystem function and provide human benefits. These kinds of "win-win" conservation strategies include wildlife-friendly farming, multi-use floodplains planted with annual crops, and low-impact outdoor recreation in conservation areas.

The benefits of conservation actions to ecosystems and Delta communities can be realized both immediately after construction and more slowly over the course of years or decades. Individual conservation projects can be designed to achieve multiple benefits within a short time frame, such as incentives for farmers to use wildlife-friendly practices or the addition of hiking trails and boat launches to restoration sites. These short-term benefits do not preclude more long-term conservation benefits, however. If properly designed, projects should also result in a slow restoration of habitats, biological processes, and ecological function to the Delta system, especially if multiple projects become established within a region.

Such forward thinking, multi-benefit approaches to conservation and agricultural evolution are especially critical for Delta stakeholders preparing for prolonged drought, extreme runoff events, potential levee failures, salinity intrusion and seepage, as sea levels rise and many parts of the Delta continue to sink. Such threats to the Delta's future agricultural productivity [26,27,28,29,30] are of particular concern on subsided lands, including most of the western and central Delta islands that are more than 10 feet below mean sea level.

The *Delta Conservation Framework* suggests that stakeholders explore a variety of possible solutions to these problems but be sure to consider science-based approaches. Scientific projections of long-term changes in climate, air temperature, precipitation, flooding, ecological trends and economic, social, and land-use priorities can all inform multi-benefit decision-making. If all stakeholders are willing to give a little and embrace certain tradeoffs — short-term losses in light of longer-term gains — community supported, multi-benefit conservation is a real possibility. [32,33,34,35]

> *"Facing forward will entail envisioning and implementing preferred transitory futures. We will need to drop old battles more quickly and look ahead to what the future holds for our environment and how it fosters our economy and well-being."*
>
> RICHARD NORGAARD, PROFESSOR EMERITUS OF ENERGY AND RESOURCES, UC BERKELEY[31]

Flood Management and Conservation

Strategy C1 under Goal C explores opportunities provided by the 2017 *Central Valley Flood Protection Plan's* (CVFPP) Conservation Strategy.[36] The CVFPP strategy presents a comprehensive, non-regulatory approach to providing ecological benefits and protecting public safety through the creation of multi-benefit improvement projects within riverine and floodplain ecosystems. It offers a regional programmatic framework for increasing the efficiency of planning and permitting, improving individual project cost effectiveness, and enhancing ecosystem benefits associated with flood control projects. The *Delta Conservation Framework* recommends that planning partnerships and project proponents follow the specific guidance in CVFPP Conservation Strategy when planning and implementing projects that integrate flood

Marinas, warehouses, riparian habitats, fishing holes and many other waterfront features all co-exist along Delta channels. Photo: Amber Manfree


Illustration: Afsoon Razavi

Goal C
Develop multi-benefit conservation and land management strategies and plans that balance environmental and human needs.

STRATEGY C1
Incorporate conservation goals in levee maintenance and flood management practices to provide or increase habitat along Delta channels, river corridors, and riparian zones.

- Work toward the objectives identified by the 2017 Central Valley Flood Protection Plan Conservation Strategy.
- Collaborate with groups of established flood control experts, such as the Delta Levee Habitat Advisory Committee.

STRATEGY C2
Support sustainable wildlife-friendly agriculture to provide additional habitat for wildlife and migratory birds.

- Develop a common, science-based understanding of the potential benefits of wildlife friendly agricultural practices in the Delta.
- Use existing incentives (such as agricultural conservation easements and Habitat Exchange programs) and investigate new financial incentives for wildlife friendly farming and ranching.
- Solicit, reference, and incorporate local agricultural and community expertise in wildlife-friendly agricultural practices during conservation planning.

STRATEGY C3
Control and reverse land subsidence and support climate change mitigation efforts in the Delta.

- Pursue carbon farming projects and conservation funding opportunities provided by growing carbon markets.
- Prioritize carbon management activities consistent with established carbon sequestration strategies including the practices for Natural and Working Lands in the 2017 AB 32 Climate Change Scoping Plan.
- Encourage and provide incentives for agricultural practices that reduce subsidence.

STRATEGY C4
Improve communication and coordination between stakeholders and state and local agencies concerning the ongoing management of state-owned lands.

STRATEGY C5
Develop best practices that ensure reliable water distribution for in-Delta uses during implementation of conservation plans and projects.

STRATEGY C6
Integrate best practices for improving surface- and groundwater quality into conservation project planning and implementation.

STRATEGY C7
Identify, develop, and implement conservation strategies that integrate habitat management goals and practices across both land and water, and for both terrestrial and aquatic species.

Flooding and levee stress have already started to affect the Delta during extreme weather conditions, and such extremes are expected to increase with climate change in the future. In the winter of 2017, heavy rains damaged levees along the North Mokelumne River, forcing residents on Tyler Island to evacuate. Flooding also spurred the evacuation of residents in the New Hope Landing Trailer Park and Marina and damaged farmland. Farmland was damaged along New Hope Road at another levee breach. These areas contain habitat for wildlife, such as the sandhill crane. Planned levee adjustments on nearby McCormack-Williamson Tract (pictured above), where a levee breached in 1997, are intended to provide tidal habitat for endangered species and improve local flood capacity. Photo: TNC

management and conservation in the Delta. The *Delta Conservation Framework* also recommends that project proponents coordinate directly with the Delta Levee Habitat Advisory Committee–a group that has been operating for 25 years to balance the need to conduct regular levee maintenance with habitat conservation efforts–and also consult the Delta Levees Investment Strategy Decision Support Tool.[37,38]

Planning partnerships and project proponents should consider lessons learned from past projects, incorporating long-term monitoring of project results and providing real world assessments of the costs of building and maintaining levee/habitat enhancement projects. Project proponents could also deliberate the importance of water elevation, vegetation (riparian and emergent), bank slope, substrate type for channel margin to benefit juvenile salmonids, for example.[35,38]

Other considerations in the Delta include evaluating the costs of constructing setback levees on subsided islands and conditioning Delta peat soil to provide stable levee foundations. Working with willing landowners and ensuring protection of existing structures and utilities are also important factors.[38] Risk assessments and outcome strategies, developed in close collaboration with levee engineers, will be required when choosing the location and design for setback levee construction. For example, the probability of flooding at a given location due to seismic events needs to be assessed, as well as state priorities for levee improvements. Planning partnerships or project proponents should consult the Delta Levees Investment Strategy and associated tools when planning setback levee projects.[37,39]

As a combined approach, the CVFPP Conservation Strategy,[36] the Delta Levees Investment Strategy,[38] and the Delta Levee Habitat Advisory Committee will continue to provide a balance of large-scale Central Valley wide planning and local site-specific expertise, both of which are essential for the success of individual projects and consistency with the broader goals of the *Delta Conservation Framework*.

Wildlife-friendly Agriculture

Strategy C2 under Goal C supports wildlife-friendly agricultural practices as tools farmers can use to improve ecosystem services, control pests, maintain biodiversity, preserve soils, reverse subsidence, and renew soil fertility.[39,40,41,42,43,44,45,46] Many of the state's HCPs/NCCPs in the Delta planning area, such as in Yolo County, include wildlife-friendly farming programs. The *Delta Conservation Framework* recommends that these and other programs that work with farmers to create and maintain habitat on private land should be promoted and expanded where possible. Many agricultural fields already contain wildlife-friendly features, such as hedgerows, irrigation canals with vegetation, and tree rows.

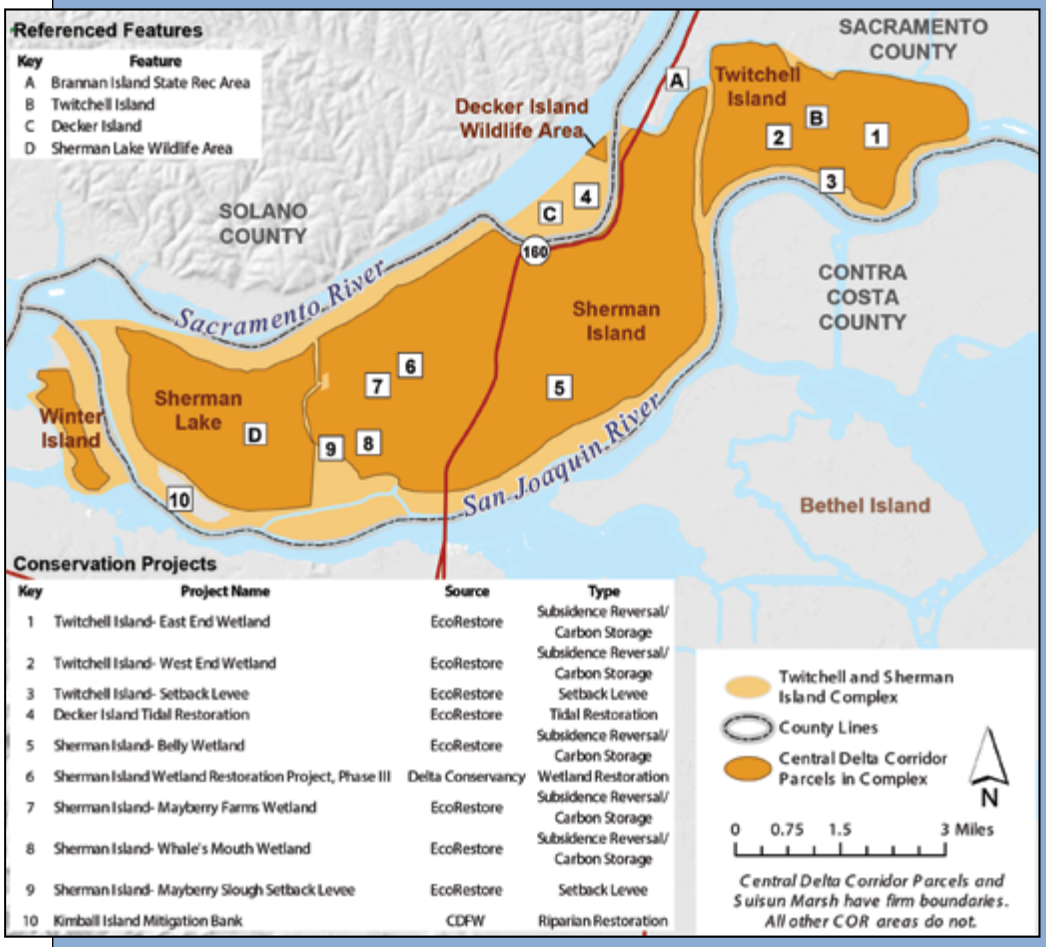
Wildlife-friendly farming is compatible with, and can even increase crop yields.[40,41] Coupled with financial incentives, this multi-objective approach to agriculture can offer benefits to both farmers and wildlife. For example, wildlife-friendly farming operations on Staten Island have benefited waterbirds—particularly migratory waterfowl and wintering sandhill cranes—while growing crops like corn, triticale, potatoes, alfalfa, and supporting permanent pastures.[39,42,46]

On the Ground Example: Twitchell Island Setback Levees

Many Delta levees need to be strengthened or upgraded to meet modern design standards and withstand future earthquakes, rising sea levels, and extreme flood events. In the process of these upgrades, it is often appropriate to consider adding habitat or additional flood plain by setting levees back from riverfronts. For example, a project on Twitchell Island under the California EcoRestore initiative, if approved and implemented, will not only stabilize a threatened section of the levee along the San Joaquin River but also construct waterside habitat features. The project will span nearly all of the San Joaquin River levee, plus a proposed 80-acre tidal marsh restoration site. Restoration through setback levees is expensive, however, and cannot be considered a standard design approach. Funding may come from Cap-and-Trade funds, Proposition 1 grants, and State Water Project mitigation.

This project would benefit both the Delta community and ecosystem function, reduce flood threat, and solve a number of problems on Twitchell Island. Currently, heavy winds cause waves to run up onto the roads and fields. The amount of space (freeboard) between high water levels and farms or structures is inadequate. The waterside levee slopes are also overly steep.[62] In addition to enhancing levee stability and increasing freeboard space, the proposed project would create waterside habitat and gently sloping "fish friendly levees." Fish friendly levees are designed to provide rearing and outmigration habitat for juvenile salmon. Adjacent to the main levee, tidally submerged and emergent vegetation will also benefit fish and marsh species, and a continuous corridor of riparian and upland scrub habitats will provide a diversity of vegetation and canopy structure for riparian birds and other wildlife.[62]

The *Delta Conservation Framework* suggests that these kinds of projects need to integrate science and monitoring into construction and maintenance in order to succeed. Evaluating the effects of different types of habitat improvements and levee designs on target species requires monitoring data.[62] Future setback levee designs should consider monitoring results, species responses and life history requirements, and Delta-specific constraints among many factors. For example, elevation of inundated areas needs to be evaluated to determine if: 1) tidal or seasonal inundation will support riparian, wetland, and upland habitats and species; 2) the setback distance will be sufficient to allow the channel to reinitiate riverine processes; and 3) the timing, duration, and frequency of flood flows are appropriate for habitat improvement. To create a multi-benefit project, the amount of setback needs to be balanced with the loss of productive farmland.



Map: CDFW, 2018

FRAMEWORK IN DEPTH: GOAL C CONTINUED

Crop rotation can also benefit wildlife and increase the economic return of farmland. For example, Swainson's hawk primarily forages in alfalfa fields within heterogeneous agricultural lands.[44] Because Swainson's hawk also forages in other crop types, they may benefit from crop rotations that follow fluctuating market values, as long as some cropland is maintained in high-value foraging crops. For example, fallowed fields, grain crops, sunflower, safflower, dryland pasture, and row crops such as beets or tomatoes are all used by Swainson's hawk[45,46,47,48] and other special status birds, such as white-tailed kite and tricolored blackbird. Crop rotation patterns are considered when scoring Swainson's hawk habitat value for the Central Valley Habitat Exchange program.[48]

Carbon farming in subsided areas offers another example of a multi-benefit approach. When rice, tules, or other wetland species are planted to replace conventional crops in subsided areas, they sequester carbon, increase organic substrate, reverse subsidence, and provide income to landowners through the emerging carbon market[49,50] (see Strategy C3, p. 57). In this example, tule marshes and rice fields could also support Delta wildlife, including giant garter snake and tricolored blackbird.[48,50,51] If conservation-focused financial incentives are available to allow farmers to continue earning revenue from wildlife-friendly agriculture, despite changes in ground water salinity levels and flooding frequencies, they could bolster long-term agricultural sustainability in the Delta.

Many governmental and nonprofit entities already recognize the value of establishing a mosaic of wildlife-friendly agricultural areas for wildlife habitat, and offer incentives to farmers for embracing this approach. Resource Conservation Districts, the Natural Resources Conservation Service, and federal Farm Bill programs—including the Conservation Reserve and Wetland Reserve Programs—have all been working in collaboration with farmers for decades to improve wildlife habitat and other aspects of environmental quality on agricultural land.[51]

As mentioned before, the DWR's ALS workgroup developed a series of strategies to expand existing collaborations between farmers and local, state, and federal agencies, which the *Delta Conservation Framework* embraces.[17]

The *Delta Conservation Framework* also supports incentive based programs such as the Migratory Bird Partnership[51] and the Nature Conservancy's Bird Returns pilot program.

The white-tailed kite relies on certain kinds of crops for food. Photo: Rick Lewis

The *Delta Conservation Framework* suggests a number of considerations be taken into account when promoting wildlife-friendly agricultural practices. These include demonstrating the economic benefits of habitat-friendly cultural practices; understanding the social, economic, environmental, and governmental policy hurdles of practicing conservation; and communicating the advantages to landowners.

This *Delta Conservation Framework* strategy recognizes that private agriculture as the major, potentially wildlife-friendly, land use of the Delta can be part of the solution.

More details on bird partnerships, wildlife friendly farming and other multi-benefit initiatives can be found in the Guide to Supporting Partnerships and Programs on pp. 70-75.

Wildlife-Friendly Agriculture[39]

- Deferring fall tillage until later in the year to increase the quantity of forage on cornfields for waterfowl and greater sandhill cranes
- Shallow flooding of seasonal croplands in fall/winter to increase the availability of forage for wintering waterfowl, shorebirds, and other species
- Retaining a percentage of the crop in the agricultural field for wildlife use to enhance the value of flooding
- Screening agricultural water diversions
- Improving fish passage at water diversion structures
- Maintaining individual trees and tree rows at the margins of agricultural fields
- Planting native hedgerows along farm and district waterways to provide wildlife, pollinator, water conservation, and erosion control benefits
- Promoting vegetated waterways and tail-water ponds
- Using livestock for weed control as a key tool to maintaining desirable habitat conditions, for example, in vernal pool grasslands

Potential benefits to agricultural stakeholders from improving conditions for wildlife include:

- Reduction in regulatory framework with species improvements
- Groundwater recharge to aquifers used for summer irrigation
- Leaching salts from soils
- Biological decomposition of crop residue
- Reduction in soil erosion
- Creation of opportunities for income from hunting and increased aesthetic values, both of which may increase property values
- Financial incentives associated with agricultural conservation easements
- Improved relationships with regulatory entities

Landscape-Level Farming[52]

Guidelines for farming in diverse landscapes with a mixture of restored ecosystems and agriculture:

- Maintain the existing benefits from a mixed landscape of agricultural and natural ecosystems, and encourage agricultural practices that maintain this diversity (e.g., maintain forest remnants, scattered trees, and crop diversity).
- Restore native ecosystem connectivity through commonly vetted projects across property boundaries or strategic land acquisition. These measures will benefit species that need large areas and are sensitive to agriculture.

Guidelines for farming in areas where farming is the predominant land use:

- Protect and expand large patches of native vegetation, because these provide important refuge habitat for species sensitive to agriculture.
- Create connections between existing conservation areas to increase the adaptive capacity of wildlife in the face of climate change. Connections may be created by traditional corridors or by innovative management strategies within agricultural lands, such as temporary fallows or intermittently flooded wetlands.
- Increase landscape heterogeneity by diversifying land use and crops, subdividing large fields to create more smaller fields, and establishing beneficial vegetation such as riparian areas and hedgerows along field boundaries and roads, irrigation and drainage canals.

Wintering sandhill cranes visit the Delta's Staten Island and Brack Tract (Isenberg Sandhill Crane Reserve) because of the food and habitat provided by wildlife friendly agriculture. Their visits also draw enthusiastic visitors to the Delta, who in turn bring in local revenue. Delta residents, meanwhile, regard the crane as a local icon and celebrate their winter arrival with events such as the Lodi Crane Festival. Photo Rick Lewis

FRAMEWORK IN DEPTH: GOAL C CONTINUED

Reversing Land Subsidence

Strategy C3 under Goal C encourages carbon farming conservation practices to reduce land subsidence, build up soils, and offset greenhouse gases. The Delta's peat soils are rich in carbon. If California converted an area the size of the subsided lands in the Delta into carbon farms, the annual benefits could equal: changing from standard light bulbs to compact fluorescents in all California households; turning all SUVs in California into small hybrids; or turning off all residential air conditioners in California.[49]

In 2006, Governor Schwarzenegger signed the Global Warming Solutions Act (AB 32, 2006)[53] to scale back California's greenhouse gas emissions to 1990 levels by 2020. AB 32 required the California Air Resources Board to develop solutions to meet emission reduction goals, including carbon sequestration and carbon credit trading. The emerging carbon market can offer opportunities for reversing land subsidence in the Delta while providing benefits to society in the form of carbon storage and financial incentives.

Carbon can be sequestered in the Delta both by restoring wetlands and conserving natural carbon trapping habitats, as well as by replacing conventional crops on subsided lands with rice, tules, or other soil-building wetland species. One large-scale demonstration project can be found on Twitchell Island in the western Delta (see also p.54). In this project the US Geological Survey is collaborating with a team of university researchers in the Carbon Capture Program[49] to show that flooding tule wetlands or rice fields during most of the year (especially during the summer and early fall months) reverses subsidence. Inundated tules and rice fields reverse subsidence by increasing root structure and producing bulky organic matter and new soil. The program shows promise as a technique to rebuild subsided Delta islands and help combat climate change by taking carbon dioxide (an important greenhouse gas) out of the atmosphere.[49]

Delta landowners can capitalize on the emerging carbon market by switching from growing traditional crops to farming carbon by planting tules, rice, or alfalfa and maintaining the land in agricultural use. Carbon farming offers a unique multi-benefit, win-win opportunity to increase elevation on subsided lands, restore a large portion of the Delta wetlands, and benefit the local Delta community.[49,50,51,53]

CARBON FARMING[49,53]

BENEFITS

- Reduces the cumulative stress on the levees
- Decreases the risk of levee failure, flooding, and costs of recovery
- Halts soil loss
- Reverses the effects of subsidence
- Sequesters carbon (captures and converts CO_2 to an organic compound and stores it)
- Generates revenue through carbon credits
- Creates habitat for Delta wildlife
- Reduces greenhouse gas emissions to meet the 2020 goal established by AB32
- Provides room for adaptation to sea level rise associated with climate change
- Preserves open space

CONCERNS

- Potential adverse environmental impacts need to be resolved, including contamination from mercury and dissolved organic carbon, and the need for mosquito control
- Implementation will be difficult on islands with multiple owners, unless all owners agree to take part in the project.
- Subsidence reversal requires land management practices that differ from much of conventional agriculture in the Delta
- Expansion of low-carbon agriculture, in the form of rice cultivation, may not be economically feasible for farmers, because rice yields are lower in the Delta than in the Sacramento Valley

GROWTH STRATEGIES

- Provide incentives to stabilize or reverse land subsidence
- Help farmers and landowners produce and sell greenhouse gas offset credits
- Investigate options to designate subsidence reduction and carbon sequestration crops as agricultural production for regulatory and incentive purposes.

FRAMEWORK IN DEPTH: GOAL C CONTINUED

Agency Land Management

Strategy C4 under Goal C seeks to advance and improve agency land management processes and procedures. Participants in the 2016 workshop series identified a number of challenges with state and federal land management practices in the Delta. Many of the public lands in the Delta are owned and managed by state agencies such as DWR, CDFW, and California Department of Parks and Recreation. County agencies have title to, and responsibility for, other Delta lands including the Petersen property in the Cache Slough region, owned by the Solano County Water Agency. Federal agencies also own land in the Delta, including the Stone Lakes National Wildlife Refuge owned by the USFWS. During the 2016 workshops, stakeholders repeatedly said there were "too many agencies involved in the Delta" and that government agency landowners can be "bad neighbors." Ownership and management of state lands in the Delta is split among several departments. Better coordination among state and local agencies could improve land management practices, streamline conservation implementation, and address some of the concerns of neighboring private landowners.

DWR's Agricultural and Land Stewardship workgroup provides a checklist (see p.75) for agencies and other conservation practitioners to ensure that they comprehensively consider the impacts of conservation lands on neighbors and neighboring land uses when managing lands in the Delta.[17]

The *Delta Conservation Framework* recommends use of this checklist, which includes specific actions such as contacting and communicating with neighbors, agreeing upon site access routes, discussing security or law enforcement, evaluating increased fire danger and introduction of invasive weeds or pests, identifying potential issues with flood control structures or other infrastructure, and understanding how neighboring agricultural operations may affect conservation projects through applications of chemicals or livestock presence. Through coordination and the development of standard procedures for management of both farmlands and conservation lands, impacts on either side could be measurably reduced.

Multi-benefit conservation, supported by collaborative public-private land management, is exemplified by the Cosumnes River Preserve, which encompasses 46,000 acres of conservation lands. The preserve offers not only hiking trails, canoe and kayak launches, waterfowl hunts, fishing, and classroom field trips, but also sustains row crops such as corn. These crops are farmed in a manner that benefits wintering migratory waterfowl and waterbirds, cranes and hawks.[32,33] Conservation in the preserve also offers local communities the benefits of improved flood protection and in-Delta water quality.[34,35,36,37] The conservation lands in the Preserve are owned and managed by multiple partners, including state and federal agencies (Bureau of Land Management, CDFW, California State Lands Commission, and DWR); Sacramento County; and non-governmental organizations (The Nature Conservancy and Ducks Unlimited). Agreed-upon goals and a management plan have been critical to good relations with neighbors. Photo: Carson Jeffres

Reliable In-Delta Water Distribution

Strategy C5 under Goal C supports the development of practices and permitting tools to assure reliable water distribution for in-Delta uses when implementing conservation. Water diversions are used to distribute water to agricultural fields or ponds throughout the Delta. As a side effect, small fish and other aquatic or semi-aquatic wildlife may be pulled into these diversions and perish.[54] Recent studies show that most small diversions take place at times and places when Delta smelt, especially larval smelt, are not likely to be present. Therefore, while small diversions are found throughout the Delta, it is unlikely that large numbers of Delta smelt have been entrained at the small intakes located close to shore.[55] Entrainment of juvenile salmon in unscreened diversions was also low relative to other fish species.[56]

While not opposed to conservation or integrated flood management in principle, local landowners and reclamation district managers are concerned that high profile projects targeted to benefit listed species could result in enforcement actions limiting local water diversions which have been providing water essential to the local agricultural economy for decades. Specifically, reclamation district managers and landowners have expressed concerns that water diversions will be curtailed in the future, or that the cost per unit of water will increase significantly as a result of successful restoration projects on neighboring lands. Without durable assurances that their operations can be maintained over the long term in the vicinity of listed species habitat, these local stakeholders find it difficult, if not impossible, to support individual projects.

The Framework suggests developing tools to minimize adverse effects of local water diversions on native fish, wildlife, and water quality and help preserve a reliable water supply for human use. These best practices could include raised awareness of the critical times when native fish, especially Delta smelt and juvenile salmonids, are most sensitive to entrainment to avoid negative effects. The Family Water Alliance is an example of a partnership among state and federal agencies and private contributors to fund and install fish screens on small agricultural diversions in the Sacramento Valley.[57] The success of the program resulted in the delivery of diverted water that is free of fish, protecting both the fishery resource and the local agricultural community.[58] As a further benefit to farmers, certain fish screens can keep fish and debris out of irrigation pipes, saving substantial operational and maintenance costs.[58]

If fish screens are not feasible — since screens are not effective in excluding larval life stages of fish — permitting tools are available to provide take authorization to conservation practitioners, neighboring landowners, and Delta residents for the diversion-associated take. Existing tools available under the California Endangered Species Act include incidental take permits, safe harbor agreements, and associated neighboring landowner agreements (see p.34 and Section V).

Irrigation water for Delta farms comes from both local waterways and state and federal water projects. Photo: Amber Manfree

FRAMEWORK IN DEPTH: GOAL C CONTINUED

Conservation-Related Water Quality

Strategy C6 under Goal C seeks to improve surface and groundwater quality when undertaking conservation related construction and restoration projects. During conservation project construction and management, certain practices such as the removal of water hyacinth or other invasive floating plants, installing new infrastructure, or breaching levees to reestablish tidal flows into marshes may affect water quality. Potential impacts can include increased turbidity and decreased levels of dissolved oxygen; nutrients and specific toxics can temporarily be affected. The *Delta Conservation Framework* recommends considering surface and groundwater quality improvements during conservation project planning and implementation. Attention should also be paid to lasting negative effects, especially if they affect groundwater and legacy contaminants.

Long-term negative impacts to water quality from wetland restoration may include an increase in the bioaccumulation of methylmercury or selenium.[59,60,61,62,63,64,65,66] For example, because of extensive mercury mining in the Coast Range and mercury use in Sierra Nevada gold mining, methylmercury production rates are higher in natural or managed Delta wetland habitat types than in other California aquatic ecosystems.[67] In some cases, wetland restoration may release mercury from sediment and increase the bioaccumulation of methylmercury in Delta wildlife.[59,60]

The Central Valley Water Quality Control Board's Delta Methylmercury TMDL Phase 1 implementation program requires studies and pilot projects to develop and evaluate management practices to control methylmercury discharges.[62,63] The studies and pilot projects will be evaluated by the Delta Mercury Control Program Technical Advisory Committee and the Board to inform implementation actions to control methylmercury during Phase 2 of the control program. These types of actions may help to minimize adverse impacts of bioaccumulatives like methylmercury or selenium caused by wetland restoration projects. Such actions have been successful in reducing methyl mercury impacts downstream in South Bay Salt Pond Restoration projects, for example.[61]

Wetland habitat restoration efforts in the Delta also provide numerous positive effects on water quality. With careful management, and attentive monitoring of hot spots and pathways related to each conservation or restoration project, potential contaminant-related negative effects can be minimized.

These gates allow managers of restoration sites in South San Francisco Bay downstream of the Guadalupe River Watershed, site of a historic mercury mine, to control water and limit methylmercury production levels. Photo: James Hobbs

Like mercury, some pesticides, such as the banned organochlorine pesticide DDT, are legacy problems in the larger San Francisco Estuary Watershed.[62] Careful project design and monitoring is all that can be done to minimize mobilization of these legacy contaminants into the Delta ecosystem. Yet, most contaminants responsible for reduced water quality arise from current-use compounds from industrial, agricultural, urban, transportation, and natural sources. There is increasing concern over new classes of contaminants, such as pyrethroid pesticides, pharmaceuticals, and personal care products.[62] Further, major contaminants of California's groundwater include salt, organic compounds, nitrates, pesticides, and metals.[63] Such water quality issues may not only affect fish and wildlife, but also recreational waters, fisheries, and farming operations.

To minimize adverse effects of restoration on water quality and Delta wildlife, the *Delta Conservation Framework* supports integrating or expanding best practices that align with State and Regional Water Board policies for improved surface and groundwater quality.[64,65] A review of existing best practices during project planning could help ensure the implementation of conservation efforts in a manner appropriate to project conditions and site specific water quality concerns.

Multi-species Floodplain Management

Strategy C7 under Goal C seeks to develop conservation goals to manage floodplain habitat for both terrestrial and aquatic species, while at the same time addressing human needs. Creating floodplains not only benefits terrestrial and aquatic species but also provides multiple benefits by conveying floodwaters away from human infrastructure and settlements, thereby reducing flood risk. In order to benefit fish species, floodplains should mimic natural flooding patterns, and remain flooded long enough to activate food webs and support fish rearing and spawning.[66] To support native fish species, remaining lakes should be managed as intermittently flooded habitat allowing fish access to cooler waters. For terrestrial species, particularly riparian wildlife, re-establishing flow and flooding is critical to ensuring dynamic woody riparian habitats.[66] To do so, re-establishing and maintaining hydrologic connection to the watershed with appropriate amounts of sediment is important, as is restoring and protecting complex, wide and continuous estuarine-terrestrial transition zones.[66]

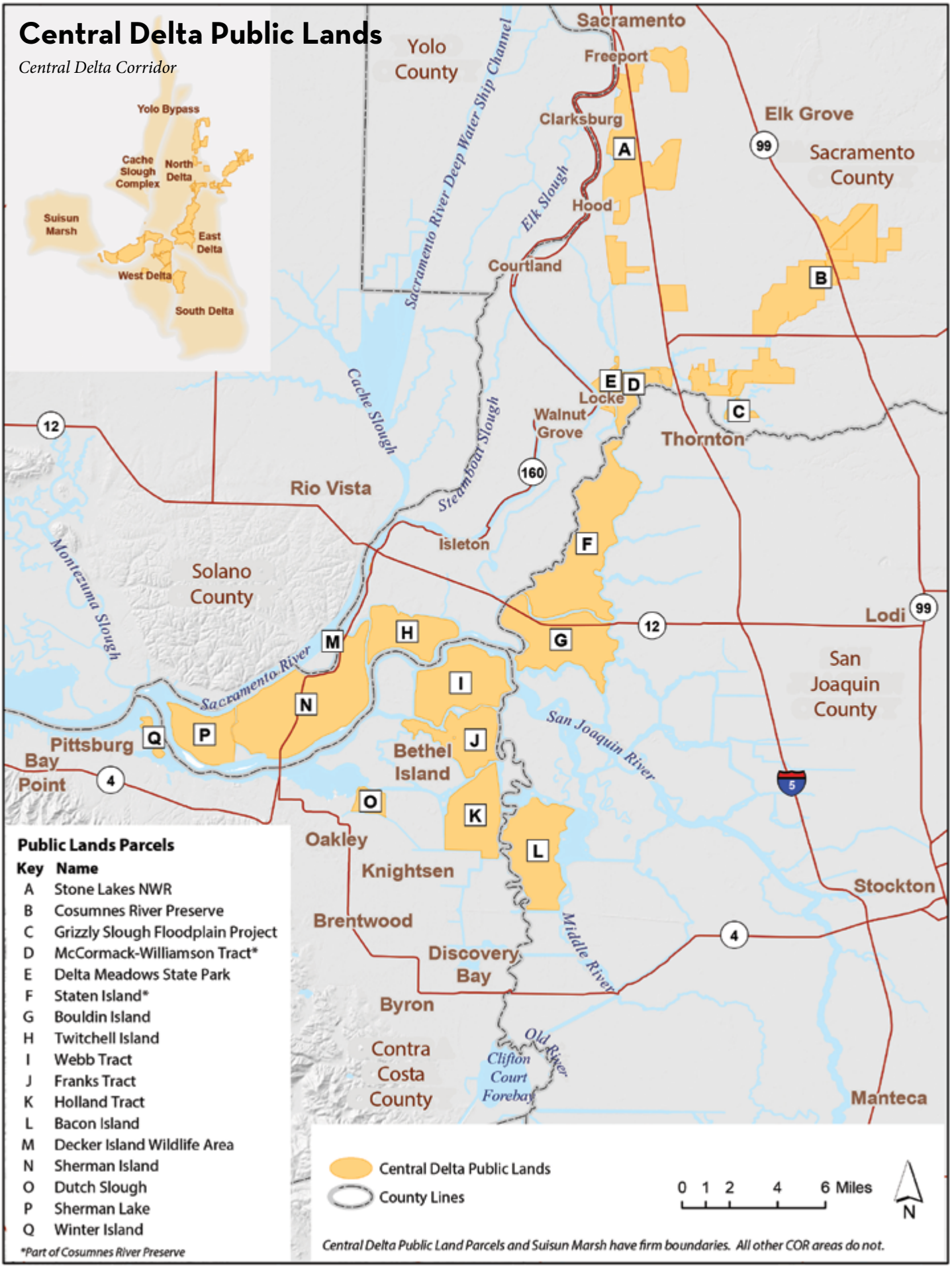
The main objective of this strategy is to identify and implement opportunities to pursue multi-benefit floodplain projects and to manage land simultaneously for terrestrial and aquatic species, for example by planting nesting trees for bird species, and establishing high water refuge areas and overwintering habitat for species such as giant garter snake within floodplains, and by mimicking natural inundation patterns. The *Delta Conservation Framework* therefore supports the assessment of habitat suitability across several aquatic and terrestrial taxa found in the Delta.

Economically viable, soil friendly agricultural practices can result in multiple benefits for wildlife and society. Developing and encouraging agricultural practices in the Delta such as no till, cover crops, periodically flooding fields, or walking wetlands helps reduce or negate the amount of subsidence that normally occurs on agricultural lands and allows for wildlife movement. Private agriculture as the major land use of the Delta can be part of the solution.

YOLO HABITAT CONSERVATION PLAN/NATURAL COMMUNITY CONSERVATION PLAN

An innovative setback levee in Hamilton City reconnects the Sacramento River to its floodplain, creates habitat, and strengthens the failing J levee, originally built in 1906. The town has been evacuated six times in the last 25 years due to flood fears. The project is a collaboration of the US Army Corps of Engineers, local landowners, Reclamation District 2140, and The Nature Conservancy. Photo: The Nature Conservancy

CONSERVATION OPPORTUNITY REGION



Map: CDFW, 2018

CONSERVATION OPPORTUNITY REGION

Public Lands First: A Coordinated Central Delta Strategy

Any talk of large scale Delta restoration, especially for those concerned about preserving the rich heritage of farming in the region, begins with the refrain "public lands first." Consideration of this important priority, and a look at just which lands were publicly-owned or funded in the heart of the Delta, reveals a corridor of islands and parcels stretching from Stone Lakes National Wildlife Refuge near Clarksburg in the north, down past the confluence of the Mokelumne and Cosumnes Rivers in the northeast, through the central Delta, and all the way southwest to Chipps Island near Pittsburg – 17+ parcels encompassing roughly 50,000 acres. More importantly, the configuration of this corridor – once mapped – suggests the potential for large-scale ecological benefit in terms of habitat connectivity for fish and wildlife often surviving on remnant patches and edges of habitat, rather than on more viable landscapes of 1,000 acres or more.

The Central Delta Corridor Partnership, established in 2017 to coordinate planning and restoration for this corridor, reflects *Delta Conservation Framework* goals for forward-thinking regional partnerships and strategies. The Framework also highlights the corridor as one of seven "conservation opportunity regions" where a critical mass of public lands, potential conservation opportunities, and conservation-minded people and existing partnerships occur in one place. The Framework seeks to support such regions and partnerships in strategic conservation planning. Together these regions will one day add up to a healthier Delta – both for people and wildlife.

Regional Setting & Background

The Central Delta Corridor Partnership (CDCP) oversees a network of roughly 50,000 acres of publicly owned or funded lands in the central delta area (see map p.62). The region is characterized by lakes, floodplain, tidal wetland, deeply subsided islands,[1] and includes the flooded Franks Tract Recreation Area. While the bulk of the lands that are included in the partnership are contiguous, some parcels are interspersed with privately owned property. The Central Delta Corridor partners include government agencies, water districts, and NGO conservancies managing publicly funded lands, among others. The partners have met regularly since early 2017, with the goal of developing a regional strategy of coordinated conservation efforts. The partnership has steadily grown by reaching out to neighboring landowners, both public and private, and including them in conservation planning.

Photo: Christina Sloop

Management goals include flood management, agricultural sustainability, and conservation of aquatic, avian and terrestrial resources. The deep subsidence on most central Delta islands limits potential prospects for conservation, but there are opportunities to enhance channel margin habitat and tidal habitat on the western-most islands. As long as levees are maintained, there is also significant potential for managed marsh for waterfowl, for subsidence reversal, and for the conservation of interior woodland areas on many of these islands. In the long term, CDCP partners believe that the creation and enhancement of wildlife habitat could go hand-in-hand with levee improvements and maintenance, and not only support target species but also improve flood protection and water quality, and sustain agriculture and the local economy.

Central Delta Corridor At A Glance

Area: ~ 50,000 acres

Location: Within the northeast and central Delta, including Stone Lakes National Wildlife Refuge, Cosumnes River Preserve, McCormack-Williamson Tract, Staten Island, Bouldin Island, Twitchell Island, Sherman Island, Webb Tract, Franks Tract, Holland Tract, Bacon Island, Decker Island Wildlife Area, and Dutch Slough

Elevation range: ~ 23 feet below sea level - 56 feet above sea level

Primary land use: ~ 50-60 percent agriculture - 40-50 percent public lands

Other primary land uses: flood protection, wildlife habitat, water supply, recreation, scientific research, carbon sequestration

Natural communities: Managed wetland, tidal wetland, freshwater emergent wetland, floodplain, grasslands, riparian, vernal pools, channel margin, open water, wet meadows

Urban population: 0

Rural or small community population: ~ 400-450

Recreational opportunities: Wildlife observation, hiking trails, boating, fishing, hunting, photography, interpretation

Listed species: Greater sandhill crane, Delta smelt, longfin smelt, Chinook salmon, Central Valley steelhead, green sturgeon, giant garter snake, Swainson's hawk, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, California black rail, Ridgway's rail, California least tern.

Planning History

When Southern California's Metropolitan Water District (MWD) acquired a number of large islands in the central Delta in 2016 for public purposes, the shape of a significant swath of public lands that could be improved, restored or managed for environmental, water quality, and wildlife purposes began to emerge. The Delta Conservancy — tasked with conserving both Delta farmlands and habitat — encouraged MWD and other public landowners in this corridor to begin thinking about their common conservation objectives and the opportunity to pursue the "public lands first" focus popular among in-Delta communities. Current members of the resulting Central Delta Corridor Partnership include MWD, The Nature Conservancy, the California Department of Water Resources (DWR), the California Department of Parks and Recreation, the California Waterfowl Association, the Bureau of Land Management, the U. S. Fish

and Wildlife Service, and the California CDFW. Their decision to collaborate in developing a collective corridor vision recognizes their capital investments in the Delta, the historical legacy of the Delta, and the state's policies to rehabilitate the Delta ecosystem. To develop this vision, the Central Delta Corridor Partnership is engaging in a regional conservation strategy planning process of the kind recommended by the *Delta Conservation Framework*. The Partnership's combination of public and private large-parcel landowners provides a unique chance to explore opportunities for conservation, identify collaborative multi-benefit solutions, and coordinate implementation.

Conservation Opportunities

From north to south, the Central Delta Corridor conservation areas range from minimally to deeply subsided, and landscape-level conservation planning efforts need to consider opportunities along the full range of this environmental gradient.[2] From the perspective of the *Delta Conservation Framework*, specific conservation strategies that should be considered within this corridor include restoring tidal marshes in areas of intertidal elevations, restoring woody riparian vegetation in areas with stronger fluvial influence, and promoting wildlife-friendly agriculture and the construction of managed marshes in deeply subsided areas.[2] Other critical connections to the corridor that should be evaluated in conservation planning include: the tidal-terrestrial transition zone in the southwest portion (along the Sacramento River near the Sacramento-San Joaquin River confluence); stepping stone marshes leading to the eastern and southern Delta from the confluence; connections to the upstream watershed and Mokelumne and Cosumnes riversheds; and connections to the brackish estuary on the western edge of the Delta.[2]

Cornfield at McCormack Williamson Tract before flooding in 2017.
Photo: Christina Sloop

Major Central Delta Corridor Existing & Planned Restoration Projects

- McCormack Williamson Tract, 1600 acres floodplain restoration
- Grizzly Slough floodplain project, 400 acres floodplain restoration
- Decker Island Wildlife Area, 34 acres tidal restoration
- Decker Island, 140 acres tidal restoration
- Twitchell Island east end wetland, 800 acres subsidence reversal and carbon storage
- Twitchell Island west end wetland, 1,250 acres subsidence reversal and carbon storage
- Sherman Island belly wetland; 1500 acres subsidence reversal and carbon storage
- Sherman Island Wetland Restoration Project Phase III
- Dutch Slough tidal marsh restoration, 1,187 acres of tidal restoration
- Sherman Island wetland restoration project Phase II, 1,009 acres wetlands
- Sherman Island wetland restoration project Phase I, 666 acres wetlands
- Winter Island, 589 acres tidal restoration
- Chipps Island 887 acres tidal restoration
- Reclamation District special projects that include some in-channel habitat enhancement

Additional Conservation Opportunities

CHANNEL MARGIN HABITAT AND LEVEE IMPROVEMENTS

Restoration of suitable zones along the aquatic side of levees to a more natural state would benefit salmonids and other native species. Restoration might include planting vegetation, anchoring woody debris, and constructing shallow benches where native species could find refuge from predators.[3] Suitable locations include from Franks Tract east through the Delta to the McCormack-Williamson Tract and the Cosumnes River Preserve. These "fish friendly levees" are currently part of the DWR's multi-benefit Delta Levees Program.

AQUATIC HABITAT RESTORATION ON TWO TRACTS

The McCormack-Williamson Tract is considered a prime site for floodplain restoration, tidal freshwater marsh, seasonal wetlands, and riparian forest. The restoration plan would allow the area to flood naturally under high-water conditions to alleviate flood risks downstream while providing valuable aquatic and terrestrial habitat for native Delta species. Over time, this could seasonally reconnect lakes, channels, and marshes to prominent features in the region including Delta Meadows, Snodgrass Slough, the Mokelumne River, Burton Lake, Grizzly Slough, Stone Lakes, Dead Horse Island, Staten Island, and the Cosumnes River Preserve.

Franks Tract offers another unique opportunity for aquatic habitat restoration as it is one of the least subsided flooded islands in the Central Delta Corridor. Restoration of Franks Tract would enhance habitat conditions for Delta smelt[4] and other native fishes by minimizing suitable habitat for nonnative fish and submerged and floating aquatic invasive plant species, as well as modifying tidal circulation to create channel conditions similar to historic conditions. Results of an early CDFW feasibility study, and efforts to engage the local community early in the planning process, both suggest Franks Tract could be a project of the multi-benefit scope and landscape scale encouraged by the *Delta Conservation Framework*. In addition, the state's Delta Smelt Resiliency Strategy[4] identifies Franks Tract as a strong candidate for improvements to smelt habitat and food supply (see also p. 88).

REFERENCING EXISTING REGIONAL HABITAT PLANNING

The *South Sacramento Habitat Conservation Plan* (SSHCP)[5] encompasses the northern and northeastern part of the corridor. The plan aims to streamline federal and state permitting processes for SSHCP-covered development and infrastructure projects while protecting habitat, open space,

Delta smelt habitat at Franks Tract, a state owned recreation area, could be improved with restoration of 40-60 percent of the now flooded tract to tidal marsh. Photo: Christina Sloop

and agricultural lands. It also provides the kind of a carefully analyzed body of existing planning work regarding ecosystems and conservation opportunities in an area of overlap with the corridor that the *Delta Conservation Framework* encourages regional partnerships such as the CDCP to reference.

Potential Solutions to Recognized Challenges

SUSTAINABLE LONG-TERM OPERATION AND MANAGEMENT OF CONSERVATION LANDS

Sherman and Twitchell islands, like other deeply subsided Delta islands, require high flood protection levees that are costly to maintain in the long term. DWR has begun to address the causes of subsidence by withdrawing from agricultural leases and developing wetlands in their place to build back peat soils. However, this transition from agricultural production to ecosystem services means a significant increase in annual management costs and associated loss in revenue. Thus far, DWR has provided the necessary funds for flood control and land management on their lands in the western Delta; however, this is not sustainable. One new possible source of revenue is carbon market credits for carbon capture now associated with subsidence reversal. By quantifying the level of carbon sequestered in the newly-developed peat soil of the wetland, credits can be sold.[6] Additional alternative sources of revenue may include authorizing hunting leases on the wetlands and fulfilling mitigation requirements associated with other DWR projects.

Levee management and maintenance remains at the forefront of challenges to all Delta islands.[7] California ground squirrel and beaver dens threaten levee integrity; bird nesting season constrains maintenance activities. Alternative conservation-compatible management activities include: grazing sheep on levees, which would clear vegetation to maintain standards and detect leaks; providing raptor perches to help limit ground squirrel activity; and pre-placing emergency materials for flood events. Creating more gradual landside levee slopes could also create more habitat.

Levee failure at McCormack-Williamson Tract in 2017. Photo: The Nature Conservancy

SUSTAINABLE WILDLIFE-FRIENDLY AGRICULTURAL USES

Providing food resources for migratory birds within a diverse land use mosaic that balances minimal foraging distances with agricultural and recreational uses remains an ongoing challenge on a landscape scale. For example, an enduring management challenge is providing adequate wintering habitat (September-March) to sustain greater and lesser sandhill crane populations on Delta islands, while maintaining economically viable agricultural operations. Both species require shallow flooded areas for roost sites and dry agricultural fields (corn, wheat, pasture, alfalfa) for foraging habitat.[8] Land management to benefit sandhill cranes involves finessing the timing and amount of flooding and drawdown, carefully selecting the types and amounts of wildlife-friendly crops that can be grown, and balancing tradeoffs between harvest efficiency and availability of residual grain for waterbirds.[9] Crop diversity in the Delta can be limited as a result of soil, climate, low commodity prices, herbicide-resistant weeds, predation by grazing geese, salt build-up, and limited markets for non-GMO crops. All of these factors also limit the economic viability of farming operations on Staten Island, one of the larger islands in the public corridor. One potential solution to balancing agricultural production with wildlife needs would be to use additional flooding to reduce salts and subsequently increase yield.

CONSERVATION OPPORTUNITY REGION CONTINUED

To evaluate where decreased agricultural productivity aligns with opportunities for conservation as sea level rises and soil salinities increase, it will be critical to use the kind of strategic scenario planning recommended by the *Delta Conservation Framework*. It will also be important to consider the carbon footprint of certain crop types commonly used to reverse subsidence of peat soils when conducting scenario planning to set the stage for the long-term sustainability of a balanced land-use mosaic across the Central Delta Corridor.

HABITAT FRIENDLY RECREATION

In order to heighten public support for conservation and benefit the local agricultural economy, the *Delta Conservation Framework* suggests that conservation planning in the corridor incorporate agro-tourism and increased public wildlife viewing opportunities. Sandhill crane conservation on Staten Island and Brack Tract in the corridor is linked not only to wildlife-friendly agriculture, but also to the Lodi Crane Festival and other crane viewing events, which bring many enthusiastic viewers to the area and draw in local revenue. In some cases, however, enhanced public use can result in trespassing, poaching, vandalism, and burglary and compromise safe access for public viewing of wildlife. As a result, the *Delta Conservation Framework* suggests that public access planning should include consideration of greater enforcement in designated public areas and more signage.[18]

CLIMATE CHANGE ADAPTATION OPPORTUNITIES

Climate change induced sea level rise and changing rainfall and temperature patterns will increasingly affect the Central Delta Corridor in the next 30-100 years. Lands currently in the intertidal zones are projected to become subtidal (Map p.20).[10] Rising water levels will induce flooding when unprotected shorelines and nearby areas are submerged and will affect levee stability and resilience, especially along subsided islands.[11] In some parts of the Delta, sea level rise will mean that current agricultural land will be lost to increased salinity levels or inundation.[11] Additionally, flood dynamics are projected to change over the next few decades, with more frequent and extreme storm and rainfall events and associated flood pulses coming through the region.[11,12]

As mentioned above, the *Delta Conservation Framework* suggests that scenario planning[13,14] could be a useful tool for helping the CDCP anticipate impacts of climate change on ecosystems, species, infrastructure, agricultural practices, recreation, and other land uses and integrate these into the long-term conservation planning picture.Another useful tool could be pilot projects supported by Proposition 1 bond funding[15] that could explore new technologies and approaches to multi-benefit, adaptive restoration — such as living shorelines,[16] horizontal levees,[17] carbon farming,[18] early detection and rapid response of invasive species[19] — and assist with levee strengthening and subsidence reversal.

Setback levee, riparian habitat strip, and carbon farming on the state's Twitchell Island. Photo: Christina Sloop

Monitoring, result sharing, and regular reevaluation of scenarios over time will help with examining how exactly projections play out and how management actions of conservation lands need to be adjusted over time.

CARBON SEQUESTRATION AND SUBSIDENCE REVERSAL

The Central Delta Corridor public lands contain a significant percentage of the most deeply subsided Delta lands. Since the late 1800s when the lands were first drained for agriculture, more than 3.3 billion cubic yards of organic soils have disappeared in the Delta, resulting in land surface elevations 20 to 25 feet below sea level (see map p.20).[20] The volume below sea level of approximately 1.7 million acre-feet not only limits continued agricultural practices, but also represents a significant opportunity to implement carbon sequestration projects. Previous research has demonstrated that carbon dioxide (CO_2) emissions are positively correlated with subsidence.[21] Modelling results estimate that 1.5 to 2 million metric tons of CO_2 are emitted from about 200,000 acres of organic and highly organic mineral soils in the Delta each year as they continue to subside. In addition to CO_2, nitrogen dioxide and methane emissions are also released during oxidation of soils. The Central Delta Corridor provides a unique opportunity to continue and expand subsidence reversal trials to stabilize peat loss and enhance soil accretion. The corridor's Twitchell and Sherman islands, for example, will continue to sink unless subsidence-neutral crops like rice, irrigated pasture, or wetland tules are grown. Subsidence reversal actions also ultimately reduce the risk of flooding as islands increase in elevation over time; maintain revenue through agricultural sales and sale of carbon credits; and provide habitat for terrestrial, aquatic, and avian species.[2]

Looking Ahead

Delta community members and stakeholders at the 2016 *Delta Conservation Framework* workshops commented that public lands should be the focus of Delta conservation efforts. The Central Delta Corridor represents a great opportunity to achieve this goal. The current Central Delta Corridor partnership initiated steps in 2018 to inventory and coordinate ongoing efforts, highlight additional opportunities, and develop an outreach strategy. The partnership also recognizes that a critical component of the success of the effort is local support. Partners are conducting focused outreach to engage neighboring landowners early in the process. The partnership is currently developing a high-level strategy document that identifies the most promising opportunities and most challenging constraints. This coordinated conservation strategy is intended to advocate for funding to better manage conservation lands, encourage wildlife-friendly farming, and implement activities for habitat restoration.

QUICK LINKS

Delta Carbon Program
http://deltaconservancy.ca.gov/delta-carbon-program/

Franks Tract Restoration Feasibility Study
https://www.wildlife.ca.gov/conservation/watersheds/dcf

Sacramento-San Joaquin Delta Conservancy Central Delta Corridor Partnerhsip
http://deltaconservancy.ca.gov/centraldeltacorridor/

South Sacramento Habitat Conservation Plan
https://www.southsachcp.com/

USGS Carbon Capture Farming Program
https://ca.water.usgs.gov/Carbon_Farm/

For more detailed descriptions of these conservation opportunity regions, see Appendix 2.

GUIDE TO SUPPORTING PARTNERSHIPS AND PROGRAMS

BirdReturns Project

STRATEGY A1, EXISTING PARTNERSHIP

The Nature Conservancy (TNC) is spearheading this project, which aims to conserve the Pacific Flyway. As a result of habitat destruction, water and food shortages, and climate change, migrating birds are having difficulty finding wetlands along the Pacific Flyway to stop for feeding, resting, and overwintering. To address the decline of the Pacific Flyway's support for avian migration from Alaska to South America, the pilot BirdReturns project combines scientific data with economic incentives to provide habitat for birds on rice fields in the Sacramento Valley. Two of the BirdReturns strategies to conserve migratory birds are to 1) protect and enhance bird-friendly agricultural lands; and 2) secure adequate water supply to wetlands and compatible agricultural lands. The project's goal is to create one million acres of Central Valley wetland habitat through citizen science. Bird sightings recorded in the eBird database are sent to the Cornell Lab of Ornithology, which will generate maps showing the highest concentration of birds on the remaining Central Valley wetlands and where the habitat needs are greatest. Along the Sacramento River, for example, TNC pays farmers to keep rice fields flooded to optimal depths as flocks of migrating birds arrive.

Central Delta Corridor Partnership

STRATEGY A1, EXISTING PARTNERSHIP

A large portion of the central Delta is publicly owned or publicly financed, and if restored and managed on a landscape scale could link together conserved lands in the northeastern and central portions of the Delta in a vibrant conservation corridor. The owners of these lands have met regularly since early 2017, and the Central Delta Corridor Partnership (CDCP) has steadily grown via outreach to neighbors. CDCP members own and manage approximately 50,000 acres of land in the Delta, and include The Nature Conservancy (TNC), the Metropolitan Water District (MWD) of Southern California, the California Department of Water Resources (DWR), the California Department of Parks and Recreation, the California Waterfowl Association, the Bureau of Land Management, the US Fish and Wildlife Service, and the California Department of Fish and Wildlife. In March 2018 CDCP began a nine-month inclusive planning process evaluating conservation opportunities available on Delta islands and other existing conservation properties in the central Delta.

See p. 63 for an overview of the Central Delta Corridor Partnership.

Central Valley Joint Venture

STRATEGY A1, EXISTING PARTNERSHIP

A long-standing and cooperative partnership in the region, the Central Valley Joint Venture (CVJV) has worked on conservation to benefit migratory birds, special status species, and other wildlife throughout the Central Valley since 1988. The CVJV is led by a management board of 21 public and private entities and is one of 18 joint ventures throughout North America formed under the North American Waterfowl Management Plan. The CVJV leverages public and private resources for projects throughout the Central Valley. The 2006 CVJV Implementation Plan outlines objectives for Central Valley habitats that support shorebirds, waterbirds, and riparian songbirds.[78] A revised CVJV Implementation Plan with updated bird population objectives is slated for release in 2019.

The objectives set by the CVJV for the Yolo-Delta, Delta Basin, and Suisun Marsh are relevant to *Delta Conservation Framework* Goal C, Strategy C2, "Support sustainable wildlife-friendly agriculture to provide additional habitat for wildlife and migratory birds"; Goal D, Strategy D1, "Restore, enhance, and manage ecosystem processes Delta-wide to improve function and life history support for native and migratory wildlife;" and Goal D, Strategy D2, "Conduct technical analyses within groups such as regional conservation partnerships" to prioritize areas for conservation and climate adaptation.

The *Delta Conservation Framework* suggests that regional partnerships and planning groups should consider and reference CVJV's habitat objectives for resident and migratory birds.

In the first year of BirdReturns, 10,000 acres owned by 40 farmers were flooded for up to eight weeks. Participating farmers included the Rue & Forsman Ranch, which grows sushi rice near Wheatland, California. While the timing of flooding may have had a disadvantage for planting, the compensation was "better than adequate," according to the farmer. Photo: Rick Lewis

See Quick Links p. 75 to access some of these partnerships and programs.

Delta Working Landscapes Program

STRATEGY A2, BEST PRACTICES

The Delta Protection Commission program, which ran from 2010–2012, provided examples of wildlife-friendly agriculture and wetland restoration measures private landowners could adopt on larger scales throughout the Delta. In collaboration with Ducks Unlimited, Hart Restoration, Inc., and local landowners, the objectives of this program were to:

- Improve the environmental quality of existing landscapes in the Delta;
- Demonstrate economic benefits of habitat-friendly cultural practices;
- Understand the social, economic, environmental, and governmental policy hurdles to conservation; and
- Communicate the advantages of wildlife-friendly agricultural practices to landowners.

The Delta Working Landscapes Program focused on pilot projects that demonstrated how farmers can integrate habitat restoration into farming practice. For example, the program established vegetative buffers along irrigation ditch banks and hedgerow plantings, designed to provide habitat for wildlife, improve water quality, and enhance levee stability. Restoration projects also included creating seasonal and permanent wetlands on marginal farmlands, providing essential habitat for waterfowl. By the time work on the program was completed in 2012, the projects resulted in a total of 312 acres of wetlands and 6.5 miles of enhanced levees and waterways. The *Delta Conservation Framework* supports multi-benefit conservation efforts that keep landscapes working for both people and wildlife.

See p. 74, Table 2.1 for examples of projects under this program.

Migratory Bird Conservation Partnership

STRATEGY A1, EXISTING PARTNERSHIP

Since 2008 this partnership has addressed issues concerning bird habitat and biological needs while working with a broad array of partners to develop multi-benefit conservation solutions for birds, wildlife, and human communities. Aligned with the work of the Central Valley Joint Venture, the MBCP is comprised of three of California's top bird conservation organizations: Audubon California, Point Blue Conservation Science, and The Nature Conservancy. The partnership currently focuses on three regions in the Central Valley: Sacramento Valley, San Joaquin River Basin, and the Sacramento-San Joaquin Delta. The ten million acre Central Valley provides particularly important habitat for Pacific Flyway migratory birds. The *Delta Conservation Framework* supports conservation efforts that integrate migratory bird ecology and habitat needs into working landscapes.

One focus of MBCP is a program on wildlife-friendly working lands. Since the steep decline of natural wetlands in California, millions of birds depend on over 25 million acres of agricultural fields. The MBCP works with farmers to keep agriculture productive for human food supply, while at the same time providing critically needed habitat and food for birds. For example, the MBCP has worked with rice farmers to optimize management practices for wildlife, so migrating birds are able to use the rice fields for nesting, roosting, and foraging on waste grains to prepare for their long migrations. Benefits to the farmers include long-term productivity and protection from urban development.

Snow geese near rice field habitats. In August 2011, the National Resources Conservation Service (NRCS) provided nearly $3 million for a pilot program to give farmers incentives to manage their lands as bird habitat. Working closely with the NRCS and the California Rice Commission, the MBCP helped to enroll about 75 farmers and more than 23,000 acres in the program. Based on that success, the MBCP helped the NRCS expand the program in 2012 and 2013 to over 100,000 acres. Today, the program encompasses roughly 20 percent of all rice lands in California. Photo: Jim Morris, California Rice Commission.

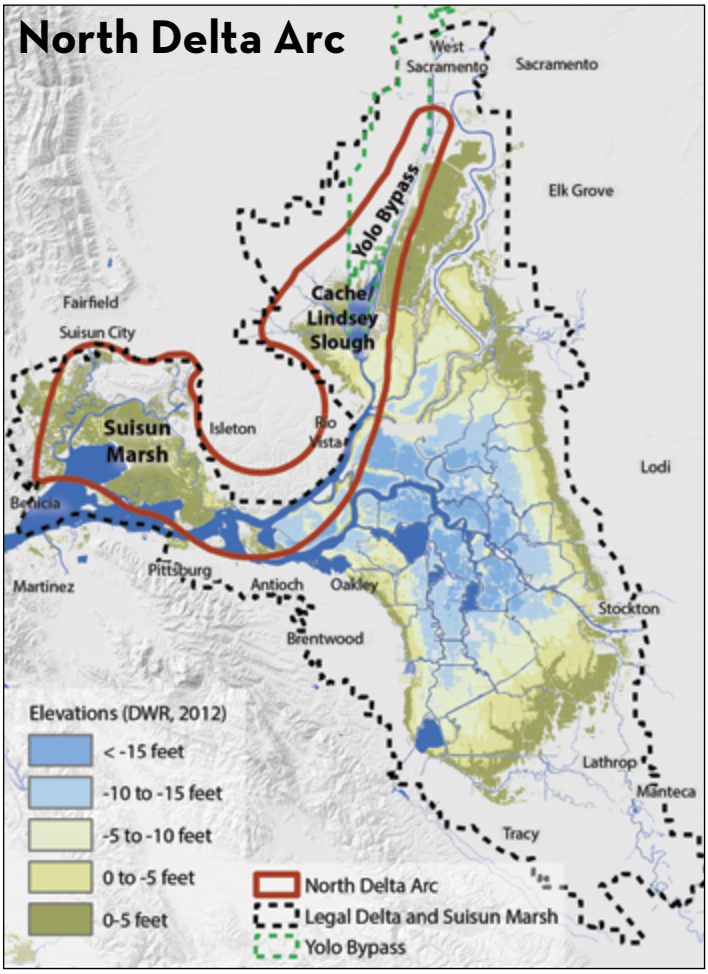
To skip these references go to p. 77

GUIDE TO SUPPORTING PARTNERSHIPS AND PROGRAMS - CONTINUED

North Delta Habitat Arc

STRATEGY A1, EXISTING PARTNERSHIP

Landscape-scale connectivity is emerging as an important emphasis for Delta conservation. Connecting a series of habitats across regions allows for continuous habitat "corridors" that are more ecologically valuable than individual disconnected parcels. The "North Delta Habitat Arc" is a reconciled ecosystem strategy (originating from UC Davis) that creates an arc of habitats connected by the Sacramento River to benefit native fish and other wildlife. The upstream end of the arc starts in the Yolo Bypass, continues through the Cache-Lindsey Slough-Liberty Island region (CSC) into the Sacramento River, includes Twitchell and Sherman Islands, and ends in Suisun Marsh. The state's Fish Restoration Program, and regional conservation plans for the two southern components of this "arc" (Suisun Marsh and CSC) are already under implementation by conservation partnerships. The northern portion includes public lands managed by CDFW (Yolo Bypass Wildlife Area) and has several existing successful planning efforts underway, including the Yolo Bypass working group, and the CVJV. While all the geographic subregions of this arc have benefited from conservation planning, there may be an opportunity to tie these efforts together through a landscape-scale approach. The *Delta Conservation Framework* supports regional scale conservation thinking such as the work that led to proposals for this arc of connected north delta habitats. For more details on the North Delta Arc components see also pp. 90 and 149.



Map: CDFW, 2018

Suisun Marsh Habitat Management, Preservation and Restoration Plan

STRATEGY A1, EXISTING PARTNERSHIP

Established in 2013, this plan (the SMP)[88] aims to provide a long-term structure for conservation planning and implementation in the Suisun Marsh region. As a 30-year, comprehensive conservation plan it balances protection and enhancement of managed wetlands and the restoration and protection of tidal wetlands. It addresses habitats and ecological processes, public and private land use, levee system integrity, and water quality. Implementation of the SMP is overseen by an advisory team of eight federal, state and regional agencies.

For more details see pp. 35 and 149.

See Quick Links p. 75 to access some of these partnerships and programs.

Yolo Bypass-Cache Slough Complex Planning Effort

STRATEGY A1, EXISTING PARTNERSHIP

Several partnership efforts have focused on conservation and floodplain management issues in the Yolo Bypass-Cache Slough Complex, described below. Their Corridor Management Framework allows local and regional agencies to engage more specifically in the Yolo Bypass partnership efforts. With sufficient coordination, these partnerships can serve as a conduit for successful conservation planning and management in the Yolo Bypass-Cache Slough region.

YOLO BYPASS CACHE SLOUGH PARTNERSHIP

This partnership offers a path for executive-level collaboration among agencies and other stakeholders at the government agency level. Formed in 2016 via a Memorandum of Understanding, the policy-level Yolo Bypass Cache Slough Partnership emphasizes the importance of achieving across-the-board improvements in habitat, flood protection, agricultural sustainability, recreation, and other public values.[90] Made up of 15 local, state, and federal agencies, its purpose is to improve executive-level interagency coordination. The partnership has set the stage for improved trust between stakeholders, a key ingredient in successful efforts of this scale. It also provides a vehicle to incorporate local governments into planning and decision making, relative to restoration actions in the Yolo Bypass and Cache Slough.

CORRIDOR MANAGEMENT FRAMEWORK

In 2015, local reclamation districts, counties, and flood control agencies developed the Corridor Management Framework (CMF), a vision for the integration of local, state, and federal interests in the region (including the Cache Slough Complex). The CMF continues to guide local agency participation in the Yolo Bypass Partnership and other forums.[91]

YOLO BYPASS WORKING GROUP

The Yolo Bypass Working Group, established in 1998, is a grassroots example of a multi-stakeholder partnership approach to conservation planning. Forty regular attendees represent a wide range of stakeholders interested in managing the multiple uses of the Yolo Bypass for flood control, agriculture, recreation, and floodplain habitat supporting juvenile salmon, waterfowl, and other waterbirds. Over the years, stakeholders have participated in discussions and problem solving efforts related to the many planning efforts affecting the Yolo Bypass. Various topics discussed over the years were the development of the Central Valley Flood Protection Plan, the Regional Corridor Management Framework, Yolo Bypass Wildlife Area Land Management Plan, *Central Valley Joint Venture Implementation Plan*s, and proposed fish passage and flood plain enhancement projects including the Bay Delta Conservation Plan and California EcoRestore. Information on federal and state habitat easement programs has been shared. Initial methyl-mercury studies and projects for Yolo Bypass Drainage and Infrastructure Study were also developed with work group participation.

CACHE SLOUGH RESTORATION PLANNING PARTNERSHIP

This effort is an example of a new regional conservation partnership process initiated in the Delta. The Cache Slough Restoration Planning Partnership (CSRPP) was launched in 2016 by the Delta Conservancy and included Solano and Yolo counties, Solano County Water Agency, Reclamation District 2068, agricultural community stakeholders from Resource Conservation Districts, and government agency representatives from the Delta Stewardship Council, California Natural Resources Agency, DWR, and CDFW. The CSRPP's purpose is to develop a regional conservation strategy for the Cache Slough Complex that identifies areas for habitat restoration and projects that would be eligible for Proposition 1 funding and avoid or minimize potential conflict between land uses. The CSRPP incorporated existing land use plans and input from local stakeholders to develop a locally supportable vision using a strategic planning approach. Ultimately, the Cache Slough Complex conservation strategy could integrate with adjacent planning efforts in the Yolo Bypass (upstream) or Suisun Marsh (downstream). This regional planning complements ongoing collaborative work among local, state, and federal agencies in the Suisun Marsh and the larger Yolo Bypass/Cache Slough region, and build on past efforts by the coalition of local agency partners in the Lower Sacramento/Delta North Region Corridor of important habitat for birds and other wildlife. Such landscape scale planning efforts are the foundation of the *Delta Conservation Framework*.

For more information on conservation opportunities and partnership activities in the Yolo Bypass Cache Slough subregion see pp. 91-101.

To skip these references go to p. 77

GUIDE TO SUPPORTING PARTNERSHIPS AND PROGRAMS - CONTINUED

Table 2.1: Delta Working Landscapes Projects, Delta Protection Commission
Strategy A2, Best Practices

Project Name and Location	Project Partners	Project Goals
Uslan Farms, Hamilton Road	Uslan Farm, Ducks Unlimited	Create semi-permanent wetland, seasonal wetland, and associated upland habitat
Winchester Vineyards, Winchester Lake	Ducks Unlimited, Hart Restoration, Winchester Vineyards, Winchester Lake Ski Club, Reclamation District 999	Create habitat along Winchester Lake that promotes slope stability, and create adjacent seasonal wetland habitat in low-yield crop area
Heringer Ranch, Elkhorn Slough	Heringer Vineyards, Hart Restoration	Reduce erosion of landside levee slope and prevent burrowing animals through plantings of native grasses
Heringer Ranch, Netherlands Road	Heringer Vineyards, Hart Restoration	Reduce erosion on slopes along Netherlands Road through vegetation plantings
Heringer Ranch (Vineyard), between Elkhorn Slough and Netherlands Road	Heringer Vineyards, Hart Restoration	Plant native vegetation to reduce erosive surface water runoff and provide habitat for wildlife
Vino Farms (Lambert Road), Pierson District	Vino Farms, Hart Restoration, Ducks Unlimited	Create slope wetland and use buffer plantings to stabilize slope bank
Vino Farms (Ditch 1 & 2), Merritt Island	Vino Farms, Hart Restoration	Plant native grasses and vegetation to reduce erosive surface water runoff and provide habitat for wildlife
C&M Orchards, North Stone Lake	C&M Orchards, Ducks Unlimited	Improve three acres of unfarmable land through creation of seasonal wetland
Woody's by the River, Empire Tract	Woody's by the River, Ducks Unlimited	Create berms around the existing corn field to facilitate seasonal flooding for waterbird habitat
Wilson Farms, Merritt Island	Wilson Vineyards, Hart Restoration	Create buffer strip to promote habitat and slope stabilization
San Joaquin Delta Farms, Lower Jones Tract	San Joaquin Delta Farms, Ducks Unlimited, U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program	Create seasonal wetland, upland habitat, and a brood pond on a 400-acre cereal crop farm
Van Loben Sels Ranch, Pierson District	Van Loben Sels Farms, Hart Restoration	Plant native grasses along the levee of Snodgrass Slough to prevent erosion. Plant wild rye, sedge, and rushes along the irrigation ditch to reduce runoff from irrigation

See Quick Links p. 75 to access some of these partnerships and programs.

Table 2.2: Good Neighbor Checklist
Strategy C4: Multiple Benefits

Department of Water Resources Agricultural Lands Stewardship Workgroup

The Sacramento-San Joaquin Delta is the home of numerous habitat restoration efforts. Many Delta farmers are concerned that habitat lands could harm nearby agriculture in various ways. They would like assurance that entities that establish and manage habitat projects will consult with their neighbors and find ways to avoid impacts and resolve problems if they arise.

Restoration project managers can use the following checklist to ensure they comprehensively consider and examine the impacts of their project on neighbors as well as the impacts of neighboring lands on conservation projects. The checklist is based on a discussion paper, entitled Agricultural and Land Stewardship Strategies, which identifies a menu of mitigation measures and enhancements for the Delta. The measures described in the discussion paper, called Strategies, are referenced in the checklist.

- Have project proponents consulted with all neighboring landowners and operators about the project and its potential impacts? (See Strategy E1.1, which recommends involvement of landowners in project planning.)
- Have project proponents designated a local contact person to meet with neighboring landowners and discuss any issues of concern? (See Strategy D5.1, which suggests establishment of a public advisor position to help the public work with government agencies.)
- Will the project need access through other properties? If so, have access agreements been obtained?
- Does the management plan for the project provide for an on-site patrol or manager to deter trespass and vandalism? (See Strategy A4.3, which suggests the hiring of game wardens, sheriff's deputies, or private security guards.)
- Will the project increase the presence of vegetation susceptible to fire? (If yes, see Strategy A4.3.)
- Will the project discontinue maintenance of flood control features, involve prolonged or repeated flooding of previously dry land, or affect wind fetch across waterways? (If yes, see Strategy A1, which discusses flood protection improvements, and Strategy E1.3.2, which discusses drainage and seepage.)
- As a result of the project, are species on the project site expected to increase markedly in abundance and move from the site to neighboring lands or waterways? If yes, which species? (See Strategy A4.2, which suggests ways to protect landowners from liability under endangered species laws.)
- Is it reasonably possible that species in the project area could damage crops or promote the growth of weeds or diseases on neighboring farms? (If yes, see Strategy A3, which suggests ways to control weeds, and Strategy A4.1, which suggests the use of buffer zones and mechanisms for compensation for crop damages.)
- Will the project disturb utilities, roads, bridges, or other infrastructure that serve agricultural uses? (If yes, see Strategy D3, which suggests improvements to transportation infrastructure.)
- Will the project fragment or isolate farmland? (If yes, see Strategy E1.1, which encourages collaborative project planning.)
- Do domestic or feral animals or livestock occur on lands neighboring the project? (If yes, see Strategy A4.1, which suggests the use of buffer zones.)
- Do neighboring farms use chemicals as fertilizer or to control weeds or crop pests? (If yes, see Strategy A4.1, which suggests the use of buffer zones.)

QUICK LINKS

Bird Returns
www.nature.org/en-us/about-us/where-we-work/united-states/california/stories-in-california/california-migratory-birds/

www.nytimes.com/2014/04/15/science/paying-farmers-to-welcome-birds.html

Change the Course 2017
http://changethecourse.us/projects/sacramento-river-wetland-enhancement-project

Delta Working Landscapes Program (DWLP)
http://delta.ca.gov/land_use/wildlife

Good Neighbor Checklist & Strategies
https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/California-Water-Plan/Docs/Materials/ALS/ALS---Framework-and-Strategies-Updated.pdf?la=en&hash=6E0ED25D3D1906C-F2AD1786DB520D3B0EF2E6539

Migratory Bird Conservation Partnership
www.camigratorybirds.org/?page_id=60

Program On Wildlife-Friendly Working Lands
www.camigratorybirds.org/?page_id=30

To skip these references go to p. 77

Your Project, Your Ideas, Your Partners?

SECTION III

Value of Conserving the Delta Ecosystem

Illustration: Afsoon Razavi

KEY TERMS

- **LANDSCAPE CONNECTIVITY** — "Structural connectivity refers to the physical relationship between landscape elements, whereas functional connectivity describes the degree to which landscapes actually facilitate or impede the movement of organisms and processes. Functional connectivity is a product of both landscape structure and the response of organisms and processes to this structure. Thus, functional connectivity is both species- and landscape-specific. Distinguishing between these two types of connectivity is important because structural connectivity does not imply functional connectivity. In general, when we use the term 'connectivity' we are using the functional definition."
- **ECOSYSTEM** — a community of living organisms interacting as a system in conjunction with the nonliving components of their environment (such as air, water and mineral soil). Each ecosystem is a defined area of varying sizes where biotic and abiotic components are interacting as a system and are regarded as linked together through nutrient cycles and energy flows. Example: Grassland ecosystems are made up of low herbaceous plants occupying well-drained soils with native forbs and annual and perennial grasses and are usually devoid of trees. The term "novel ecosystem" is described on p. 108.
- **HABITAT** — an ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism. The term typically describes the area in which this organism lives and where it can find food, shelter, protection, and mates for reproduction. It can describe the natural environment in which an organism lives or the physical environment that surrounds a population of a given species. Example: In portions of San Joaquin County, native grassland ecosystems provide habitat to the endangered San Joaquin kit fox.
- **ECOLOGICAL RESILIENCE** — the amount of disturbance that an ecosystem could withstand without changing self-organized processes and structures (defined as alternative stable states).
- **ECOLOGICAL SUSTAINABILITY** — the ability of ecological systems (ecosystems) to persist indefinitely by remaining diverse and productive, another product of functioning ecosystems.

Footnotes: The Delta Conservation Framework *footnote and endnote references can all be found in Appendix 1 online by section.*

Introduction

Delta ecosystems have degraded substantially over time, and continue to do so, because of a host of factors including land use changes, poor water quality, reduced sediment supply, and invasive species. Populations of native fish and wildlife species have seriously declined in the past decade.[1,2] The Delta's capacity to supply ecosystem services, drinking and irrigation water, and agricultural livelihoods to its residents and the state, while also sustaining its native fish and wildlife, continues to decrease. The novel Delta ecosystem is much altered.[3] Climate change and related extreme weather events will intensify pressures on the Delta (see Section IV, p. 119-120).[4]

This section of the *Delta Conservation Framework* explains how long-term landscape-scale conservation planning can be used to implement projects that improve ecosystem function and connectivity. It also describes how this approach can benefit listed species and be successfully integrated with the strong agricultural traditions and local communities of the Delta.

Recent investigations into the way Delta ecosystems functioned prior to 1800, how their function changed once land use changes took effect, and what processes will reestablish or improve this function serve as the foundation for Goal D of the Framework. Goal D aims to conserve Delta ecosystems to improve resiliency to climate change and benefit society and wildlife over the long term. Seven strategies under Goal D address the following key factors determining the health of Delta ecosystems:

- ecosystem function and life-history support for resident and migratory species
- conservation of transition zones
- ecosystem and wildlife population connectivity
- conditions conducive to listed species recovery
- support for aquatic food webs
- invasive species detection, management and control
- public access to conservation sites

Regaining ecological function in the Delta is crucial to sustaining native wildlife, supporting persistence and recovery of special status species, and maintaining ecosystem services to Delta residents and Californians.[5,6] These services directly or indirectly support human survival and quality of life. Uncertainty over future development and climate change impacts on the Delta ecosystem, however, threaten even the most well-intended, well-planned conservation measures. It is both unclear how effectively conservation efforts will reestablish ecological processes and improve resilience in today's Delta[7,8,9,10] but also clear that without such efforts some of the biological and physical foundations of the Delta may fail.

The *Delta Conservation Framework* seeks to integrate improved ecosystem function with human uses of the Delta, while supporting the persistence of native plants and animals over the long term. The *Delta Conservation Framework* does not seek to achieve a Delta that resembles a pre-development, "pristine" state. Instead it supports an adaptive, long-term management process that guides future responses to uncertain conditions.

This section of the *Delta Conservation Framework* provides a historical overview of changes in Delta ecosystems over the past 300 years, and highlights conservation strategies that promote ecological function on a landscape scale. It also offers an overview of the specific Delta ecosystem types targeted for conservation.

Wetland habitats in the Delta. Photo: Amber Manfree

Historical Change in Ecosystems and Uses

Before the 1800s, the Delta was home to a number of Native American tribes (primarily Miwok and Wintun).[11] Native American Delta residents fished, hunted, and foraged for food and materials. Although they did not practice agriculture, they managed the landscape with fire and other tools to favor the plants they used for food, work, or shelter.[11] Population estimates in the Delta before European arrival are between 3,000 and 15,000, with most native villages situated on natural levees on the edges of the eastern Delta, typically containing around 200 residents in each.

Prior to European settlement, large areas of the Delta were subject to seasonal flooding, and nearly 60 percent was submerged by daily tides, occasionally flooding it entirely during "spring" tides. (A spring tide refers to the 'springing forth' of the tide during new and full moons, while the term "king tide" describes an especially high spring tide. When king tides coincide with extreme storms or floods, water levels rise significantly).

During historic tidal cycles, water within the interior Delta remained primarily fresh, although most of the Delta was a tidal wetland. Early explorers reported saltwater intrusion during the summer months in some years.[12] The historical Delta contained a massive network of small distributary or "capillary-like" channels with natural levees that created floodplains, marshes, and riparian forests and served as an extensive fluvial-tidal interface (Figure 3.1 below). The upland edges of transition zones from the wetlands were composed of alkali seasonal wetlands, grassland, oak savannas, and oak woodlands. Gently sloping sand mounds around the marshes provided high-tide refugia for terrestrial species.[3]

The San Francisco Estuary, and in particular the Delta, once supported an extraordinary diversity and abundance of endemic, resident, and migratory wildlife within a wide array of native animal and plant communities.[3] Before European arrival, the Delta teemed with birds and wildlife such as tule elk, deer, and California grizzly bear.[7] Few traces of the early Native American culture, diversity of wildlife, and rich plant communities remain in the Delta today.

Scientists, resource managers, and residents all recognize that we cannot return to the historic Delta conditions. Indeed the Delta no longer functions as an estuarine delta, distributing water and sediment from rivers and ocean tides across wetlands, floodplains, and riparian forests.[3] Instead, the Delta now comprises a system of confined

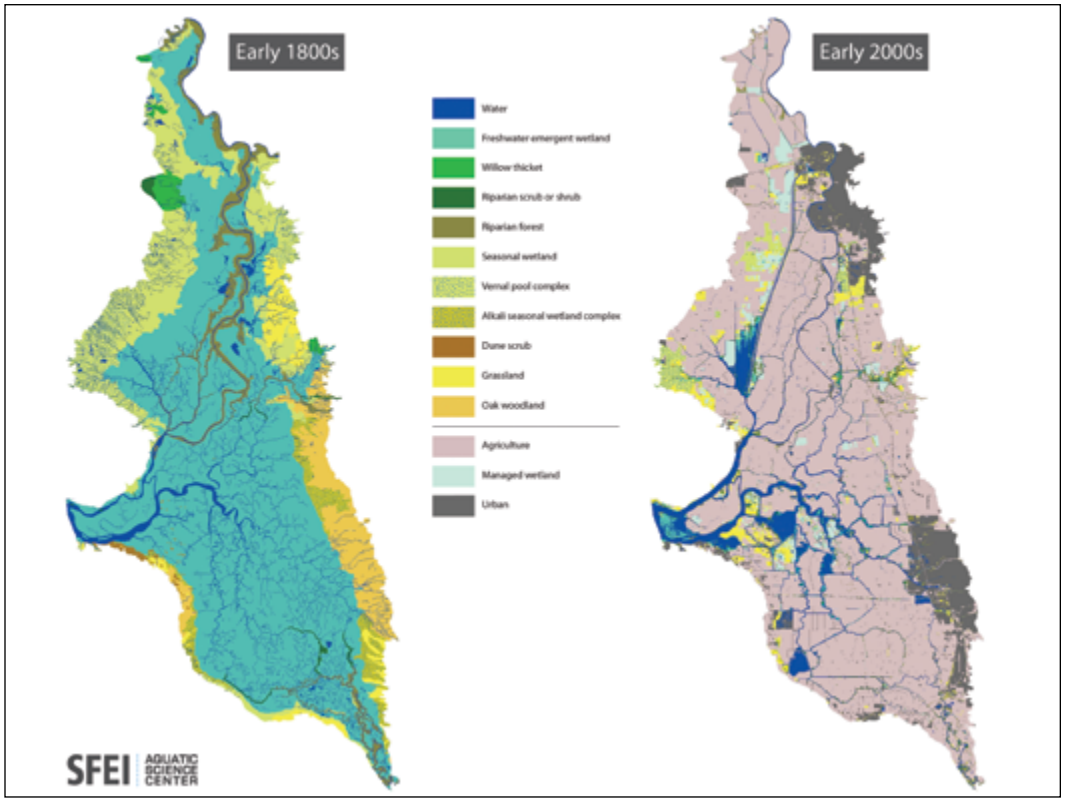


Figure 3.1: Delta waterways historically (left) and current (right). Historical channels depict "capillary-like" distributary channel networks, now largely missing. Aqua green (left) depicts wetlands; pink (right) depicts agricultural land-scapes.[6] Source: SFEI

channels and levees, engineered by people to protect their communities and agricultural land from flooding, and to convey water where humans want it to go (Figure 3.1, p.80). Fresh water entering the Delta from rivers and watersheds is used to irrigate in-Delta agricultural fields or diverted by the state and federal water projects for delivery to farms and municipalities in the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and southern California. Depending on the time of year, some of the fresh water is allowed to stay in the Delta, mix with ocean tides, and flow out to San Francisco Bay to meet water quality standards and endangered species requirements.[13] The remaining Delta hydrograph fluctuates much less than it did historically, as dams upstream store and manage freshwater releases into the system.

"Before modern development, almost half of California's coastal wetlands were found in the Sacramento-San Joaquin Delta. The Delta supported the state's most abundant salmon runs, the Pacific Flyway, and endemic species ranging from the Delta smelt to the Delta tule pea. In the region's Mediterranean climate, the Delta's year round freshwater marshes were an oasis of productivity during the long dry season. Until reclamation, the Delta stored vast amounts of carbon in its peat soils." [17]

DELTA HISTORICAL ECOLOGY,
SAN FRANCISCO ESTUARY INSTITUTE

Tule pea. Photo: Amber Manfree

Beginning in the mid-1800s, mining, reclamation, agricultural practices, and urbanization by European immigrants dramatically changed the Delta landscape and function.[3,7] Agriculture has been the mainstay of economic life and culture in the Delta since then. According to the 2012 *Economic Sustainability Plan for the Sacramento-San Joaquin River Delta*, close to 80 percent of all farmland in the Delta is classified as prime farmland, with annual economic value of approximately $702 million from crop-based agricultural operations and $93 million from animal production.[14]

Delta ecosystems, and their historic ecological and biophysical processes, were altered significantly to support this agricultural growth over the past 160 years. Agricultural practices and urbanization cleared forests and stripped natural levees of vegetation.[7] Land reclamation and flood protection activities drained wetlands, constructed riprapped levees, straightened meandering channels, eliminated small distributary channels and extended blind channels so they connected with others. In the process, they also converted vast and fertile floodplains and riparian woodlands into cultivated fields.[3] As a result, the ability of Delta ecosystems to support native California fish, wildlife, and plant species and communities is now severely degraded or absent entirely.[1,12,15,16]

The Delta ecosystem, which now encompasses agricultural lands, remnant marshes, riparian habitats and aquatic habitats, has continued to decline since reclamation.[17] While much of the land continues to serve viable and productive agricultural enterprises today, portions are slowly subsiding or degrading due to oxidation and wind erosion of peat soils. Remnant wetlands and riparian zones, meanwhile, are also subsiding or eroding. Many are now functionally disconnected from the estuary, dominated by nonnative invasive species, and damaged by pollution, diminishing their habitat quality for native species and their resilience to climate change and other anthropogenic impacts.[18,19,20,21,22,23,24] Some habitats are so degraded that a number of California native and Delta endemic species are in serious decline or almost extinct.

The loss of these valuable ecosystem services and native species isn't just felt in the accounting of numbers of small fish and nesting birds; it is also a loss in terms of the recreational and environmental quality of human habitat; not to mention the flood safety provided by natural buffers and healthy woodlands and wetlands. All subsided islands in the Delta — whether habitat for humans, crops or wildlife — are dependent upon levees increasingly vulnerable to seismic events and sea level rise.[25,26] As the conditions continue to change, future Delta ecosystems will not resemble historical or contemporary ones.

Resilient Delta

Landscapes

The central challenge for Delta conservation is to create and maintain resilient "landscapes that support desired ecological functions while retaining the overall agricultural character and water-supply service of the region."[26,27] Landscape-scale conservation differs from more piecemeal, smaller-scale approaches to conservation focused on the restoration or enhancement of particular sites or parcels. Planning on a landscape scale integrates consideration of ecological factors such as large-scale connectivity, biodiversity, and resilience to climate change with consideration of other factors such as local economies, agriculture, ecotourism, geographic diversity, and the health and social benefits of the environment to humans.[28] As such, landscape scale conservation planning is both ambitious and rewarding for all, given a consistent commitment to embracing the complexities.

The *Delta Conservation Framework* provides landscape-level guidance by offering strategies for conservation based on the latest insights from scientific and historical ecology investigations conducted by the San Francisco Estuary Institute with support from the California Department of Fish and Wildlife.[5,17]

These investigations highlight the importance of processes, diverse ecosystems, connectivity, and scale.

Processes

Thriving wildlife populations depend on functional ecosystems where biological and physical processes, or groups of processes, link different elements together. Ecological processes are dynamic, not static, and occur over large landscapes. These processes sustain habitats, food supplies, species, and many other components of the Delta ecosystem. Examples include the energy transfer in food webs (a biotic process) or the daily exchange of tides that supports these food webs (an abiotic process). These natural ecological processes don't stop at property lines, though they may be altered or deflected by fences, levees, and other barriers to landscape connection. On working landscapes, such as farm fields, the same biological processes of nutrient cycling, plant growth and decomposition, as well as wildlife movement, still occur, along with physical processes such as erosion and water filtration. On working landscapes there is more human intervention in these processes, however.

To maximize benefits for native species, landscape-scale conservation planning must support, for example: fluvial processes along streams, functional channels, river corridors, and tidal floodplains to benefit resident and anadromous fish; tidal marsh processes linking intertidal, open water, and transition zone areas to benefit marsh wildlife and the aquatic food web; and other processes that connect terrestrial habitats, wildlife-friendly agricultural zones, and managed wetlands to benefit migratory birds and other wildlife species.

Ecosystem Types

The Delta is composed of a mosaic of interconnected types of aquatic, terrestrial, transitional, and agricultural ecosystems. Improving the function of these ecosystems will benefit not only wildlife species, but also provide water quality, pollination, open space, flood protection, and other services to humans.[2,29,30,31]

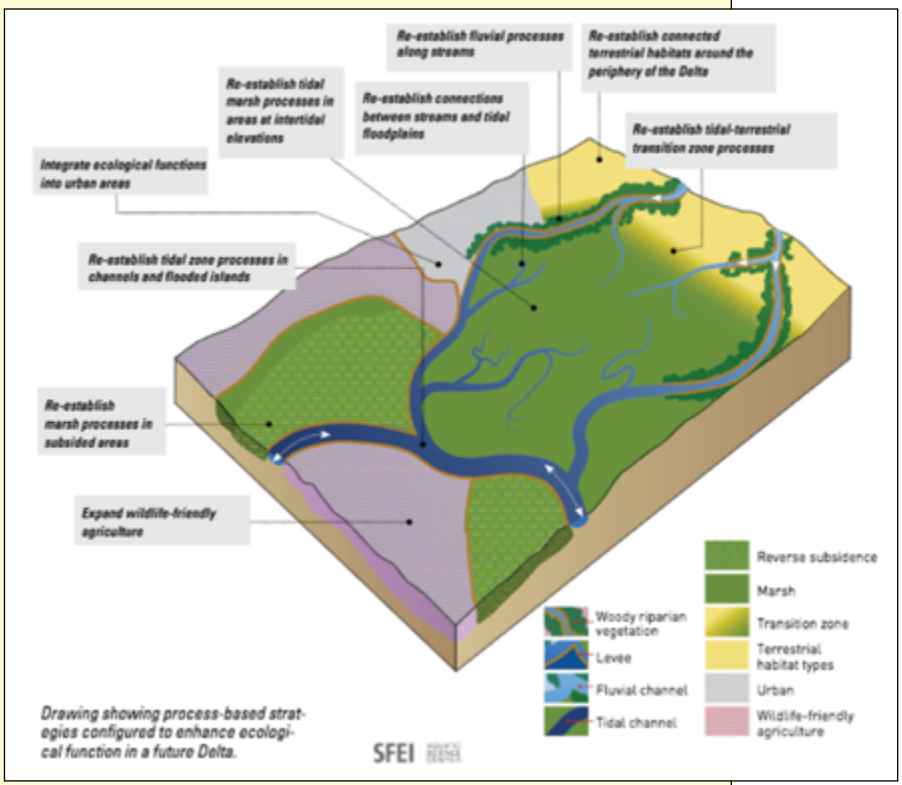


Figure 3.2: Future Delta model. Source: A Delta Renewed, SFEI

The Delta's diverse ecosystems can be divided into a number of basic categories. The vegetation, wildlife, and natural communities in each of these ecosystems are characterized by their location in the Delta landscape. In terrestrial and upland areas woodland and grassland ecosystems can be found, along with farms and cities. In riparian zones along creeks and rivers, willow thickets and floodplain ecosystems still occur. In aquatic and intertidal areas, freshwater and salt water influences lead to a variety of ecosystems, ranging from freshwater ponds to tidal channels to salt marshes. Finally, the transitional areas between natural areas and developed land uses support ecosystems at the edge of marshes, floodplains, levees, and hedgerows. For a full description of Delta ecosystems see Guide to Delta Ecosystems, Table 3.1, pp. 102-105.

Connectivity

Planning for conservation, and habitat and process connectivity at larger scales, requires consideration of the fact that wildlife, water, sediment and other components of a healthy ecosystem move around. When conditions become inhospitable, species move into new habitats. When conditions become extreme, such as during a large rain and flood event, and there is no contiguous place to retreat, species may be permanently displaced. As the Delta continues to develop, and as sea levels rise, fewer and fewer connections and pathways for migration, transition and adaptation will remain.

Today, fragmentation and habitat loss already threaten the movement of organisms and their genes.[32] For example, the giant garter snake requires uplands for hibernation and cover[33] and wetlands for foraging and reproduction, and a disconnect between these two critical habitats can reduce species viability. The giant garter snake is just one example of many species that may suffer from reduced connectivity between habitats and across larger landscapes.

Any disruption of the size and quality of available habitat, wildlife movement among habitats, and seasonal migration patterns can lead to detrimental effects on populations and species, including decreased carrying capacity, loss of genetic variation, and ultimately species extinction.[3,25,29] While these dynamics generally apply to all wildlife species, they may serve as stronger stressors on special status species present in the Delta.[33,34] Small populations are more sensitive to isolation and reduced genetic diversity may affect their long-term fitness.[35,36,37]

Landscape Scale

A landscape-scale approach to conservation planning offers the opportunity to strike a balance between implementing many smaller, widely spaced projects and fewer, larger, and less spatially distributed conservation projects. The main questions are where and how to reestablish the dynamic natural processes and diverse connected ecosystems. The recommended approach is to create an appropriate configuration of ecosystem types at the landscape scale (see Figures 3.2 and 3.3). Restoring a diversity of interconnected ecosystem components provides insurance in the form of resiliency and redundancy across the Delta landscape.[3,31] Associated monitoring and adaptive management will allow tracking of whether restored processes and ecosystem functions remain resilient over time.[3,31]

Many current conservation efforts acknowledge the importance of protecting and enhancing landscape-scale connectivity and ecosystem resilience to potential threats by establishing interconnected reserve networks, or in case of the Delta, mosaics of conservation areas (for more information see Goal D, Strategy D2, p. 84).[32,38]

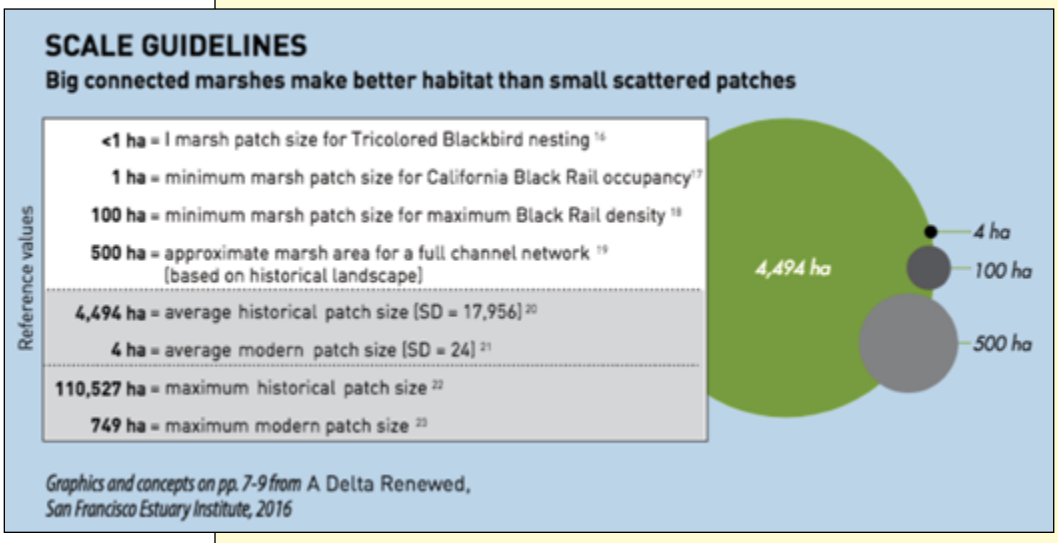


Figure 3.3

Framework in Depth: Goal D

Conserve Ecosystem Function and Processes

The *Delta Conservation Framework*'s overarching goal for improving ecosystem function (Goal D) is founded on a landscape-scale approach.[5] The goal's associated strategies are intended to serve as starting points for restoring ecosystem function over the next 30 years, and to occur within the context of "Delta as an evolving place." Many of the strategies associated with Goal D are also consistent with climate adaptation strategies that have been identified for biodiversity and habitat.[4,39] and with efforts to address long term challenges such as invasive species, pollution, and maintenance the vast Delta levee system.[40,41] In order to find long-term solutions, alternative future scenarios considering evolving human land uses, different levels of flood protection, a changing climate, and other ecosystem pressures need to be evaluated going forward (see Section VI).

Ecosystem Processes

Strategy D1 under Goal D focuses on recovering and restoring ecological processes to improve Delta ecosystem function. To achieve this, the Framework recommends that planning partnerships and project proponents consider the latest insights from a series of historical ecology investigations conducted by the San Francisco Estuary Institute with support from the California Department of Fish and Wildlife and regional agencies. These investigations focus on the status of Delta ecosystems now in relation to their historical condition. They also provide a big-picture perspective on how to reestablish a landscape that functions well for people and native wildlife.[2,3,32] The most recent report from this series, *A Delta Renewed*, provides tools and on-the-ground strategies for reestablishing desired ecological functions in different regions of the Delta.[5]

The *Delta Conservation Framework* recommends that any new region-specific targets align with parameters described in *A Delta Renewed*. They should also take into consideration of existing regional targets (such as the habitat conservation plans presented in Table 3.2, p. 86) and broader targets, such as those outlined in the 2017 *Central Valley Flood Protection Plan Conservation Strategy* (CVFPP) described on p.31.[33]

Landscape Connectivity and Resilience

Strategy D2 under Goal D focuses on protecting ecosystems to improve connectivity and resiliency.

To maximize functional connectivity and resilience (see Key Terms p. 78), the Framework recommends that regional conservation partnerships conduct technical analyses to identify potential ecosystem types that would persist over the long term in the region and prioritize available opportunities to protect them. In any of the conservation opportunity areas, region-specific targets could be developed based on an assessment of ecological opportunities, existing land uses, and existing plans. These then should also integrate, where possible, with broader-scale plans that pertain to the surrounding landscape, such as the 2017 CVFPP mentioned above, or other relevant planning or regulatory documents (see Guide pp. 30-37).

In doing so, two primary approaches to promote connectivity should be employed: 1) protecting areas that facilitate movement and 2) restoring connectivity across areas that impede movement (e.g., by removing a fence, aquatic barrier, or building a wildlife-friendly highway underpass).[42] A mosaic of interconnected ecosystem types, including wildlife-friendly agricultural lands and managed ecosystems, will maximize the adaptive capacity of wildlife populations at various scales.[42] A highly connected landscape is crucial for facilitating species movement and accommodating distribution shifts in response to climate change.[42] In some contexts, those undertaking conservation planning should also recognize that the subtidal aquatic system in the Delta could be viewed as overly connected. Historic meandering channels, and residence time diversity that benefit native fish species were much reduced through land reclamation and channelization activities.

One historic and current ecosystem process is flooding, and in this photo the Yolo Bypass – historic Sacramento River floodplain – absorbs high waters (2017) on multi-objective pastures and farm fields. Photo: Carson Jeffres

Illustration: Arsoon Razavi

GOAL D

Conserve Delta ecosystems and their ecological processes and functions to benefit society and wildlife, and to enhance resilience to climate change.

STRATEGY D1

Restore, enhance, and manage ecosystem processes and habitats Delta-wide to improve function and life history support for native and migratory wildlife and to build ecological resilience.

- Align ecosystem conservation initiatives with *A Delta Renewed* strategies to restore tidal marsh processes at intertidal elevations; marsh processes in subsided areas; tidal zone processes in channels and flooded islands; connections between streams and tidal floodplains; fluvial processes along streams; tidal-terrestrial transition zone processes; connected terrestrial habitats; expanded wildlife friendly agriculture; and ecological functions in urban areas.
- Align enhancement of ecosystem processes with Regional Conservation Investment Strategies.

STRATEGY D2

Conduct technical analyses within groups such as regional conservation partnerships to coordinate, identify, and prioritize available geographic areas for conservation and climate adaptation.

- Protect and restore transition zones with the potential for providing landscape connectivity and ecosystem resiliency.
- Protect areas in regional landscapes most vulnerable to climate change.
- Identify opportunity areas to support climate-vulnerable species.
- Support the development and initiation of projects that improve migration and movement corridors for species to improve the connectivity of populations at multiple scales.

STRATEGY D3

Create conditions conducive to maintaining or improving the distribution and abundance of native Delta species, and to meeting the goals of existing habitat and species recovery plans.

- Consider *Habitat Conservation Plans* and *Natural Community Conservation Plans*.
- Support *Regional Conservation Investment Strategies*.
- Consult the multi-agency *Sacramento Valley Salmon Resiliency Strategy* and *Delta Smelt Resiliency Strategy*.
- Consider California's *State Wildlife Action Plan*.

Goal D continued next page

GOAL D - continued

STRATEGY D4

Support a thriving aquatic food web in the Delta through conservation actions, scientific investigations, and existing management initiatives.

STRATEGY D5

Support and coordinate proactive approaches for the early detection, rapid response, and long-term control and management of harmful invasive species.

- Reduce negative impacts on ecosystem function, special status species, Delta communities, and ecosystem resilience.
- Use existing resources such as Delta County Weed Management Areas and California State Parks and Recreation Division of Boating and Waterways programs when possible.

STRATEGY D6

Balance human use of conservation areas with protection of sensitive Delta wildlife.

- Reduce adverse effects of human disturbance.
- Consider existing or develop new public access plans and land management plans.
- Support increased law enforcement and public safety on conservation lands.

Table 3.1

Current Conservation Planning Documents	Related DCF Conservation Opportunity Regions
Suisun Marsh Plan	Suisun Marsh
East Contra Costa County HCP/NCCP	West Delta
South Sacramento HCP	North Delta
San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP)	South Delta
Solano Multispecies HCP (MSHCP)	Yolo Bypass; Cache Slough Complex
Yolo HCP/NCCP; Yolo RCIS	Yolo Bypass; North Delta

Native tree assemblage in the Delta.
Photo: Amber Manfree

Special Status Species

Strategy D3 under Goal D focuses on improving Delta conditions for special status species. The *Delta Conservation Framework* suggests that individual conservation projects should address existing recommendations in species recovery plans, federal and state conservation plans (HCP and NCCP respectively), and Regional Conservation Investment Strategies (RCIS). HCPs and NCCPs provide endangered species take authorizations and associated mitigation for development projects. Most HCPs and NCCPs overlapping the Delta have a strong link to agricultural preservation, striking a balance between natural resource conservation and economic sustainability in the region. The *Delta Conservation Framework* defers to the conservation targets outlined in the HCPs and NCCPs available or under development in Delta counties or priorities set in the Yolo County RCIS (Table 3.1 opposite). The various descriptions of conservation opportunity regions in this Framework include short overviews of ongoing HCPs, NCCPs, and RCISs relative to each specific portion of the Delta (see also Guide pp.33-34). Regional conservation partnership efforts should integrate targets and goals of these plans or strategies into their conservation planning efforts.

The *Delta Conservation Framework* recommends that efforts to meet or exceed recovery goals for special status species should also consider improving the long-term resiliency and adaptive capacity of ecosystems and wildlife populations to habitat loss, climate shifts, exotic species invasions, and other pressures.[43,44,45]

California State Wildlife Action Plan

This 2015 plan (SWAP) is an ecoregion-based strategic conservation plan developed by the California Department of Fish and Wildlife.[3] The document provides a blueprint for actions necessary to sustain the integrity of California ecosystems, for their intrinsic values and as natural resources and heritages. The SWAP highlights the Delta as part of the Bay Delta Conservation unit, within the Bay Delta and Central Coast Province. The conservation target ecosystems for the Bay Delta Conservation unit are freshwater marsh, including non-tidal freshwater emergent wetlands; salt marsh, including saline emergent wetlands and tidal freshwater wetlands in the Delta; and American Southwest riparian forest and woodland, which includes the Valley Foothill Riparian natural community in the Delta. The SWAP highlights the pressures in the Delta that make it a prime region for conservation. (See also Guide p. 30).

Swainson's hawk. Photo: Rick Lewis

As mentioned before, several special status species including giant garter snake, greater sandhill crane, tricolored blackbird, and Swainson's hawk benefit from agriculture in the Delta (see Species Recovery Briefs, Appendix 5). Continued conservation and agricultural land stewardship will require a common appreciation among stakeholders for how crop selection and management to support special status species will affect agricultural productivity, and how growing stressors such as sea level rise or salinity intrusion will affect both agriculture and wildlife.

Food Webs

Strategy D4 under Goal D focuses on supporting the Delta's aquatic food web.

Primary production is an essential ecosystem process that may limit the quality and quantity of food available for invertebrates, fish, and other secondary consumers, including species of special concern. An inventory of organic-carbon sources — which included phytoplankton, detritus, and aquatic weeds — revealed that the Delta is currently a low productivity ecosystem, yet it is unclear whether this was always the case.[46,47,48] A recent research study tested the hypothesis that "the Delta has been transformed from a high-productivity ecosystem largely dependent upon marsh-based production to a low-productivity ecosystem dependent upon production of aquatic plants and algae."[47,47,48] Such studies linking changes in primary production over time with reductions in the extent of tidal marshes and associated marsh channel networks have generated a renewed appreciation for the importance of primary productivity in the Delta aquatic food web.

Large-scale conversion of tidal marsh to agriculture has altered the Delta's current capacity to produce food for native biota and support species of concern. The *Delta Conservation Framework* recommends that estimates of differences between historic and modern primary production be used to shape targets and evaluation metrics,[46,47,48] assess the progress of individual conservation projects, and gauge the trajectory of ecological recovery. Of particular relevance to the Framework are recent investigations highlighting the importance of landscape configuration in determining levels of primary production in the Delta. These investigations demonstrate that interactions between terrestrial and aquatic food webs vary across the current landscape.[46,47,48]

FRAMEWORK IN DEPTH: GOAL D CONTINUED

The *Delta Conservation Framework* also supports development of the Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary (see p. 115). This monitoring initiative seeks to evaluate the potential benefits of tidal wetland restoration to aquatic food webs and at risk Delta fish species.[49]

With the additional information provided by these investigations and monitoring results, the *Delta Conservation Framework* can give priority to those conservation actions most likely to improve ecosystem primary production and better track the course and progress of Delta ecosystem recovery at the base of the food chain.

Resiliency Strategies for Fish

Two native fish species now declining in the Delta are the subject of resiliency strategies that inform the *Delta Conservation Framework*.

The *Delta Smelt Resiliency Strategy* is a science-based document prepared by the State of California to voluntarily address both immediate and near-term needs of Delta smelt. The Strategy aims to promote smelt resiliency to drought conditions, as well as to future variations in habitat conditions.[43] The Strategy relies on the Interagency Ecological Program's Management, Analysis, and Synthesis Team ("MAST") report and conceptual models[44] that suggest actions designed to benefit Delta smelt. These will be implemented within the next few years to address predation, turbidity, and food availability and quality.[46] These management actions include:

- Aquatic weed control
- North Delta food web adaptive management projects
- Outflow augmentation
- Reoperation of the Suisun Marsh salinity control gates
- Sediment supplementation in the low salinity zone
- Spawning habitat augmentation
- Roaring River distribution system food production
- Coordinating managed wetland flood and drain operations in Suisun Marsh
- Adjusting fish salvage operations during summer and fall storm water discharge management,
- Rio Vista Research Station and Fish Technology Center
- Near-term Delta smelt habitat restoration
- Franks Tract restoration feasibility study

The *Sacramento Valley Salmon Resiliency Strategy* promotes actions that address specific life-stage stressors and contribute to the achievement of overall viability of Sacramento Valley salmonids. The Strategy outlines habitat restoration and management actions necessary to improve the immediate and long-term resiliency of Sacramento Valley salmonid species.[45] For each proposed action, the Strategy lays out objectives, linkages to conceptual models that are consistent with existing priorities, estimated costs, funding sources, and timing. Recommended actions relevant to the Delta include:

- Improve Yolo Bypass adult fish passage
- Increase juvenile salmonid access to Yolo Bypass, and increase duration and frequency of Yolo Bypass floodplain inundation
- Construct a permanent Georgiana Slough nonphysical barrier
- Restore tidal habitat in the Delta

Delta smelt. Photo: Joel Sartore/ The Photo Ark/ National Geographic Collection

Research by UC Davis and USDA continues to evaluate the best mix of surfacants and herbicides, and the best spray volumes, for optimizing control of the water hyacinth infestation in the Delta (test plots pictured). For conservation planning purposes, the impacts of control (spraying and mechanical removal) on the ecosystem have to be balanced with the impacts of infestation on navigation, algal blooms, and predation on native species. In a novel ecosystem like the Delta, trade offs are not always black and white which is why conservation partnerships are so important to decisionmaking. Photo courtesy: UC Davis

Invasive Species

Strategy D5 under Goal D focuses on controlling invasive species area-wide through coordinated partnership efforts. Such coordination has the potential to reduce their spread throughout Delta waterways, farmlands, and Delta conservation lands, lowering management costs over the long term. Both terrestrial and invasive aquatic plant species are a widespread problem in the Delta and can have multiple adverse effects on native wildlife, recreation, and local agriculture and businesses.

Aquatic weeds – spread through water – are the most difficult to control. Over the last decade, floating and submerged aquatic plant species – water hyacinth, water primrose, Brazilian waterweed, and giant reed – have spread dramatically within the Delta. This spread has steadily reduced the quality of habitat for native species, hampered recreation and navigation, increased mosquito habitat, and impeded the flow of water (increasing the cost of pumping). It has also increased the need for pesticides and decreased water quality.[50,51,52,53,54]

The *Delta Conservation Framework* supports the Delta Region Areawide Aquatic Weed Project, which informs state aquatic invasive species programs under State Parks' Division of Boating and Waterways (DBW). These efforts control floating and submerged invasive aquatic vegetation in the Delta except inside State Water Project facilities, where the Department of Water Resources has jurisdiction and manages weeds.

On land, terrestrial weeds and invasive plant species have enjoyed long and careful management on the part of both private landowners and farmers, and local agricultural and conservation districts. The *Delta Conservation Framework* supports the DWR Agricultural Lands Stewardship (ALS) Workgroup's suggested strategies for both terrestrial and aquatic weeds, including prioritizing weeds and other pests for area-wide control, and reinvigorating county Weed Management Areas (WMAs). Led by the County Agricultural Commissioner or local Resource Conservation District, WMAs are local stakeholder groups with strategic plans focusing on invasive species control and management, both aquatic and terrestrial. The WMAs that overlap the Delta are Alameda-Contra Costa, Sacramento, Northern San Joaquin Valley, Solano, and Yolo.

Sustaining current control efforts by DBW, and a revival of WMAs, will help keep the focus of Delta conservation projects on the invasive species challenge, and emphasize the value of early detection and rapid response both on public and private lands and waterways. Once identified, invasive species populations, particularly those outlined in the Delta smelt and salmon resiliency strategies,[43,45] could be prioritized by the WMAs for coordinated area-wide control or eradication, offering multiple benefits of reduced environmental impacts, nuisance, and cost and reduced threat to ecosystem function, special status species, and Delta community interests. Changing climatic conditions may favor or accelerate the spread of certain invasive plant species. Early detection and eradication can help to reduce existing ecosystem stressors and increase overall resilience to change.

Public Access

Strategy D6 under Goal D focuses on optimizing the use of conservation areas for both people and wildlife. In the Delta, public access to open space is a mainstay of Delta life, with its long history of hunting, fishing, boating, recreation use, and tourism. These kinds of recreational activities have long been considered compatible with species protection. An increasing body of research demonstrates, however, that outdoor recreation — even non-consumptive activities like bird watching and hiking (as compared to hunting and fishing) — can negatively impact plant and animal communities.[55,56,57,58,59] This is particularly the case in the absence of buffers or exclusion zones to mitigate potential negative effects. As a result, public access is not always recommended in conservation and restoration designs.

The *Delta Conservation Framework* recognizes the importance of balancing tradeoffs between desired restoration outcomes and human use. In addition to many recognized human health and economic benefits of outdoor recreation,[60] access to open space also encourages public support for land and wildlife conservation.[61]

Despite public awareness and support for conservation in general, California still has the greatest number of listed species threatened by recreation in the U.S.[55] Land and wildlife managers in the Delta, as elsewhere, must seek solutions for balancing the benefits of outdoor recreation for human visitors with the potentially negative effects on species and ecosystems. Signage, informational kiosks, and clearly developed nature trails or boardwalks can reduce visitor impacts on sensitive wildlife and their habitat.

The *Delta Conservation Framework* suggests careful consideration of where to allow and how to best regulate and enforce public access in relation to protecting wildlife needs. The Framework also suggests consideration by regional planning partnerships as they evaluate potential conservation scenarios in their area, and at the entire Delta landscape scale.

CDFW cannabis patrol, human and canine, in the Delta.
Photo: CDFW

CONSERVATION OPPORTUNITY REGION

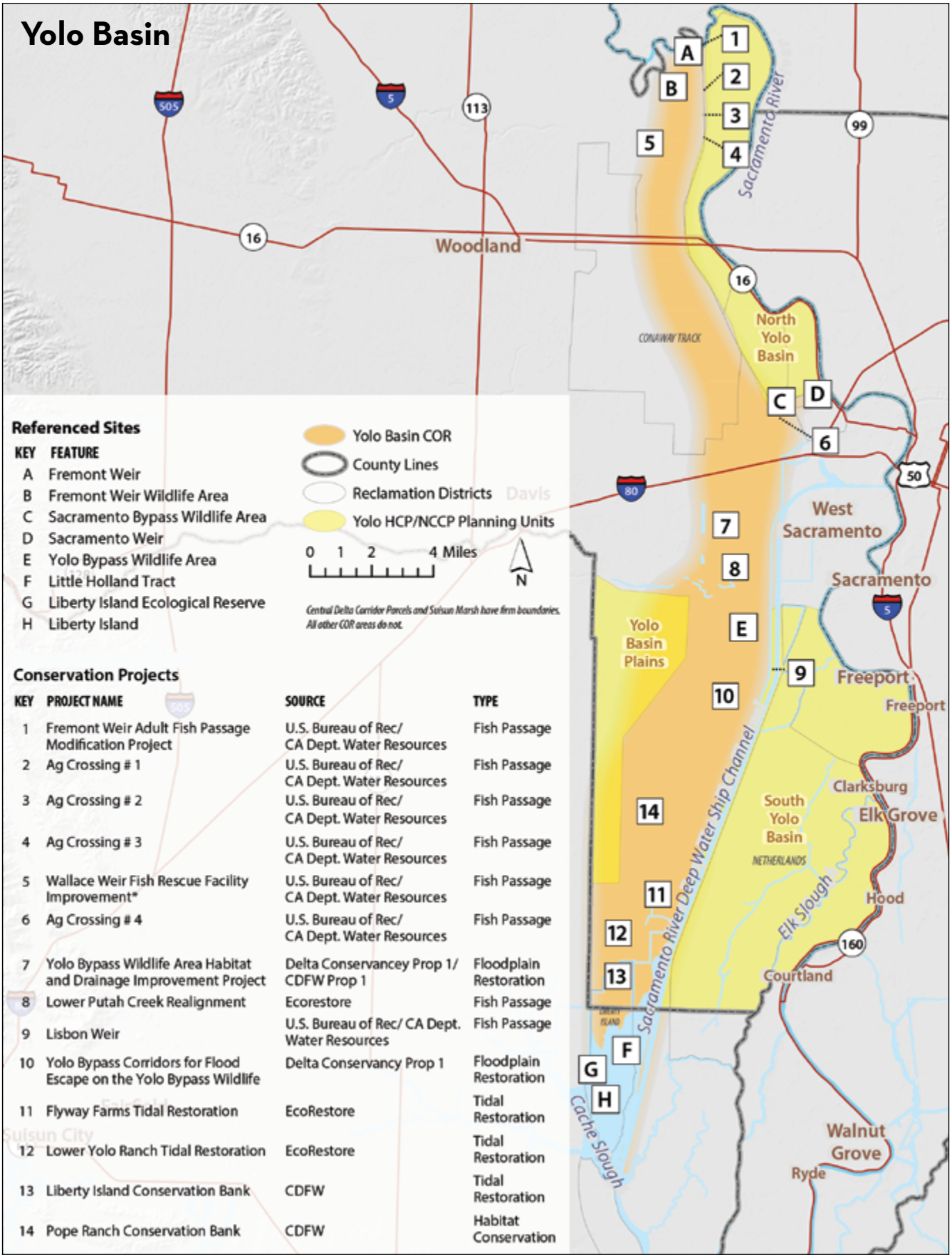
A Big Canvas for Multi-Benefit Conservation – Yolo Bypass, Cache Slough and the North Delta Arc

Photo: Carson Jeffres

When it really rains and the Sacramento River swells, it spreads out into its former floodplain in the Yolo Bypass. These vast flats off Highway 80 between Davis and Sacramento provide essential flood protection for the City of Sacramento and surrounding towns; here local farmers have learned to live with these somewhat infrequent flood events and plan their crops and pastures accordingly. In addition to rice, safflower, and tomatoes, this floodable farmscape also grows salmon fry and fish food when wet. For decades now local landowners, several counties, and myriad government agencies have been working in partnerships at many levels to make the most of the bypass as a multi-use landscape for flood protection, fish and bird habitat, and agriculture. Linked with major fish and habitat restoration efforts in Cache Slough and Suisun Marsh to the south, Yolo County and the bypass are at the heart of big ideas, high hopes, and hard work to improve conditions in the Delta.

These Yolo-Cache partnerships and initiatives reflect *Delta Conservation Framework* goals for forward-thinking regional partnerships and strategies. The Framework also highlights the Yolo Bypass and Cache Slough as two of seven "conservation opportunity regions" where a critical mass of natural landscapes, public lands, potential conservation opportunities, conservation-minded people, and existing partnerships occur in one place. The Framework seeks to support such regions and partnerships in strategic conservation planning. Together these regions will one day add up to a healthier Delta – both for people and wildlife.

CONSERVATION OPPORTUNITY REGION



Referenced Sites

KEY	FEATURE
A	Fremont Weir
B	Fremont Weir Wildlife Area
C	Sacramento Bypass Wildlife Area
D	Sacramento Weir
E	Yolo Bypass Wildlife Area
F	Little Holland Tract
G	Liberty Island Ecological Reserve
H	Liberty Island

Conservation Projects

KEY	PROJECT NAME	SOURCE	TYPE
1	Fremont Weir Adult Fish Passage Modification Project	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
2	Ag Crossing # 1	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
3	Ag Crossing # 2	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
4	Ag Crossing # 3	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
5	Wallace Weir Fish Rescue Facility Improvement*	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
6	Ag Crossing # 4	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
7	Yolo Bypass Wildlife Area Habitat and Drainage Improvement Project	Delta Conservancy Prop 1/ CDFW Prop 1	Floodplain Restoration
8	Lower Putah Creek Realignment	Ecorestore	Fish Passage
9	Lisbon Weir	U.S. Bureau of Rec/ CA Dept. Water Resources	Fish Passage
10	Yolo Bypass Corridors for Flood Escape on the Yolo Bypass Wildlife	Delta Conservancy Prop 1	Floodplain Restoration
11	Flyway Farms Tidal Restoration	EcoRestore	Tidal Restoration
12	Lower Yolo Ranch Tidal Restoration	EcoRestore	Tidal Restoration
13	Liberty Island Conservation Bank	CDFW	Tidal Restoration
14	Pope Ranch Conservation Bank	CDFW	Habitat Conservation

Map: CDFW, 2018

Regional Setting

Constructed about 100 years ago, the 59,000-acre Yolo Bypass is a complex mosaic of agricultural fields and managed wetlands located within the historic 89,000-acre Yolo Basin. Primarily a flood protection area, the bypass reduces the risk of flooding in the Sacramento region through a system of weirs that connect to the Sacramento River to the north (Fremont Weir) and to the east (Sacramento Weir). Fremont Weir overtopped in approximately 70 percent of flood seasons between 1934 and 2012, augmenting flows from western tributaries.[1] In addition to these freshwater outflows, there is a significant tidal influence in the lower Yolo Bypass south of Interstate 80.

Fremont Weir.
Photo: Christina Sloop

The portion of the Yolo Bypass north of Interstate 80 and North Yolo Basin is largely owned by a few private landowners, and also includes two state wildlife areas containing unmanaged grassland and riparian forest. These areas provide wetland values when their weirs overtop. Several thousand acres just north of the Union Pacific Railroad tracks are in private ownership but are managed wetlands protected by federal easements. The southern Yolo Bypass (south of Interstate 80) includes the state's 16,800-acre Yolo Bypass Wildlife Area (YBWA). It also includes thousands of acres of privately owned wetlands that are managed as duck clubs, many protected by state or federal wetland conservation easements. A large giant garter snake mitigation bank lies just south of the YBWA.

The bypass ultimately drains into the Cache Slough complex. Cache Slough in turn drains into the Sacramento River and San Francisco Estuary. Low-lying grasslands and seasonal wetland/vernal pool complexes separate the Cache Slough complex from the

Yolo-Cache At A Glance

- **Size**:
  Yolo: 59,000 acres
  Cache: 53,000 acres
- **Location**:
  Northwestern Delta in Solano and Yolo counties
- **Elevation range:**
  Yolo:10 feet below to 36 feet above sea level
  Cache:10 below to 45 above sea level
- **Zoning**:
  Yolo: 60 – 65 percent agriculture; 35 – 45 percent public lands
  Cache: 80-92 percent agriculture; 15-20 percent public lands
- **Other primary land uses**: flood protection, wildlife habitat, water supply, recreation, duck clubs (Yolo), scientific research
- **Natural communities:**
  Yolo: Managed wetland, tidal wetland, freshwater emergent wetland, vernal pools, seasonal floodplain, grasslands, valley foothill riparian, alkali prairie
  Cache: Seasonal wetlands, vernal pools, seasonal floodplain, tidal perennial aquatic, grasslands, valley foothill riparian
- **Urban population:** 0
- **Rural population:**
  Yolo: 40-45
  Cache: 600-650
- **Recreational opportunities:** Wildlife observation, boating, fishing, hunting, interpretive services, as well as proposed hiking, picnicking, paddling (Cache)
- **Sampling of Listed Species:** Delta smelt, longfin smelt, Chinook salmon, Central Valley steelhead, green sturgeon, giant garter snake, Swainson's hawk, tricolored blackbird, least Bell's vireo, bank swallow, Solano grass, Colusa grass, Conservancy fairy shrimp; vernal pool fairy shrimp, vernal pool tadpole shrimp, California black rail, western burrowing owl, and western yellow-billed cuckoo.

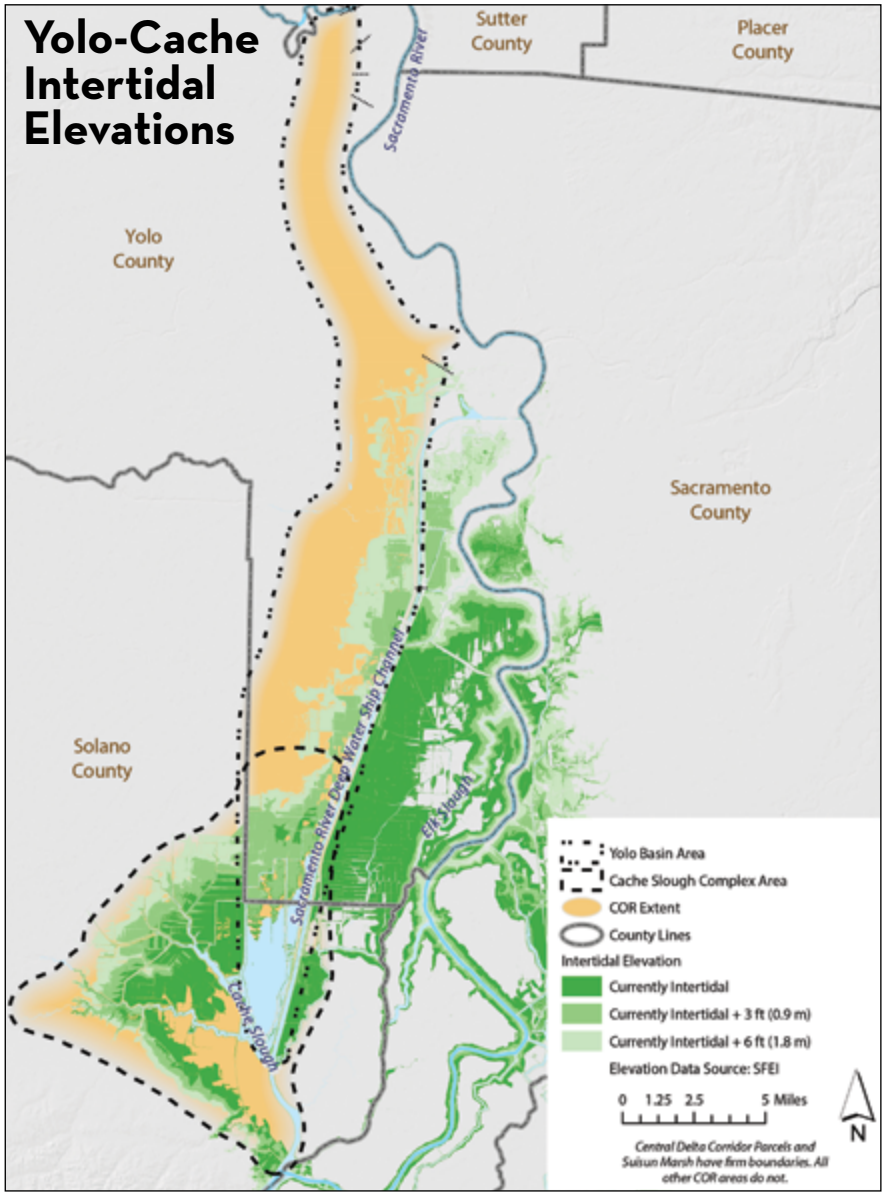
northeast corner of Suisun Marsh. Primary land uses include grazing, local and regional flood protection, terrestrial and aquatic wildlife habitat, and water supply for local agriculture and regional municipal and industrial needs, including the North Bay Aqueduct. Agriculture is the primary land use in the Cache Slough region and relies both on water rights and soils suitable to support a range of agricultural land uses, as well as on protection from the tides and floods influencing the Yolo Bypass, Sacramento River, and local watersheds.

Planning History

The Yolo-Cache region is emerging as a test case for how to effectively manage a variety of land uses in combination, such as flood protection, agriculture, recreation, education, and habitat for fish, migratory birds,[2] and other wildlife. The Yolo Bypass has been the focus of public agency planning efforts around sensitive species and habitat restoration over the past two decades, as has Cache Slough. [3,4,5,6,7,8,9,10,11,12,13,14] Both regions are now at the intersection of many public and private interests and efforts to discuss and vet implementation of state- and federally- led initiatives in the context of local land uses. Ensuring sustained cross-communication among the varied partnerships is a critical element for achieving multiple benefits in the region (see also Section II and Guide p. 73 for details on each).

Opportunities for Conservation and Potential Solutions

The Yolo Basin and Bypass offer notable conservation value for wildlife species associated with floodplains, managed wetlands, seasonal and semi-permanent wetlands, tidal wetlands, grasslands, pasture, and riparian zones, and for a number of special status species.[3] Fish and wildlife include resident and anadromous fish native to the Delta, amphibians and reptiles, as well as resident and migratory birds, including shorebirds, neo-tropical migrants, waterfowl, raptors, and wading birds. There are thousands of acres of existing conservation easements and a wildlife area owned by



Map: CDFW, 2018

Primary Yolo-Cache Partnerships

- **The Yolo Bypass Cache Slough Partnership** (BCSP) is focused on flood risk reduction, ecosystem restoration, and local sustainability. The partnership provides a framework and arena for dialogue for the planning and management of the Yolo Bypass and Cache Slough. Made up of 15 local, state, and federal agencies, the partnership's purpose is to improve executive-level interagency coordination. This policy-level partnership was formed via a 2016 Memorandum of Understanding[6] that emphasizes the importance of achieving across-the-board improvements in habitat, flood protection, agricultural sustainability, recreation, and other public values. This foundational acknowledgement and high-level support has set the stage for developing trust among stakeholders. One new potential focal point for the partnership is the development of a road map for collective, multi-benefit, integrated water management in the region.
- **The Yolo Bypass Working Group** (YBWG), coordinated by the Yolo Basin Foundation, offers an example of local "grassroots" collaboration. Established in 1998, the group is a forum for about 40 stakeholders representing a wide range of interests in managing the multiple uses of the Yolo Bypass. This forum has been particularly helpful in vetting flood plain modeling tools, and assessing the impacts of various projects on agriculture and wetland management. Over the years, stakeholders have participated in discussions and problem solving related to the development of the *Central Valley Flood Protection Plan,* the *Regional Corridor Management Framework,* the *Yolo Bypass Wildlife Area Land Management Plan*, the *Central Valley Joint Venture Implementation Plans*, and proposed fish passage and flood plain enhancement projects under the *Bay Delta Conservation Plan* and California EcoRestore, among many topics. The group has also shared information on federal and state habitat easement programs and recent methyl-mercury studies, and provided input on infrastructure and drainage projects.
- **Regional Corridor Management Framework** (CMF) is a coalition of local reclamation districts, counties, and flood protection agencies that developed the framework as a vision for the integration of local, state, and federal interests in the Yolo-Cache region.[7] Established in 2015, the CMF continues to guide local agency participation in the BCSP and other forums.
- **The Cache Slough Restoration Planning Partnership** (CSRPP) a regionally focused effort including the Delta Conservancy, state agencies, local RCDs, reclamation districts and counties, and consultants such as the San Francisco Estuary Institute and Flow West. Outreach added Delta farmers, landowners, and residents to the partnership. The partnership[8] examined opportunities to develop a broader regional conservation strategy for the Cache Slough complex. Building on the California EcoRestore[9] and Department of Fish and Wildlife's Fish Restoration Program,[10] the aim of the first phase was to develop a locally supportable vision and strategic planning approach that reduces potential conflicts between land uses, and recognizes opportunities for a landscape-level integrated approach to conservation that includes ecosystem processes, multiple habitat types, and species.

Current Yolo-Cache State and Federally Led Planning Efforts

- **California EcoRestore.** The Department of Water Resources and the US Bureau of Reclamation are pursuing the enhancement of up to 17,000 acres of floodplain habitat and restoration of 8,000 acres of tidal habitat in the Yolo Bypass and Suisun Marsh, consistent with a 2008 USFWS Biological Opinion and a 2009 NMFS Biological Opinion.[11] California EcoRestore is focused on benefitting native fish species through provision of increased juvenile rearing habitat, enhanced adult fish passage, and improvement of primary production. This includes priority projects like the realignment of the Lower Putah Creek and is consistent the 2012 *Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan* (see p. 36).
- **Central Valley Flood Protection Plan** (CVFPP). The 2017 CVFPP Conservation Strategy[12] includes continued analysis of floodplain restoration opportunities. This analysis offers decision diagrams to identify and prioritize potential locations for: 1) modifying floodplain topography (specifically, lowering floodplain topography through targeted excavation) and 2) relocating levees (specifically, constructing setback levees). Yolo Bypass levee setbacks and weir extensions are central to the state strategy for increasing flood system resiliency.
- **Sacramento River General Reevaluation Report.** Working in partnership with the California Department of Water Resources (DWR), the US Army Corps of Engineers is developing this planning vehicle to secure Congressional approval for significant improvements to the Yolo Bypass and Sacramento River.
- **Central Valley Joint Venture Implementation Plan.** This plan is part of an international effort to manage and restore migratory bird populations along the North American flyways. This plan has specific objectives for wetlands and riparian habitat in each of the Joint Venture planning regions associated with the Sacramento River. The goals for the Yolo Basin are based on sustaining current rice growing operations, and sustaining and improving managed wetlands (see p. 70).
- **Cache Slough Complex Conservation Assessment.** DWR completed Volume 1 of the assessment in 2016 in collaboration with the California Department of Fish and Wildlife Fish Restoration Program (FRP).[13] The assessment evaluates the potential for restoring the Cache Slough complex as part the FRP. It also provides information on current and historic conditions in order to generate a regional landscape conceptual model for conservation of tidal habitats to support the recovery of Delta smelt. Volume 2 will present restoration strategies and assess compatibility with other regional plans.

Yolo Bypass. Photo: Christina Sloop

CONSERVATION OPPORTUNITY REGION CONTINUED

the California Department of Fish and Wildlife in place within the Yolo Bypass that protect habitat managed to benefit these fish and wildlife species.

Just downstream, the Cache Slough complex offers notable conservation value for species associated with tidal wetlands, seasonal wetlands (including vernal pools), and grasslands in and around the Delta.[15] The complex has been established as the only known Delta site supporting year-round populations of endangered Delta smelt, and provides spawning and rearing habitat for populations migrating from the San Francisco Estuary's low salinity zone.[16,17] Moreover, undeveloped lowland grasslands and ranch land span the short distance between the Cache Slough complex and Suisun Marsh to the west. Altogether these offer an ecological corridor for movement of wildlife and provide sea level rise accommodation space over the long-term.[18]

Major planned and existing conservation projects in the Yolo-Cache complex are listed in the sidebar. Additional conservation opportunities follow.

REFERENCING EXISTING REGIONAL HABITAT PLANNING

The Yolo Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP)[19] is a countywide conservation plan coordinated by the Yolo Habitat Conservancy. The plan addresses Endangered Species Act permits and associated mitigation for infrastructure (e.g. roads and bridges) and development activities (e.g. agricultural facilities, housing, and commercial buildings) identified for construction over the next 50 years in Yolo County.[20] The Yolo HCP/NCCP will coordinate mitigation to maximize benefits and conserve habitat beyond required mitigation for 12 identified species. The plan has a strong link to agricultural preservation, and strikes a balance between natural resource conservation and economic growth in the region.

Major Yolo-Cache Planned or Existing Restoration Projects

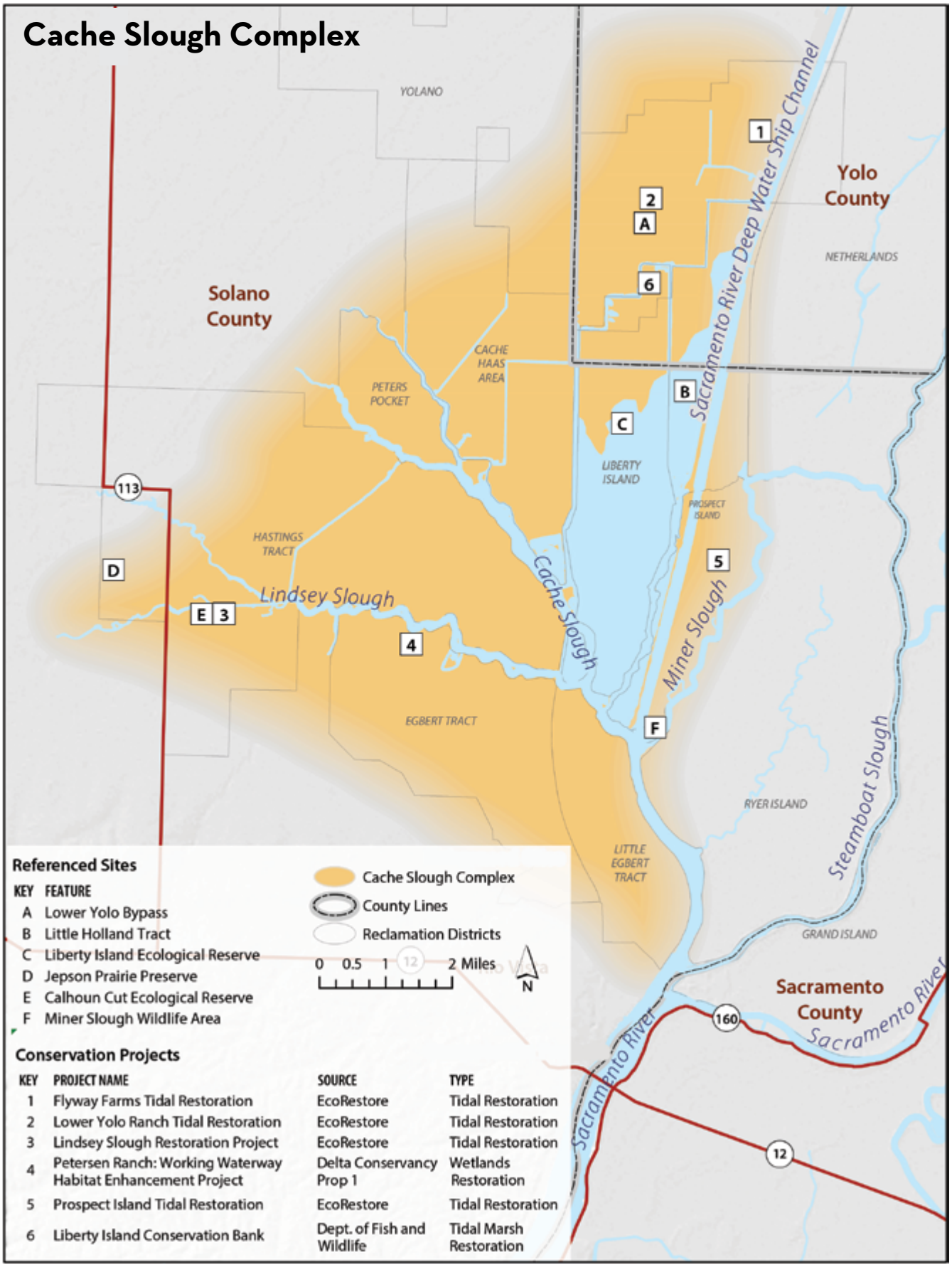
- Lower Yolo Ranch tidal and floodplain restoration (1,480 acres)
- Liberty Island Conservation Bank (809 acres, tidal)
- North Delta Fish Conservation Bank (Liberty Island 809 acres, tidal)
- Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project
- Fremont Weir Adult Fish Passage Modification Project
- Wildlife corridors for flood escape on the Yolo Bypass Wildlife Area (approximately four linear miles, 82 acres)
- Yolo Wildlife Area habitat and drainage project (approximately 2,617 acres)
- Putah Creek realignment project (approximately two channel miles of Lower Putah Creek in the Bypass to enhance fish passage)
- Yolo Bypass agricultural crossing fish passage improvements
- Lisbon Weir modification project
- Yolo Flyway Farms (359 acres of subtidal, intertidal, and seasonal wetlands)
- Lower Elkhorn levee setback project (approximately 7 miles of setback levee for floodplain enhancement)
- Prospect Island restoration project (1,617 acres tidal)
- Lindsey slough tidal restoration, completed 2015.
- Pope Ranch Garter snake mitigation bank
- Wallace Weir improvement project and fish collection facility (keeps adult salmon out of the Ridge Cut and Colusa Basin)

(see also maps pp. 92 & 97)

The Solano Multi-Species HCP is still in development, with a final administrative draft last updated in October 2012. This HCP will promote conservation of biodiversity and preservation of covered species and their habitats in relation to urban development, flood control, and infrastructure improvement activities.[21] Federal- and state-listed fish species and other species of concern on lands within the Delta will be included in the HCP as covered species. Natural communities to be protected include grasslands and vernal pools, riparian and stream habitats, and marshes.

The Yolo Regional Conservation Investment Strategy/Local Conservation Plan (Yolo RCIS/LCP)[22] is a voluntary, landscape-scale conservation plan identifying conservation priorities to guide public and private conservation actions and investment. It will provide a blueprint for additional voluntary, non-regulatory conservation in Yolo County that addresses needs not covered in the Yolo HCP/NCCP.

CONSERVATION OPPORTUNITY REGION



Map: CDFW, 2018

NORTH DELTA ARC CONNECTIONS

Both the Yolo Bypass and Cache Slough fit into a "grand strategy" to create an interconnected series of habitats, mostly tidal, in this region as a result of its potential for biodiversity conservation and location at the southern end of the Yolo Bypass. Developed by the UC Center for Watershed Sciences, this strategy is referred to as the "North Delta Habitat Arc" and consists of a reconciled ecosystem strategy to create an arc of habitats connected by the flows of the Sacramento River.[23] The Yolo Bypass is the upstream end of the arc, which continues through the Cache-Lindsey Slough-Liberty Island region (Cache-Slough complex), down the Sacramento River (including Twitchell and Sherman Islands), and into Suisun Marsh. Very few areas of the Delta offer these opportunities for significant habitat connectivity (for more information see p. 72).

FISH, FLOODPLAIN, AND MARSH HABITAT IMPROVEMENTS

The Northwest Delta around Yolo Bypass and Cache Slough offers unique opportunities to support native fish using landscape scale approaches and ecological processes. What's special about the Yolo Bypass region is the opportunity for floodplain habitat and shallows rich in food and shelter for young salmon and resident fish; what's special about Cache Slough is its proximity to the Yolo Bypass and the distributary channels of the lower Sacramento River. Cache Slough benefits from natural flood pulse flows, providing seasonal migration, spawning, and rearing habitats for adult and juvenile native and anadromous fish. The flood plains and distributary channels are primary sources for food web productivity during inundation and high flow events, and also bring winter sediment supply. The Cache Slough complex also hosts mineral soils that minimize land subsidence relative to the more organic soil in other parts of the Delta. The gradual alluvial slopes of the surrounding uplands could accommodate sea level rise through lateral marsh expansion.[24] As the Cache Slough complex still contains natural drainage patterns, and connects to the Sacramento River, the area is widely regarded as prime location for restoration projects. Liberty Island (1998)[25] and Little Holland Tract (1982)— two very large, naturally restored islands—now support a mix of emergent tidal marsh, intertidal flats, and shallow-to-moderate-depth subtidal aquatic habitats. The Cache Slough complex is also adjacent to a biologically unique, broad, lowland grassland/vernal pool complex which connects to Suisun Marsh.

*Copepod (*p. Marinus*), a favored fish food for young salmon and other natives. Photo: Vogt*

Geese over bypass near Sacramento. Photo: David Feliz

Potential Solutions to Recognized Challenges

In any Yolo-Cache complex conservation planning effort, tradeoffs must be considered. For example, floodplain related conservation goals to provide extended inundation to promote juvenile salmonid rearing habitat,[26] or tidal restoration related goals to improve the

Delta food web, have the potential to conflict with existing agricultural land uses, wetlands management, hunting, wildlife viewing, and education.[27,28] Increased restoration activities may also create the need for mosquito control, and the potential for mercury contamination. Below are some potential solutions to some of these challenges:

WILDLIFE-FRIENDLY AGRICULTURE

Wildlife-friendly farming integrates conservation goals with agriculture to benefit wildlife and conserve biodiversity. Wildlife-friendly agricultural practices in the Yolo Bypass include farming crops that benefit wildlife (such as rice, safflower, and irrigated pasture), and providing drainage ditches and hedgerows with habitat value. In the Yolo Bypass and Cache Slough region, like elsewhere in the Delta, agriculture has been a way of life for generations, however, and farmers and ranchers remain concerned about being displaced by conservation. As conservation projects are implemented and managed over the long term, it is essential to have early, clear, and consistent communication among all stakeholders (landowners, agencies, and NGOs), and to consider good neighbor practices such as those outlined by the Agricultural Lands Stewardship Working Group (see p. 75).[29]

INTEGRATED FLOOD MANAGEMENT

The Yolo Bypass is part of the regional integrated flood management system. It is important to recognize the critical role agriculture and managed wetlands play in maintaining an open floodway. During standard operations, farmers and wetland managers on the Yolo Bypass keep their fields clear (emergent vegetation at less than five percent of total cover). Without these efforts, the Yolo Bypass would eventually support large woody vegetation that would slow the flood flows. Long term-flood protection, levee maintenance, and agricultural operations can be linked to conservation outcomes in other ways.[30] For example, maintaining hedgerows at the margins of agricultural fields can increase their habitat value, and levees can be used to provide wildlife transition habitat. These potential links between flood control and conservation provide opportunities consistent with specific actions identified in the Central Valley Flood Protection Plan Conservation Strategy for the Yolo Bypass, and with the goals and objectives of California EcoRestore and the Sacramento River General Reevaluation Report. While Cache Slough does not provide the key flood protection role of Yolo Bypass, considering the two as part of one important Sacramento River drainage system offers further opportunities for integrating habitat conservation with flood protection.

Hawks harvest rodents in tractor's wake. Photo: Dave Feliz

LOW-IMPACT RECREATION

Several state-run areas within the Yolo Bypass provide public access for recreation and waterfowl hunting, including the Yolo Bypass Wildlife Area, and Fremont Weir and Sacramento Weir Wildlife Areas. The California State Parks Proposal for the Sacramento-San Joaquin Delta[31] recognizes potential additional opportunities in this area for ecosystem restoration coupled with outdoor recreation (wildlife observation, boating, fishing access, and hunting), particularly in the southern end of the Yolo Bypass. The integration of floodplain conservation activities with

current educational and recreational uses may provide additional opportunities. However, providing public access to restoration sites remains a general challenge in the Delta. Human activities — vehicles, litter, illegal hunting — can disturb wildlife and damage sensitive habitats.

Around Cache Slough, there are several private facilities set up for hunting waterfowl and other game birds, as well as public areas such as the Miner Slough Wildlife Area and Liberty Island Ecological Reserve that allow hunting and fishing. Barker Slough is on a list of locations for a new state park, where habitat restoration could be integrated with picnic sites, trails, kayak, canoe and other small paddle-craft facilities, and interpretive services. The expansion of recreation and related tourism, if integrated with conservation efforts, could increase both the economic value and the ecosystem services derived from the Delta.

CLIMATE CHANGE AND ADAPTATION OPPORTUNITIES

The Yolo-Cache region will be affected by climate change induced sea level rise within the next 30-100 years. Lands currently in the intertidal zones are projected to become subtidal.[32] Rising water levels will alter and submerge current shorelines and nearby areas. In some areas sea level rise will mean that current agricultural land will be lost to increased salinity levels or inundation. Further, flood dynamics will likely change over the coming decades, with more frequent and extreme storm and rainfall events and associated flood pulses. Scenario planning will help evaluate forecasted impacts on ecosystems and species, and integrate these into the long-term planning and management picture. Regular re-evaluation of scenarios over time will allow land managers and planners to re-examine how earlier projections played out and to adapt to changes.

Yolo Bypass. Photo: Christina Sloop.

Looking Ahead

The *Delta Conservation Framework* supports further efforts to make the most of the Yolo-Cache conservation opportunity regions, existing planning foundations, and active partnerships. Efforts in both Yolo and Cache to date exhibit the cornerstones for successful conservation planning and implementation including establishing trust and inclusion among stakeholders, setting goals, agreeing on structure for partnerships, communicating, and using science to support decision-making.

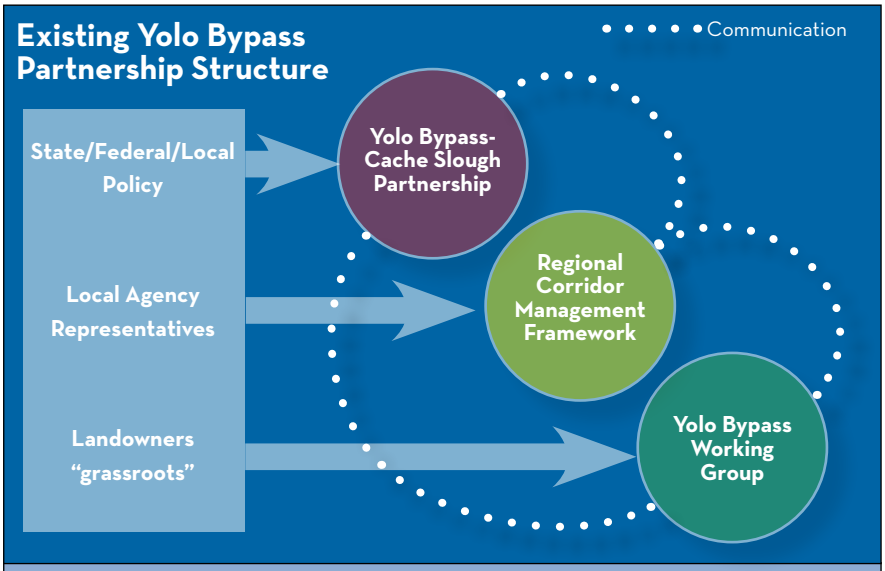


Figure 2.2

Several partnership efforts have focused on conservation and floodplain management issues in the Yolo Bypass-Cache Slough Complex. With sufficient and consistent communication, coordination, and an effective governance structure, these efforts could serve as an ongoing forum for successful long-term conservation in the Yolo Bypass-Cache Slough region and lead to the development of regional conservation strategies. This would afford landscape scale integration of the existing HCP/NCCP, RCIS/LCP, and other Yolo Bypass and Cache Slough focused plans, tying them in with the *Delta Conservation Framework's* landscape scale and long-term goals and strategies.

A Yolo Bypass or Cache Slough regional conservation strategy could utilize scenario planning to develop strategies to ensure flood protection, improve ecological function, assist species recovery, integrate benefits for wildlife-friendly farming operations, and provide recreation at the local and landscape scales.

For Yolo, regular communication and coordination (between BCSP, CMF, and YBWG) as part of a Yolo Bypass regional conservation strategy effort would help balance the interests of each group, consistent with *Delta Conservation Framework* Goal A. An RCS could also focus on developing multi-benefit conservation solutions consistent with Framework Goals C, D & E. The Cache Slough Restoration Planning Partnership, meanwhile, is also poised to develop priority projects that tie in with the *Delta Conservation Framework* overarching goals and strategies.

A Yolo Bypass-Cache Slough regional conservation strategy could present a unique opportunity to align with the North Delta Arc vision, as well as with *Delta Conservation Framework* Goals F and G. These Framework goals are aimed at addressing conservation-related permitting through a general regional permit approach, and developing short-and long-term funding via bond initiatives and other opportunities. A facilitated process for Yolo Bypass conservation related permitting would increase the efficiency of project implementation and continued management, and help balance short and long term impacts and benefits.

QUICK LINKS

Yolo Bypass-Cache Slough Partnership
www.dailydemocrat.com/2016/05/11/agencies-to-coordinate-flood-and-habitat-projects-in-yolo-bypass/

Yolo Bypass Wildlife Area
www.wildlife.ca.gov/Lands/Places-to-Visit/Yolo-Bypass-WA

http://yolobasin.org/yolobypasswildlifearea/

For more detailed descriptions of these conservation opportunity regions, see Appendix 2.

Guide to Delta Ecosystems and Associated Habitat Types

This listing was developed through collaboration between the California Department of Fish and Wildlife, Delta Conservancy, and Delta Stewardship Council, with close alignment to the information presented in A Delta Transformed *(Robinson, Safran et al. 2014) and* A Delta Renewed *(Robinson, Safran et al. 2016).*

Table 3.1: Delta Habitats

Upland / Terrestrial Ecosystem	Definition	Source
Grassland	Low herbaceous communities occupying well-drained soils and composed of native forbs and annual and perennial grasses and usually devoid of trees. Few to no vernal pools present.	Delta Transformed (p. 18)
Oak woodland/savanna	Oak dominated communities with sparse to dense cover (10-65 percent cover) and an herbaceous understory.	Delta Transformed (p. 18)
Stabilized interior dune vegetation	Vegetation dominated by shrub species with some locations also supporting live oaks on the more stabilized dunes with more well-developed soil profiles.	Delta Transformed (p. 18)
Agriculture - high intensity	Active agricultural lands in high-intensity crops such as fruit or nut orchards and/or vineyards.	Delta Transformed (p. 18) with added split between high/low intensity
Agriculture - low intensity	Active agricultural lands in low-intensity crops such as row crops, rice fields, alfalfa, or pasture.	Delta Transformed (p. 18) with added split between high/low intensity
Ruderal/nonnative	Areas dominated by nonnative vegetation and ruderal lands.	Delta Transformed (p. 18)
Urban	Urban remnant natural areas (greens, trees, and other features such as water-treatment wetlands).	Delta renewed (p. 78)

Riparian Ecosystem	Definition	Source
Valley foothill riparian	Mature riparian forest usually associated with a dense understory and mixed canopy, including sycamore, oaks, willows, and other trees. Historically occupied the supratidal natural levees of larger rivers that were occasionally flooded.	Delta Transformed (p. 18)
Willow riparian scrub-shrub	Riparian vegetation dominated by woody scrub or shrubs with few to no tall trees. This habitat type generally occupies long, relatively narrow corridors of lower natural levees along rivers and streams.	Delta Transformed (p. 18)
Willow thicket	Perennially wet, dominated by woody vegetation (e.g., willows). Emergent vegetation may be a significant component. Generally located at the "sinks" of major creeks or rivers as they exit alluvial fans into the valley floor.	Delta Transformed (p. 18)

Aquatic - Perennial Wetland Ecosystem	Definition	Source
Freshwater emergent marsh/wetland - tidal	Perennially wet, high water table, dominated by emergent vegetation. Woody vegetation (e.g., willows) may be a significant component for some areas, particularly the western-central Delta. Wetted or inundated by spring tides at low river stages (approximating high tide levels).	Delta Transformed (p. 18)
Freshwater emergent wetland/marsh - nontidal	Temporarily to permanently flooded, permanently saturated, freshwater nontidal wetlands dominated by emergent vegetation. In the Delta, occupies upstream floodplain positions above tidal influence.	Delta Transformed (p. 18)
Saline emergent wetland (SEW)	Herbaceous-dominated: > 2 percent total cover by herbaceous species and < 10 percent total cover by tree or shrub species; limited to tidally-influenced portions of coastal regions. SEW cross-walks to CALVEG[1] pickleweed-cordgrass and tule-cattail.	(CDFG 1988, Springer 1988)
Vernal pool complex	Area of seasonally flooded depressions, characterized by a relatively impermeable subsurface soil layer and distinctive vernal pool flora. These often comprise the upland edge of perennial wetlands.	Delta Transformed (p. 18)

Aquatic - Seasonal Wetland Ecosystem	Definition	Source
Alkali seasonal wetland complex	Temporarily or seasonally flooded, herbaceous, or scrub communities characterized by poorly-drained, clay-rich soils with a high residual salt content. These often comprise the upland edge of perennial wetlands.	Delta Transformed (p. 18)
Wet meadow and seasonal wetland	Temporarily or seasonally flooded, herbaceous communities characterized by poorly-drained, clay-rich soils. These often comprise the upland edge of perennial wetlands.	Delta Transformed (p. 18)
Managed wetland	Areas that are intentionally flooded and managed during specific seasonal periods, often for recreational uses such as duck clubs.	Delta Transformed (p. 18)

Aquatic - Open Water Ecosystem	Definition	Source
Fluvial - low order channel	Distributaries, overflow channels, side channels, swales. No influence of tides. These occupy nontidal floodplain environments or upland alluvial fans.	Delta Transformed (p. 18)
Fluvial - mainstem channel	Rivers or major creeks with no influence of tides.	Delta Transformed (p. 18)
Fluvial - shaded riverine aquatic	Aquatic edge habitat that is shaded by adjacent riparian vegetation.	(IAMIT 2017)
Fluvial - channel margin habitat	In-water habitat along the channel margin which generally ranges from perennial aquatic wetlands to floodplain and riparian habitats. This habitat type generally includes shaded riverine aquatic habitat at upper elevations. It is also referred to as fish-friendly levee habitat.	(IAMIT 2017)
Freshwater pond or lake	Permanently flooded depressions, largely devoid of emergent Palustrine vegetation. These occupy the lowest-elevation positions within wetlands.	Delta Transformed (p. 18)
Freshwater intermittent pond or lake	Seasonally or temporarily flooded depressions, largely devoid of emergent Palustrine vegetation. These are most frequently found in vernal pool complexes at the Delta margins and also in the nontidal floodplain environments.	Delta Transformed (p. 18)
Tidal - mainstem channel	Rivers, major creeks, or major sloughs forming Delta islands where water is understood to have ebb and flow in the channel at times of low river flow. These delineate the islands of the Delta.	Delta Transformed (p. 18)
Tidal - low order channel	Dendritic tidal channels (i.e., dead-end channels terminating within wetlands) where tides ebb and flow within the channel at times of low river flow.	Delta Transformed (p. 18)

To skip these references go to p. 107

Guide to Delta Ecosystems and Associated Habitat Types - CONTINUED

Overlapping/Transitional Ecosystem Categories/ Features	Definition	Source
Upland transitional corridors	The connected terrestrial ecosystems within and around the periphery of the Delta (e.g., to support wildlife movement and dispersal).	Delta Renewed (p. 70)
Marsh-terrestrial transition zone	"Marsh" includes both tidal and nontidal freshwater emergent wetland; the "marsh-terrestrial transition zone" was mapped wherever marsh polygons and terrestrial habitat type polygons were adjacent to one another; "terrestrial habitat types" include oak woodlands, seasonal wetlands, and riparian habitat, among others (i.e., everything other than marsh, open water, urban/barren, and agricultural/nonnative)	Delta Transformed (pp. 71-72)
Marsh to open-water edge	All areas mapped as open water and marsh, regardless of their tidal status, connectivity, or form. Seasonally and tidally inundated areas are not included within the area mapped as open water. Linear areas where the two habitat types were mapped as adjacent to one another are identified as the open water-marsh edge.	Delta Transformed (p. 44)
Floodplain	The area at low to mid elevations adjacent to and transitioning between fluvial, or riverine, and tidal areas, that is subject to flooding during periods of high discharge.	(IAMIT 2017)
Floodplain - seasonal short-term flooding	**Floodplain:** The area at low to mid elevations adjacent to and transitioning between fluvial, or riverine, and tidal areas, that is subject to flooding during periods of high discharge. **Seasonal short term flooding:** Short-term fluvial inundation • intermediate recurrence (~10 events per year) • low duration (days to weeks per event) • generally shallower than seasonal long-duration flooding	(IAMIT 2017); Delta Transformed definitions for subtypes (pp. 38-39)
Floodplain - seasonal, long duration	**Floodplain:** The area at low to mid elevations adjacent to and transitioning between fluvial, or riverine, and tidal areas, that is subject to flooding during periods of high discharge. **Seasonal, long duration:** Prolonged inundation from river overflow into flood basins • low recurrence (~1 event per year) • high duration (persists up to 6 months) • generally deeper than seasonal short-term flooding	(IAMIT 2017); Delta Transformed definitions for subtypes (pp. 38-39)
Floodplain - tidal inundation	**Floodplain:** The area at low to mid elevations adjacent to and transitioning between fluvial, or riverine, and tidal areas, that is subject to flooding during periods of high discharge. **Tidal inundation:** Diurnal overflow of tidal sloughs into marshes • high recurrence (twice daily) • low duration (<6 hours per event) • low depth ("wetted" up to 0.5 mile)	(IAMIT 2017); Delta Transformed definitions for subtypes (pp. 38-39)
Floodplain - ponds, lakes, channels, and flooded islands	**Floodplain:** The area at low to mid elevations adjacent to and transitioning between fluvial, or riverine, and tidal areas, that is subject to flooding during periods of high discharge. **Ponds, lakes, channels, and flooded islands:** Perennial open water features (with the exception of historical intermittent ponds and streams) • recurrence not applicable (generally perennial features) • high duration (generally perennial features) • variable depth	(IAMIT 2017); Delta Transformed definitions for subtypes (pp. 38-39)

Overlapping/Transitional Ecosystem Categories/Features	Definition	Source
Wildlife-friendly agriculture best management practices (BMPs)	Any activity carried out on agricultural lands that benefits wildlife. These wildlife-friendly activities may help protect or increase quantity and/or quality of habitat found in or adjacent to agricultural landscapes. Availability, quantity, and quality of crop and grain residue within the field and fence-line vegetation, pesticide application and management, water management, and timing of these activities affect the value agricultural lands provide for wildlife. Delta Renewed guidelines to benefit wildlife include six categories of BMPs, defined as "practices that support native wildlife on agricultural lands, including practices which manage fields as wetlands that wildlife can access (rice crops and flooded fields)."	(Burmester 2015); Delta Renewed (pp. 76-77, 117)
Wildlife-friendly agriculture BMPs - minimize water quality impacts from agriculture	BMPs that include reduced pesticide use, integrated pest management, settling basins, and buffer strips to filter runoff.	Delta Renewed wildlife-friendly agriculture (pp. 76-77, 117)
Wildlife-friendly agriculture BMPs - minimize water diversion impacts from agriculture	BMPs that could include adding fish screens to prevent entrainment, conservation measures to reduce volume of water diverted, or changing the location or timing of diversion to minimize impacts.	Delta Renewed wildlife-friendly agriculture (pp. 76-77, 117)
Wildlife-friendly agriculture BMPs - flexible and responsive management in agricultural areas	Managing different crops with potential to provide support for different wildlife species. For example, The Nature Conservancy's "pop-up habitats" divert water to farms when waterbird densities are high; or row crops and rice fields support waterbirds and fish, while hedgerows support terrestrial wildlife.	Delta Renewed wildlife-friendly agriculture (pp. 76-77, 117)
Wildlife-friendly agriculture BMPs - agricultural fields managed as seasonal wetland or floodplain	Agricultural practices that create seasonal or perennial wetlands that mimic the hydrology of historical wetlands. For example, rice fields provide long-duration floods and invertebrate-rich rearing habitats, which flood basins provided historically. Agricultural wetlands can support high densities of wintering and migrating waterbirds, as well as fish, and are critical to supporting these species in the absence of extensive natural wetlands. Agricultural wetlands support different species depending on crop type, flooding patterns, and post-harvest practices.	Delta Renewed wildlife-friendly agriculture (pp. 76-77, 117)
Wildlife-friendly agriculture BMPs - hedgerows and native vegetation within/between agricultural fields	Patches of native vegetation within or between agricultural fields, whether remnants of historical habitats (e.g., oak trees, vernal pools) or linear features along the edge of fields (e.g., buffer strips, hedgerows), to provide habitat for native wildlife and easier movement through the landscape.	Delta Renewed wildlife-friendly agriculture (pp. 76-77, 117)
Wildlife-friendly agriculture BMPs - minimize distance from agricultural fields to nearby wildland areas	Species supported by wildlife-friendly agriculture that benefit from close proximity to appropriate wildland habitats.	Delta Renewed wildlife-friendly agriculture (pp. 76-77, 117)

1 The CALVEG ("Classification and Assessment with Landsat of Visible Ecological Groupings") system

QUICK LINKS

Landscape Connectivity, Meiklejohn, et al. 2009

www.wildlandsnetwork.org/sites/default/files/terminology%20CLLC.pdf

To skip these references go to p. 107

Your Project, Your Ideas, Your Partners?

SECTION IV

Delta Conservation Based on Science

Illustration: Alison Kozai

KEY TERMS

- **ADAPTIVE MANAGEMENT** - involves a series of cyclical steps that include: defining the problem; establishing measurable goals and objectives; modeling linkages between objectives and proposed actions; selecting actions and related performance measures; designing and implementing actions and developing an associated monitoring plan; analyzing, synthesizing, and evaluating new data; disseminating learned information; and adapting practices to incorporate what was learned.[21] Adaptive Management is not to be confused with managing adaptively. Both have value – yet they are very different concepts. Managing adaptively, or adjusting management actions to fit circumstances, often based on experience, is common practice.[21]
- **CLIMATE CHANGE** - Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change may result from natural factors, including changes in the sun's intensity or changes in the Earth's orbit around the sun; natural processes within the climate system (such as changes in ocean circulation); or human activities that change the composition of the atmosphere (for example, through release of carbon) and land surfaces (for example, deforestation or urbanization).
- **X2** - The point identified by the distance from the Golden Gate Bridge where salinity at the bottom of the water column is about two parts per thousand. Keeping X2 within a range of positions around Suisun Marsh (by managing fresh water outflows as needed) is considered supportive of the health of the estuarine food web. X2 serves as a metric for both the extent of native fish habitat in the low salinity zone in the San Francisco Estuary and the salinity standard in the state's water quality control plan.
- **EXTREME EVENTS** - One of the most visible consequences of climate change is an increase in the intensity and frequency of extreme weather events. Weather and climate extremes include hurricanes, tornadoes, heavy downpours, heat waves, and droughts that affect all sectors of the economy and the environment, impacting people where they live and work.
- **NOVEL ECOSYSTEMS** - A novel ecosystem can be identified by its origins rooted in human agency, the ecological thresholds it has crossed, a significantly altered species composition, and a capacity to sustain itself. In 2013 Hobbs and co-authors defined a novel ecosystem as "a system of abiotic, biotic, and social components (and their interactions) that, by virtue of human influence, differ from those that prevailed historically, having a tendency to self-organize and manifest novel qualities without intensive human management."
- **SEA LEVEL RISE** - An increase of the global volume of water in the oceans, resulting in receding shorelines and increased flooding. Sea level rise is often discussed in the context of climate change (such as thermal expansion of ocean waters and the melting of glaciers and ice sheets).
- **RESILIENCE** – Resilience is a means by which ecosystems, habitats, and species are likely to successfully adapt and thrive over time. The concept of resilience in conservation focuses on creating systems that are robust enough to persist and adapt over the long term, in order to manage ecosystems for an uncertain future. Resilience can also refer to non-ecological systems, such as agriculture.
- **RECONCILIATION ECOLOGY** - Reconciliation ecology seeks to improve conditions for native species while recognizing that most ecosystems have been altered irrevocably by human use and will continue to be used to support human goals. Improving ecosystem conditions for native species must therefore happen in a context of continuing use of land and water by humans and continuing physical and biological change.[28]

Footnotes: The Delta Conservation Framework footnote and endnote references can all be found in Appendix 1 online by section.

Introduction

Throughout the Delta, a multitude of stressors impair ecosystem processes and discourage the persistence of native species.[1,2,3,4,5,6,7,] Ecosystems are most resilient and functional when they are interconnected at various scales.[8,9] To achieve lasting resilience, it is important to understand how ecological processes function across time and space within a mosaic of wildlife-friendly land management approaches and agriculture in the Delta.[10,11] In addition, sustaining functional ecosystems, native species, agriculture and other human land uses will become much more difficult with the projected increase in environmental extremes over the coming decades.[7, 12, 14] It may become necessary to shift the focus from managing "native" or "natural" systems to managing for "reconciled" or "novel" ecosystems.[13,14] (See also Key Terms p.108.)

Understanding such complexities, and the reverberating impacts on the use of the Delta by both people and native species, requires collaborative multi-interest science, long-term monitoring, and adaptive management based on this research and monitoring. Without science-based conservation practices that support rapid responses to crises and provide long-lasting solutions, Delta conservation may not be successful in the long term.[15,16,17]

This section offers an overview of science capacity in the Delta, including current and upcoming scientific research and progress made toward comprehensive adaptive management programs. (The relationships among some of these programs, however, is still in the process of being clarified.) Several such programs are addressing the needs of upcoming conservation and mitigation actions under California EcoRestore,[18] state and federal water project operations, and California WaterFix, [19,20,21] as well as those of restoration programs outside these mandates.

The *Delta Conservation Framework* supports these and other efforts to tailor Delta science to current conditions and future challenges. The Framework, in its push for science-based restoration on a landscape scale, recognizes the value and intent of the Delta's existing collaborative science and management programs. In following up on Framework goals and strategies, regional partnerships should tap this strong existing capacity to monitor progress and manage conservation outcomes.

One Delta – One Science

The most comprehensive recent effort to organize the Delta's diverse regional science and monitoring programs, and to increase transparency, integration, and collaboration, is the *Delta Science Plan*.[20] The *Delta Science Plan* sets the vision for "One Delta, One Science," a collaborative and open science community that contributes to a shared body of scientific knowledge to inform future water and environmental decisions.

The Delta Stewardship Council's Delta Science Program has coordinated a set of collaborative documents that make up a Delta Science Strategy[20,21] aimed at achieving the vision of One Delta, One Science:

- The Plan offers a cooperative science-oriented approach that extends across multiple agency and program authorities.
- The Strategy prioritizes and aligns near-term science actions to inform management actions and achieve the objectives of the *Delta Science Plan*.
- The State of Bay-Delta Science reports synthesize scientific knowledge about the Delta, including progress made on key research questions and remaining knowledge gaps.

Fish and food web sampling under the Interagency Ecological Program. Photo: IEP

Connecting Agency-Driven Science to Future Science

One Delta One Science is a broadly focused, program in a constellation of Bay-Delta science and monitoring endeavors. The region has a 60+-year history of data collection for management purposes, and one of its longest running programs is the Interagency Ecological Program (IEP). IEP was established in the 1970s to "provide and integrate relevant and timely ecological information for use in the management of the Bay-Delta ecosystem and the waters that flow through it." The IEP currently conducts research, monitoring, and synthesis to address high-priority management and policy needs in order to fulfill responsibilities established under various water rights decisions, the state and federal Endangered Species Acts, and the Clean Water Act. The mission directives are carried out by multi-disciplinary teams composed of agency, academic, nongovernmental organizations, and consultants.[21,22]

Multi-Layered Science, Monitoring, and Adaptive Management

Increasingly, Delta science is undertaken in teams combining agency or policy driven science with socio-economic or ecosystem-based science. These teams are supported by regional or area wide monitoring programs and linked to adaptive management programs. In addition to those mentioned above, some of these active teams are involved in the Collaborative Science and Adaptive Management Program, the Fish Restoration Program Monitoring Team, and the Delta Regional Monitoring Program. Other significant scientific contributions to conservation and land management in the Delta include cross-cutting projects such as the Delta Region Area-wide Aquatic Weed Project (see Section III), the Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary[23] and various research programs conducted by the San Francisco Estuary Institute and the UC Davis Center for Watershed Sciences. The Public Policy Institute of California, meanwhile, helps communicate science to decision-makers to inform public policy.

Science Enterprise

Collectively, all the science programs and activities in the Delta region that inform and serve managers and stakeholders in decision-making are referred to as the "Science Enterprise."[19] Collectively, the Science Enterprise was a joint Delta Stewardship Council-US Geological Survey effort that recognized a need for additional levels of collaboration and integration, particularly in the context of conservation planning, implementation, and adaptive management. Those initiatives or plans spearheading increasing cross-cutting science coordination include the Science Action Agenda and its development process, the Delta Independent Science Board, IEP's science agenda process, and the *Delta Plan* Interagency Implementation Committee's Delta Agency Science Workgroup.

> *"Big changes are always impractical for those deeply embedded in existing practices that are failing us."*
>
> RICHARD NORGAARD, UC BERKELEY
> DELTA INDEPENDENT SCIENCE BOARD

A Framework for Conservation Science

Available ecological and socioeconomic studies in the Delta should inform conservation-related decision-making. The *Delta Conservation Framework* encourages priority setting throughout the Delta Science Enterprise to support long term monitoring and adaptive management and acquire the data needed to evaluate the effectiveness of conservation-related actions over time. Using this information to improve on ineffective management actions will help keep costs down and avoid unnecessary impacts.

Strategic science and action priorities will also help elicit competitive and informed grant solicitations, agency budget change proposals, coordinated multi-agency efforts, updates to individual science programs within federal and state governments, and integration with outside science. Having a common direction and a strong science-based infrastructure for conservation, management, and policy decisions will be especially useful in light of upcoming challenges related to climate change, and public support for action on that front.

More details about these science programs are presented in the following pages under Goal E, Strategies 1 and 2, and in the Guide to Related Plans and Programs on pp. 128-132.

Framework in Depth: Goal E

Assessing Conservation Progress and Informing Effective Management

Decisions about individual conservation project design and long-term management should be based on the best-available science and a commitment to long-term monitoring and evaluation.

This *Delta Conservation Framework* goal supports the strong existing science capacity available in the Delta to inform decisions. Goal E also supports multi-agency, cross-cutting, coordinated science priorities to inform conservation and restoration planning, among other science, monitoring, and adaptive management strategies and objectives.

A USGS monitoring station in Suisun Marsh, one of 35 in a network spread throughout the Delta monitoring hydrodynamics, salinity, chlorophyl (base of the food web for fish), and other biogeochemical variables. These stations report remotely, offering gigabytes of real time information on Delta conditions to help optimize management for ecosystem health and beneficial uses of the state's waters. Photo: Amber Manfree

Illustration: Akoon Razavi

GOAL E

Evaluate conservation progress and address climate change stressors and other drivers of change by implementing the science strategies and priorities of the Delta Science Program and Interagency Ecological Program, the adaptive management program for Biological Opinions related to state and federal water project operations, and adaptive management recommendations emerging from interagency integration teams.

STRATEGY E1

Implement and increase communication of established priority research, science, and monitoring actions and needs.

- Reference the Delta Science Strategy and Science Action Agenda.
- Consider the Interagency Ecological Program Science Agenda.
- Consult the *Delta Smelt Resiliency Strategy* and the *Sacramento Valley Salmon Resiliency Strategy*.
- Utilize the Tidal Wetland Monitoring Framework.

STRATEGY E2

Assess conservation progress, as well as the status and trends for species and habitats of interest, using existing Delta adaptive management approaches and programs.

- Consider the guidance in the Adaptive Management Program for the California Water Fix and Current Biological Opinions on the Coordinated Operations of the Central Valley and State Water Projects.
- Support the Collaborative Science and Adaptive Management Program.
- Support the Delta Stewardship Council's Interagency Adaptive Management Integration Team.

STRATEGY E3

Evaluate best practices to maintain and increase ecosystem and species resiliency to projected climate change.

- Develop and recommend best practices to enhance the resilience of Delta ecosystems and species to climate change effects such as sea level rise, salinity intrusion, precipitation and temperature changes (in air and water), and extreme weather events.
- Include climate change in regional conservation partnership planning processes.

FRAMEWORK IN DEPTH: GOAL E - CONTINUED

Priority Science Actions

Strategy E1 under Goal E supports implementation of priority science actions identified by the 2017-2021 Science Action Agenda, the Interagency Ecological Program, the salmon and Delta smelt resiliency strategies, and related socioeconomic research.[19,21,24,25,26,27] In response to declining native species populations and reduced ecosystem health, efforts are accelerating to restore ecological processes and recover ecosystem functions in the Delta.[25,26] Advanced scientific methods and tools such as computer models are needed to plan and implement projects in an integrated, consistent, and systematic way and to improve implementation of adaptive management over the long term.[28,29,30,31,34,35,36,37] Efforts to set meaningful, collaborative priorities should be supported and strengthened.

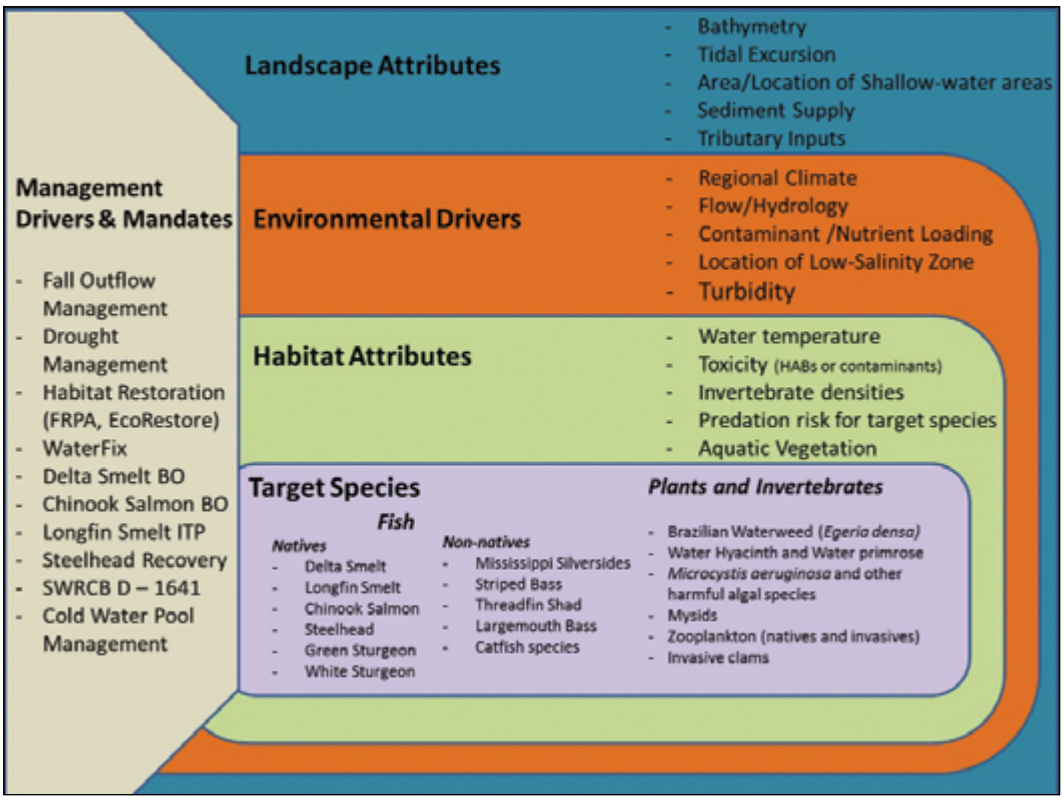
As mentioned earlier in this section, one important reference for the *Delta Conservation Framework* in terms of identifying Delta science action priorities that support Framework conservation and restoration goals is the 2017-2021 Science Action Agenda (SAA).[19] The Agenda, a collaborative document coordinated by the Delta Science Program, "identifies science actions that fall between the mission statements and priorities of a single group, program, or agency but are otherwise recognized as cross-agency and multi-group priorities, as feasible to implement and perform, and as opportunities to promote collaborative efforts. In this way, the SAA fills gaps and serves as the glue for synergistic and multi-benefit science to support important management needs." [19]

The *Delta Conservation Framework* references the SAA because it is founded on the latest Bay-Delta science and earlier efforts to identify high impact priorities. It also expands upon the critical activities of existing collaborative efforts, including IEP and the Delta Regional Monitoring Program (Delta RMP). It further advances the vision of One Delta, One Science and the broad Delta Science Enterprise.

Of particular relevance to the *Delta Conservation Framework* is the priority placed on understanding the human dimension of conservation[27] in the SAA, as well as the management needs outlined in the SAA addressing landscape-scale practices to evaluate the functionality of restored areas, conduct effective planning, and assess potential cumulative effects. SAA priority science actions focused on these management needs include: 1) developing methods for evaluating long-term benefits of habitat restoration based on current understanding of how species use restored areas and how use changes over time as habitats evolve (such as outlined in the Tidal Wetland Monitoring Framework;[23] and 2) estimating and assessing the system-wide effects of location and sequence of tidal marsh habitat restoration projects in areas that are impacted by sea level rise and climate change.

San Joaquin Restoration Program biologist holds first fall run Chinook salmon reintroduced to the river.

FRAMEWORK IN DEPTH: GOAL E - CONTINUED



IEP Science Strategy conceptual model.

A second important resource for the *Delta Conservation Framework* and regional conservation partnerships is the Interagency Ecological Program Science Strategy.[21] This agenda guides IEP agencies as they select studies for the IEP Work Plan and employ strategies to achieve the goals of the 2014 Strategic Plan.[24] Other planning efforts, including the Delta Science Program's SAA, are taken into consideration in the setting of the IEP's science agenda, and vice versa. By institutionalizing a science agenda, the IEP serves evolving priority management needs, policy needs, and diverse perspectives.[32] The IEP Science Agenda uses a conceptual model (see above) and emphasizes five areas of near-term science: effects of climate change and extreme events; the ecological contribution of restored areas; the impacts of non-native species; food webs; and the restoration of native species and communities. For each of these topic areas, the Science Agenda lays out the current knowledge base and lists priority science questions to inform management of needs for monitoring, focused studies, data synthesis, and coordination. The *Delta Conservation Framework* supports this kind of strategic approach to key science questions in the San Francisco Estuary.

Another important strategic science initiative that can inform decision-making by regional conservation partnerships and the *Delta Conservation Framework* is the Collaborative Science and Adaptive Management Program (CSAMP).[33] The CSAMP is coordinating a research program to investigate to what extent increased Delta outflow can positively affect environmental drivers and habitat attributes important to Delta smelt resiliency.[26] The CSAMP will determine appropriate research methods for evaluating management actions in the *Delta Smelt Resiliency Strategy* (details in Section III, p. 88) individually and synergistically, and will also oversee implementation and synthesis of results to inform subsequent management actions. In addition, those entities implementing the *Sacramento Valley Salmon Resiliency Strategy* will consult with CSAMP regarding designs for research, monitoring, and evaluation to assess action performance, review of proposed research or monitoring, and progress reporting.[25] These collaborative efforts can help inform regional conservation strategies and actions targeting endangered fish.

The Delta Ecosystem Integrated Modeling Steering Committee is another collaborative science and management effort, supported by the Delta Stewardship Council. This effort aims to integrate Delta ecosystem modeling, model users, and decision makers, and to build capacity by sharing data sets and equations that are required for integrated modeling. The committee effort seeks to demonstrate the value of integrated models for management decisions by creating and

documenting transparent, repeatable processes for addressing complex Delta issues.

In addition to these collaborative science and management efforts, tools for integrated computer modeling are also important resources for planning within the *Delta Conservation Framework*. Well-established modeling tools commonly used to analyze Delta hydrodynamics, water quality and ecological conditions include CalSim 2 and DSM2.[30,34] Additionally, the State Department of Water Resources' Fish Restoration Program has initiated and begun developing another modeling effort that can help regional conservation managers ensure consistency with other restoration goals. With the help of this effort, the Department can work collaboratively with other tidal restoration practitioners to better understand how collective restoration efforts are impacting salinity and the tidal prism on a system-wide scale (see Quick Links p. 132).

Longfin smelt in lab. Photo: DWR

Good science and strong models benefit from consistent data from monitoring programs, another important component of *Delta Conservation Framework* efforts to support successful outcomes with data-based results. One cornerstone new monitoring program is the Tidal Wetlands Monitoring Framework (TWMF) for the Upper San Francisco Estuary.[23] This monitoring framework will develop scientifically sound, project-specific plans to monitor the effectiveness of tidal wetland restoration in providing benefits to at-risk Delta fish species. TWMF will serve as a model for preparing similar frameworks for the assessment of other conservation actions in the Delta. It includes recommendations for data management, analysis, quality assurance, and reporting protocols for compliance with various regulations and policies. Regional conservation partnerships can learn from the protocols and the results of the TWMF.

Finally, to achieve the multi-benefit — float all boats — approach embraced by the *Delta Conservation Framework*, all this biological and physical science research must also be integrated with social science evaluations of how human uses of Delta landscapes directly influence conservation opportunities.[27] The *Delta Conservation Framework* supports strong consideration of the needs and opinions of landowners and the public, both of which are essential to long lasting conservation success. When designing and adaptively planning for future Delta landscapes, regional conservation partnerships should consider specifics on local cultures, local economies, and human interactions with restored landscapes revealed by socioeconomic research. This should help ensure that conservation projects fit within a broader cultural context that supports the "Delta as an evolving place", as outlined in the Delta Reform Act (CA Water Code §85054).

A generalized water resources modeling system for evaluating operational alternatives of large, complex river basins, CalSim 2 is used by California's state and federal water projects to simulate operations. DSM2, a second modeling package, is used by water managers, engineers, and scientists for analysis of complex hydrodynamic, water quality, and ecological conditions in riverine and estuarine systems.[30,34]

Many of the Delta's science programs also highlight the importance of considering the human impacts of natural resource management decisions and the big picture effects of changing land use in the Delta when planning for conservation. In order to integrate these factors into conservation planning and decision-making, a variety of tools and processes are available.[33,34,35,38,39,40]

See Guide to Related Plans and Programs pp.128-132 for more detail on initiatives described above.

FRAMEWORK IN DEPTH: GOAL E - CONTINUED

Conservation Status and Progress

Strategy E2 under Goal E suggests using adaptive management, including coordinated area wide monitoring programs, as an integrated part of conservation management. Adaptive management involves a series of cyclical steps that include: defining the problem; establishing measurable goals and objectives; modeling linkages between objectives and proposed actions; selecting actions and related performance measures; designing and implementing actions and developing an associated monitoring plan; analyzing, synthesizing, and evaluating new data; disseminating learned information; and adapting practices to incorporate what was learned. [16]

Adaptive management allows land, water and wildlife managers to proactively look ahead to potential sources of uncertainty such as drought, deluge, earthquakes, invasive species, or restoration timelines and budgets, and to use accumulated knowledge in a structured approach to management and decision-making. For Delta conservation partnerships to evaluate progress on conservation projects or programs, they must be able to determine baseline ecosystem conditions, quantify the efficacy of conservation actions, and assess progress towards landscape-scale goals and objectives.

As a science-based, flexible approach to resource management decision-making, adaptive management programs offer the opportunity to make and implement decisions while simultaneously conducting research to reduce the ecological uncertainty of a decision's outcome.[35,36,37] This approach also facilitates resource management that is transparent, collaborative, and responsive to changes in scientific understanding. Multi-stakeholder collaboration, decision-support, scenario-evaluation tools, and conceptual and simulation models, are available to help plan and implement this assessment process (see Section V1).

This strategy of the *Delta Conservation Framework* recognizes the need for landscape scale adaptive management of conservation projects and programs, and the current programs underway to support it. In the Delta three prominent adaptive management programs are already in place to plan, assess, and evaluate the progress of conservation in meeting initial goals and objectives.

1. **The Collaborative Science and Adaptive Management Program**[33] (CSAMP) for the Delta was established in 2013 to inform sound decision-making regarding the implementation and revision of the current US Fish and Wildlife (USFWS) and National Marine Fisheries Service (NMFS) Biological Opinions on the operations of the State Water Project (SWP) and Central Valley Project (CVP). A management team (CAMT) under the CSAMP is designed to answer a set of prioritized scientific questions, and identify new initiatives based on the results of these studies.
2. **The Adaptive Management Program for the California WaterFix and Current Biological Opinions on the Coordinated Operations of the Central Valley and State Water Projects**[35] (the AMP) was established by DWR, CDFW, the NMFS,

UC Davis and USGS collaborate on sampling for the Complete Marsh Project in the Rush Ranch National Estuarine Research Reserve in Suisun Marsh. Photo: Amber Manfree

A blue-green algae bloom producing cynobacteria that killed fish in this reservoir. Photo: CDFW

USFWS, and the Bureau of Reclamation (a.k.a five agencies) in 2017. Collectively, the intention is for the five agencies commit to ongoing adaptive management in implementing the current BiOps, as well as future operations under California WaterFix.[48] The aim is to decrease uncertainty and improve the performance of CVP and SWP water operations in protecting listed species and maintaining water supply reliability.

3. **The Delta Stewardship Council Interagency Adaptive Management Integration Team**[37] (DSC-IAMIT) formed in 2016 to address the gaps and inefficiencies associated with having multiple, distinct adaptive management programs. The DSC-IAMIT is currently focused on providing technical and scientific recommendations on how adaptive management of restoration projects in the Delta and Suisun Marsh can be developed and implemented.[39]

The *Delta Conservation Framework* recommends that the goals and objectives of conservation planning efforts, and program or project budgets, be woven into a strong adaptive management approach as appropriate, given the high level of uncertainty of desired outcomes in the Delta. Adaptive management actions must inform the planning and implementation of regional conservation strategies, or similar bottom-up collaborative partnership approaches. In addition, regional conservation partnerships should use adaptive management to test best management practices for projects designed to benefit Delta ecosystems and for multi-benefit projects linked to Delta agriculture and communities.

Conducting adaptive management across larger landscapes or to address multi-interest mandates will always be challenging. The Review of Research on the Sacramento-San Joaquin Delta as an Evolving Place by the Delta Independent Science Board[40] and the Delta Science Program SAA suggests that more research and interdisciplinary science is needed to inform decisions on when, where, and how adaptive management can be integrated into larger planning, design, and management frameworks.

Nutrients are one current challenge for Delta adaptive management programs. Nutrients are increasingly affecting water quality in the San Francisco Estuary and its watershed due to changing environmental conditions (turbidity, runoff, water temperature, etc.). Since 2015, the Central Valley Regional Water Quality Control Board and a stakeholder advisory group have worked on a collaborative nutrient research plan and management strategy. Concerns include cyanobacteria blooms, invasive aquatic macrophytes, nutrient forms and ratios, numeric modeling, and drinking water.

For more information on the programs mentioned under this strategy see Guide to Related Plans and Programs, p. 128-132.

FRAMEWORK IN DEPTH: GOAL E - CONTINUED

Climate Change Effects

Strategy E3 under Goal E emphasizes developing resources and recommending best practices for increasing wildlife and ecosystem resiliency to climate change. Climate change is already affecting California ecosystems, biodiversity, and agricultural land throughout the state.[41,42,43,44,45,46,47,48,49,50] Case studies have shown that climate change has increased temperatures, altered hydrology, changed precipitation levels, increased drought-induced water stress and adverse effects on wildlife habitats, and impacted agricultural production in the Delta and Central Valley watersheds.

The *Delta Conservation Framework* recommends that more resources and best practices be developed to address projected climate change effects and maintain or increase the resiliency of ecosystems, wildlife, and conservation projects.

Climate change impacts will continue to increase over time in coastal and estuarine systems, including the Delta.[49,50,51,52,53] During the next century, California winters will likely become wetter and warmer, with more extreme weather events earlier or later in the season, reduced snow packs in the Sierra Nevada, earlier snowmelt, more precipitation falling as winter rain than snow, and increases in run-off quantity and velocity during storm events.[49,53,54]

Accordingly, summers will be longer, hotter, and drier. This will likely result in warmer summer water temperatures, changes in water quality, and increases in water demand by people and wildlife.[55,56,57,58,59] The Delta region is expected to experience more intense winter flooding and storm events, causing greater erosion of riparian areas and increased sedimentation in wetlands.[49] In the summer there will be increased likelihood of saltwater intrusion farther upstream in the Delta, disrupting ecosystem processes, food webs, agriculture, and local water supplies.[45,49]

Globally, sea level is projected to increase between 0.22-1.5 meters (0.72-5 feet) in the 21st century, or even to as high as three meters (10 feet).[41,49] Sea level rise (SLR) combined with more extreme storm events and tidal action will put additional pressures on Delta levees.[50] Assuming a 1.5-meter SLR by 2050 under a scenario in which there are no significant global efforts to limit or reduce emissions (RCP 8.5)[50] it is anticipated that the acreage of flood prone land (during a 100-year flood event) in Solano County will increase from 15,241 to 69,877 acres.[49] In Contra Costa County, flood-prone land is expected to increase from 847 to 8,607 acres.[49] In Sacramento County it is expected to increase from 171.4 to 411 acres.[49] An additional more extreme climate scenario (H++) that incorporates the likelihood of extreme SLR of up to 10 feet in San Francisco by 2100 (see Figure 4.1), should be consid-

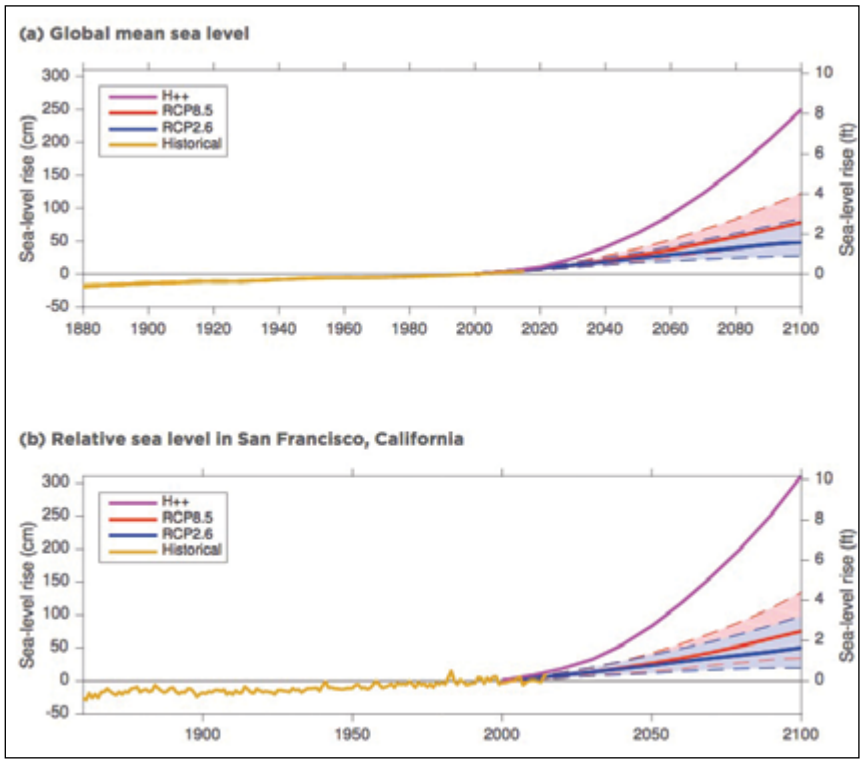


Figure 4.1
Comparison of the projections of (a) Global mean sea level, and (b) Relative sea level in San Francisco, CA. Source: Griggs et al 2017.[50] A "Representative Concentration Pathway" (RCP) represents a greenhouse gas (GHG) concentration trajectory, adopted by the Intergovernmental Panel on Climate Change (IPCC).[41] The IPCC recognizes four RPCs, or projected scenarios, for climate change. They are: RCP 2.6 (global annual GHG emissions peak between 2010 and 2020 then decline); RCP 4.5 (emissions peak around 2040 then decline); RCP 6 (emissions peak around 2080 then decline); and RCP 8.5 (emissions continue to rise throughout the 21st Century). RCP 8.5 is the scenario with the highest amount of human-generated emissions.

ered alongside the probability distributions for other scenarios (RCPs 2.6, 4.5, and 8.5).[49] At this point, however, it is scientifically premature to estimate the probability that the more extreme scenario will come to pass and, if so, when the world will move onto that trajectory. [49]

Looking ahead, the *Delta Conservation Framework* recognizes that climate change impacts must be given immediate and sustained consideration if the region is to adapt without serious hardship or ecological losses. Regional conservation partnerships and resource managers need to develop actions that integrate Delta climate change adaptation into ongoing Delta conservation management practices. Creating more redundancy, interconnectivity, diversity, and complexity of landscape features and land stewardship will help increase resiliency and sustain wildlife and ecosystems.[60] Conservation managers must also consider how the ongoing need to maintain water supply reliability for human use, and impending climate change impacts, will continue to put pressure on Delta ecosystems, levee systems, and agricultural operations. Over the long term, the *Delta Conservation Framework* supports regionally integrated management of water, energy, food, and related ecosystem processes to better adapt to global climate change at the regional scale.

The Framework also recommends that regional conservation partnerships including climate change in project planning examine a range of scenarios and tradeoffs. Scenario evaluation is essential for long term, science-based decisionmaking.

Anticipated Climate Change Effects on Delta Ecosystems[46,498,49,50,51,52,53,54,55,56,57,58,59,60]

Distribution of Delta Ecosystems: The location, extent, and composition of Delta ecosystems currently at or below sea level will change as a result of increased sea level, saltwater intrusion, and shifts in the tidal hydrologic system. Tidal wetland ecosystems will become more deeply inundated, unless they can accumulate additional layers of sediment or organic matter and "migrate" upslope. Wetlands protected by levees will be submerged if levees are overtopped, unless strategies are implemented to raise the elevations. Salt marsh and freshwater marsh are among the natural communities most exposed and vulnerable to climate change. The Delta also supports species that have been identified as climate vulnerable such as salt marsh harvest mouse and Delta smelt. Fluctuations in the size of wildlife populations will occur at different rates, because individual species will respond differently to changes in ecosystems. While some species will adapt in place, others will move to more suitable areas or become locally extinct.

Flood risk: Rising sea levels, increased tidal range and winter river flows, and more intense winter storms will significantly increase the hydraulic pressure on levees in areas where current farming practices continue and subsidence increases over time. If key levees collapse during a storm or seismic event, it could lead to catastrophic seawater intrusions and flooding throughout the Delta. Portions of the Suisun Marsh are particularly vulnerable to these anticipated stressors and tidal marsh drowning.

Water quality: Changes in the timing and volume of freshwater inflows and the projected increase in sea level make it possible the Delta will experience higher salinities, requiring increased intervention to maintain water quality standards . Additionally saline water will continue to seep into subsided areas. Stream temperatures throughout the region could also increase with climate change as ambient air temperatures rise and inflow changes. For example, projections for estuarine inflows are expected to be 20 percent higher on average October through February, and 20 percent lower March through September.

Average temperature and precipitation: The Delta region is expected to experience increases in average ambient air temperatures. January average temperatures are expected to increase by 4.5-4.9°F by 2070; average July temperatures are projected to increase by 6.6-6.9°F by 2070. Annual mean precipitation is expected to increase in Solano County (from 19.4 to 25.4 inches), Contra Costa County (from 18.4 to 23.1 inches), Yolo County (from 19.4 to 25.1 inches), Sacramento County (from 18.4 to 22.2 inches), and San Joaquin County (from 13.8 to 16.8 inches) by 2100 (RCP 8.5 emission scenario). Upland areas of the Delta, including portions of Contra Costa, San Joaquin, and Sacramento counties, are also projected to experience increased risk of wildfire.

Ecosystem services: The phenology of animal migration, flowering, and insect emergence is expected to shift in response to increased temperatures. Shifts in phenology that cause plants and pollinators to be out of sync, could disrupt pollination timing and associated natural and agricultural plant production. The structure and function of transition zones and upland ecosystems are also likely to be disrupted by shifts in temperature and precipitation, and increased frequency of extreme weather events. Resulting droughts and extreme storms will directly affect water availability and quality, and increase flood risk for Californians in the Delta and associated watersheds.

California's Fourth Climate Change Assessment: 2018[60]

Since California's last state-led climate change assessment in 2012, the Golden State has experienced a litany of natural disasters. This includes four years of severe drought from 2012 to 2016, an almost non-existent Sierra Nevada snowpack in 2014-2015 costing $2.1 billion in economic losses, widespread Bay Area flooding from winter 2017 storms, and extremely large and damaging wildfires climaxing with the 2018 Camp Fire that destroyed Paradise. California's most recent climate assessment, predicts the state can expect even more in the future.

The results are alarming for our state's future: an estimated four to five feet of sea level rise and loss of one to two-thirds of Southern California beaches by 2100, a 50 percent increase in wildfires over 25,000 acres, stronger and longer heat waves, and infrastructure like airports, wastewater treatment plants, rail and roadways increasingly likely to suffer flooding.

California's latest assessment dives into climate consequences on a regional level. Academics representing nine California regions spearheaded research and summarized the best available science on the variable heat, rain, flooding and extreme event consequences for their areas.

The following is some information largely excerpted from the assessment's regional sections on the Sacramento Valley and the San Joaquin Valley, which encompass the Delta.

Sacramento Valley:

- In terms of agriculture, climate change will bring about longer growing seasons; insufficient cold for some tree crops; low elevation flooding; changes in productivity of current crop varietals; and conversion of agricultural land to other land uses.
- In terms of floods, climate change will bring about more extreme floods; greater floodplain vulnerability; pressure to expand flood bypasses, levees, and flood storage in reservoirs; and higher Delta water levels.
- In terms of water supply, the region will experience more extreme droughts; pressure to reduce water supply storage due to larger floods; and possibly greater water demands from higher crop and landscape water use. In the Delta, saltwater will intrude into areas from which water is pumped for agricultural and municipal uses.
- In the Delta, higher sea levels, levee subsidence, and greater floods will threaten levees. By 2050-2080, some Delta levees may no longer meet federal standards.
- In terms of the ecosystem, climate change will produce higher temperatures that threaten native species, make reservoirs less effective for sustaining salmon populations, and increase Delta water levels.

Some of the more promising ways to reduce climate change risks to the Delta region related to conservation and agriculture include: climate-smart buildings and more accessible "cooling centers" for heat waves; strategic forest thinning, controlled burning, and fire reduction practices; enhanced emergency preparedness with a focus on disadvantaged communities; increased land use planning to prepare for extreme floods and drought, including innovations to levees, bypasses, and reservoir capacity; increased water availability and attention to integrated water supply management within the entire watershed; improved management for climate-adaptive native species and assisted migration to protect ecosystem services, including outdoor recreation; and incorporation of climate risks into regional plans for energy, water, transportation, land use and conservation.

San Joaquin Valley:

In the San Joaquin Valley, the problems and solutions related to climate change challenges are similar but different. In general however, the agricultural sector may see shifts in cropping patterns and repurposing of fallowed lands. Regulatory and physical constraints on water supply for agriculture, and environmental factors such as warmer temperatures and more variable precipitation, new pests, and reduced chill hours will, affect agricultural decision-making and implementation. Managing sustainable agro-ecosystems in the San Joaquin Valley will require a systems approach that accounts for resource linkages to other economic sectors, such as water for cities and the environment.

Ecosystems in the San Joaquin Valley are highly vulnerable to climate change given existing stressors and the lack of organization of landscape-scale science, funding, and mitigation of adverse impacts within the region. This is particularly the case during prolonged droughts when scarce water supply disproportionately impacts ecosystems. Building resilience in ecosystems through active management, developing physical and biological connectivity, and restoring key biophysical processes will greatly improve ecosystem response to acute extreme climate events and chronic anthropogenic stressors.

Photo: Carson Jeffres

CONSERVATION OPPORTUNITY REGION

Balancing Conservation and Development in the West Delta

Dutch Slough. Photo: Christina Sloop

Like many areas of the Delta, prime farmland and wildlife habitats are threatened by urban development in the West Delta. All along the Contra Costa County shore open spaces and habitats are feeling the squeeze – landward from populations seeking more affordable homes and lives in the ever more expensive Bay Area, and seaward from rising sea and salinity levels pushing in from the upper estuary. Add noxious invasive species and impacts from agricultural operations and the West Delta region faces many conservation challenges.

Current West Delta conservation efforts reflect *Delta Conservation Framework* goals for forward-thinking regional partnerships and strategies. The Framework also highlights the West Delta as a "conservation opportunity region" where a critical mass of natural landscapes, public lands, potential conservation opportunities, conservation-minded people, and existing partnerships occur in one place. The Framework seeks to support such regions and partnerships in strategic conservation planning. Together these regions will one day add up to a healthier Delta – both for people and wildlife.

Regional Setting

The West Delta conservation opportunity region is located in northeastern Contra Costa County. The area roughly extends along Highway 4 between Bay Point and Discovery Bay, and reaches north to Bethel Island. While much of the area adjacent to the highway is developed, the more eastern and northern portions of the West Delta are mainly a rural mosaic of farms, ranches, and open space. Public lands include the Antioch Dunes National Wildlife Refuge and Big Break Regional Shoreline. These lands offer recreational and educational opportunities to the public, and provide wildlife habitat. The adjacent Dow Chemical plant manages the 472-acre Dow Wetlands Preserve of tidal marshes and beaver ponds. Other public lands in the region include potential regional park sites (identified in the *East Bay Regional Park District Master Plan*), Jersey Island (owned by the Iron Horse Sanitary District) and creek and riparian habitats (owned by the Contra Costa County Flood Control and Water Conservation District). Due in part to its proximity to the San Francisco Bay Area, the population in the area is growing. Forecasts predict a population increase of 127,000 people in Contra Costa County between 2007 and 2025, with a significant portion of this urban growth occurring in the West Delta. The West Delta is also home to over 150 rare species, however (see At a Glance sidebar). The potential loss of habitat for these species could create conflicts between conservation and economic development.

Planning Context

Conservation planning in the West Delta region is currently most strongly guided by the *East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan* (ECCC HCP/NCCP).[1] These plans provide a framework for comprehensive species, wetlands, and ecosystem conservation that contributes to the recovery of threatened and endangered species while clearing regulatory obstacles to continued economic development. They help to avoid costly and time-consuming project-by-project permitting and uncoordinated, biologically ineffective mitigation. The HCP/NCCP enables multiple stakeholders — including Contra Costa County, the Contra Costa County Flood Control and Water Conservation District (Flood and Water District), the East Bay Regional Park District, and the Cities of Brentwood, Clayton, Oakley, and Pittsburg — to coordinate endangered species permitting for activities and projects in their respective management areas. The City of Antioch, on the western edge of the West Delta, originally elected not to participate in the ECCC HCP/NCCP; however, as of 2017, they began developing their own HCP/NCCP, modeled after the ECCC HCP/NCCP.

At the state level, the California EcoRestore initiative, a comprehensive suite of habitat restoration actions to support the long-term

West Delta At A Glance

Size: 100,000-110,000 acres

Location: Northeastern Contra Costa County

Elevation Range: 91 feet below sea level to 436 above sea level

Zoning: 30-35 percent agricultural; 20-25 percent public or conservation lands

Other Primary Land Uses: urban, flood management

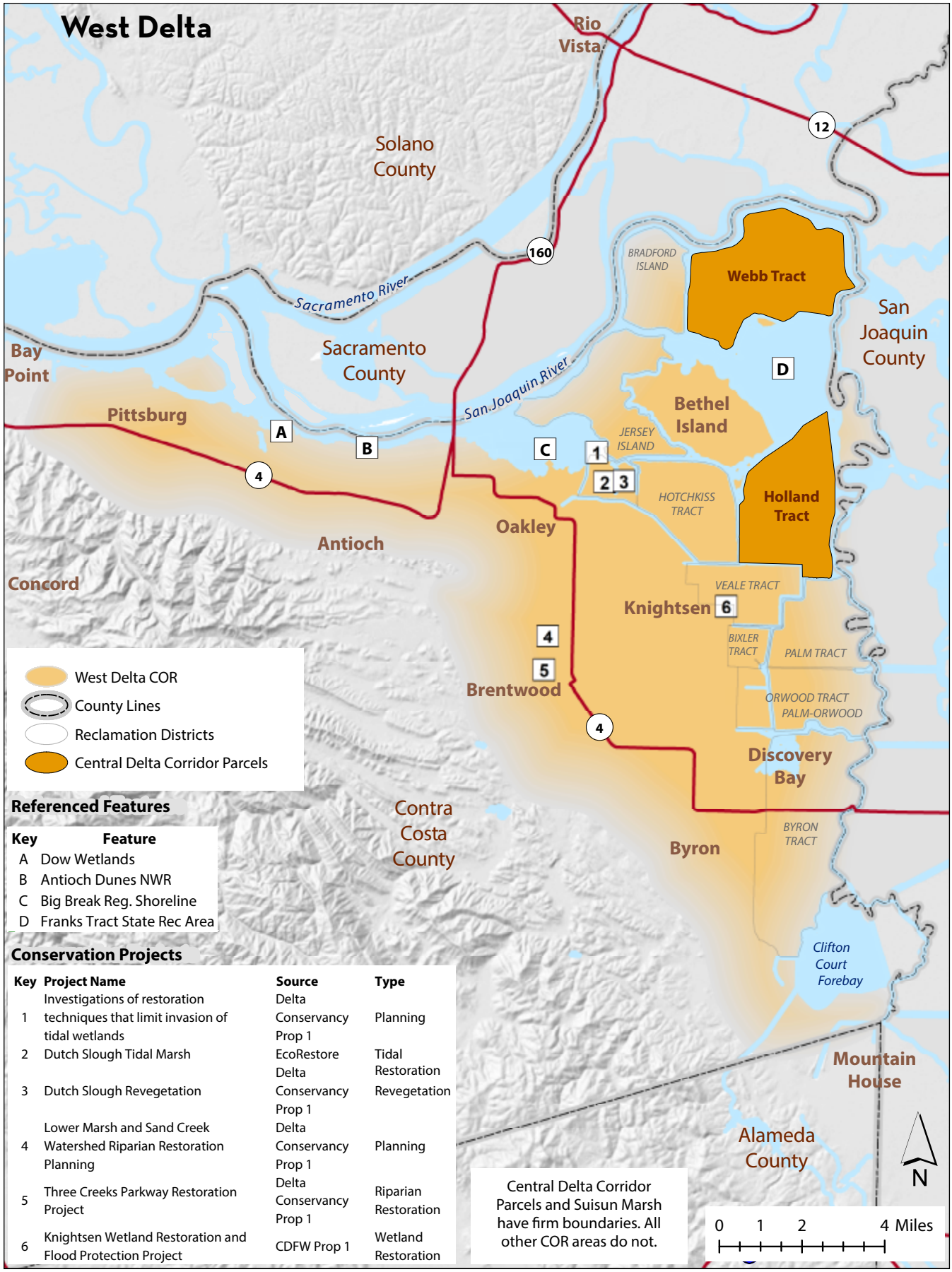
Urban Population: 243,000-283,000

Rural Population: 9,000-20,000

Recreational Opportunities: Trails, wildlife observation, boating, picnicking, nature study

Sampling of Listed Species: Delta smelt, longfin smelt, Chinook salmon, Central Valley steelhead, giant garter snake, Swainson's hawk, salt-marsh harvest mouse, San Joaquin kit fox, California black rail, California tiger salamander, California red-legged frog, vernal pool fairy shrimp, soft bird's beak, Antioch Dunes evening primrose, Contra Costa wallflower.

CONSERVATION OPPORTUNITY REGION



Map: CDFW, 2018

health of the Delta and its native fish and wildlife species, supports a number of projects situated in the West Delta including the Dutch Slough and Winter Island Tidal Marsh Restoration projects.

At the county level, voters approved an Urban Limit Line (ULL) for Contra Costa County in 1990, which was extended in 2006. The limit line restricts urban development to no more than 35 percent of the County, requiring in turn that at least 65 percent of the County be preserved for agriculture, open space, wetlands, parks, and other non-urban uses. The ULL helps to prevent urban sprawl, provide more infill housing development near transit and existing urban infrastructure, and ensure that schools, fire, and police services are not overburdened.

Opportunities for Conservation

Several major conservation opportunities for the West Delta region were identified in the ECCC HCP/NCCP. These include the Three Creeks Parkway Restoration Project, the Dutch Slough Tidal Marsh restoration project, and enhanced habitats and connections along the Contra Costa shoreline containing Antioch Dunes National Wildlife Refuge, Dow Wetlands Preserve, and Big Break Regional Shoreline. Other conservation opportunities in the region include the restoration of part of Franks Tract to tidal marsh (also a feature in the Central Delta Habitat Corridor of public lands, see p. 63).

Planned or existing conservation projects include the following:

DUTCH SLOUGH TIDAL MARSH RESTORATION

This critical, large-scale habitat restoration project broke ground in 2018 two decades after it was first conceived. The site, located in Oakley on land formerly slated for urban development, offers suitable soil types and elevations for the creation of 1,187 acres of tidal marsh and complex intertidal channels favored by native Delta species. The site encompasses three leveed parcels to be restored to a mosaic of tidal marsh, riparian woodland, open water, and managed marsh (see Figure 5.1, p. 139).[2] Native grasslands and riparian forests will also be restored in the upland portions of the site. The Dutch Slough project is adjacent to Big Break Regional Shoreline and Marsh Creek and consequently provides landscape-scale connectivity benefits for the Delta ecosystem.

WINTER ISLAND TIDAL HABITAT RESTORATION

This 589-acre project will restore tidal action to the interior of Winter Island. The island, once farmed by handful of socialist utopians in the 1890s, is located just north of Pittsburg. The current goal is to breach the perimeter levee to create both aquatic habitat at intertidal and shallow subtidal elevations, as well as associated high marsh and riparian habitats, to benefit native fish species.

Dutch Slough. Photo: Christina Sloop

KNIGHTSEN WETLAND RESTORATION AND FLOOD PROTECTION

This project will restore a mosaic of habitats on a 645-acre property near Knightsen, and provide flood protection for the community. The project will convert agricultural and fallow fields to habitat for special status species (including giant garter snake, western burrowing owl, among others). This multi-benefit project also improves Delta water quality and provides new recreational opportunities. The project is a partnership with the ECCC Habitat Conservancy, EBRPD, and the Knightsen Community Services District.

Burrowing owls. Photo: Rick Lewis

Potential Solutions to Recognized Challenges

The primary conservation challenges in the West Delta relate to habitat loss due to housing development, impacts from agricultural operations and noxious invasive species, and projected flooding of shoreline ecosystems and infrastructure due to climate change.

WILDLIFE-FRIENDLY AGRICULTURE

Agriculture has been the main way of life, industry, and cultural linkage to the land in the West Delta for several generations. According to the 2015 *Economic Contributions of Contra Costa County Agriculture Report*,[2] agriculture in the county provides 2,277 jobs and contributes approximately $225 million to the local economy. With such strong cultural ties to the land, local landowners are concerned about livelihoods and lifestyles being displaced by restoration and habitat protection activities. Wildlife-friendly farming can provide a welcome link between these two beneficial uses of Delta landscapes, however. Wildlife-friendly agricultural practices include farming crops that also benefit wildlife — for example rice or irrigated pasture — and providing drainage ditches, hedgerows, and trees for habitat value.[3] The Central Valley Farmland Trust (CVFLT), formerly Brentwood Agricultural Land Trust, is a land trust that works with West Delta farmers and the agricultural community to protect fertile orchards and farms permanently. By partnering with local agencies, and using agricultural easements, CVFLT has helped to secure properties such as the 520-acre Cecchini property near Discovery Bay. Such projects have helped preserve farmland at risk of development[4] and provide habitat for the Swainson's hawk, burrowing owl, and the Western long-eared bat.

RECREATIONAL OPPORTUNITIES

Recent acquisitions by the East Bay Regional Parks District (EPRPD) in the West Delta conservation opportunity region include future potential parklands. On several of these properties, the intent is to provide multiple benefits including restored habitat for special status species and new trail links and recreational opportunities. Such efforts are also creating new collaborations. The EBRPD is collaborating with the Ironhouse Sanitary District, for example, to evaluate sites on Jersey Island for not only recreation and education opportunities, but also opportunities to use reclaimed water for farming and restoration. The District's 3,520-acre property on Jersey Island uses recycled water to irrigate fields of hay.

INTEGRATED FLOOD MANAGEMENT

In the West Delta, reclamation districts maintain the levees that provide flood protection for agricultural operations. The

CONSERVATION OPPORTUNITY REGION - CONTINUED

Contra Costa County Flood Control and Water Conservation District (the District) serves all of the West Delta conservation opportunity region. The District owns property throughout the County for the purpose of constructing and maintaining regional flood control basins, channels, and creeks. Since 1951 when it was formed (funded primarily through property taxes and developer fees), the District has worked to protect local communities from flooding. Today, the District offers regional flood protection and environmental resources stewardship in District-owned creeks. Within the West Delta conservation opportunity region, the District is actively seeking opportunities to have their facilities function as a combination of flood control and habitat, including along Marsh Creek, Walnut Creek, Pinole Creek, and other areas.

The District's $10 million Upper Sand Creek Basin flood protection and habitat restoration project in Antioch offers an example. The project will expand the basin to store eight times more storm water than before and build an 1800-foot-long dam, ranging in height from one to 40-feet. The project will also restore 3,500 linear feet of Sand Creek. The expansion will include planting over 2,500 willow trees, creating 10 acres of wetlands inside the basin, and installing an innovative trash capture device to help clean up the creek. This integrated habitat and flood management project is an important part of the District's Marsh Creek regional flood protection master plan, which significantly reduces the flood risk for Antioch, Brentwood, and Oakley residents living downstream along Sand Creek and Marsh Creek.

The District is also working with partners on the Three Creeks Parkway, a multi-benefit flood control, creek restoration, and public access project. The project will improve approximately 4,000 linear feet of Marsh Creek[1] in Brentwood by widening the channel with a floodplain bench and planting with native vegetation. Begun in 2015, this multi-agency public-private partnership project will transform some of the Marsh Creek flood control channel into high quality salmon and riparian habitat. Such efforts within existing infrastructure projects offer opportunities to enhance and connect surrounding conservation projects.

CLIMATE CHANGE AND ADAPTATION OPPORTUNITIES FOR LONG-TERM SUSTAINABILITY

In general, the Delta region is expected to experience more intense winter flooding and storm effects due to climate change, causing greater erosion of riparian areas and increased sedimentation in wetlands.[5,6,7] In the West Delta, as in other Delta regions, more intense winter storms with increased winter river flows will likely significantly increase the hydraulic pressure on levees which could lead to catastrophic flooding. In the summer, lower river

Three Creeks Parkway Project at the confluence of Sand and Marsh Creeks. Photo courtesy Contra Costa County Flood Control and Water Conservation District

flows could increase the possibility of saltwater intrusion farther upstream in the Delta, disrupting ecosystem processes, food webs, agriculture, and local water supplies along the Contra Costa shoreline. Annual mean temperatures and precipitation are expected to increase in the West Delta by 2100.[8]

Climate change is also expected to affect the range and habitat needs of special status species. The *Delta Conservation Framework* notes that the West Delta conservation opportunity region is located in an important transition zone between the Delta, the San Joaquin Valley, and the Mount Diablo ecosystems. The area supports the northern and westernmost extent of some species. As summers become dryer, conservation partnerships should work to create and restore habitats and protect movement corridors for species migrating to cooler, wetter areas. For example, as reduced rainfall leaves vernal pools in the area dry, species may need alternative seasonal wetlands and pools during the hydro-period of their life cycle. Species will also need safe movement corridors to new ranges.

Looking Ahead

The *Delta Conservation Framework* supports current and planned conservation efforts and partnerships in the West Delta, and suggests that more may need to be done to increase transition zones for wildlife as the climate changes and to link current habitat planning and preservation to the future. A regional partnership could develop a regional conservation strategy that considers all conservation opportunities in the West Delta region, including flood management and wildlife-friendly agricultural efforts that link the ECCC HCP/NCCP preserve area to surroundings.

The partnership base and vision for the West Delta region is already strong. Signatories to the Implementing Agreement of the ECCC HCP/NCCP include ECCC Habitat Conservancy, County of Contra Costa, City of Brentwood, City of Clayton, City of Oakley, the Flood and Water District, EBRPD, USFWS, and CDFW. For Dutch Slough and Winter Island, the state's DWR and CDFW are already strong partners in tidal marsh restoration efforts. For the Three Creeks Parkway Restoration Project, partners include American Rivers, the Contra Costa County Flood Control and Water Conservation District, Friends of Marsh Creek Watershed, and City of Brentwood. The *Delta Conservation Framework* supports the expansion of these early partnerships to better integrate conservation, flood management, and sustainability planning in the West Delta.

Swainson's hawk. Photo: Rick Lewis

QUICK LINKS

Dutch Slough Tidal Restoration Project
https://water.ca.gov/Programs/Integrated-Regional-Water-Management/Delta-Ecosystem-Enhancement-Program/Dutch-Slough-Tidal-Restoration-Project

East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan (ECCCHC 2006).
www.co.contra-costa.ca.us/depart/cd/water/HCP/documents.html

For more detailed descriptions of these conservation opportunity regions, see Appendix 2.

Guide to Related Plans and Programs

Adaptive Management Program for the California WaterFix and Current Biological Opinions on the Coordinated Operations of the Central Valley and State Water Projects (the AMP)

STRATEGY E2

The Delta Reform Act of 2009 identified adaptive management as the desired approach to reduce ecological uncertainty related to the management of the Sacramento-San Joaquin Delta ecosystems. The federal and state water operations agencies (Reclamation and DWR) and the state and federal fisheries agencies (USFWS, NMFS, and CDFW) (collectively, the Five Agencies) agree that adaptive management is the tactic best suited to advance the management of the Delta and its resources. However, there were differences among agencies regarding the definition of adaptive management and how and when to implement it. Under the AMP, the intention is for the five agencies to commit to ongoing adaptive management in implementing the current biological opinions, as well for future operations under California WaterFix. The aim is to decrease uncertainty and improve the performance of the Central Valley Project and State Water Project in protecting listed species and maintaining water supply reliability. To do this, significant new investments in related research, monitoring, and modeling are needed, with the understanding that all efforts (existing and new) will build on each other. The AMP relies on Collaborative Sciences Workgroups to develop priority science needs to support decision making. A new Interagency Implementation and Coordination Group (IICG) is to be formed to coordinate science and management recommendations coming out of the workgroups, and to support implementation of those recommendations. The IICG will make its recommendations to the Five Agencies for a decision by the agency or agencies with final decision-making authority. The AMP will also integrate with existing adaptive management plans or programs that are more focused on specific conservation goals or regions within the Delta.

Photo: Amber Manfree

Collaborative Science and Adaptive Management Program/ Collaborative Adaptive Management Team

STRATEGY E2

The CSAMP and CAMT were formed as part of a federal and state proposal to modify the court-ordered remand schedule for the salmon and Delta smelt biological opinions for the water export facilities. CSAMP is comprised of state and federal resource agencies, other public water agencies, and nongovernmental organizations. It was established in 2013 to promote the collaborative development of scientific information to inform sound decision-making regarding the implementation and revision of the current USFWS and NMFS biological opinions on the operations of the State Water Project and the Central Valley Project. Although CSAMP originated during litigation related to the biological opinions, the legal requirement for the program ended in 2015.

In addition to its focus on the initial scientific investigations, the program has served as a forum for discussion and consideration of emerging topics such as the effects of proposed drought operations, the efficacy of proposed seasonal Delta outflow augmentations, and implementation of the *Delta Smelt Resiliency Strategy*.

The CAMT's mission is to complete studies designed to answer a set of prioritized scientific questions, and identify new initiatives based on the results of these studies. CAMT has two scoping teams, one focused on Delta smelt (DSST), and the other focused on juvenile salmon (SST). Products currently being developed by the scoping teams and principal investigators include analysis and synthesis tools and reports concerning Delta smelt entrainment, potential biases in fish survey data, fall Delta smelt habitat effects, and juvenile salmonid survival.

See Quick Links p. 132 to access above plans and programs.

Delta Independent Science Board

ONE DELTA, ONE SCIENCE, STRATEGY E1

The Delta Independent Science Board (Delta ISB) provides independent oversight of the scientific research, monitoring, and assessment programs that support adaptive management of the Delta through periodic program reviews. The Delta ISB is composed of nationally or internationally prominent scientists with expertise to evaluate the broad range of scientific programs that support adaptive management of the Delta.

Zooplankton sampling in the Delta. Photo: CDFW

Delta Nutrient Research Plan

STRATEGY E2

This plan (the DNRP) is currently being developed by the Central Valley Regional Water Quality Control Board. A Stakeholder and Technical Advisory Group (STAG) was formed in 2015 to develop the DNRP as part of a Delta Nutrient Management Strategy, representing interests including water supply, drinking water, waterways, irrigated agriculture, environmental justice, wastewater, storm water, and resource management. To inform the DNRP, the STAG provides research recommendations that fill knowledge gaps in understanding the potential effects of nutrients in the Delta. A set of white papers now reflects information gathered through discussions among scientific working groups, and from a public workshop (CA EPA 2017). These white papers (available online) represent five topic areas: cyanobacteria blooms, invasive aquatic macrophytes, nutrient forms and ratios, numeric modeling, and drinking water. The STAG developed initial prioritization criteria and overall ranking of research for each topic area. Regional Water Board staff are now in the process of writing the *Nutrient Research Plan*, based on findings from the white papers, documents from scientific working groups, the public workshop, and the initial prioritization and overall ranking developed by the STAG.

Delta Regional Monitoring Program Science Enterprise

STRATEGY E1

This program monitors pesticides and toxicity, nutrients (nitrogen and phosphorous), mercury in fish, water, sediment, and pathogens. The mission of the Delta RMP is to produce objective and cost-effective scientific information critical to understanding regional water quality conditions and trends in the Delta. Results inform decisions on how to protect, and where necessary, restore beneficial uses of water in the Delta. The Central Valley Regional Water Quality Control Board, the San Francisco Estuary Institute-Aquatic Science Center, and other scientists and interested parties collaborate to conduct the Delta RMP. Representatives of publicly owned treatment works, municipal stormwater programs, irrigated agriculture, water suppliers, and state and federal agencies are participants in the program. Since state and federal laws require dischargers to monitor waters downstream of their discharge, coordinated regional monitoring allows them to pool their funds, as well as to share expertise to provide data for improved water quality management and informed policy decisions facing the Delta.

To skip these references go to p. 133

Guide to Related Plans and Programs - continued

Delta Science Program

ONE DELTA, ONE SCIENCE, STRATEGY E1

The Delta Science Program works to achieve the One Delta, One Science mission by funding research to fill critical gaps, conducting and facilitating science synthesis and independent peer review, coordinating agencies, and interpreting and communicating scientific information to decision-makers, stakeholders, scientists, and the public. Information gathered and evaluated by the program must be unbiased, independently peer-reviewed, relevant, authoritative, integrated across state and federal agencies, and communicated to Bay-Delta decision-makers such as agency managers, stakeholders, the scientific community, and the public. In 2018 the Delta Science Program coordinated the development of the *Delta Science Plan*,[32] which is a framework for conducting science that organizes and integrates Delta science activities and builds an open collaborative science community known as One Delta, One Science. Established by the Delta Reform Act of 2009, the Delta Science Program is the replacement for and successor to the CALFED Science Program.

Delta Science Action Agenda 2017-2021

ONE DELTA, ONE SCIENCE, STRATEGY E1

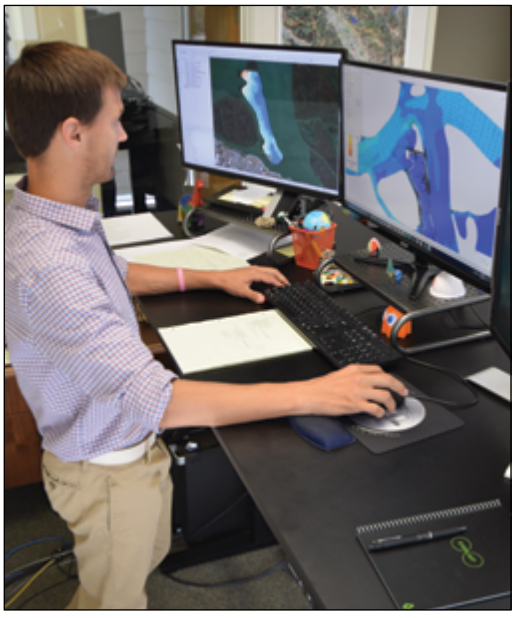
The Delta SAA prioritizes and aligns near-term science actions to inform management needs and achieve the objectives of the *Delta Science Plan*. The State of Bay Delta Science's (SBDS) past (2008 and 2016) and future publications synthesize the current scientific knowledge in the Delta, including science topics of high management concern in the Bay-Delta system. The knowledge gaps identified in the SBDS are used to guide updates to the SAA, and integrate science actions across multiple agencies and their science programs. The 2017-2021 Science Action Agenda identifies 13 science actions organized under five priority action areas that address knowledge gaps and build scientific infrastructure and capacity on a four-year implementation cycle:

1. Invest in assessing the human dimensions of natural resource management decisions.
2. Capitalize on existing data through increasing science synthesis.
3. Develop tools and methods to support and evaluate habitat restoration.
4. Improve understanding of interactions between stressors and managed species and their communities.
5. Modernize monitoring, data management, and modeling.

Delta Stewardship Council Interagency Adaptive Management Integration Team (DSC-IAMIT)

STRATEGY E2

The Interagency Adaptive Management Integration Team (IAMIT) aims to help achieve habitat restoration goals and increase restoration success for the benefit of the long-term health of the Sacramento-San Joaquin Delta and Suisun Marsh's native fish and wildlife species. The California Natural Resources Agency asked the Delta Science Program to convene an interagency technical team to develop recommendations to support adaptive management for the EcoRestore initiative. The focus was broadened in 2018 to support existing habitat restoration efforts besides EcoRestore, such as the Proposition 1 and 68 restoration grants programs. The goal is to create a strong foundation for habitat restoration adaptive management in the Delta, Yolo Bypass, and Suisun Marsh. The IAMIT supports both system-wide adaptive management and individual habitat restoration projects by identifying gaps, improving coordination, and providing technical assistance.



Data driven information sharing and scenario modeling helps inform collaborative adaptive management of a complex system with multiple interacting variables derived from both human actions and natural processes. Photo: Amber Manfree

See Quick Links p. 132 to access above plans and programs.

Fish Restoration Program

SCIENCE ENTERPRISE, STRATEGY E2

A collaborative effort between California Departments of Fish and Wildlife and Water Resources, the Fish Restoration Program (FRP) aims to restore 8,000 acres of tidal wetlands in the Delta and Suisun Marsh required by the 2008 USFWS Biological Opinion on the long-term operations of the state and federal water projects. The collaboration was established via the FRP Agreement in 2010. CDFW provides assistance to DWR in planning and implementing restoration and in monitoring the biological effectiveness of restoration. The program's monitoring team (the FRPMT) is responsible for assessing the biological effectiveness of the restoration project. The team coordinates the IEP's Tidal Wetland Monitoring Project Work Team that developed and recently published online the Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary, Standard Operating Procedures for recommended sampling methods, and the Effects of Tidal Wetland Restoration on Fish (an IEP technical report). The Fish Restoration Program's pilot monitoring studies are currently included in the IEP work plan. The FRPMT writes project-specific adaptive management and monitoring plans, conducts on-the-ground work to inform the work group products, and actually does the monitoring for FRP projects.

Interagency Ecological Program

STRATEGY E1

This program promotes collaborative and scientifically sound monitoring, research, modeling, and information synthesis for the Bay-Delta ecosystem. The IEP mission addresses high-priority management and policy needs in order to fulfill responsibilities established under various water rights decisions, the State and Federal Endangered Species Acts, and the Clean Water Act. The mission directives are carried out by multidisciplinary teams composed of agency, academic, nongovernmental organizations, and private scientists. The IEP consists of nine member agencies, including the Department of Water Resources, the Department of Fish and Wildlife, the State Water Resources Control Board, U. S. Fish and Wildlife Service, Bureau of Reclamation, U.S. Geological Survey, U. S. Army Corps of Engineers, National Marine Fisheries Service, and the Environmental Protection Agency. The IEP also partners with the San Francisco Estuary Institute and Aquatic Science Center, the Delta Science Program, and the Central Valley Regional Water Quality Control Board.[67]

Public Policy Institute of California

SCIENCE ENTERPRISE, STRATEGY E2

As a nonprofit, nonpartisan think tank, the Public Policy Institute of California (PPIC) is dedicated to informing and improving public policy in California through independent, objective, and nonpartisan research. PPIC includes three policy centers that integrate science information at the policy level to inform decision makers. Most relevant to the Delta is the PPIC Water Policy Center, which recommends water management solutions that support a healthy economy, environment, and society. Other PPIC capacities include the PPIC Higher Education Center, advancing practical solutions that enhance educational opportunities for all of California's students. Topics that may be relevant to the Delta include Climate Change/Energy, Economy, and Political Landscape. PPIC multidisciplinary research staff include experts in economics, demography, political science, sociology, and environmental resources. PPIC was established in 1994 to conduct research without partisan or ideological biases, encourage productive dialogue, and inspire the search for sustainable solutions in Sacramento and across the state.

Water supply and gentrification in the Delta continue to be major public policy issues for the region, and are often seen as at odds with conservation initiatives. Photo: Amber Manfree

To skip these references go to p. 133

Guide to Related Plans and Programs - continued

San Francisco Estuary Institute

DELTA LANDSCAPES PROJECT
SCIENCE ENTERPRISE, STRATEGY E1

SFEI is an aquatic and ecosystem science institute that aims to "provide independent scientific support and tools for decision-making and communication through collaborative efforts". SFEI's Resilient Landscapes Program focuses on assessing and improving the health of the waters, wetlands, wildlife, and landscapes of the San Francisco Bay Area and the Delta, which included the completion of the Delta Landscapes Project in 2016. Rather than attempting to recreate the Delta of the past, given the nature and scale of documented changes, the project instead highlights the services that altered Delta ecosystems currently provide and could provide in the future. Recommendations are based on extensive research that analyzes how the Sacramento-San Joaquin Delta used to function, how it has changed, and how it could evolve given implementation of a suite of conservation and management actions that focus on providing enhanced ecological function of Delta ecosystems into the future. Its recommended approaches to reestablishing or mimicking certain natural processes aim to establish an appropriate functional configuration of habitat types at the landscape scale, and they aim to use multi-benefit management strategies to create a more viable Delta ecosystem that can adapt and continue to provide valued functions as the climate and land uses change. The recommended approaches are also designed to integrate with the human landscape to provide ecosystem improvements that also benefit the agricultural economy, water infrastructure (and diversions), and urbanized areas in the Delta. The recommendations provided in *A Delta Renewed* directly inform a number of *Delta Conservation Framework* overarching goals, strategies, and objectives (see Section III).

State of Bay-Delta Science

ONE DELTA, ONE SCIENCE, STRATEGY E1

The State of Bay Delta Science is a regularly updated collection of synthesis reports on scientific topics that emphasize progress made on management-relevant science topic areas during the past decade, and identify remaining knowledge gaps. The 2016 SBDS report includes insights from recent scientific research regarding multiple stressors that impact the continuing existence and resilience of native species. These stressors include: habitat loss, increased frequency of extreme weather conditions linked to climate change, sea level rise, anthropogenic changes in flow regimes, potential for heightened importance of nutrients in Delta waterways (related to the spread of floating aquatic invasive plants, and influence the growth of phytoplankton at the base of the food web); and an ever-changing mixture of contaminants derived from agricultural, urban, and industrial discharges.[3, 71] The reports cover the status and population dynamics of endangered and threatened fish species; the Delta as a changing landscape; food web dynamics, climate change impacts, agricultural and urban water supply reliability; dynamics of water contaminants and their transportation; multi-dimensional models on distribution and movement of fish and food organisms; levee system vulnerability; nutrient dynamics, and contaminant effects in the Delta.

UC Davis Center for Watershed Sciences

SCIENCE ENTERPRISE, STRATEGY E2

Dedicated to the interdisciplinary study of critical watershed challenges, the UC Davis Center for Watershed Sciences (Center) was founded in 1998 by geologist Jeffrey Mount and fish biologist Peter Moyle. The original focus was to develop more integrated and imaginative approaches to water science and policy; over time, the Center grew in size and disciplinary breadth to stay ahead of potential water crises associated with climate change and increased water demands. It is now one of California's leading water management academic institutes. Today, the Center utilizes expertise from physical, biological, social, and engineering sciences to conduct quantitative analyses of ecological, economic, and social aspects of water management systems and to evaluate critical uncertainties in watershed, riverine, riparian, floodplain, and tidal marsh restoration efforts. Center scientists partner with agencies and conservation groups to conduct problem-solving research and data syntheses on topics such as restoration and water resource management. The Center also conducts non-partisan research supported primarily by foundations, public agencies, and conservation groups.

QUICK LINKS

Delta Nutrient Research Plan Stakeholder and Technical Advisory Group
www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/delta_nutrient_research_plan/index.html

Fish Restoration Program
www.wildlife.ca.gov/Conservation/Watersheds/FRPA

Interagency Ecological Program
www.water.ca.gov/Programs/Environmental-Services/Interagency-Ecological-Program

Public Policy Information Center
Water Policy Center: www.ppic.org/water
Delta-relevant publications:
www.ppic.org/publications/#t1

San Francisco Estuary Institute
www.sfei.org/projects/delta-landscapes-project

Science Action Agenda
http://scienceactionagenda.deltacouncil.ca.gov

State of Bay-Delta Science
http://stateofbaydeltascience.deltacouncil.ca.gov

SECTION V

Facilitating Permitting and Funding for Delta Conservation

Illustration: Afsoon Razavi

KEY TERMS

COMMON PERMITS, AGREEMENTS, AND DISCLOSURES REQUIRED FOR CONSERVATION PROJECTS

- **CALIFORNIA DEPARTMENT OF FISH & WILDLIFE LAKE AND STREAMBED ALTERATION AGREEMENTS** (CDFW-LSA): A project proponent is required to notify CDFW before starting any project that may divert or obstruct the natural flow of any river, stream, or lake; change or use any material from the bed, channel, or bank of any river, stream, or lake; or deposit debris, waste, or other materials that could pass into any river, stream, or lake under Fish and Game Code sections 1600-1603.
- **CALIFORNIA ENDANGERED SPECIES ACT AUTHORIZATION FOR INCIDENTAL TAKE:** Take of a threatened, endangered, or candidate species (listed species) is defined as "hunt, purse, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" in Fish and Game Code Section 86. Take is generally prohibited without a permit under section 2081 of the Fish and Game Code.
- **CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMITS:** The Board requires an encroachment permit for any project that is within an area for which there is an Adopted Plan of Flood Control.
- **CLEAN WATER ACT SECTION 402 CONSTRUCTION GENERAL PERMIT:** Required for all construction sites greater than one acre, which discharge wastewater or stormwater from a point source into a surface water of the U.S.
- **CLEAN WATER ACT SECTION 404 PERMIT:** Regulates the discharge of dredge or fill material into waters of the U.S., including wetlands.
- ***DELTA PLAN* CONSISTENCY:** If a project determines that it meets the conditions outlined in Water Code section 85057.5 as a Covered Action under the Delta Reform Act, it must submit a certification for consistency with the *Delta Plan* to the Delta Stewardship Council.
- **EIS/EIR UNDER CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) AND NATIONAL ENVIRONMENTAL POLICY ACT (NEPA):** Each require a lead agency and a process to evaluate impacts of a project on environmental resources, including air quality, water quality, and biological, archeological, cultural, and other resources.
- **NATIONAL HISTORIC PRESERVATION ACT SECTION 106 LETTER OF CONCURRENCE:** Project proponents must consider potential effects of a project on historic properties before acquiring a permit under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act.
- **MCATEER-PETRIS AND MARSH DEVELOPMENT PERMITS:** Projects within the Primary or Secondary Management Areas in Suisun Marsh should work with the San Francisco Bay Conservation and Development Commission to secure permits needed for compliance with the Suisun Marsh Preservation Act and the McAteer Petris Act.
- **PORTER-COLOGNE ACT SECTION 401 WATER QUALITY CERTIFICATION AND WETLANDS PROGRAM:** Regulates discharge of fill and dredged material into state waters under the Clean Water Act Section 401 and waste discharge under California's Porter-Cologne Water Quality Control Act.
- **RIVER AND HARBORS ACT SECTION 10 PERMIT:** This requires authorization of the U.S. Army Corps of Engineers (USACE) to construct any structure in or over a navigable water of the United States or alter the course, condition, location or capacity of a navigable water of the U.S.
- **RIVERS AND HARBORS APPROPRIATION ACT SECTION 408 PERMIT:** USACE issues permits to projects that alter civil works projects such as levees or other flood control infrastructure.
- **US ENDANGERED SPECIES ACT (ESA) AUTHORIZATIONS:** U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibilities of administering the ESA. The ESA directs all Federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the ESA. Section 7 of the ESA is the mechanism by which Federal agencies insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat. The term "take" means to harass, harm, pursue, hunt, shoot, would, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Section 9 of the ESA prohibits activities affecting plants and animals designated as endangered or threatened, and the habitats in which they depend, unless authorized by a permit from the USFWS and NMFS or exempted through section 7. The basic permit types are section 10(a)(1)(A), which include Recovery Permits and Interstate Commerce permits, and section 10(a)(1)(B) Incidental Take Permits and Enhancement of Survival Permits (including Safe Harbor Agreements and Candidate Conservation Agreements with Assurances)."

See also Guide to Related Tools, Permits, Requirements and Programs p. 157-164, as well as Ideas for Tackling Two Common Permitting Challenges, Table 5.1, pp. 104-105.

Footnotes: The Delta Conservation Framework *footnote and endnote references can all be found in Appendix 1 online by section.*

Introduction

Whether it's restoring a few acres of wetland or planting riparian vegetation on levees or removing invasive weeds, most conservation projects on Delta landscapes require permissions and permits from government regulators. Myriad regulations reflect federal, state, regional and local goals for environmental quality, wildlife protection, public safety, land use, and other areas of public interest and common good. Faced with the many layers of regulatory oversight governing Delta projects – not to mention sometimes conflicting definitions and directives – any first time project manager undertaking a Delta conservation project might feel overwhelmed. Indeed even the most seasoned engineers, resource managers, biologists, and advocates for conservation projects complain of the complexity and cost of moving projects through planning, permitting, compliance, and construction. By the time projects are approved and shovel-ready, the dollars and equipment required to do the job may have already evaporated.

During the 2016 stakeholder workshops held as part of the development of this *Delta Conservation Framework*, participants repeatedly voiced frustration about the number and complexity of permits required for a single restoration project. Many stakeholders commented on the challenges of working with such a variety of agencies, each with different authorities, and on the length of time and amount of documentation required to apply for, and obtain permits for, each component of a conservation project. According to stakeholders, it can take years, even decades, before permits are granted and conservation projects are authorized for implementation. This has inherent drawbacks, especially when degraded environmental conditions are left to linger until conservation actions move forward. Delays can also increase the costs of conservation, and undermine timelines for mitigation or compliance.

Another major challenge for conservation success is the lack of long-term funding for maintenance, monitoring, and adaptive management of projects after construction. Planning and implementing conservation projects is most often based on short-term government or donor funding cycles that grant funds over the course of three- or five-year contracts. Longer term funding can be harder to come by, and neighbors and communities in the Delta remain concerned about adequate ongoing stewardship of public lands and conservation initiatives.

The *Delta Conservation Framework*, as an overarching framework for coordinating large scale conservation, recognizes that these are major challenges to the timely and cost-effective implementation of conservation projects in the Delta, and offers strategies and solutions for how to facilitate permitting and funding for conservation.

One recurring comment voiced in the stakeholder workshops held to develop the Delta Conservation Framework in 2016 was the extraordinary complexity of the permitting process for conservation projects. Schedules and budgets are often stretched by efforts to meet the array of regulatory requirements in the Delta. Photo: Christina Sloop

Framework in Depth: Goal F

Improve Agency Capacity for Permitting Conservation Projects

Infrastructure, habitats, waterways, communities, and agriculture all occur side-by-side in the Delta landscape, and each can be undermined by neighboring activities, construction, or factors ranging from weeds and floods to disturbance and disaster. To guard against negative impacts, agencies across all levels of government—federal, state, regional, and local—have regulatory responsibilities concerning the review of potential impacts of new projects on the infrastructure and environment in the Delta, the Yolo Bypass, and Suisun Marsh.

Potential project impacts to infrastructure (including roads, bridges, flood protection structures, transmission lines, and natural gas lines) must be reviewed to minimize negative effects on public facilities and services, and to preserve public safety. Potential project impacts on sensitive species, water quality, and the environment must also be reviewed and mitigated as necessary, even if there are projected long-term project benefits to wildlife or ecological health.

Despite the best intentions of each agency, the process of complying with regulatory requirements and implementing conservation projects in the Delta can be daunting. Goal F of the *Delta Conservation Framework* identifies some opportunities and strategies for improving the permitting process.

In the Delta, where rivers connected to 40 percent of the state flow through myriad channels and sloughs, impacts on sensitive native species migrating through, such as Chinook salmon, add to the permitting complexity of conservation projects. Photo: CDFW

Illustration: Afsoon Razavi

GOAL F

Improve resource agency and regulatory capacity for permitting Delta conservation projects.

STRATEGY F1

Find ways to improve the permitting process through direct engagement with regulatory agencies and existing venues aimed at greater efficiencies.

- Build on the efforts of the Collaborative Science and Adaptive Management Program and the Delta Plan Interagency Implementation Committee.
- Make the most of regional partnerships and relationships to increase collaboration and efficiency.
- Dedicate staff in permitting agencies to liaison with conservation partnerships and managers
- Use planning tools to help project proponents better understand permitting processes.

STRATEGY F2

Support the development of planning tools for permitting, in coordination with regulatory agencies, to provide high-level guidance for project proponents and agency staff issuing permits for individual projects in the Delta.

STRATEGY F3

Support the development of regional programmatic permits for conservation projects in the Delta.

Innovative and rapid permitting of multi-benefit flood protection habitats and blue infrastructure - such as the Yolo Bypass — will be increasing important in protecting cities like Sacramento, and their agricultural surroundings, from increased flooding due to climate change. Photo: Carson Jeffres

Coordination Among Regulators and Project Proponents

Strategy F1 under Goal F highlights the need to improve the efficiency of permitting for conservation projects in a way that meets the regulatory requirements of federal, state, regional, and local permitting agencies. The complexities of permitting conservation projects can discourage proponents of high-value projects. In addition, the steep costs associated with protracted permitting processes can drain the already limited funds available for conservation projects.

Under this strategy, the *Delta Conservation Framework* provides three recommendations. These recommendations are based on proven solutions that have improved coordination and expanded resources in support of efficient permitting and implementation of Delta conservation efforts.

The *Delta Conservation Framework's* first recommendation under this strategy is to continue to support the existing executive-level coordination position established by the California Natural Resources Agency in 2015. This position was created to coordinate and facilitate landscape-level and project-specific Delta habitat restoration actions that further multiple state objectives, including but not limited to regulatory obligations and voluntary restoration goals, consistent with the California Water Action Plan and California EcoRestore. The person in this position represents California's Secretary of Natural Resources and Governor in matters concerning the restoration of ecosystems within the Delta and associated regions in order to accelerate and maximize the ecological impact and scope of state restoration efforts. If institutional challenges for permitting conservation projects are identified through normal regulatory review and permitting processes, the person in this position is a resource for facilitating high-level collaboration and overcoming roadblocks along the way.

The *Delta Conservation Framework's* second recommendation under this strategy is to support the funding of new staff positions at regulatory agencies that are dedicated to permitting conservation projects located within the Delta. Dedicated staff will improve permitting efficiency by creating one consistent point of contact at each regulatory agency to communicate with project proponents and participate in regular coordination meetings. Over the long term, dedicated staff will also have the opportunity to develop expertise in a specific area, making them more efficient at permit review and processing. A current example of the effectiveness of this approach are staff at the California Department of Fish and Wildlife dedicated to permitting Delta restoration and levee projects under the state's Fish

Dutch Slough restoration site in early 2018, two decades of negotiation, planning, design, and permitting after first being identified as a likely, higher elevation, freshwater marsh restoration site. Photo: Christina Sloop

Restoration Program Agreement. These dedicated positions have successfully facilitated project compliance with state environmental laws and regulations.

The *Delta Conservation Framework's* third recommendation under this strategy is to support the development of planning tools to help project proponents better incorporate permitting processes into their plans. As a general practice, incorporating permitting and compliance monitoring into project timelines, implementation plans, and overall budgets allows more accurate planning and more complete funding over the life cycle of each project. Alternatively, to improve cost-effectiveness, long-term projects implemented or managed over decades could take a phased approach to planning, permitting, and implementation with separate budgets and timelines for each phase.

Conservation practitioners also need easily accessible online resources to explain permitting requirements and guidelines clearly. Specific Delta-wide, general resources could include:

1. A permitting guide book and training workshops that summarize steps to take and lessons learned from past projects;
2. A decision tree and table that show all the permits required for conservation projects and their associated timelines;
3. A regularly updated list of points of contact within each regulatory agency to assist project proponents during the process of applying for required permits.

Combined, these resources should help practitioners better incorporate permitting processes in project planning and foster interagency coordination ahead of, and during, planning and construction.

The Guide to Related Tools, Permits, Requirements and Programs at the end of this section, starting on p.157, contains examples of commonly required permits, disclosures, or notifications, among other resources for navigating the complexities of Delta conservation work. Further examples are provided under Key Terms, "Common Permits" on p.134. In addition, the CDFW Habitat Conservation Planning Branch website explains the state permitting options available.[9]

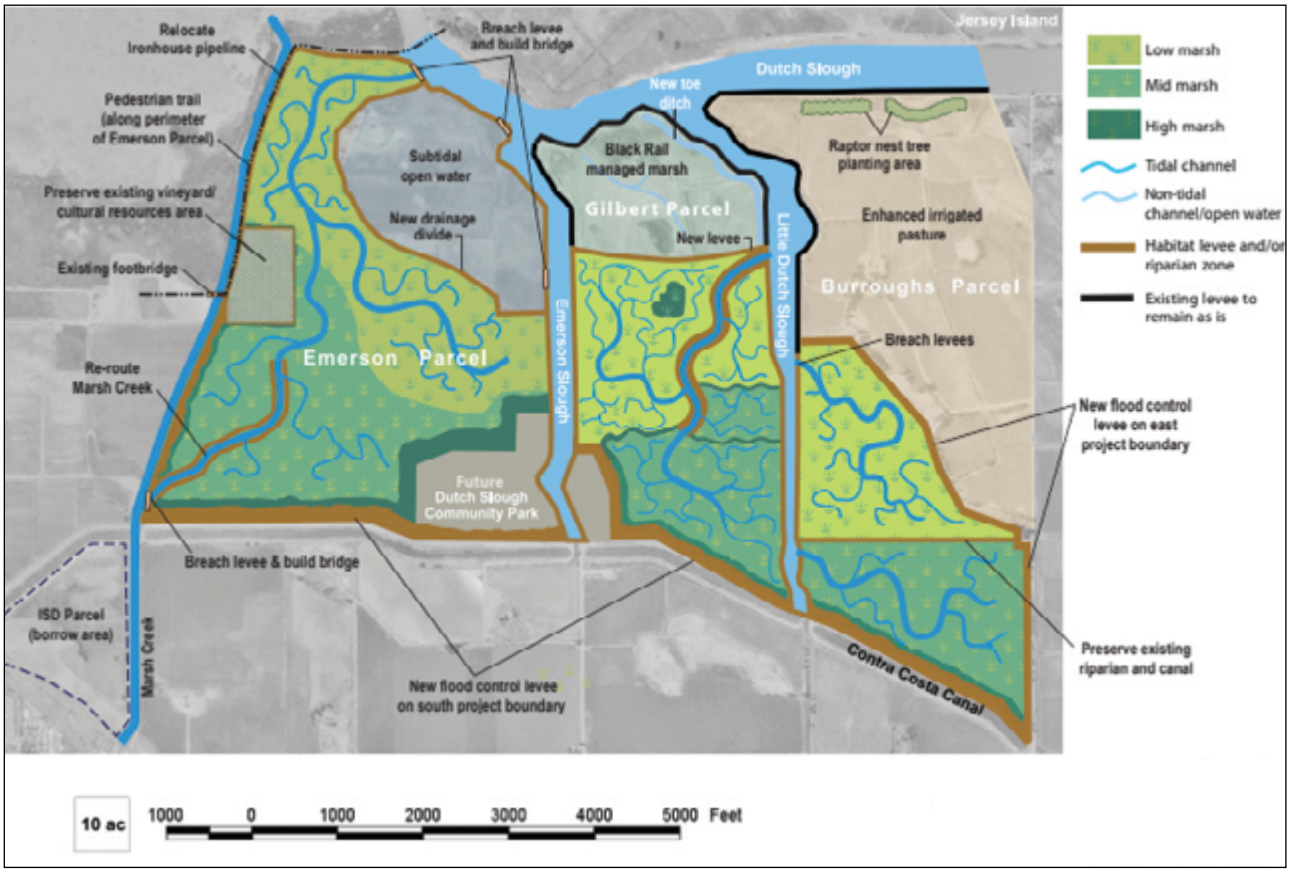


Figure 5.1: The Dutch Slough restoration plan includes several experiments to test conservation outcomes. Rendering: ESA Assoc.

Table 5.1: Ideas for Tackling Two Common Permitting Challenges

Incidental Take & Long Term Funding for Mitigation Sites

The following section highlights six options for tackling two common permitting challenges: the incidental take of listed species, and the requirement that long term funding and monitoring be available for mitigation sites. Options identified include: 1) pursuing permits exempt from mitigation requirements; 2) planning for advanced mitigation; 3) negotiating consistency among state and federal requirements; 4) mitigating through on-site restoration; 5) expanding the state's advance mitigation sites and banks; and 6) requesting take authorization for management purposes. The *Delta Conservation Framework* offers this short-list of options as a first step to implementing Goal F, and as an introductory guide to navigating the regulatory environment for Delta conservation.

As project proponents may be well aware, construction of restoration projects designed to benefit a species listed as endangered or threatened under the California Endangered Species Act (CESA) or US ESA (listed species) may result in incidental take of that species. In some cases, restoration targeted to benefit one listed species can result in take of other listed species. Take may trigger the need to work with California Department of Fish and Wildlife (CDFW) and federal agencies or only one regulatory agency. In either case, incidental take of listed species triggers regulatory requirements for projects, potentially including requirements to mitigate for impacts off-site and guarantee long-term funding to support the mitigation site. Although the decision to seek take authorization for state-listed species through an incidental take permit with the CDFW is at the discretion of the project proponent, take authorization under CESA is generally requested if even the potential for take is low. Even in instances when a project provides on-site mitigation for impacts to listed species, the area set aside for mitigation is required under CESA to have long-term funding and monitoring in place. It can be challenging for projects initiated with short-term funding to demonstrate financial assurances over the long term. Options 1-5 below suggest ways to approach incidental take challenges, while options 6-7 tackle long term funding and monitoring challenges for mitigation sites.

Option 1: Pursue permits that are exempt from mitigation requirements.

Incidental take of listed species under CESA: Within CESA, Fish and Game Code Section 2081(a) allows CDFW to authorize public agencies to take listed species for management purposes through a Memorandum of Understanding (MOU). Projects that qualify for an MOU under Section 2081(a) would be exempt from mitigation requirements because the benefit of the management action offsets the take of individuals.

Safe Harbor Agreements: A federal Safe Harbor Agreement (SHA) is a voluntary agreement between cooperating non-federal property owners and the US Fish and Wildlife Service (USFWS) or the National Oceanic and Atmospheric Administration (NOAA), that authorize take resulting from ordinary activities when actions of the landowner contribute to the recovery of the species listed as threatened or endangered under ESA.[1] For example, see p. 143 for a description of the Lower Mokelumne River Programmatic Safe Harbor Agreement.[2]

The California Safe Harbor Agreement Program Act was introduced to Fish and Game Code in 2009 to encourage landowners to voluntarily manage their lands to benefit listed species.[3] Through state SHAs, CDFW may authorize incidental take of a listed species if implementation of the agreement is reasonably expected to provide a net conservation benefit to the species, among other provisions (Fish and Game Code, §2089.6). California SHAs are analogous to the federal safe harbor agreement program. CDFW has the authority to issue a consistency determination (CD) based on a federal safe harbor agreement for species that are listed under both ESA and CESA (Fish and Game Code, §2089.22). A CD is issued when the federal authorization is consistent with the requirements of CESA (Fish and Game Code §208.1, §2081). California SHAs do not require mitigation; although, there must be sufficient funding to determine baseline conditions on the property and to carry out the management action and monitoring for the duration of the agreement (Fish and Game Code, §2089.6 (g)). However, SHAs cannot be entered into with state or federal entities (Fish and Game Code, §2089.4(d)).

Completed California Safe Harbor Agreements include:

- Rock Creek, Shasta County, Shasta crayfish (2016)
- Rock Creek Upper Pool, Shasta County, SHA CD, Shasta crayfish (2015)
- Carrington Coast Ranch, Sonoma County, Townsend's big-eared bat (2014)
- Fireworks America, San Joaquin County, large-flowered fiddleneck (2014)
- Morrison Ranch, Alameda County, large-flowered fiddleneck (2014)
- Kerns Pond, Shasta County, SHA CD, Shasta crayfish (2012)
- Agriculture and Land Based Training Association, Monterey County, California tiger salamander (2012)

Habitat Restoration and Enhancement Act (Act): Assembly Bill 2193 established a permitting process for landowners, state and local government agencies, and conservation organizations to implement small-scale voluntary habitat restoration projects in California.[4] Habitat restoration projects, as defined by the Act, are projects that have a primary purpose of improving fish and wildlife habitat, meet the eligibility requirements of Clean Water Act Section 401, avoid and minimize incidental impacts, and result in measureable ecosystem benefits. Projects approved by CDFW, pursuant to the Act, will not require additional permits from CDFW, such as LSA Agreements or Incidental Take Permits.

Habitat Conservation Plans (HCP) and Natural Community Conservation Plans (NCCP): If a project is located within the boundaries of an existing or developing HCP and/or NCCP planning area, take of listed species could be covered by the conservation plan if it is considered a covered activity and may not result in additional mitigation requirements. Siting the project within an approved and operating conservation plan may require strategically planning the restoration project far in advance of its initiation, but would streamline regulatory requirements. Projects may also be eligible to participate in an existing, approved conservation plan under provisions for special entities (see p. 33 for Delta related HCPs/NCCPs).

Photo p. 135 tiger salamanders; p. 136 giant garter snake. Photos courtesy CDFW

Environmental impacts analyzed under CEQA/NEPA: Mitigation for project impacts under CEQA can be avoided by designing conservation projects to meet certain categorical exemptions. For example:

- Small restoration projects (less than five acres) can be sited so that there are no significant impacts on listed species or their habitats (Cal. Code Regs., tit. 14, §15333).
- Projects that are designed to not result in a serious or major disturbance to an environmental resource, and that are designed for the purpose of collecting information before construction or during adaptive management, may be exempt under Class 6 (Cal. Code Regs., tit. 14, §15306).
- Conservation actions other than construction may be taken by regulatory agencies so that they protect natural resources (exemption Class 7) and protect the environment (exemption Class 8) (Cal. Code Regs., tit. 14, §15307-§15308).

If a conservation project does not meet categorical exemptions under CEQA, a Negative Declaration can be prepared if an initial study is conducted and clearly shows no substantial evidence that the project may have a significant effect on the environment (No Effect Determination).[5] If the initial study shows potential for significant environmental impacts, revising the project proposal and design to avoid or mitigate those impacts could enable the lead agency to issue a Mitigated Negative Declaration and avoid preparing an Environmental Impact Report. NEPA also has categorical exclusions that can be met through careful project planning. In general, designing projects that avoid or have negligible impacts on wildlife or their habitats simplifies the process of developing a CEQA/NEPA document and decreases or eliminates the associated mitigation requirements.

Option 2: Explore advance mitigation.

Advance mitigation[6] could enable conservation project proponents to purchase credits from mitigation banks[7] to meet regulatory requirements prior to project implementation, after potential impacts have been identified and proponents have received the respective permit or agreement. This approach avoids temporary loss of habitat that can result in higher mitigation ratios, because the mitigation is purchased and habitat is restored and protected before the immediate need occurs. If designed and placed on a landscape scale that considers the needs of multiple target species (including daily and seasonal migratory movement distances), mitigation banks could potentially improve ecosystem function more effectively than small, scattered mitigation projects. In many instances, mitigation credits are available for purchase through the services of firms that broker project credits with mitigation banks approved by regulatory agencies. For example, the Burke Ranch Conservation Bank, just west of the Cache Slough Complex, provides mitigation banking for California tiger salamander, Swainson's hawk, and vernal pool species.Mitigation credits with CDFW could also be developed through the Regional Conservation Investment Strategies Program (see p.157).

Option 3: Negotiate consistency among state and federal requirements.

Conservation projects may address potentially conflicting permit requirements for species listed under both ESA and CESA, present at a given project site, through negotiated consistency. For example, CDFW could issue a consistency determination on a federal ESA authorization, if CESA mitigation requirements are fully met by the ESA authorization. Otherwise, mitigation requirements can be negotiated and agreed upon ahead of time. These requirements can be included in the project description and conditions of the federal authorization to meet the CESA requirements and ensure that incidental take and impacts of the taking are minimized and fully mitigated. The more consistent the authorizations are, the faster they can be processed.

Option 4: Mitigation through on-site restoration.

Occasionally, the needs of listed species conflict, and restoration targeted to benefit one species can result in take of another listed species. For example, habitat restoration activities to benefit Delta smelt at Dutch Slough will likely result in take of Swainson's hawk when restoration of tidal marsh habitat removes known nest trees and associated foraging habitat. In this specific case, the project proponent met with CDFW to develop a project design that benefits and fully mitigates impacts to both species through on-site restoration, habitat enhancement, and long-term conservation. This meets the CESA requirement because the incidental take of Swainson's hawk can be fully mitigated within the project area.

Option 5: Expand the state's advance mitigation sites, banks, and credits.

Expand the number or size of advance mitigation sites established by state agencies and make them more affordable as a way to establish "credits" before a given project is launched. Existing mitigation banks are managed and monitored by third parties over the long term, which relinquishes project proponents from the requirement to secure and document their own long-term funding source.

Option 6: Request take authorization for management purposes.

Under Fish and Game Code, §2081, subdivision (a), there is the option for CDFW to authorize public agencies to take listed species for management purposes. Projects that qualify for a SHA or a Memorandum of Understanding (MOU) under Fish and Game Code, §2081 (a), would be exempt from the requirement to establish a long-term funding source because take of individuals is offset by the benefit of the management action to the listed species. For example, a 2081(a) MOU[8] was issued to the Los Molinos Water Company in 2015 for the rescue and relocation of Chinook salmon and increasing instream habitat to benefit salmon. This MOU was established to provide a framework for cooperative activities and monitoring in Mill Creek, eastern Tehama County, that includes or addresses issues of importance to Central Valley spring-run Chinook salmon, listed as threatened under CESA. The MOU provides authorization for take associated with actions by either party to rescue and relocate the salmon, or assist with increasing flows in the creek to benefit salmon, as management activities under authority of California Fish and Game Code section 2081(a). General MOU elements include fish rescue efforts, designated fish passage flows, changes in the timing of diversions to provide improved instream flow and water temperature conditions that would minimize the need to rescue fish, and the monitoring and evaluation of management actions. Further specific items of the program, tailored by stream, as well as the effective time of the agreement, are also outlined in the MOU.

FRAMEWORK IN DEPTH: GOAL F CONTINUED

CDFW crews dipnet at Jepson Prairie Preserve to monitor health of California tiger salamanders. Photo: Mandy Culpepper.

Common Guidelines

Strategy F2 under Goal F recommends that individual regulatory agencies establish common planning tools for evaluating and permitting conservation projects in the Delta. In addition to the general, delta-wide planning tools and checklists identified in Strategy F1, the efficiency of permitting (for both project proponents and agency staff) could be improved by developing permit planning toolkits within each agency tailored to conservation projects in the Delta, Suisun Marsh, and the Yolo Bypass. These specific toolkits could be developed by individual agencies, based on their expertise wth their specific regulatory responsibilities, vetted internally, and used to help agency staff efficiently review and make decisions about permits for individual projects. For example, guidelines could include consistent definitions of key terms such as temporary impact, permanent impact, and listed species habitat characteristics, as well as suggested procedures for project evaluation, consultation, and mitigation (if relevant) in the Delta, Suisun Marsh, and the Yolo Bypass. These Delta-focused guidance documents should be designed to facilitate internal communication within regulatory agencies and helpful, time-saving, informed discussions between project proponents and agency staff. In the end, this would likely require less time and fewer staff resources than developing a formal programmatic or regional permit. Regardless, any work completed could also provide a useful foundation for developing any eventual, more formal, regional or programmatic permit as suggested below.

Strategy F3 under Goal F supports the development of regional and programmatic permitting frameworks for the Delta. In general, these kinds of authorizations provide a pre-approved region-specific (Delta) or problem-specific (pollution or habitat loss or levee maintenance, for example) umbrella of priorities and parameters under which individual projects can gain approval.

While regulations and permitting requirements applicable to conservation projects are likely to vary based on site-specific conditions in the Delta, Yolo Bypass, and Suisun Marsh, the result can be burdensome. Except in areas where HCPs and NCCPs have been developed (see Section 1 Guide, pp. 31-37), permits are currently issued on a project-by-project basis by a variety of federal, state, regional, and local agencies. This individual project approach requires new analyses of impacts and associated mitigation for each project by each regulatory agency — a very complex, costly, and lengthy process for all involved, as described above.

Based on stakeholder suggestions during the 2016 workshops, the *Delta Conservation Framework* supports the development of regional regulatory frameworks, or "programmatic permits," to 1) provide clear guidance to project proponents regarding characterization of impacts and associated mitigation requirements (if any), 2) allow for better integration of individual projects into a regional planning vision. Agencies can process permit applications more quickly for projects that apply through a regional permit (generally Clean Water Act related) or under a programmatic authorization (generally ESA-related).

Programmatic permits, or regional regulatory authorizations, could improve the efficiency of conservation project implementation in the Delta by clearly defining eligible project types and associated mitigation upfront. This information can help project proponents better plan project budgets and timelines, and help agency staff process permits.

Programmatic permits or regional regulatory authorizations are nothing new. There are many California examples of programmatic biological opinions that authorize incidental take of species listed under the federal Endangered Species Act (ESA) for multiple similar projects within the same region. Their purpose is to expedite consultation under ESA Section 7 for proposed projects that have limited impacts on the listed species.[10]

"Regional" permits are more often water related. In one example, the San Francisco Bay Regional Water Quality Control Board issued a regional municipal permit for stormwater discharge (under the Clean Water Act) under which 76 cities and counties throughout the Bay Area are collectively reducing impacts on Bay water quality.

Conservation actions that may be suitable for programmatic or regional permitting and compliance with state and federal regulations include: planting native vegetation, restoring historic features (such as channel alignment), controlling invasive species, managing watersheds to control runoff, removing barriers to fish passage and unnatural hard points within and along channels, and undertaking minor vegetation or tree removal, among others.[11]

The Guide on p. 157 offers examples of state and federal programmatic or regional permits in the Delta, including the new CDFW Regional Conservation Investment Strategy Program that enables agencies in a region to conduct conservation projects that could serve as mitigation for other projects within the same region.

Safe Harbor Agreement for the Lower Mokelumne

Efforts to protect the valley elderberry longhorn beetle without imposing burden on neighbors and farmers along the Mokelumne River offer one well-known example of the benefits of programmatic permits. The 2006 Lower Mokelumne River Programmatic Safe Harbor Agreement (SHA) between the California Association of Resource Conservation Districts and the US Fish and Wildlife Service promotes ecosystem restoration and conservation of the federally-listed valley elderberry longhorn beetle. The agreement is accomplished through the voluntary restoration, enhancement, and management of native riparian habitat in the lower Mokelumne watershed under ESA Section 10(a)(1)(A) (Policy 64 FR 32717 and regulation 64 FR 32706). The SHA provides certain regulatory assurances to landowners participating in conservation activities by authorizing take of valley elderberry longhorn beetle that occurs during the course of normal farming operations. The SHA details specific "enrolled properties" in the watershed the agreement pertains to, and lists the baseline determination, responsibilities, and management activities for each participating property. The SHA is based on a collective conservation benefit derived from all enrolled properties and parties. The SHA also outlines how adjacent landowners may secure incidental take authorization through a Neighboring Landowner Agreement if they maintain current farming practices.

Valley longhorn elderberry beetle. Photo courtesy Jon Katz and Joe Silveira, USFW

Framework in Depth: Goal G

Securing Lasting Conservation Funding

It is not feasible to protect, enhance, restore, and manage Delta ecosystems for the benefit of people and wildlife without committed, long-term financial support. Strategies to provide long-term funding for conservation planning, implementation, research, and adaptive management of conservation lands are vital to realizing the goals of the *Delta Conservation Framework*, as well as other Delta conservation initiatives.

In general, there are four existing sources for funding conservation.[12]

- **Government Funding** – including federal, state, and local government programs.
- **Donor-based Funding** – including nongovernment organizations, private foundations, and individuals.
- **Payments for Ecosystem Services** – including greenhouse gas reduction, outcome-based bonds (green bonds or Environmental Impact Bonds), water rights, tourism fees, and habitat exchanges.
- **Mitigation Funding** – including endowments through Business Biodiversity Offset Programs[13,14] or other mechanisms to create and manage protected areas as mitigation for impacts to environmental resources.

In addition to these existing funding sources new voter-approved fees, taxes, fines, or dedicated bonds could provide funding for conservation projects. A centralized source of information about available funding streams and mechanisms is needed to align conservation practitioners with available funding methods, solicitations, and programs.

Illustration: Alison Razavi

GOAL G

Optimize use of existing short-term funding and support current and new mechanisms to secure long-term funding for continued conservation implementation and management.

STRATEGY G1

Optimize use of existing short-term state funding for conservation by updating grant solicitation language to improve project consistency with existing regional plans and Delta Conservation Framework goals.

STRATEGY G2

Support the development of long-term funding for Delta conservation, monitoring, and adaptive management of conservation lands.

STRATEGY G3

Support the development of online resources to publicize available funding for planning and implementing conservation in the Delta

This retrofitted offloader helped save money, meet "least cost" permit requirements, and move a lot of mud to increase elevations at the Cullinan Ranch wetland restoration site in the San Francisco Estuary. Finding the right equipment for the job, and in this case aided by engineering innovations undertaken by the operator Curtin Maritime to become more competitive in the construction bidding process, can facilitate conservation. Photo: Curtin Maritime

Short Term Funding

Strategy G1 under Goal G seeks to optimize use of short term funding opportunities for conservation. The *Delta Conservation Framework* supports direct referencing of Framework goals in current and future state grant solicitation language. Current short-term funds via government and donor grants are a first step to achieve long-term goals for the *Delta Conservation Framework*. Short-term funding is ideally suited for some projects, such as fee-title acquisitions of conservation lands, tree-planting programs, research, or targeted short-term agricultural assistance to promote wildlife-friendly practices. However, this approach is not sufficient to support functional ecosystem outcomes that may take decades to unfold. In cases where longer-term programmatic funding is needed after short-term funding is used to initiate a project, usually for operations and management of passively restoring lands, reliable financing is hard to come by.

Implementing the larger scale, ecosystem process-based, and multi-benefit goals of the *Delta Conservation Framework* will require a shift away from the project-by-project and parcel-by-parcel thinking that pervades short term funding models. This shift — and how to make it work — is something the Delta needs to start developing and testing now within agencies, NGOs, and public-private partnerships. Experimenting now with ways to make short term funding more flexible and amenable to innovation will be critical as Delta managers and conservation proponents move from crisis management of droughts, floods, and species declines to long-term, community-based stewardship of the Delta.

Long Term Funding

Strategy G2 under Goal G focuses on developing and advocating for more long term funding opportunities for Delta conservation. Unfortunately, conservation projects often fail to reach their objectives when they are implemented without long-term financial support for operations, management, and evaluation.[16] Such failures can even jeopardize the projects' initial—often substantial—conservation investments. The *Delta Conservation Framework* supports the development of more long term funding commitments for conservation. Long-term support would provide for more effective land management, for the evaluation of progress and resulting adaptive management, for focused scientific research to ensure past, present, and future Delta conservation projects succeed, and for local community integration into project planning and long term stewardship.

The constraints that often come with accepting funding from government bonds, or other time-limited sources and grant programs with a specific shelf life (typically 10 years), create a fundamental limitation on project implementation and long-term success. In many cases, once short-term funding is gone, work on the project ends or the project languishes—either during the planning stage or after initial project implementation—until a new source of funding can be secured. Just as often, emerging conservation projects fail to gain traction with stakeholders and reach the planning stage because of the lack of sustained funding for project planning, permitting, implementation, and management. Many valuable initiatives—such as sustained management of ecosystems in the

FRAMEWORK IN DEPTH: GOAL G CONTINUED

face of climate change — fail or aren't fully realized over the long term because support for long term monitoring and adaptive management isn't available. Such follow up activities are not only critical to conservation success, but also save money and make future conservation activities more effective — just like any business practice that plans ahead, prepares for change, and corrects actions based on outcomes so as not to lose initial investments.

Participants in the 2016 workshops held to develop the *Delta Conservation Framework* encouraged agencies to do more to explore innovative funding opportunities to ensure long-term success of habitat projects, including tapping the emerging carbon market and environmental trust funds supported by enduring endowments, as well as developing new bond measures and securing allocations from the state's general fund for long term, Delta-specific conservation. All of these may be needed to implement regional conservation strategies supported by the Framework.

"State and federal funding remains insufficient to address land subsidence that threatens the California water system, and carbon market revenues could help fill the funding gap. The new American Carbon Registry methodology provides an incentive to landowners in the Sacramento-San Joaquin Delta, Suisun Marsh and other historically natural wetland areas in California to convert their most subsided and marginal agricultural lands to wetlands, or to produce wetlands crops such as rice, which will stop land subsidence and reverse it over time."

CAMPBELL INGRAM,
DELTA CONSERVANCY

A direct state budget allocation could be used to support implementation of adaptive management at the project-scale, or to contribute to larger, landscape-scale "programmatic" adaptive management monitoring that informs the evaluation of progress across the entire Delta, such as the Tidal Wetland Monitoring Framework.[16] Direct budget allocations could also provide funding to support multi-benefit projects that promote agricultural practices and optimize ecosystem services, for example wildlife-friendly farming, as highlighted in Section II.

Workshop participants also called for a focused and consistent messaging campaign to the California legislature from state and local agencies, stakeholders, and NGOs, to highlight the need for additional long-term funding for the implementation and ongoing management of conservation lands (a campaign that should be coordinated with other outreach efforts described in Section II, Goal B). They suggested that a portion of California's general funds should be dedicated to Delta conservation efforts, with the premise that Delta ecosystem conservation is a public benefit that provides essential ecosystem services to Californians.

Short-Term Delta Conservation Funding Sources

Short-term public funding to support Delta conservation is available from government grant programs administered by the California Department of Fish and Wildlife (CDFW), the Wildlife Conservation Board, the Delta Conservancy, the Coastal Conservancy (Suisun Marsh), the Delta Science Program, the California Department of Conservation, and California Department of Water Resources. For example, of the 30,000 acres of conservation included in the California EcoRestore initiative, 5,000 acres of habitat enhancement and restoration projects will be implemented through public funding from Proposition 1, the Wetlands Restoration for Greenhouse Gas Reduction Grant Program, and grants to local governments, nonprofit organizations, and other entities. The CDFW Proposition 1 funding also supports scientific research in the Delta. Funding may also be obtained for agricultural easements under the California Farmland Conservancy grant program.[15] A few examples of current grant programs follow (see Guide p. # for more detail).

California Department of Fish and Wildlife

- Proposition 1 - Delta Water Quality and Ecosystem Restoration Grant Program
- Wetland Restoration for Greenhouse Gas Reduction Grant Program (California Climate Investments – AB 32 Greenhouse Gas Reduction Fund)
- Fisheries Restoration Grant Program
- Environmental Enhancement Fund (near waters of the state)

Wildlife Conservation Board

- Proposition 1 – Stream Flow Enhancement Program

Sacramento – San Joaquin Delta Conservancy

- Proposition 1 - Ecosystem Restoration and Water Quality Grant Program
- Other state or regional grants may be available through the Interagency Ecological Program and the Delta Stewardship Council, and from other state agencies. Federal programs are also an important source of conservation funding but remain outside state control.

In terms of the *Delta Conservation Framework*, the goal of this new campaign would be to maximize the effectiveness of limited government conservation funds by simultaneously considering the larger planning context of Delta conservation and the Delta as Place, contemplating restoration of ecosystem function on a landscape scale, and recognizing the value of implementing projects in phases driven by available funding and ongoing insights from adaptive management. Without public support, and transparent reporting to the public on the results of these conservation investments, little progress can be made.

While long term public funding is a necessary goal, it may be difficult to obtain. In the meantime, donor-based funding, market-based opportunities involving private-public partnerships, pay-for-ecosystem services or performance contracting, environmental impact or "green" bonds, mitigation credit agreements, and additional mechanisms for leveraging new funding sources all offer other pathways to progress.

Funding Information Exchange

Strategy G3 under Goal G aims to create a conservation funding information exchange. To attract the best possible conservation projects for implementation as part of regional conservation strategies, or as individual projects that address *Delta Conservation Framework* goals, it is essential to advertise available Delta conservation funds effectively. Strategy G3 calls for a lead organization and tools to publicize available funding opportunities relevant to the Delta in one place. Information about funding opportunities could be advertised on an independent website or organization webpage, where funding entities broadcast current and upcoming solicitations. The San Francisco Bay Joint Venture's Funding Opportunities webpage[18] provides an example for this type of funding clearinghouse. Any such clearinghouse for the Delta might include tools for portraying the landscape-scale picture of currently funded projects, and links to funded project reports. This could help applicants understand how their projects might "fit" into the wider landscape of Delta conservation. Information could also be organized to reflect and inform the Delta stakeholder community about the status of ongoing conservation efforts.

In the future, to keep communities and habitats safe from flooding, the Delta will need a combination of bigger, better maintained, rock-lined levees and multi-benefit landscapes capable of absorbing overbanking. All of these steps will require assurances of long term funding to protect restoration and conservation investments, and to adapt to changes in the climate. Photo: TNC

Sustaining Carbon Farming on Sherman Island

Recent efforts to restore wetlands on Sherman Island offer a model of how new climate change mitigation funds can support Delta conservation in the long term. The state's Greenhouse Gas Reduction Fund supported the Sherman Island project, which aims to restore approximately 1,700 acres of permanent wetlands on the island. The project is a collaboration of the University of California, Berkeley, the Department of Water Resources' (DWR) Division of Flood Management, DWR's Delta Ecosystem Enhancement section, and Reclamation District 341. The project encompasses two DWR-RD341 project sites on Sherman Island.

Once the wetlands are mature, they are projected to sequester approximately 11.5 metric tons carbon dioxide-equivalent per acre per year, or nearly 20,000 metric tons carbon dioxide-equivalent per year for the entire project. The project includes critical monitoring components that will help assess future success in meeting goals. For example, the island is included in a Delta wide monitoring program for carbon dioxide, methane, and nitrous oxide, which builds upon data collected already. These data sets will support the further development and calibration of models allowing greenhouse gas (GHG) predictions of both baseline and treatment results from wetland restoration Delta-wide. The project is also closely coordinated with other Delta efforts to develop a GHG protocol for both the voluntary and regulatory cap-and-trade markets. Additionally, DWR biologists monitor and assess native plant species annually within the restoration areas, conduct biannual bird surveys, and compare observations to pre-project conditions. DWR engineers are also monitoring subsidence reversal rates.

This multi-objective project isn't just trying to reduce greenhouse gases and earn credits for it. Additional objectives include restoring connectivity among west Delta habitats, enhancing nesting and foraging habitats for native wildlife, improving flood protection, protecting climate refugia, and minimizing establishment of non-native species, among others.

Project proponents are recommending a Regional General Permit for rejuvenation maintenance of carbon farming wetlands every 5-10 years. Maintenance under this proposed permit would involve turning over and thinning out dense patches of tules that become less productive over time. Although the permitting of the original project is straightforward and takes advantage of uplift in wetland habitat types, this type of maintenance may require work within high value wetlands and a temporary loss of wetland values, resulting in a greater mitigation burden. State and federal Safe Harbor Agreements may also be feasible here.[17]

Increasing the quality and quantity of key wetlands in California will provide measurable carbon sequestration benefits consistent with the most recent climate change adaptation and mitigation strategies, and wildlife and fisheries management and recovery plans. Delta wetland conservation, in particular connected to subsidence reversal as an additional benefit, closely aligns with implementation of *Delta Conservation Framework* overarching goals and strategies (Goals D-E).

Sherman Island. Photo: Christina Sloop

CONSERVATION OPPORTUNITY REGION

Optimizing Stewardship and Management of Suisun Marsh for Greater Delta Conservation Goals

Photo: Carson Jeffres

Suisun Marsh encompasses more than 100,000 acres of open space and rural lands, about half of which is fresh and brackish water wetlands long managed to attract ducks and support waterfowl hunting. In addition to it's established value to duck hunters, such a large swath of high-functioning wetlands between the metropolitan regions of Sacramento and the San Francisco Bay Area is very unusual and increasingly valuable for nature-based recreation, native species habitat, and future adaptation to rising sea levels. Both federal and state wildlife agencies consider Suisun Marsh a prime area to advance habitat conservation in the Delta and San Francisco Estuary. Likewise, leading conservationists and biologists increasingly see a connected North Delta habitat "arc" – ranging from Cache Slough in the north to Suisun Marsh in south – as a singular opportunity to carve out one place in the Delta for native species that is big enough, and at the right elevations in relation to sea level, to substantially contribute to ecosystem health.

The objectives of the existing 2013 *Suisun Marsh Habitat Management, Protection and Preservation Plan* embody many other important Delta planning and habitat goals and collaborative public-private partnerships around conservation. The *Delta Conservation Framework* supports such forward-thinking regional plans. The Framework also highlights Suisun Marsh as one of seven "conservation opportunity regions" where a critical mass of public lands, potential conservation opportunities, and conservation-minded people and existing partnerships occur in one place. Together these regions will one day add up to a healthier Delta – both for people and wildlife.

Regional Setting

Suisun Marsh is located in Solano County between the Carquinez Strait and the Delta, and adjacent to Suisun Bay, an important mixing zone for the fresh and salt waters of the San Francisco Estuary. The "Marsh" encompasses 116,000-acres of brackish and managed wetlands long recognized as a region of special conservation opportunities with a sustained history of wetland protection, conservation, and stewardship of natural resources. In 1974, legislators passed the Suisun Marsh Preservation Act directing the San Francisco Bay Conservation and Development Commission and the Department of Fish and Game to prepare a Suisun Marsh Protection Plan to "preserve the integrity and assure continued wildlife use" of the Marsh, as well as to maintain habitat for waterfowl. Suisun Marsh now comprises about 12 percent of California's wetland habitat, and is the largest contiguous brackish marsh remaining on the Pacific Coast of the United States.

Land use in Suisun Marsh is primarily focused on conservation of 52,000 acres of waterfowl management areas and duck clubs. These managed marshes are a mosaic of public and privately owned lands. The largest public landowner is the California Department of Fish and Wildlife, which oversees 15,000 acres wildlife management areas and refuges on the Grizzly Island complex.

Suisun Marsh is separated from full tidal action by exterior levees. These levees not only prevent salinity intrusion into parts of the Delta water supply but also protect the ecological and aesthetic values of the Marsh, as well as extensive private and public infrastructure. Significant examples of infrastructure in the Marsh include Solano County roads, Southern Pacific rail lines, Amtrak Capitol Corridor rail lines, and various petroleum product pipelines, natural gas production wells and transmission pipelines, and electrical transmission lines. The levees also protect water conveyance facilities managed by the Department of Water Resources, the U.S. Department of the Interior, and the U.S. Bureau of Reclamation.

Suisun Marsh At A Glance

- **Size:** 100,000 – 110,000 acres
- **Location:** West of the legal Delta between the confluence of the Sacramento and San Joaquin Rivers and the Carquinez Strait (and near the cities of Fairfield, Cordelia and Benicia)
- **Elevation range:** Up to five feet below sea level
- **Zoning:** 4–6 percent agriculture; 15- 20 percent public lands
- **Other Primary Land Uses:** Flood protection, wildlife habitat, recreation, duck clubs
- **Natural Communities:** Managed wetlands, tidal wetlands, vernal pools, mudflat, tidal perennial aquatic (tidal bays and sloughs), grassland, riparian
- **Rural Population:** 300 – 350
- **Recreational Opportunities:** Wildlife observation, boating and water excursions, fishing, hunting, hiking, interpretive services

Photo: Carson Jeffres

Planning History

In 1974 the California Legislature passed the Nejedly-Bagley-Z'berg Suisun Marsh Preservation Act, with the support of Suisun Marsh landowners. This Act placed various restrictions on development within the Marsh, and required preparation of a *Suisun Marsh Protection Plan* (SMPP) by the San Francisco Bay Conservation and Development Commission and the state Department of Fish and Wildlife. When complete, the SMPP components were formally adopted as part of the enactment of the 1977 Suisun Marsh Preservation Act. The 1977 Act provided a mechanism to preserve and enhance the wildlife habitat of the Marsh, and assured retention of upland areas adjacent to the Marsh for uses compatible with its protection. The Suisun Marsh Preservation Act names the Bay Commission as the state regulatory agency responsible for overseeing permitting and development in the marsh.

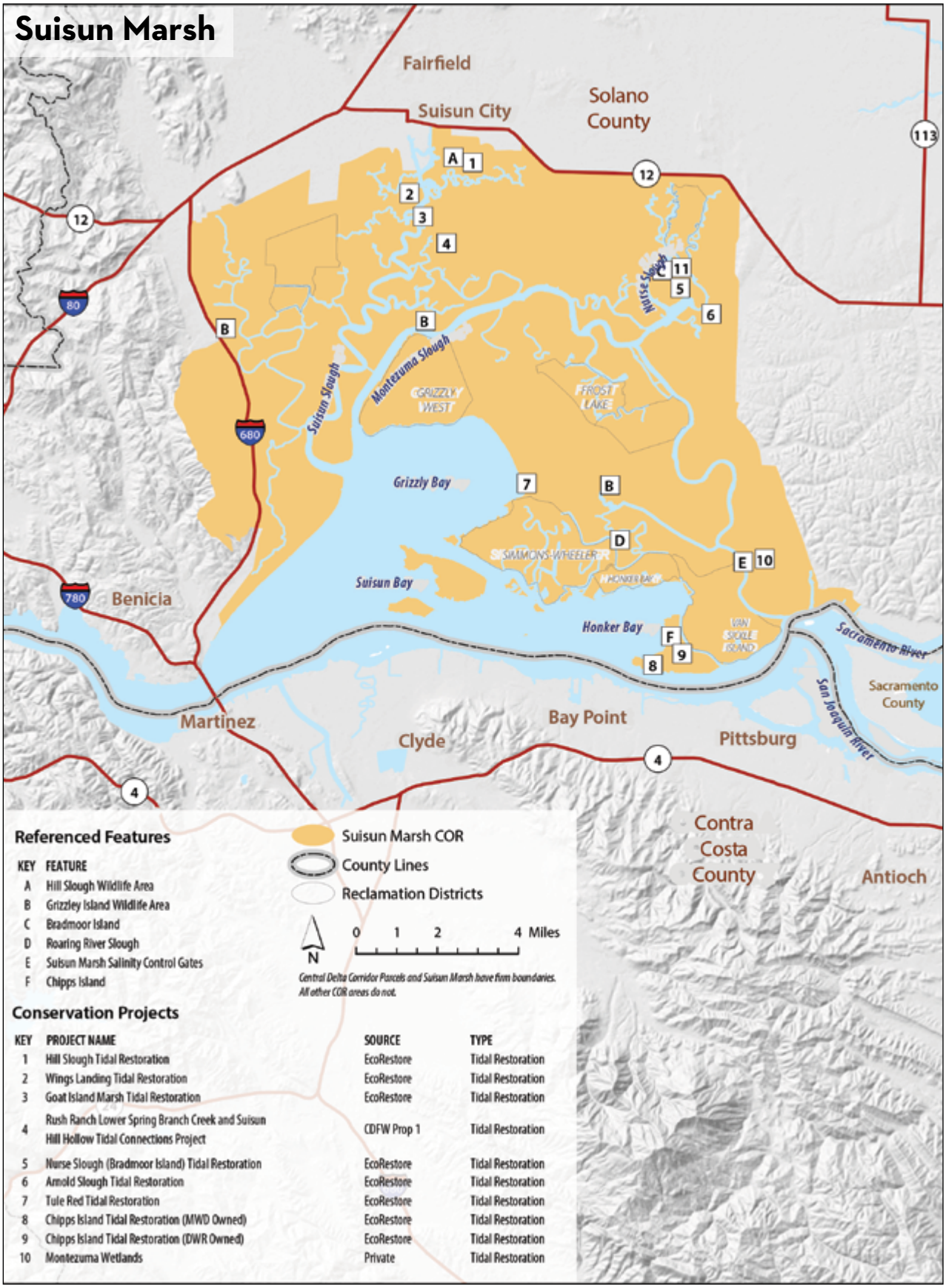
To meet the legislative requirements of the 1977 Act and the state's 1978 Suisun Marsh salinity standards (under water rights decision 1485), the US Bureau of Reclamation prepared the 1981 Suisun Marsh Management Plan and the Department of Water Resources prepared the 1984 Plan of Protection for the Suisun Marsh, including an EIR. The plans shared four key elements: 1) Delta outflow, 2) physical facilities, 3) monitoring program, and 4) the employment of efficient management, operation, and maintenance activities of public and private managed wetlands in Suisun Marsh.

Over the next twenty years, various activities were undertaken to preserve, protect and enhance the quality and diversity of Suisun Marsh habitats, and to maintain the waterfowl carrying capacity of the managed wetlands. This included efforts by the resource agencies, the Suisun Resource Conservation District, and private landowners to implement provisions of the various preservation acts and protection plans.

In 2001, the principal agencies involved with Suisun Marsh management were directed to develop another plan for Suisun Marsh, this time to balance various values and uses of this special region. Under this directive, the agencies produced the 2013 *Suisun Marsh Habitat Management, Preservation, and Restoration Plan* (Suisun Marsh Plan) and companion EIR/EIS. The Suisun Marsh Plan is a 30-year comprehensive regional implementation plan addressing various conflicting uses of Suisun Marsh resources and aimed at achieving a multi-stakeholder approach to the restoration of tidal wetlands and the maintenance of managed wetlands. The Plan provides a vision for managing habitats and ecological processes, public and private land use, levee system integrity, and water quality. As such, the Plan is

Biologists attach radio tracking device to mallard duck to monitor habitat usage. Photo: Cliff Feldheim

CONSERVATION OPPORTUNITY REGION

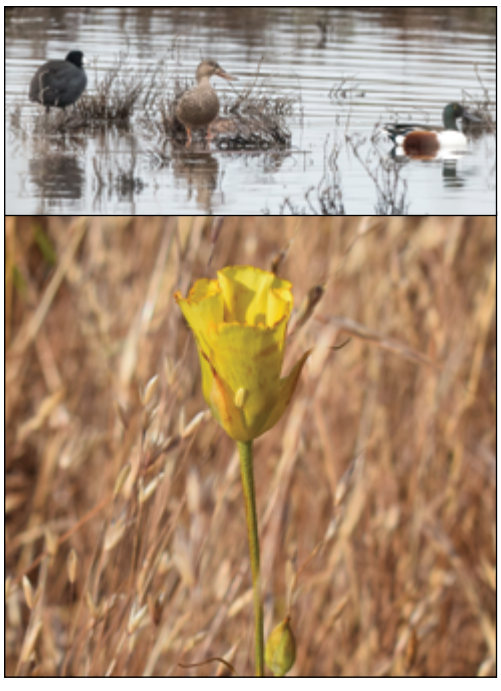


Source: CDFW, 2018

the most current, most science-based management plan for Suisun Marsh to date. The Plan is designed to be consistent with the revised Suisun Marsh Preservation Agreement, the CALFED Bay-Delta Program, and the Delta Stewardship Council *Delta Plan*. The Plan also provides a strong foundation for any further conservation actions in Suisun Marsh related to *Delta Conservation Framework* goals and objectives.

Opportunities for Conservation

Suisun Marsh is well-suited to tidal habitat restoration because of its elevations, location in the San Francisco Estuary, abundance of undeveloped existing managed wetland habitats, high turbidity, productivity within the aquatic food web (primary and secondary), and use by Delta smelt, Chinook salmon, and other native fishes. Throughout Suisun Marsh, land subsidence has been relatively modest due to a history of wetland conservation and limited agricultural practices, increasing the prospects for further tidal habitat restoration. The hydrodynamic, habitat, and salinity variability in the region supports a range of aquatic and terrestrial native species.



Coot, shoveler and teal. Photo: Cliff Feldheim

Mariposa lily, Jepson Prairie. Photo: Amber Manfree

In addition, the gradual alluvial slopes of the surrounding uplands may accommodate sea level rise through lateral marsh expansion. The undeveloped grasslands of Jepson Prairie also span the short distance between Suisun Marsh and the Cache Slough complex, creating a wildlife corridor between the two areas.

Current & Planned Tidal Habitat Conservation Projects

- **Hill Slough** (750 acres tidal restoration)
- **Tule Red** (610 acres tidal restoration)
- **Bradmoor Island** (382 acres tidal restoration)
- **Meins Landing**
- **Goat Island Marsh** (80 acres tidal restoration)
- **Rush Ranch Lower Spring Branch Creek and Suisun Hill Hollow** (67 acres tidal connections)
- **Wings Landing** (approximately 270 acres of tidal and subtidal marsh restoration)
- **Arnold Slough**

In addition, Suisun Marsh's proximity to Cache Slough, Lindsey Slough and Liberty Island, as well as to the lower Sacramento River and the western Delta, allows the Marsh to benefit from natural flood pulse flows. These flows provide seasonal migration, spawning, and rearing habitats for adult and juvenile native and anadromous fish. In addition, the seasonal flooding of managed wetlands produces food for fish during the winter and spring. The degree of ecological benefits from flows and flooding in this region could, however, be affected by actions further upstream, especially any modifications resulting from state and federal water conveyance operations, local water district use, the location of X2 where salt and freshwater meet (see p. 108), salt water intrusion, and restoration projects elsewhere in the Delta.

There are a number of tidal habitat restoration projects currently being planned in Suisun Marsh through California Ecorestore and the Department of Water Resources' Fish Restoration Program Agreement (see sidebar). In the meantime, the proximity of Suisun Marsh's biologically rich areas to important ecotones and ecological corridors should favor

these and other efforts to boost terrestrial and aquatic wildlife. Indeed, conservation biologists have included Suisun Marsh in a grand strategy to create an interconnected series of habitats for native species, mostly tidal and managed wetlands, referred to as the North Delta Habitat Arc (see map p. 72).

Potential Solutions to Recognized Challenges

The *Delta Conservation Framework* recognizes the value of historical planning and preservation efforts in Suisun Marsh, and the value of the current Suisun Marsh Plan in addressing ongoing challenges related to proposed changes to the Marsh and future conservation goals.

Detailed information on how the Suisun Marsh Plan addresses future challenges, and how it meshes with various existing plans and agreements, can be found in the Plan itself. In brief, and in general, the Suisun Marsh Plan has the following objectives:

- Restore 5,000 to 7,000 acres of tidal marsh, and protect and enhance of 40,000 to 50,000 acres of managed wetlands in Suisun Marsh (implementing targets established in the CALFED Ecosystem Restoration Program Plan)
- Maintain the heritage of waterfowl hunting and other recreational opportunities and increase awareness of the ecological values of Suisun Marsh in surrounding communities.
- Maintain and improve the integrity of the Suisun Marsh levee system to protect property, infrastructure, and wildlife habitats from catastrophic flooding.
- Protect, and where possible improve, water quality for beneficial uses in Suisun Marsh, including estuarine, spawning, and migrating habitat uses for fish species as well as recreational uses and associated wildlife habitat.

The Suisun Marsh Plan requires that these interrelated and interdependent objectives be implemented concurrently and in parallel over the 30-year planning period. As such, both restoration and managed wetland activities could proceed simultaneously. One aim is to provide adequate restoration to both mitigate impacts related to managed wetland activities and to contribute to recovery of listed species. A few more specific challenges and potential solutions related to Suisun Marsh planning in the future include climate change, land use conflicts, invasive species, and the need for long term funding for adaptive management and monitoring of restoration success.

CLIMATE CHANGE AND ADAPTATION OPPORTUNITIES

The Suisun Marsh region will be affected by climate change induced sea level rise within the next 30-100 years. The region's diked managed wetlands are protected by nearly 200 miles of exterior levees and are currently in intertidal zone. The increased pressure of rising water levels and flooding will threaten levee system integrity and the long-term viability of managed wetlands. In some areas, current managed

Windmills in Montezuma Hills, uplands near Suisun Marsh, generate clean energy. Photo: Carson Jeffres

Heritage hunting program at Grizzly Slough, Suisun Marsh. Photo: Robinson Kuntz

wetlands will be lost and shorelines or tidal wetland habitats submerged. In others, levee widening, reinforcement, and maintenance may affect duck club operations and hunting activities and encroach on restoration sites.

In terms of hydrodynamics, sea level rise will also increase salt-water intrusion into Suisun Marsh. Coupled with prolonged droughts and changes in the timing of fresh water inflows from the Central Valley, climate change could significantly increase salinity levels in the Marsh. In addition, Susiun Marsh will be exposed to more frequent, more extreme storm and rainfall events and associated flood events from surrounding watersheds. All these changes will affect wetland diversity, species composition, and existing habitat functions and values in Suisun Marsh.

Today's exterior levees are maintained primarily by private landowner assessments, local Reclamation Districts, and public agencies such as California Department of Fish and Wildlife. Currently there is little state or federal funding for maintenance. A long term levee maintenance program and fund (similar to the Delta Levee Subvention Program or Delta Investment Strategy) is necessary to sustain marsh values and protect Delta water quality.

Suisun Marsh could benefit from a scenario planning effort to help project likely climate change impacts on ecosystems and species (see Guide p.185). This type of planning could also evaluate salinity changes resulting from restoration, over the near and long-term, and allow for adaptive management, adjustments, and short and long term cost evaluation.

LAND USE CHANGES

Of the 100,000 acres of Suisun Marsh, the Suisun Marsh Plan has set goals of restoring 5-7,000 acres (5-7 percent) to tidal marsh within the next 30 years. In the process, conflicts will no doubt arise between existing managed wetland/ waterfowl hunting club land uses (the legacy way of life for the region) and future habitat restoration goals. Restoration projects could displace existing land uses and decrease the number of wintering waterfowl in Suisun Marsh. Conversion could also potentially increase mercury contamination, require additional mosquito control measures, create conflicts due to expanded public access, and impact salt marsh harvest mouse populations. The net effect of restoration projects on overall salinity levels and the future of the Marsh remains unclear. Potential solutions detailed in the Suisun Marsh Plan include requirements for: regional distribution of tidal habitat restoration projects; detailed environmental commitments; avoidance and minimization measures; and salinity modeling to ensure that local and regional conditions are protected as part of restoration design and project development, including post-construction verification. Additionally, the Plan requires that all land acquisitions for tidal restoration must be from willing sellers.

INVASIVE SPECIES CONTROL

Non-native invasive species have colonized most of the wetland and upland habitats of the Suisun Marsh. Control of invasive species is very labor intensive, costly, and requires diligence over the long-term. Complete eradication is unlikely, but ignoring existing conditions will ensure continued degradation of current habitat and likely failed restoration of targeted habitats. Limited resources exist for invasive plant species management once a site has been breached. As a solution, restoration projects should incorporate control mechanisms (such as the ability to dry out a site, or ongoing weed management programs) into adaptive management plans.

Looking Ahead

The *Delta Conservation Framework* views the Suisun Marsh Plan as the foundational existing regional conservation strategy for the Suisun Marsh conservation opportunity region. The Plan is also consistent with the CALFED Ecosystem Restoration Program Implementation Strategy, the 2013 *USFWS Recovery Plan for Tidal Marsh Ecosystems of the Northern and Central California*, and a number of other relevant plans and programs. The Suisun Marsh Plan was developed by the agencies with primary responsibility for Suisun Marsh management, and is intended to balance the benefits of tidal wetland restoration with other habitat uses in the Marsh by evaluating alternatives that provide a politically acceptable change in marsh-wide land uses.

The *Delta Conservation Framework* supports the efforts of the principal agencies involved in the development and implementation of the Suisun Marsh Plan. The principal agencies are: the US Fish and Wildlife Service, the US Bureau of Reclamation, the California Department of Fish and Wildlife, the Department of Water Resources, the National Marine Fisheries Service, the Suisun Resource Conservation District, and the Delta Stewardship Council. Though the principals also consulted with numerous regulatory agencies in developing the Plan, implementation of individual projects would still require permits and approvals from the San Francisco Bay Conservation and Development Commission.

The *Delta Conservation Framework* also supports the development of a Suisun Marsh Plan adaptive management plan, as it provides a mechanism to collect and use information to optimize restoration activity benefits. To this end, a multi-agency Adaptive Management Advisory Team has been formed to review proposed projects and ongoing progress of restoration.

So much work has already gone into planning and organizing a restored and sustainable future for Suisun Marsh. What the *Delta Conservation Framework* hopes to add is a context for how current marsh plans fit into the larger, landscape scale picture of conservation throughout the Delta, in which large habitat patches and migratory corridors are all connected. Suisun Marsh, as the southwesternmost patch in this constellation, will play an important role in the Delta's future ecological riches and prosperity.

QUICK LINKS

Suisun Marsh Habitat Management, Preservation and Restoration

CDFW: www.wildlife.ca.gov/Regions/3/Suisun-Marsh

Bureau of Reclamation: www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=781

For more detailed descriptions of these conservation opportunity regions, see Appendix 2.

Guide to Related Tools, Permits, Requirements and Programs

PERMITTING

California Department of Fish & Wildlife Regional Conservation Investment Strategies Program

STRATEGY F3, REGIONAL PERMITTING TOOL

In 2016, Assembly Bill (AB) 2087 was signed into law, enabling CDFW to initiate a new pilot Regional Conservation Investment Strategy (RCIS) Program.[9] This new program encourages a voluntary, non-regulatory, and non-binding regional planning process intended to result in high quality, regional-scale conservation outcomes throughout California. Yolo County was identified as one of four pilot Regional Conservation Investment Strategies in California. The RCIS Program consists of three components: [15]

1. **Regional Conservation Assessments** – An RCA is an assessment that provides information and analyses that document the ecosystems, ecosystem functions, species, habitat, protected and conserved areas, and habitat linkages within an ecoregion to provide the appropriate context for nonbinding, voluntary conservation strategies and actions. These assessments include information for the identification of areas with the greatest probability for long-term ecosystem conservation success incorporating co-benefits of ecosystem services, such as carbon cycling, water quality, and agricultural benefits. An RCA may be used to provide context at an ecoregional or sub-ecoregional scale to assist with the development of an RCIS. RCAs are intended to provide scientific information for the consideration of public agencies and their preparation is voluntary. RCAs are optional and not required to prepare an RCIS or MCA.
2. **Regional Conservation Investment Strategies** – An RCIS provides information and analyses that inform conservation and habitat enhancement actions. An RCIS offers non-binding, voluntary guidance for the identification of conservation priorities, investments in ecological resource conservation, or identification of priority locations for compensatory mitigation for impacts on focal species, habitats, and natural resources. An RCIS is intended to provide scientific information for the consideration of public agencies, to establish biological goals and objectives at the species level, and to describe conservation actions and habitat enhancement actions that, if implemented, will contribute to achievement of those goals and objectives. They may be used as a basis to provide advance mitigation opportunities through the development of credits (see 3 below) or to inform other conservation investments. Any public agency may develop an RCIS. RCISs are required if MCAs are to be developed.
3. **Mitigation Credit Agreements (MCA)** – RCISs and MCAs do not provide take authorization for individual projects. Rather, MCAs create credits that may be used as compensatory mitigation for impacts under CEQA, CESA, and the LSA Program. Any person or entity may enter into an MCA with CDFW to create credits, even if the person or entity was not involved in the development of the RCIS. People or entities may create and use, sell, or otherwise transfer mitigation credits upon CDFW's finding that credits have been created in accordance with the RCIS Program requirements.

The development of an RCA or RCIS does not create, modify, or impose regulatory requirements or standards, regulate land use, establish land use designations, or affect the land use authority of a public agency. An RCIS can be used, however, to streamline mitigation requirements through the development of credits through an MCA. If approved by CDFW, a RCIS may be valid up to 10 years. CDFW may extend the duration of an approved or amended RCIS for an additional 10 years, provided the RCIS is updated to include new scientific information and the RCIS continues to meet the program's requirements outlined in Fish and Game Code section 1850, et seq.

Photo: Amber Manfree

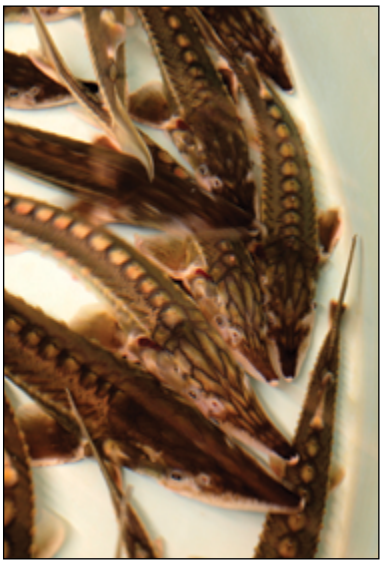
To skip these references go to p. 165

Guide to Related Tools, Permits, Requirements and Programs - continued

US Fish and Wildlife Service Guidance on Streamlining ESA Consultations for Restoration and Recovery Projects

STRATEGY F3, REGIONAL PERMITTING TOOLS

In 2016, the USFWS developed guidance for streamlining ESA Section 7 consultations for certain restoration and recovery projects (RRPs), with the primary purpose of facilitating and incentivizing projects that further habitat conservation and recovery of listed species.[22] To increase efficiency in permitting these projects, the USFWS developed template Biological Assessments and Biological Opinions for expediting the permitting process for RRPs that meet the standards outlined in the guidance. Criteria for RRP inclusion include projects or programs that have the primary purpose of conserving listed species in a manner that is consistent with the recovery needs of the species and that have a high level of certainty of producing a beneficial impact to the species. For example, restoration or conservation projects with small levels of adverse impacts, incidental take, and permanent loss of species' habitats may be eligible for the program.



Green sturgeon, a listed species. Photo: UC Davis

U.S. Army Corps of Engineers Nationwide Permit 27

STRATEGY F3, REGIONAL PERMITTING TOOL

In 2017, the U.S. Army Corps of Engineers issued Nationwide Permit 27 (NWP 27) to authorize aquatic habitat restoration, enhancement, and establishment activities in waters of the U.S., under Section 404 of the Clean Water Act (33 CFR Part 330).[20]

Specifically, activities eligible for authorization by USACE under NWP 27 include:

"Activities in waters of the United States associated with the restoration, enhancement, and establishment of tidal and non-tidal wetlands and riparian areas, the restoration and enhancement of non-tidal streams and other non-tidal open waters, and the rehabilitation or enhancement of tidal streams, tidal wetlands, and tidal open waters, provided those activities result in net increases in aquatic resource functions and services."[20]

NWP 27 clearly defines specific activities that are eligible to be authorized through the nationwide permit, and lists reporting, notification, and general permit conditions required for authorized projects. Additionally, NWP 27 states that eligible projects are not required to conduct compensatory mitigation because they must result in net increases in aquatic resource functions and services. Combined, these definitions and consistent requirements provide clarity for both project proponents and staff reviewing permit applications of specific projects.

To account for regional variation within the U.S., the Sacramento District of USACE also issued region-specific conditions under NWP 27 for projects in the Delta.[21] Specifically, the Sacramento District requires all projects in the Delta applying under NWP 27 to provide a preconstruction notification, including:

"Sufficient justification to determine that the proposed activity would result in a net increase in aquatic resource functions and services. Functions and services to be considered in the justification include, but are not limited to: short- or long-term surface water storage, subsurface water storage, moderation of groundwater flow or discharge, of energy, cycling of nutrients, removal of elements and compounds, retention of particulates, export of organic carbon, and maintenance of plant and animal communities."[21]

The Sacramento District office also requires that the preconstruction notification includes: descriptions of how the project design minimizes adverse temporary and permanent effects to waters of the U.S., drawings and plans depicting the proposed project and its location relative to delineated waters of the U.S., delineation of aquatic resources consistent with Sacramento District standards, and proposed Best Management Practices during construction.

Section 401 of the Clean Water Act requires states to certify that projects permitted by a NWP meet all state water quality requirements; and under California's Porter-Cologne Water Quality Act, waste discharge requirements are also necessary. For NWP projects, the State Water Resources Control Board or Regional Water Quality Control Boards may streamline Section 401 and Porter-Cologne requirements by combining or even waiving them for small projects that meet certain CEQA exemptions. When taken together, the guidelines, definitions, and requirements outlined in NWP 27 and the Sacramento District NWP regional conditions provide clear guidance to project proponents and regulatory staff and should help improve the efficiency of conservation project planning and implementation.

See Quick Links p. 164 to access above tools and programs.

US Fish & Wildlife Service Programmatic Biological Opinion for US Army Corps of Engineers 404-Permitted Projects with Small Effects on Giant Garter Snake

STRATEGY F3, REGIONAL PERMITTING TOOL

In 1997, USFWS issued a programmatic biological opinion to USACE for individual projects permitted under Section 404 of the Clean Water Act with impacts on giant garter snake in northern and central California (USFWS Programmatic Biological Opinion).[22] Projects with less than three acres of permanent impacts, or less than 20 acres of temporary impacts to giant garter snake habitat were eligible to seek take authorization under the USFWS Programmatic Biological Opinion. It includes descriptions of procedures required to implement specific projects, mitigation required to offset impacts of individual projects, and clear definitions of key terms necessary to assess impacts to giant garter snake, including disturbance area, temporary impacts, and permanent impacts.

"The purpose of this programmatic consultation is to expedite Corps permitted projects, including activities which may qualify for authorization under nationwide permitting, with relatively small effects on the giant garter snake and its habitat. Projects, which exceed the programmatic threshold, will require individual biological opinions. The Service will re-evaluate this programmatic consultation annually to ensure that its continued application will not result in unacceptable effects on the giant garter snake or its habitat. Restricting this programmatic consultation to projects with permanent impacts of less than 3.00 acres (1.21 hectares) and temporary impacts of less than 20.00 acres (8.09 hectares) of giant garter snake habitat per project will limit the effects of the programmatic process on the giant garter snake and its habitat. Tracking and restricting project effects over time will serve to minimize cumulative effects at local and regional levels."[21]

The clear guidelines, definitions, and mitigation requirements in the USFWS Programmatic Biological Opinion enable USFWS and USACE staff to more efficiently discuss and permit individual projects that require take authorization for giant garter snake. Although this biological opinion has expired, USFWS staff continue to use it as a set of informal guidelines when evaluating individual projects with low-level impacts to giant garter snake habitat.

Giant garter snake. Photo: CDFW

SHORT-TERM FUNDING

California Department of Fish & Wildlife Wetlands Restoration for Greenhouse Gas Reduction Grant Program

STRATEGY G1, SHORT TERM FUNDING

In 2014, CDFW developed the Wetlands Restoration for Greenhouse Gas Reduction Grant Program[23] in response to the Global Warming Solutions Act of 2006 (Assembly Bill 32, Nunez, Statutes of 2006). California's Cap-and-Trade Program includes an auction system where a portion of the tradable greenhouse gas emission permits (called allowances) can be purchased at quarterly auctions.

"Cap-and-Trade is a market-based regulation that is designed to reduce greenhouse gases (GHGs) from multiple sources. Cap-and-trade sets a firm limit or cap on GHGs and minimize the compliance costs of achieving AB 32 goals. The cap will decline approximately 3 percent each year beginning in 2013. Trading creates incentives to reduce GHGs below allowable levels through investments in clean technologies. With a carbon market, a price on carbon is established for GHGs. Market forces spur technological innovation and investments in clean energy. Cap-and-trade is an environmentally effective and economically efficient response to climate change."[23]

Proceeds from the sale of state-owned allowances are deposited in the Greenhouse Gas Reduction Fund (GGRF). Appropriations from the GGRF support California Climate Investments that provide greenhouse gas reductions and other important co-benefits for California. CDFW is administering a portion of these funds, through this grant program, to support the restoration or enhancement of Sacramento-San Joaquin Delta wetlands, coastal wetlands, and mountain meadow ecosystems in order to reduce GHG emissions and provide co-benefits. To date, CDFW has received two appropriations that included local

To skip these references go to p. 165

Guide to Related Tools, Permits, Requirements and Programs - continued

assistance funds for grants (FY14-15 and FY17-18). Future funding is dependent upon GGRF budget appropriations enacted by the Governor and Legislature. Examples of potential co-benefits this program provides include enhancing fish and wildlife habitat, protecting and improving water quality and quantity, and helping California adapt to climate change. Public agencies, recognized tribes, and nonprofit organizations are eligible to apply.

Increasing the quality and quantity of key wetlands in California will provide measurable carbon sequestration benefits consistent with the most recent climate change adaptation and mitigation strategies, and wildlife and fisheries management and recovery plans.[23]. This is critical because wetlands have among the most efficient carbon sequestration rates per unit of all habitat types, allowing both effective and extensive carbon sequestration, and only about 10 percent of the wetlands that existed in California 200 years ago remain today. Funding such efficiencies will help optimize use of limited financial resources for conservation in the long term.

California Farmland Conservation Program Grants

STRATEGY G1, SHORT-TERM FUNDING

The California Farmland Conservation Program, under the California Department of Conservation, provides grants for farmers and landowners to enter into easements that maintain their properties' farmland values and agricultural production. These easements provide long-term protection of farmlands against development pressure and other land use changes (Pub. Resources Code, §§ 10211, 10237). Funding for easements may be granted to local governments, nonprofit organizations, resource conservation districts, or regional park or open space districts that have farmland conservation as a stated purpose of their easements (Pub. Resources Code § 10211). Under the federal Farm and Ranch Lands Protection Program, a survey found that farmers that enter into long-term easements to protect their agricultural practices often use the funding for multi-benefit purposes, such as wildlife-friendly habitat or the public benefits of protecting soil and water quality.[24]

Photo courtesy Delta Protection Commission

California Wildlife Conservation Board

STRATEGY G1, SHORT-TERM FUNDING

The WCB offers a number of funding programs in California aimed at ecosystem conservation.[25] These include programs for land acquisition; ecosystem restoration on agricultural lands; habitat enhancement and restoration; public access development; streamflow enhancement, rangeland, grazing land, and grassland protection; riparian habitat and inland wetlands conservation; and a Natural Heritage Preservation tax credit.

Through the **Land Acquisition Program**, WCB acquires real property or rights in real property on behalf of CDFW, or provides grant funds to other governmental entities or nonprofit organizations to buy real property or rights in real property. All acquisitions are made via a Department of General Services approved fair market value appraisal on a "willing seller" basis. The acquisition activities generally entail CDFW evaluating the biological values of property through development of a Land Acquisition Evaluation (used for a single property) or a Conceptual Area Protection Plan (used for multiple properties).

The WCB's **Ecosystem Restoration on Agricultural Lands** program provides funding to assist landowners in developing sustainable wildlife-friendly practices on their properties that can co-exist with agricultural operations.

The **Habitat Enhancement and Restoration Program** is WCB's general restoration program. It comprises all projects that fall outside WCB's and other mandated programs, and it includes native fisheries restoration and restoration of wetlands such as coastal, tidal, or fresh water habitats that fall outside the jurisdiction of the Inland Wetlands Conservation Program. It also contains other projects that improve native habitat quality within the state.

See Quick Links p. 164 to access above tools and programs.

The **Public Access Development Program** aims to improve public access to hunting, fishing, or other wildlife-oriented recreation throughout California. Financial assistance is available to develop public access facilities such as fishing piers or floats, access roads, boat launching ramps, trails, boardwalks, interpretive facilities, lake or stream improvements, and restrooms and parking areas.

The **Rangeland, Grazing Land and Grassland Protection Program** aims to protect the long-term sustainability of livestock grazing; ensure continued wildlife, water quality, watershed, and open space benefits to Californians as a result of livestock grazing; and support innovative uses of grasslands compatible with sustainability. The Program encourages projects to address regional landscape issues.

The **California Riparian Habitat Conservation Program** (CRHCP) aims to identify areas critical to riparian ecosystem maintenance; pinpoint areas in imminent danger of destruction or significant degradation; prioritize protection needs based on site significance and potential habitat loss or degradation; develop and fund project-specific strategies to protect, enhance, or restore significant riparian habitat; develop, administer, and fund a grant program for riparian habitat conservation; and provide a focal point for statewide riparian habitat conservation efforts.

The **Inland Wetlands Conservation Program** (IWCP) was created to help the Central Valley Joint Venture achieve its goal of increasing bird populations through land acquisitions, wildlife friendly agriculture, conservation easements, and restoration or enhancement of habitats within the CVJV basins, including Yolo, Suisun Marsh, and the Delta.

Pheasant hunting in the Delta. Photo: CDFW

The WCB's **Natural Heritage Preservation Tax Credit Program** (Public Resources Code Section 37000 et seq) provides state tax credits for donations of qualified land (fee title or conservation easement) and water rights. The program demonstrates the state's commitment to natural resources protection by rewarding landowners who perceive habitat as an asset rather than a liability. Initially implemented in 2001, the Tax Credit Program to date has resulted in the approval of $54.5 million in tax credits and the donation and transfer of ownership of more than 9,407 acres of critical parkland, open space, agricultural conservation easements, wildlife corridors, and archaeological resources.

Central Valley Project Improvement Act

STRATEGY G1 SHORT-TERM FUNDING

The Central Valley Project Improvement Act (CVPIA)[26] established certain actions to restore, protect, and enhance fish, wildlife, and associated habitats in the Central Valley—including the San Francisco Estuary (Bay-Delta) and Trinity River basins of California—and to address impacts of the Central Valley Project (CVP) on fish, wildlife, and associated habitats. To provide irrigation and municipal water to much of California's Central Valley, the CVP regulates and stores water in reservoirs in the northern half of the state and transports it to the San Joaquin Valley via a series of canals, aqueducts, and pumping plants. To offset CVP impacts, the CVPIA provides restoration funds available from Central Valley water and power users. This restoration fund may be appropriate to fund conservation projects in the Delta, Suisun Marsh, and Yolo Bypass.

To skip these references go to p. 165

Guide to Related Tools, Permits, Requirements and Programs - continued

Proposition 1 Water Quality, Supply, and Infrastructure Improvement Act —Delta Programs

STRATEGY G3, SHORT TERM FUNDING

The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1; California Water Code §79700 - §79798) provides funding to implement the objectives of the *California Water Action Plan* (CWAP-see also p.31): more reliable water supplies, restoration of important species and habitats, and a more resilient and sustainably managed water infrastructure.[27] Chapter 6 of Proposition 1 authorizes funding, upon appropriation by the Legislature, for competitive grants for "Protecting Rivers, Lakes, Streams, Coastal Waters, and Watersheds." Delta-focused Proposition 1-funded grants, established by the California Department of Fish and Wildlife (CDFW) and the Delta Conservancy, offer short-term support for scientific studies; water quality improvement projects; and acquisition, planning, and implementation of projects that align with *Delta Conservation Framework* goals and strategies. California public agencies, nonprofit organizations, public utilities, Native American tribes recognized by federal and state entitites and listed on the Native American Heritage Commission's Tribal Consultation List, and mutual water companies are eligible to apply (California Water Code §79712[a]). Projects that are undertaken to meet mitigation obligations, or projects that are under an enforcement action by a regulatory agency, are not eligible for funding.

In 2015, CDFW established the Delta Water Quality and Ecosystem Restoration Grant Program to administer $87.5 million of Proposition 1 funds for projects that benefit the Delta (California Water Code §79738). CDFW will distribute these funds on a competitive basis through annual proposal solicitation notices issued over a 10-year period. The program focuses on water quality, ecosystem restoration, and fish protection facilities that benefit the Delta. Projects must be consistent with the purposes of Proposition 1 and contribute to implementation of the CWAP, *State Wildlife Action Plan, Delta Plan, Delta Science Plan*, Central Valley Flood Protection Plan Conservation Strategy, and/or California EcoRestore[28] (see Guide pp. 30-37). [29]

Also in 2015, the Delta Conservancy launched a grant program to award $50 million (identified in Chapter 6 of Proposition 1) over a five-year period "for competitive grants for multi-benefit ecosystem and watershed protection and restoration projects in accordance with statewide priorities" (California Water Code §79730 and §79731). Proposition 1 and the Delta Conservancy's enabling legislation both focus on projects that use public lands and maximize "voluntary landowner participation in projects that provide measurable and long-lasting habitat or species improvements in the Delta." To the extent feasible, projects need to promote state planning priorities and sustainable communities strategies consistent with Government Code 65080(b)(2)(B). Furthermore, all proposed projects must be consistent with statewide priorities as identified in Proposition 1, the CWAP, the Delta Conservancy's enabling legislation, the *Delta Plan*, and the Delta Conservancy's Strategic Plan.[30]

LONG TERM FUNDING

Conservation Easements for Mitigation

STRATEGY G2, LONG-TERM FUNDING

There are several types of state conservation easements used for project mitigation that provide for long-term monitoring and management funding provided by the project. A conservation easement is a grant by a landowner to an eligible easement holder, which restricts the use of the conserved property to natural, scenic, historical, agricultural, or open-space purposes in perpetuity (Civ. Code § 815.1). The state requires adequate funding to implement measures required by a CESA permit (14 CCR 783). Such measures often require monitoring and adaptive management for the duration of the easement. Some non-statutory easements may provide long-term mitigation funding but are more flexible for the landowner. Such easements may not provide funding in perpetuity, but they may provide longer-term funding than short-term grants, and they are generally used when mitigation requirements are compatible with existing land uses. These include open space easements (Civ. Code §§ 51070, 51075, 51080 - 51093); agricultural easements (Cal. Pub. Resources Code, § 10211, Civil Code section 815.1); or deed and covenant restrictions (Civ. Code §§ 1461, 1462, 1468, 1469, 1471). The U.S. Fish and Wildlife Service established mitigation guidelines to evaluate financial assurances for ESA mitigation that contain a landscape-scale approach to conservation and long-term monitoring and adaptive management (USFWS 2017).[32] Landowners engaged in regional conservation partnerships that are interested in entering into conservation easements for mitigation can do so through habitat exchange programs, becoming a mitigation bank sponsor, or other mechanisms specified by the regulatory agencies (see FR 81 95316, Section 6.2 – Eligible Lands).

See Quick Links p. 164 to access above tools and programs.

Donor-Based Funding

STRATEGY G2, LONG-TERM FUNDING

Delta conservation partnerships, such as the Yolo Basin Foundation-Yolo Bypass Working Group, Central Valley Joint Venture, and Migratory Bird Conservation Partnership, include a number of NGO partners (e.g., The Nature Conservancy, Audubon California, Ducks Unlimited, CalTrout, and American Rivers). These NGOs rely partially on donor funding for their programs, which ultimately benefit Delta conservation efforts. For example, over the past decade, the private David and Lucile Packard Foundation (Packard Foundation) has supported a number of NGOs to advance conservation and underlying science in the Delta.[33] The Packard Foundation has also been active in attempting to increase federal conservation funding for western states. The Resources Legacy Fund, with core funding from the Packard Foundation, is leveraging additional support from foundations and individuals to implement their California Conservation Innovations initiative (CCI).[34] This initiative focuses on:

1. Conservation policies that will "advance state climate change adaption and resiliency policies and will monitor and engage strategically in sea level rise and energy development policy areas, adapting its engagement to changing needs and opportunities;"
2. Conservation funding to "develop new, stable sources of conservation funding by identifying viable approaches at local, regional, and state levels; " and
3. Conservation constituencies to "engage with younger and more ethnically diverse populations on important CCI policy and funding priorities statewide and in Los Angeles, the Bay Area, and portions of the San Joaquin Valley."

The National Fish and Wildlife Foundation (NFWF) also use their programs to leverage public with private funds to achieve lasting conservation solutions across the nation. Through their Western Water Program, NFWF is currently working to develop freshwater restoration initiatives in the Sierra Nevada, Central Valley, and Bay-Delta watersheds of California.[35] With appropriate planning and coordination, these donor-related funding sources could be leveraged to support upcoming Delta-related conservation projects and implement *Delta Conservation Framework* goals.

> *"In a habitat exchange, landowners such as farmers and ranchers create, maintain and improve habitat on their property and earn credits for their efforts. Landowners sell these credits to offset impacts from development, such as roads, transmission lines and wind turbines, that impact species and habitat. An independent habitat exchange administrator monitors and verifies credit transactions and reports on progress to ensure species protection. Every credit sale makes species and habitat better off."*
>
> ENVIRONMENTAL DEFENSE FUND

Endowments for Conservation

STRATEGY G2, LONG-TERM FUNDING

Conservation trusts or environmental trust funds (ETF) created with an endowment are suited to be a long-term source of funding for conservation.[36] Most ETF that finance conservation are legally independent institutions (i.e., established outside of government) managed by an independent board of directors. Many existing ETF have a permanent endowment that has received grants from government and international donor agencies. They may also manage sinking funds, created through debt-for-nature swaps, in which a portion of a developing nation's foreign debt, for example, is forgiven in exchange for local investments in environmental conservation measures, or revolving funds financed through specially designated user fees or taxes that are only to be used for conservation. Environmental trust funds are an independent legal entity and investment vehicle to help mobilize, blend, and oversee the collection and allocation of financial resources for environmental purposes. It is a solution that facilitates strategic focus, rigorous project management, solid monitoring and evaluation, and high levels of transparency and accountability. The term encompasses conservation trust funds, wildlife trusts, climate and forest funds, and other funds established to deliver environmental, social, and economic benefits.

Participants in the *Delta Conservation Framework*'s 2016 workshops suggested endowments for the operation and management of conservation lands should be incorporated into the planning process in the early stages. Although they don't fund restoration projects, endowments required by CESA permits for other projects also contribute to perpetual management of conservation lands that may be interconnected across the landscape.

To skip these references go to p. 165

Guide to Related Tools, Permits, Requirements and Programs - continued

Market-Based Opportunities and Payments for Ecosystem Services

STRATEGY G2, LONG TERM FUNDING

Payments for Ecosystem Services (PES) have the potential to serve as long-term market-based revenue systems and supply long-term funding for Delta conservation. PES is the mechanism for payments when a beneficiary or user of an ecosystem service (such as a business) makes a direct or indirect payment to the provider of that service; in other words, whoever preserves or maintains the ecosystem (such as farmers, landowners, or other natural resource owners) gets paid for doing so. Opportunities through growing American Carbon Registry (ACR)37 carbon markets are emerging as another source of conservation funding, particularly in the context of implementing solutions to the land subsidence prevalent in the Delta (see Section II, p.57). In both voluntary and regulatory carbon markets, the ACR oversees registration of carbon offset projects, which pay for carbon credits to be used for emissions reduction in the Cap-and-Trade Program (including wetland restoration). The California Department of Fish and Wildlife's Wetlands Restoration for Greenhouse Gas Reduction Grant Program (see p.159) is based on this new marked-based model for funding conservation.[23]

Other ecosystem services related opportunities for Delta conservation include funding obtained from tourism fees. In the Delta, tourism fees can be collected, for example, from visitors to parks and refuges by California Department of Parks and Recreation, CDFW, and the Stone Lakes National Wildlife Refuge. These user fees may be, in part, utilized for operations and management of these parks and reserve lands.

Fitting under the broad umbrella of green bonds, environmental impact bonds (EIBs), are beginning to gain some traction with private-sector investors willing to bet on a "pay-for-success" bond offering. The EIBs are a new financial tool that ties rewards to water infrastructure or wetland restoration projects, for example, or other measurable social or environmental outcomes. Three key components must be present to make an EIB successful as a financing tool: 1) Returns must be determined by outcomes; 2) EIBs should generate savings on overall project cost; and 3) Performance metrics must be well defined.

Leveraging water markets is another financing concept developed by The Nature Conservancy, utilizing an innovative conservation and impact investment model called Water Sharing Investment Partnerships.[38] This investment partnership concept is focused on soliciting investor capital, as well as government grants and philanthropic donations, to acquire a water rights portfolio (similar to stocks or commodities). Most of the water rights are leased or sold back on the market, ensuring a financial return for investors and access to water for farmers and cities. A portion of these water rights are used to divert water back to natural ecosystems and to generate funds for ongoing ecological monitoring. This idea has been tested in a number of places, including San Diego. To know whether it can be applied to the Delta will take further investigation.

Emerging habitat exchanges also have the potential to provide an indirect long-term funding mechanism to support multi-benefit conservation activities. The Central Valley Habitat Exchange[39] (Exchange) is one example of a voluntary program that creates new financial returns for private landowners willing to engage in sustainable land management practices and restoration activities that have quantifiable benefits to the environment. The Exchange facilitates investment in conservation through private and public investors, managing the transactions of a market of habitat credits by leveraging wildlife habitat created by willing landowners. Through the Exchange, farmers are essentially paid to use management practices that provide habitat for wildlife, such as migratory birds. This new funding stream can create revenue landowners can earn by employing new strategies to manage or restore functional habitat. Habitat exchanges are being considered for other Delta wildlife—including riparian songbirds, shorebirds, waterfowl — and for sandhill cranes, monarch butterflies, and greater sage-grouse.[40]

QUICK LINKS

Environmental Trust Funds
www.undp.org/content/sdfinance/en/home/solutions/environmental-trust-funds.html)

Environmental Defense Fund Habitat Exchanges
www.edf.org/ecosystems/habitat-exchanges-how-do-they-work

Resources Legacy Fund
http://resourceslegacyfund.org/

Wildlife Conservation Board Grant Programs
https://wcb.ca.gov/Programs

CDFW Proposition 1 Restoration Grant Programs
www.wildlife.ca.gov/Conservation/Watersheds/Restoration-Grants

SECTION VI

Conservation Pathways to 2050

Illustration Afsoon Razavi

KEY TERMS INDEX

Introduction

The *Delta Conservation Framework* is a guide for all Delta stakeholders suggesting how best to approach conservation planning and project implementation. The Framework builds on a strong foundation of existing plans and stakeholder feedback. As described in Section II, this critical feedback was gathered from a series of public workshops and comment letters in 2016 and 2017. The Framework also represents a careful vetting of myriad plans, programs and approaches, and a first-ever effort to combine and organize all these resources within a single framework and guide, in a summary style. All too often anyone launching a new conservation project can become overwhelmed by the complexities.

The Framework's strategic approach to conservation offers tools, processes, and opportunities for partnerships that can be used by any individual, landowner, agency, or organization on any scale (Sections II-V).

As the practice of conservation is inherently multi-disciplinary — relying upon expertise from ecology, engineering, sociology, agriculture, local land use, public policy and regulation, as well as on local knowledge of the landscape and its history — it requires regular communication and collaboration. Implementation of this ambitious 30-year vision must include every possible stakeholder, not just state agencies. In partnership, and with a commitment to honoring each others' perspectives, residents, businesses, stewards, and managers can all build a healthier, more sustainable Delta together.

Flowering willow, a riparian tree. Photo: Amber Manfree

Nationwide, conservation planners and advocates are wrestling with the same questions and hurdles we confront in the Delta. Many have developed tools to help structure difficult conversations and work together collectively to implement conservation. Descriptions and examples appear in the Guide to Planning Tools pp.184-187.

This following section of the Framework describes two approaches to strategic conservation planning and implementation— a regional approach and an individual project approach.

Both approaches require attention to monitoring and adaptive management based on conservation outcomes as described in Section IV, and to funding needs as described in Section V.

Workshops gathering stakeholder input to the Delta Conservation Framework in 2016. Photo: Christina Sloop

Regional Approach to Conservation

As described in prior sections, the *Delta Conservation Framework* suggests that a collaborative, regional approach to conservation planning is an important key to successful implementation on a landscape scale. To recap, regional partnerships can be initiated by any interested Delta stakeholder, with a purpose of developing and implementing a regional conservation strategy. The Framework identifies seven possible conservation opportunity regions within the Delta (see p. 170) though working on a sub-regional or individual project scale is also possible (see next sections)

Regional conservation partnerships should include all local stakeholders: local, state, and federal agencies, landowners, and business owners and others. Inclusivity from partnership inception ensures consideration of a diversity of perspectives and prevents unanticipated conflicts and challenges.

Regional conservation strategies should reflect the Framework's Guiding Principles (see p. 189) and align with the relevant goals and strategies described in Sections 2 - 5. In developing a regional conservation strategy, partnerships should evaluate regional datasets on vegetation, habitat quality, presence of species, agricultural and other land use patterns, water management, existing infrastructure (e.g., levees and water diversions), and other relevant socioeconomic information like land values, projected sea level rise, and flood risk. If regional partnerships overlap with existing plans (such as Regional Conservation Investment Strategies, Habitat Conservation Plans, or Natural Community Conservation Plans), they should include experts involved in implementing these plans and defer to plan goals and objectives within plan boundaries. Consideration of all of these factors should provide a comprehensive picture of where conservation will work or won't work on a specific Delta landscape.

Costs for engaging in a nine-month partnership-oriented process are estimated at $300,000 but could range widely. This includes administrative support and facilitation of twelve partner meetings and several workshops, technical expertise utilizing visualization tools and analyses, honoraria for participation as needed, and development of a regional conservation strategy report.

It is important to recognize that partnership work is not always easy. In some regions there is a foundational distrust between members of the Delta public and government agencies, or between special interest organizations and municipalities, regardless of their good intentions. Acknowledging this distrust and welcoming all participants to the planning table to achieve the most acceptable solution, despite differences in individual roles, is the foundation of a successful partnership. Participants should be ready to commit time and energy to build trust and

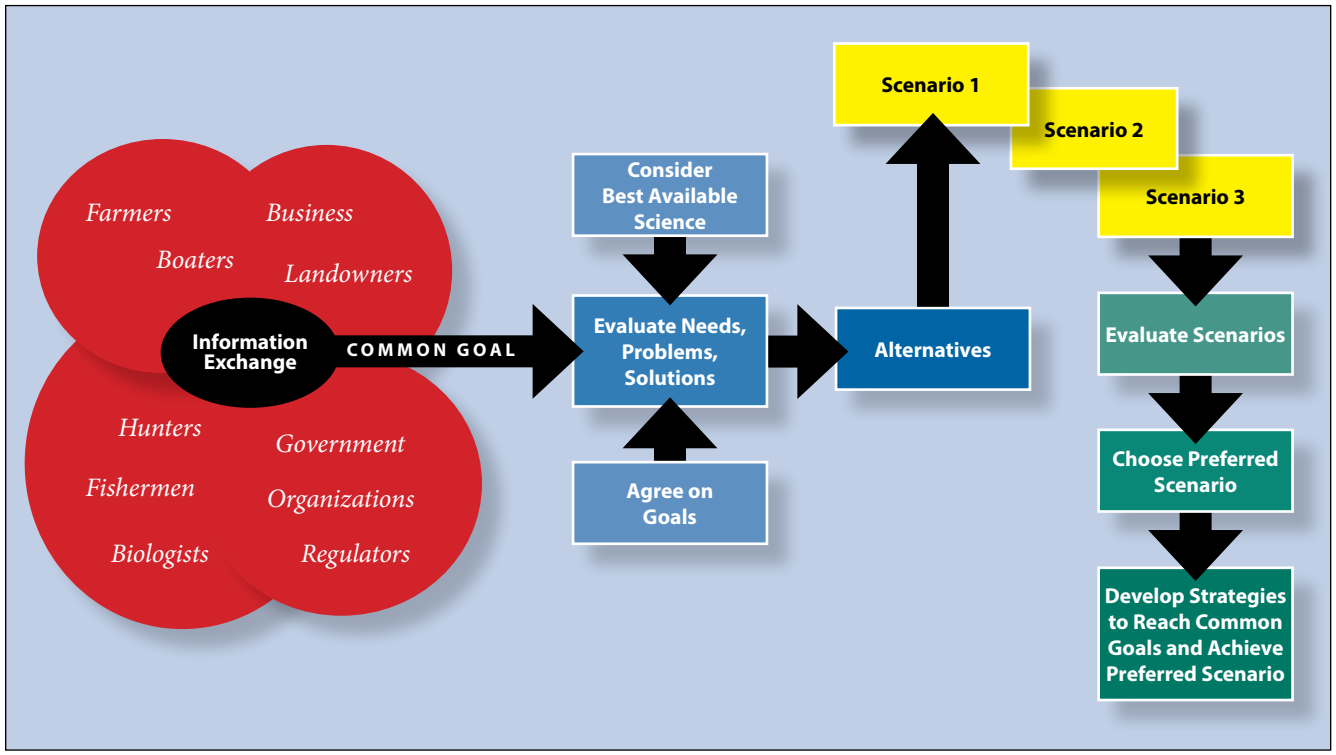


Figure 6.1: How a regional conservation partnership works, a sample process.

strong working relationships with diverse interests within their region.

See Figures 6.1 and 6.2 for suggested sample steps in any regional planning process.

A variety of tools and processes are available to help regional partnerships succeed. For starters, regional partnerships should engage independent facilitators familiar with these tools to guide the process. Available conservation tools include scenario planning,[1,2] the Open Standards for the Practice of Conservation,[3] and Structured Decision Making,[4] among a variety of others.[5,6,7,8,9,10,11,12,13] The Guide to Planning Tools at the end of this section provides short overviews of these three approaches.

Regional Conservation Planning Template

Stage 1- Partnership Initiation

A local champion, agency, non-profit organization or other stakeholder gathers support for initiation of a regional conservation partnership in a given Delta region. This small group of visionaries becomes a core planning team that launches and coordinates the partnership. As a first step, the team develops a scope of work and proposals to obtain funding to support the planning phases. Once funding is available, the team hires an independent facilitator to guide the planning process. The facilitator helps the team to conduct outreach to potential partners and to hold public meetings inviting interested stakeholders to join the partnership.

Stage 2-Scenario Planning

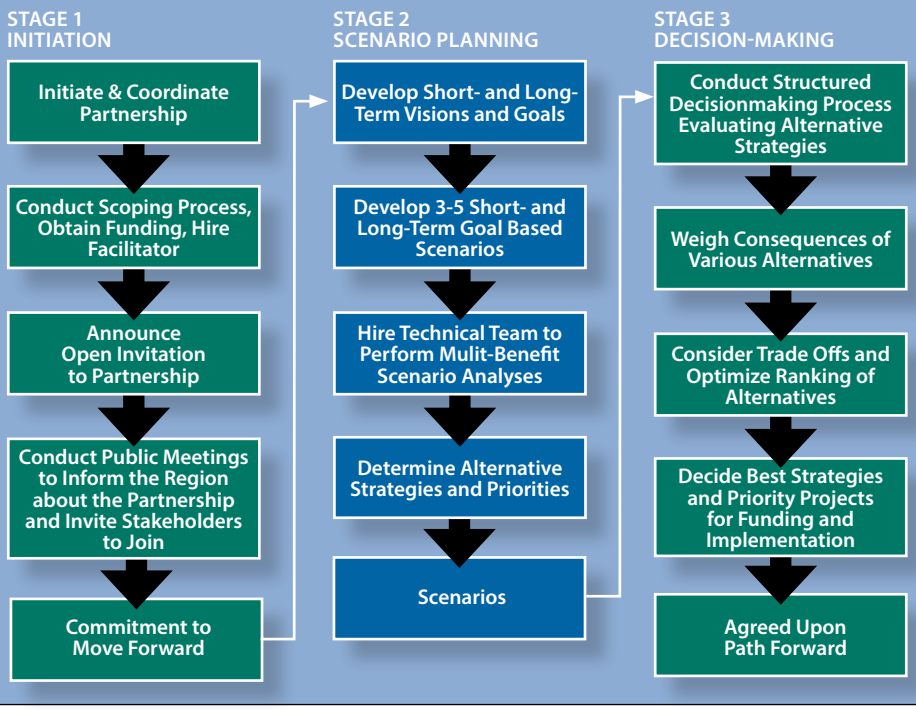
The newly formed regional conservation partnership develops two visions, one short-term, one long-term. Through a facilitated process, each partner can inform the visioning excercise by sharing their interests, mission, goals, and constraints. These factors all exert an important influence on each individual partner's respective level of cooperation and collaboration in the planning partnership. The partnership then creates a set of goals for each finalized vision, guided by the overarching goals of the *Delta Conservation Framework* and partner interests and constraints.

At this stage, the partnership is ready to hire a technical team which can perform goal-based scenario analyses using modeling, GIS overlays and other data sets and tools. For each goal, the partnership, with help from the technical team, then develops three to five possible outcome scenarios for evaluation. These scenarios capture various combinations of important actions to reach the desired outcome for a given goal. The technical team then offers a set of alternative scenarios to the regional conservation partnership for prioritization.

Stage 3- Decisionmaking

The regional conservation partnership uses a structured decision making process to decide which scenarios and related actions to prioritize for implementation. With help from the technical team, the partnership develops criteria to weigh the consequences of the various alternatives, produce an initial ranking of alternatives, consider trade-offs, and optimize the ranking. As a final step, the regional conservation partnership identifies priority projects and best scenario actions needed to reach each of the outlined goals. Ultimately, the technical team develops work and adaptive management plans as final deliverables that enable the partnership to find funding for high priority projects. If all proceeds as planned, most regional conservation partnerships can complete all three stages of this example process in six to twelve months, depending on individual partner availability.

Figure 6.2 Sample Planning Steps



Conservation Opportunity Regions

Each section of the Delta Conservation Framework *includes on-the-ground examples of the different conservation opportunities to be found in various sub-regions of the Delta.*

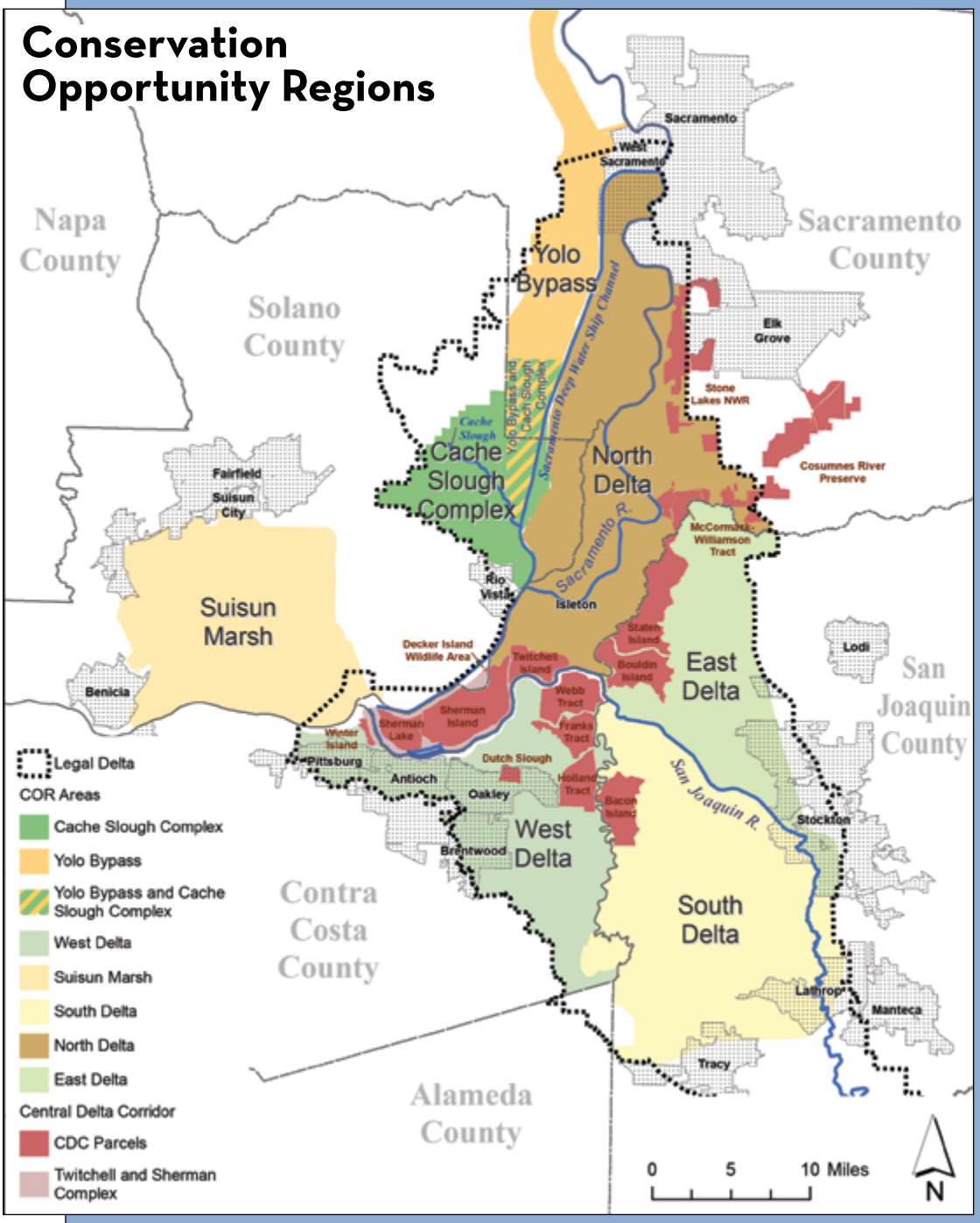
These regional sub-divisions – as a planning tool – were vetted during the 2016 Delta Conservation Framework public workshops. Divisions were loosely based on variation in local land use, communities, ecosystem types, and the location of existing publicly owned lands.

While the result of this process was eight sub-regions, only seven were further described in the Framework (Central Delta Corridor, Yolo Bypass, Cache Slough, Suisun Marsh, and the North, South and West Delta); details on opportunities in the East Delta are less developed.

Within these sub-regions of the Delta, public lands, existing conservation lands, and existing planning partnerships already offer many opportunities for conservation. In many areas, willing private landowners are also contributing to the conservation efforts with the help of nongovernmental organizations like The Nature Conservancy or California Waterfowl Association, partnerships such as the Central Valley Joint Venture or the Migratory Bird Partnership,[14] and agricultural practitioners working with these and other entities.

The information presented in the Framework on each conservation opportunity region includes planning history, activities, conservation projects and challenges.

All of this information is intended to provide a springboard for building regional conservation partnerships and strategies.



Source: CDFW, 2018

Individual Project Approach to Conservation

The *Delta Conservation Framework* also encourages implementation of individual projects in areas without an established regional partnership or regional conservation strategy. The Framework recommends that individual conservation projects should be implemented on publicly owned lands first, or through collaborations between willing landowners and local, state, or federal agencies. Individual projects in areas where no regional partnership exists should adhere to good neighbor practices, such as making contact with neighbors, encouraging regular communication, and discussing important issues like access needs, on-site management practices, agricultural infrastructure, how to avoid increased flood or fire danger, and potential impacts of species movement onto neighboring land.[15] This will help avoid or minimize short- and long-term impacts on neighboring land uses. Proponents of individual projects should also understand how they align with the overarching goals of the *Delta Conservation Framework* and consider using some of the suggested strategies to help achieve each goal during the process of planning, implementing, and managing conservation over the long term.

Windmills in the Montezuma Hills. Photo: Francis Parchaso, USGS

Long-term Sustainability through Delta Conservation

In the context of ecology, the term sustainability describes the ability of ecological systems (ecosystems) to persist indefinitely by remaining diverse and productive. As described throughout this document, conservation is needed to reestablish degraded ecological functions within many Delta ecosystems. Making the connection between the people of the Delta and those entities committed to implementing conservation is vital. Effective education and outreach regarding the benefits of lasting and sustainable Delta ecosystems–their ecosystem services for all Californians–is a key goal with important political, economic, social, and environmental ramifications. Heightening public awareness of the direct connection between a sustainable and healthy environment and the socioeconomic well-being of all Californians is critical to sustaining the motivation to support and implement ecosystem conservation over the long term.[16]

Ecological systems function on many interrelated scales. Untangling this functional complexity to identify key actions that will improve ecosystem function is a daunting task, especially when the drivers of ecosystem function are intermingled with human land uses in the Delta. Great strides have been made in developing a strong, science based understanding of how the Delta functions, and what its species and people need to enjoy a sustained future. However, there will always be numerous uncertainties surrounding our understanding of how each driver of Delta ecosystem function interacts with others, and how climate change will affect our future options and livelihoods, that must be recognized to effectively plan conservation for long-term outcomes.

As described above and in the following Guide, there are a number of effective tools to help planners untangle this complexity and make the best possible decisions concerning conservation goals, actions, strategies, and priority projects. Tools can also help conservation partnerships to manage adaptively once strategies are implemented. Regional conservation partnerships should consider using these tools, along with available Delta science, to ensure full consideration of the influence of conservation actions on ecosystem function. Instead of basing decisions on short-term thinking, conservation planners and stakeholders should be able to rely upon an evolving knowledge of what makes our Delta healthier and more sustainable.

The bridge over Three Mile Slough, one of many intersections of waterways, roads, levees, and landscapes that evoke challenges to long term sustainability, as sea levels rise, in the Delta. Photo: Christina Sloop

The Way Forward

Following the initiation of California WaterFix[17] and EcoRestore,[18] the California Department of Fish and Wildlife committed to leading a high-level planning effort to advance the conservation of the Delta, the Yolo Bypass, and Suisun Marsh. The resulting document — the *Delta Conservation Framework* — is intended to serve as a guide for Delta stakeholders interested in planning for and implementing conservation actions. The Framework includes an array of tools, and summarizes a selection of well-thought out plans and programs, that should enable stakeholder integration, conservation, and adaptive management of Delta ecosystems to benefit both human and natural communities.

Soaring white tailed kite. Photo: Rick Lewis

Building on prior Delta planning efforts, the *Delta Conservation Framework* also provides a shared vision and long-term, landscape-scale goals in the context of the rapidly changing planning parameters associated with climate change. Some of the goals and strategies, for example Goal E, highlight pre-existing and ongoing efforts to successfully implement conservation in the Delta that should be used as resources moving forward. In contrast other goals, such as Goals F and G, highlight the need to consider and motivate new approaches to implementing conservation.

As described throughout Sections II-V, there are many current efforts that align with the Framework and collectively move the Delta closer to the vision for 2050 (for a reminder in brief see right).

Long-term conservation of Delta ecosystems can and will benefit both people and the environment. The *Delta Conservation Framework* embraces this premise with seven broad goals supporting stakeholder communication and outreach, decision making based in science, and thinking ahead collectively to improve permitting and funding. The Framework's goals offer collaborative approaches to conservation challenges, potential regulatory conflicts, and other impediments to conservation initiatives. The Framework also embraces regional-scale conservation goals based on multi-interest partnerships, and supports the strong scientific foundation reflected in the substantive, forward-thinking map for future ecosystem function described in *A Delta Renewed* (see Section IV). Going forward, the *Delta Conservation Framework* will serve as one of several resources informing the amendment of ecosystem elements of the *Delta Plan* and state funding priorities. It should also inform the myriad different plans, programs, projects, and initiatives all in some state of progress as of December 2018, the Framework's publication date. So much is going on all around the Delta that the Framework can only provide a strong vision for integration as of this moment.

Current Major Initiatives Aligned with the Delta Conservation Framework

- **Agricultural Lands Stewardship Framework and Toolkit:** A working group launched by the Department of Water Resources in 2014 to develop a list of strategies to provide project proponents and those affected by proposed conservation projects with an integrated and collaborative approach to address protecting and changing uses of agricultural land.
- **California Department of Fish and Wildlife Grant Solicitation Guidelines:** Draft 2018 Proposition 1 solicitation guidelines make it a priority to fund the development of regional planning partnerships and to facilitate the collaborative development of regional conservation strategies or plans in the Delta.
- **Central Delta Corridor Partnership:** A partnership launched in 2017 to coordinate planning and restoration on a network of roughly 50,000 acres of publically-owned or funded lands in the central Delta.
- **Delta Plan Interagency Implementation Committee:** A committee established in 2013 to facilitate *Delta Plan* implementation through increased coordination and integration among local, state and federal agency participants. The committee has encouraged the development of programmatic permitting tools for conservation projects.
- **Delta Science Program Social Science Task Force:** The Delta Science Program is coordinating a Social Science Task Force tasked with developing a strategic plan to strengthen and integrate social sciences into the science, management, and policy landscape of the Delta. Composed of individuals with a diverse set of expertise in the social sciences, the task force's key goal will be to develop a set of recommendations that can be acted upon by the Delta science community.
- **Franks Tract Feasibility Study:** A study led by the California Department of Fish and Wildlife aimed at restoring portions of Frank's Tract to tidal marsh. This effort solicited feedback from local residents, boaters, and anglers and includes a locally proposed design.
- **Yolo Bypass Cache Slough Partnership:** A partnership of representatives from local, state, federal agencies who signed an memorandum of understanding to oversee collaborative implementation of conservation in this region, all before initiation of the Framework in 2016.

Communities like Discovery Bay will be at the frontlines of Delta adaptation to future conditions. Increasing the acreage of absorbent wetlands, riparian zones, and multi-benefit floodplains (farm fields that can flood occasionally) will vastly improve the safety of Delta communities in the future. But planning and action must occur now, in the small window of time before the Delta faces a marked acceleration in the frequency of extreme flood events and the rate of sea level rise. Efficiencies and cost effectiveness are always lost with crisis management. A Delta in Common, planned now, can benefit both people and the ecosystem. Photo: Christina Sloop

Delta in Common

The path toward more ecologically functional Delta ecosystems within a thriving Delta community remains controversial. Despite mitigation requirements for infrastructure projects and the state and federal water projects, and a long history of public investment in Delta ecosystems through bond funds, few projects have been initiated and managed over the long term. Implementing conservation in the Delta will continue to stall unless Delta stakeholders are willing to work collaboratively, knowing they may have to be open to considering and accepting tradeoffs. If no solutions can be found, Delta ecosystem conservation will remain on hold, or occur in a piecemeal fashion. In the meantime, Delta ecosystems and their important services to humans and wildlife will continue to decline.

Multi-benefit projects that float all boats may seem like an impossible dream. But in reality, what local landowners, hunters, farmers, fishers, and boaters want may not be that far off from what species need to survive and what public infrastructure projects need to provide the greatest good for the lowest price. Every interest – both human and wild – faces the common uncertainty of drought, fire, earthquakes, and political change. There is an equally common reverence, however, for the Delta landscape and a desire to renew the riches of the past in the future.

The *Delta Conservation Framework* reminds the public, farmers, legislators, and water managers about how essential it is to recognize that Delta ecosystems provide services to both people and wildlife. It is an invitation to all interested stakeholders to come to the table. It is a call to continue the work of improving ecosystem health, supporting and recovering Delta wildlife, and growing the science capacity to learn from conservation actions. It is a warning of the urgency of facing the challenges of climate change, drought, and flooding head on.

Progress on key Delta conservation decisions has been stalled for far too long. Collaborative conservation must be in everyone's future.

Find your place, your region, your partners, review the goals and tools provided in the *Delta Conservation Framework*, and set out to make positive progress.

It's up to each and every one of us to build the conservation commons of the future within the unique landscape, and among the unique people, that comprise the Delta.

CONSERVATION OPPORTUNITY REGION

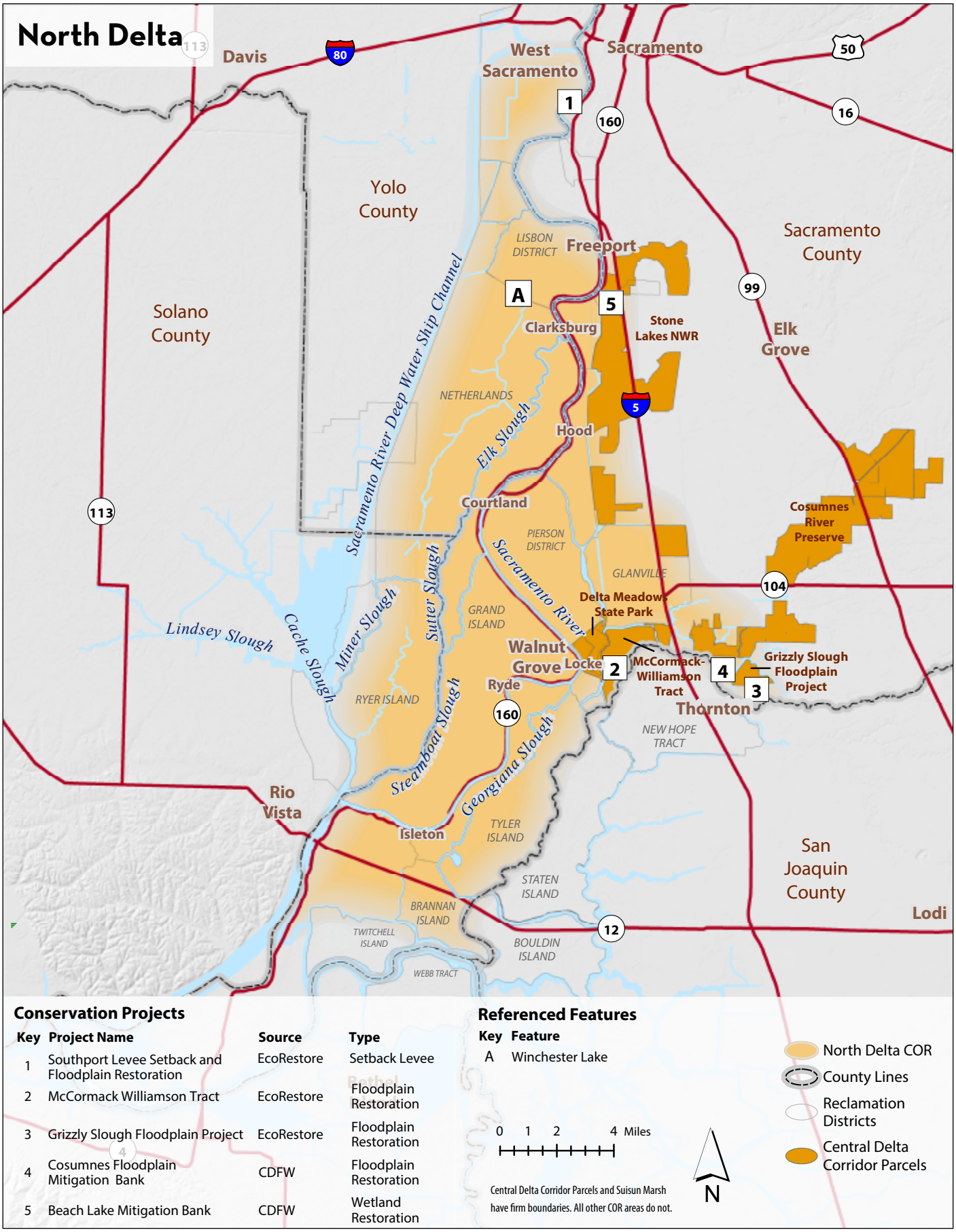
North and South Delta — The Way Forward

Photo: Amber Manfree

Many of the most obvious and ongoing conservation opportunities in the Delta lie around the edges and on public lands in and around the Yolo Bypass, Cache Slough, Suisun Marsh and in the West Delta (see pp. 90, 121 & 149). However, the heart of the Delta, east of the Yolo Bypass and west of the San Joaquin River, encompasses two productive and important agricultural zones. In the North Delta region, high value orchards and vineyards and numerous historic small towns dominate the landscape. In the South Delta region along the San Joaquin, Middle and Old Rivers, agricultural lands predominate with farmers growing tomatoes, corn, and peas, or grazing cattle. In both these regions, where there is little publicly owned land, conservation opportunities lie more with wildlife-friendly farming, improvements around the margins of channels, and optimization of new investments in levees, floodways and bypasses to protect towns and farms.

While supporting the Delta way of life in these regions remains central to the conservation of both people and place, it is important to also recognize from an ecosystem perspective that fish, wildlife, migratory birds, and water still move through these heartland regions. In these regions, no regional partnerships or vast areas of public land exist as opportunity areas for ecosystem improvement, as they do in other areas of the Delta. However it is still worthwhile to consider providing healthy corridors along farm edges and riverfronts, and to build on existing flood management projects, as part of the holistic, landscape scale approach to conservation recommended by the *Delta Conservation Framework*.

CONSERVATION OPPORTUNITY REGION



Conservation Projects

Key	Project Name	Source	Type
1	Southport Levee Setback and Floodplain Restoration	EcoRestore	Setback Levee
2	McCormack Williamson Tract	EcoRestore	Floodplain Restoration
3	Grizzly Slough Floodplain Project	EcoRestore	Floodplain Restoration
4	Cosumnes Floodplain Mitigation Bank	CDFW	Floodplain Restoration
5	Beach Lake Mitigation Bank	CDFW	Wetland Restoration

Referenced Features

Key	Feature
A	Winchester Lake

North Delta COR
County Lines
Reclamation Districts
Central Delta Corridor Parcels

Central Delta Corridor Parcels and Suisun Marsh have firm boundaries. All other COR areas do not.

Map: CDFW, 2018

Regional Setting

Seen from the air, the two conservation opportunity regions on the north and south sides of the Delta are a patchwork of orchards, vineyards, crops, waterways, islands and rural communities. Most are closely tied to a diverse agricultural way of life. These two regions also host a number of high-value ecosystems supporting people and wildlife.

The North Delta conservation opportunity region loosely straddles Highway 160, and crosses several counties as it extends from West Sacramento down to Highway 12. The South Delta region begins slightly south of Highway 12, and occupies an area in San Joaquin County that flanks Highway 4 to the west of I-5. Some of the legacy towns within these conservation areas include Freeport, Clarksburg, Hood, Courtland, Isleton, Walnut Grove, Ryde, and Locke in the North Delta, and Lathrop in the South Delta. No major urban developments encroach into these areas, though they are bounded by Sacramento to the north and Stockton to the southeast (see maps).

Compared to other conservation opportunity regions described in the *Delta Conservation Framework*, the North and South Delta regions include little public land (1-10 percent). Most of the public land is in the North Delta region within the 17,640-acre Stone Lakes National Wildlife Refuge,[1] a refuge partially owned and managed by the U.S. Fish and Wildlife Service. Entirely within the Sacramento River's 100-year floodplain, Stone Lakes' strategic location prevents urban encroachment into the Delta and provides a habitat link with the neighboring Cosumnes River Preserve.[2] In addition, Elk Slough, near Clarksburg, remains as one of the most intact riparian ecosystems of its kind in the Delta. Due to the proximity of the Sacramento River and its tributaries, including the American River, flood risk remains an important consideration for the North Delta region's lands, citizens, infrastructure, and environment.

In the South Delta conservation opportunity region, one of the most important planning features is the Paradise Cut. This slough protects the River Islands development from flooding and directs floodwaters away

North & South Delta Regions At A Glance

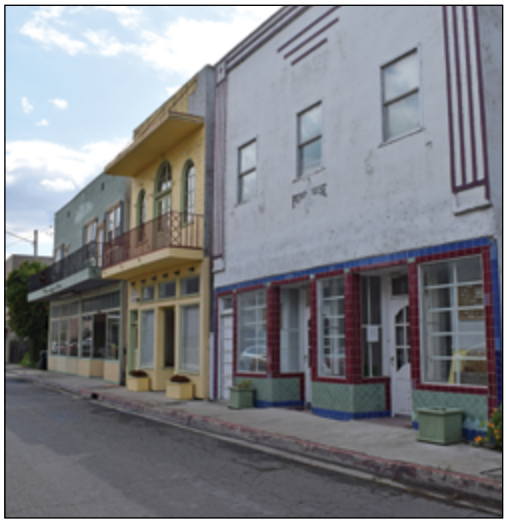
- **Size**
  NORTH: 140,000-150,000 acres
  SOUTH: 220,000 – 250,000 acres
- **Location**
  NORTH: from approximately west sacramento to just south of State Route 12
  SOUTH: west of the San Joaquin River and generally east of Contra Costa County
- **Elevation Range**
  NORTH: -23 feet below to 45 feet above sea level
  SOUTH: -23 feet below to 331 feet above sea level
- **Land Use**
  NORTH: 75-80 percent agriculture; 5-10 percent public lands
  SOUTH: 65-70 percent agriculture; 1-5 percent public lands
  OTHER PRIMARY LAND USES: flood protection, wildlife habitat, residential, water supply and storage, recreation, legacy towns, tourism
- **Natural Communities**
  NORTH: managed wetland, tidal wetland, freshwater emergent wetland, floodplain, grasslands, riparian, vernal pools, channel margin, perennial aquatic, alkali seasonal wetland
  SOUTH: managed wetland, freshwater emergent wetland, floodplain, grasslands, valley foothill riparian, channel margin, perennial aquatic, vernal pool complex
- **Urban/Town Population**
  NORTH: 20,000 – 30,000
  SOUTH: 100,000 – 110,000
- **Rural Population**
  NORTH: 5,500 – 6,000
  SOUTH: 7,000 – 8,000
- **Recreational Opportunities**
  NORTH: wildlife observation, picnic areas, hiking trails, boating, water skiing and water excursions, fishing, hunting, photography, interpretative services, camping, water sports (e.g., windsurfing, swimming), heritage sites, scenic highways.
  SOUTH: boating,water skiing, water excursions, fishing, hiking and cycling trails. (proposed: picnic areas, interpretive water trails, and camping)
- **Sampling of Listed Species**
  NORTH: greater sandhill crane, Delta smelt, longfin smelt, Chinook salmon, Central Valley steelhead, green sturgeon, giant garter snake, Swainson's hawk, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, California black rail, western yellow-billed cuckoo
  SOUTH: Fish, shrimp, snake and several bird species listed above plus riparian brush rabbit, riparian woodrat, San Joaquin kit fox, California red-legged frog, California tiger salamander, Delta button celery

from the urbanized floodplains in Lathrop and Stockton.[3] Historically, the Paradise Cut was one of the chief distributary branches of the San Joaquin River and, given high enough flows, connects the San Joaquin with Old River downstream. Twice during the 19th century, the main floodwaters of the San Joaquin River flowed through Paradise Cut and will likely do so again.

Planning History

The North Delta's planning history is shaped by the 2016 Community Action Plans for the three largest north Delta communities: Clarksburg, Walnut Grove, and Courtland.[4,5,6] These plans were developed in response to the 2009 Delta Reform Act and the *Delta Plan* (Chapter 5),[7] and recognize the "Delta as Evolving Place" concept (see Section II, p. 43). These plans — whose main themes include transportation, communications, and community ameneties — lay out goals, actions, and implementation steps based on community input. Though the plans don't have any specific focus on conservation, community members generally voiced an appreciation for the Delta's open space, fresh air, scenic views, and recreational opportunities, as well as a desire to expand access to the Sacramento River and other natural areas. Community members also valued the economic benefits of tourism (sandhill crane festivals etc.). Their major concerns included flood insurance,the state's plans for twin tunnels that might have a diversion point along the Sacramento River within the North Delta region (California WaterFix), and aquatic invasive species.

In the South Delta, most planning activities have focused on protecting the Stockton area from flooding and improving the Paradise Cut, a flood bypass in the region. Improvements to the cut, as well as expansion of the lower San Joaquin River's flood capacity and levees, have been the subject of more than 15 years of studies on the part of the US Army Corps of Engineers and the state's Central Valley Flood Protection Board, along with many local partners. Various feasibility studies and overlapping projects, including those referring to a project called the Lower San Joaquin River Bypass, and more recent recommendations developed by the board in the 2017 *Central Valley Flood Protection Plan*, and also endorsed in the 2013 *Delta Plan*, feature some related conservation elements. These include multiple setback levee projects to restore connectivity between the river and portions of the floodplain, and the enhancement of native vegetation.



Legacy town of Walnut Grove in the North Delta. Photo: Amber Manfree

At the 2016 *Delta Conservation Framework* workshops, stakeholders praised the Central Valley Flood Protection Plan's Conservation Strategy. In terms of the larger conservation opportunities in the South Delta, they envisioned a corridor of functional riverine and riparian ecosystems between Highway 5 and the San Joaquin River National Wildlife Refuge near Vernalis, providing a connection to the floodplains in Paradise Cut and restored channel margin habitat in the legal Delta.

North and South Delta Planned or Existing Restoration Projects

NORTH

- Habitat enhancement for Swainson's hawk at Elliot Ranch (approximately 215 acres)
- McCormack Williamson tract floodplain restoration (approximately 1,498 acres)
- Grizzly Slough floodplain restoration project (approximately 400 acres)
- Southport setback levee project (four miles of levee setback creating up to 152 acres of mixed floodplain and riparian habitat)

SOUTH

- Fish barriers
- Paradise cut and Lower San Joaquin Bypass floodplain, levee, and riparian habitat, projects (including 19 miles along the San Joaquin and Old Rivers)
- River Islands mitigation

Riparian brush rabbit in San Joaquin Valley National Wildlife Refuge. Photo: H. Grimes

Opportunities for Conservation

Conservation opportunities in the North Delta include wildlife-friendly agriculture and improvement or expansion of floodplain, tidal marsh, nontidal marsh, riparian, and channel margin habitat for Delta wildlife, including special status species such as the greater sandhill crane, Delta smelt, and tricolored blackbird. Juvenile salmon may benefit from improved channel margins along the Sacramento River and Steamboat and Sutter sloughs, which could provide an alternative route for passage through the Delta to the Sacramento River. Stone Lakes National Wildlife Refuge provides opportunities for wetland and riparian conservation. Washington Lake could also offer terrestrial oak woodland habitat conservation opportunities for wildlife in the North Delta. Other conservation opportunities include continued support for the state's aquatic invasive species management programs[8,9] and efforts to better understand how to avoid blooms of cyanobacteria, such as *Microcystis*, in the Delta.[10]

In the South Delta, the planned expansion of Paradise Cut offers numerous conservation opportunities, with a strip seven miles long and at least 1,000 feet wide permitting seasonal inundation.[11,12] This could offer the potential for riparian forests to reestablish, as well as for large areas of restored freshwater marsh downstream from Paradise Cut, into which floodwaters could feed. The South Delta region also supports a remnant population of the endangered riparian brush rabbit and these actions could support recovery of the species, as well benefitting sensitive fish and plants.[13,14]

Potential Solutions to Recognized Challenges

Consideration for the safety, well-being and sustainability of local communities may be one overriding challenge in the North and South Delta. In the North, small legacy towns represent a historic and current agricultural way of life important to the Delta as an evolving place. In the South, areas of the cities of Manteca, Lodi, and Stockton that lie around the edges of the conservation opportunity region have disadvantaged community status. With very little public land available in either of these Delta regions the challenges of undertaking conservation become even more complex and multi-faceted.

WILDLIFE-FRIENDLY AGRICULTURE

In the North and South Delta, local farming communities remain concerned that the push for more conservation will displace agriculture and its supporting industries. As described in Section II of the *Delta Conservation Framework*, however, there is growing recognition that conservation in areas with little public land should focus more on integrated, dynamic land use management that continues wildlife-friendly agriculture,[15] and on existing flood and channel management projects, than on land purchases from unwilling sellers.The Framework also recognizes that agricultural commodities and their related industries change over time.

In the North Delta, one focus of conservation could be Elk Slough, where a remnant mature riparian zone provides aquatic, transition, and terrestrial habitat for Delta wildlife. Planning for conservation could address existing flood protection needs while potentially restoring an alternative migratory corridor for salmon by expanding its width, where possible, and encouraging maintenance

of adjacent wildlife-friendly farming operations with field crops rather than permanent row crops. Such steps could provide high-quality habitat and connectivity for riparian zone wildlife to the larger Delta landscape.

In the South Delta, conservation in collaboration with agriculture could continue to maintain wildlife-friendly grazing, seasonal crops, and alfalfa adjacent to enhanced riparian vegetation projects along the San Joaquin River and other south Delta channels. This would help expand wildlife movement corridors beyond the riparian zone. The Middle River, which is silting up and mires irrigation intakes, could be a focal point of future multi-benefit conservation initiatives focused on improving channel depths and creating more riparian channel margin habitat.

INTEGRATED FLOOD MANAGEMENT

In the North Delta, areas best suited for shoreline enhancement along the Sacramento River, where floodplain or low riparian bench habitats could be established, were evaluated as part of the *Bay Delta Conservation Plan Channel Margin Opportunities Assessment*.[16] One project broke ground in May 2017 in West Sacramento, a setback levee aimed at improving nearly six miles of vulnerable levee along the west bank.[17] This multi-benefit Southport levee project contributes toward California EcoRestore[18] floodplain and riparian habitat restoration goals, and will provide additional flood protection for the North Delta's legacy communities. To further expand habitat in the area and provide an alternative migratory route for salmon through Elk, Sutter, and Steamboat sloughs, improvements to Elk Slough would need to be considered, including re-establishing a functional connection to the Sacramento River.

In the South Delta, planned projects along the Paradise Cut described above would lower the San Joaquin River flood stage by over two feet where Interstate Highway 5 crosses the river. Modeling suggests they would also

Important Planning Documents

NORTH DELTA

South Sacramento Habitat Conservation Plan

This HCP is currently under development (2010 working draft). Its primary focus is to protect vernal pool and other upland habitats that are being diminished by vineyards and development, but it also protects wetland and riparian habitats and agriculture.[12] The plan covers several special status terrestrial species. The geographic scope includes a small portion of the Delta in Sacramento County, extending from the Stone Lakes National Wildlife Refuge in the north to Tyler Island in the south. Portions of the plan area are included in the *Delta Conservation Framework's* extended planning zone, where habitat could become important for species such as sandhill crane and giant garter snake as sea levels rise and other future conditions render legal Delta habitat less suitable. Reserve areas adjacent to the Delta could also provide stepping-stone connectivity between Delta wildlife populations and populations to the east. (See also p.33)

Yolo Habitat Conservation Plan and Natural Communities Conservation Plan

This countywide HCP/NCCP conservation plan is focused on endangered species and associated mitigation for infrastructure projects (e.g. roads and bridges) and development activities (e.g. agricultural facilities, housing, and commercial buildings). It is coordinated by the Yolo Habitat Conservancy and has a strong link to agricultural preservation, aiming to strike a sensible balance between natural resource conservation and economic growth in the region. Yolo County only overlaps the Delta in the Yolo Bypass and the area between the Sacramento Deep Water Ship Channel and the Sacramento River. However, many special status species are found in this area, including valley elderberry longhorn beetle, giant garter snake, and least Bell's vireo. (See also p 34 and pp.91-101)

Yolo Regional Conservation Investment Strategy

This voluntary, landscape-scale conservation plan serves to identify conservation priorities to guide public and private conservation actions and investment, such as habitat restoration and protection. It will provide a blueprint for additional voluntary, non-regulatory conservation in Yolo County that addresses conservation needs that are not covered in the Yolo habitat conservation plan (HCP/NCCP, see above and also pp. 91-101)

SOUTH DELTA

Bay Delta Conservation Plan Public Draft

The 2013 BDCP plan considered the potential for floodplain restoration and enhanced riparian corridors along the San Joaquin River which traverses the South Delta region.[13] The evaluation of conservation potential in the BDCP focused on a) increased inundation acreage to benefit listed fish species and b) increased frequency of inundation and residence time to improve production of listed fish species food resources.[x] Overall, potential actions for riparian corridor and seasonal floodplain improvements include levee setback installation, creation of flood bypasses, riparian planting, and channel margin enhancement. The BDCP also includes a number of conservation actions in the North Delta region.

Central Valley Flood Protection Plan and Conservation Strategy & San Joaquin Basin Feasibility Study

The 2017 CVFPP serves as a guide to the state's participation in managing flood risk (see Guide p. 31). Various related basin specific plans are pertinent to this conservation opportunity region and suggest options for reducing flood risk, improving wildlife habitat, and adapting to climate change in Paradise Cut, the San Joaquin River Bypass, and the San Joaquin River Basin. (Appendix 10 of the basin feasibility study includes ecosystem restoration concepts).

San Joaquin County Multi-Species Habitat Conservation and Open Space Plan

Approved in 2001, this HCP was developed to provide guidelines for preserving agriculture and protecting species in the context of open space conservation and conversion to other land uses.[14] The geographic scope includes all lands within the legal Delta that overlap with San Joaquin County, as well as secondary zones to the east and southwest of the Delta. (See also p. 34)

substantially reduce flood risk between I-5 and Stockton. Expanding the floodway at Paradise Cut will also improve sensitive species habitat without changing most agricultural production, because farmland in the expanded floodway would only likely be inundated every 12 years. Goals for the Lower San Joaquin River Bypass project, which encompasses Paradise Cut, include maintaining existing agricultural operations; restoring shaded riparian aquatic habitat along decommissioned levees; providing riparian cover for riparian brush rabbit, riparian woodrat, and valley elderberry longhorn beetle; removing revetment to restore geomorphic process along decommissioned levees; and restoring the southern portion of the current in-channel bar for salmon floodplain rearing habitat. In addition, related plans for new, stronger levees setback from the San Joaquin and Old rivers offer similar, multiple, integrated benefits.

Paradise cut. Photo: Patrick Kelly, http://sfoap.com

RECYCLED WATER USE

Underlying many Delta conservation projects is a concern about impacts on water supply and efficiency. In the North Delta, the South County Ag Program[19] (Sacramento County) represents a new water recycling and reuse project designed to provide a sustainable, drought-proof water supply for agriculture, urban, and environmental purposes. The program is supported by a broad group of local and regional stakeholders and aims to: recharge groundwater supplies and increase groundwater levels up to 30 feet; increase flows in the Cosumnes River in the Highway 99 area during critical fish passage and spawning periods; promote ecosystem restoration and viability of unique habitats and special status species; enhance smart irrigation practices through the use of recycled water; and provide groundwater storage opportunities for regional water supply reliability.

INVASIVES SPECIES MANAGEMENT

The South Delta remains ground zero for the greater Delta in terms of the extent of invasions from floating and submerged aquatic invasive plant species. Poor circulation exacerbates this problem. The North Delta also suffers from impacts from invasives. Agricultural welfare and efficiencies in both areas can be impacted by plants clogging irrigation intakes, invading levee banks and waterways, and preventing access and navigation. The *Delta Conservation Framework* recommends that planning for any conservation project, channel margin improvement, floodway expansion, setback levee or riparian habitat development should include an aggressive and adaptive invasive species management component.

CLIMATE CHANGE AND ADAPTATION OPPORTUNITIES FOR LONG-TERM SUSTAINABILITY

In general, the Delta region is expected to experience more intense winter flooding and storm effects due to climate change, causing greater erosion of riparian areas.[20,21,22,23] In the North and South, as in other Delta regions, more intense winter storms with increased winter river flows will likely significantly increase the hydraulic pressure on levees which could lead to flooding.[24] Climate change induced sea level rise could also affect tidal dynamics and exacerbate exisiting salt water intrusion into the Delta.

Additionally ongoing subsidence in these areas releases greenhouse gases and increases potential flood risk. Conservation planning should identify tools to stop or reverse subsidence, through alternative cropping focusing on alfalfa and rice which both build bulky organic matter (adding elevation) and provide benefits to waterfowl, cranes and Swainson's hawks.

Scenario planning[25] is a critical tool that conservation planners can use to help anticipate impacts of climate change on ecosystems, species, infrastructure, agricultural practices, recreation, and inform other land uses and integrate these into the long-term planning picture.[26] A scenario planning approach integrated within a structured decision making process[27] could also incorporate long-term adaptive management and funding planning to anticipate the evolution of near-term conservation actions into the future. See Guide to Planning Tools p.184 for more details.

Looking Ahead

In regions with limited public lands, conservation efforts must continue to focus on multi-benefit land and flood management driven by local support. The *Delta Conservation Framework* supports the expansion of all such efforts. Opportunities to implement conservation in collaboration with private landowners, and areas where conservation is not compatible with local land uses, should be clearly identified as a first step in regional planning.

A partnership process could be a valuable asset in moving integrated planning forward in both the North and South Delta. In the North Delta, any new partnership should be inclusive of very diverse interests, ranging from residents, businesses, and agricultural practitioners to local, state, and federal agencies. Other valuable partners could be non-governmental organizations with a track record of expertise in the North Delta, as well as local reclamation districts, agricultural commissioners, the local farm bureau, and the North Delta Water Agency.

In the South Delta, while there is no current regional partnership focused on conservation, there are a lot of existing partnerships focused on flood management. Efforts could be made to build on the multi-benefit aspects of flood management and riparian habitat improvement here, with important potential partners for continued planning including: the San Joaquin Area Flood Control Agency, the Southern Delta Levee Protection and Channel Maintenance Authority, San Joaquin County, the San Joaquin County Council of Governments, the San Joaquin Farm Bureau, the San Joaquin Valley Resource Conservation District, the River Islands Development, LLC, American Rivers, and the Natural Resources Defense Council. The Resource Conservation District is emerging as a local champion for planning with available funding. The South Delta Water Agency and Reclamation Districts 17 and 2062 are the primary leaders and entities that could engage landowners in the South Delta during planning and implementation of the bypass project. The bypass project would also benefit from an established permitting liaison to resolve permitting issues as they arise, and to potentially develop a Memorandum of Understanding between participating entities.

QUICK LINKS

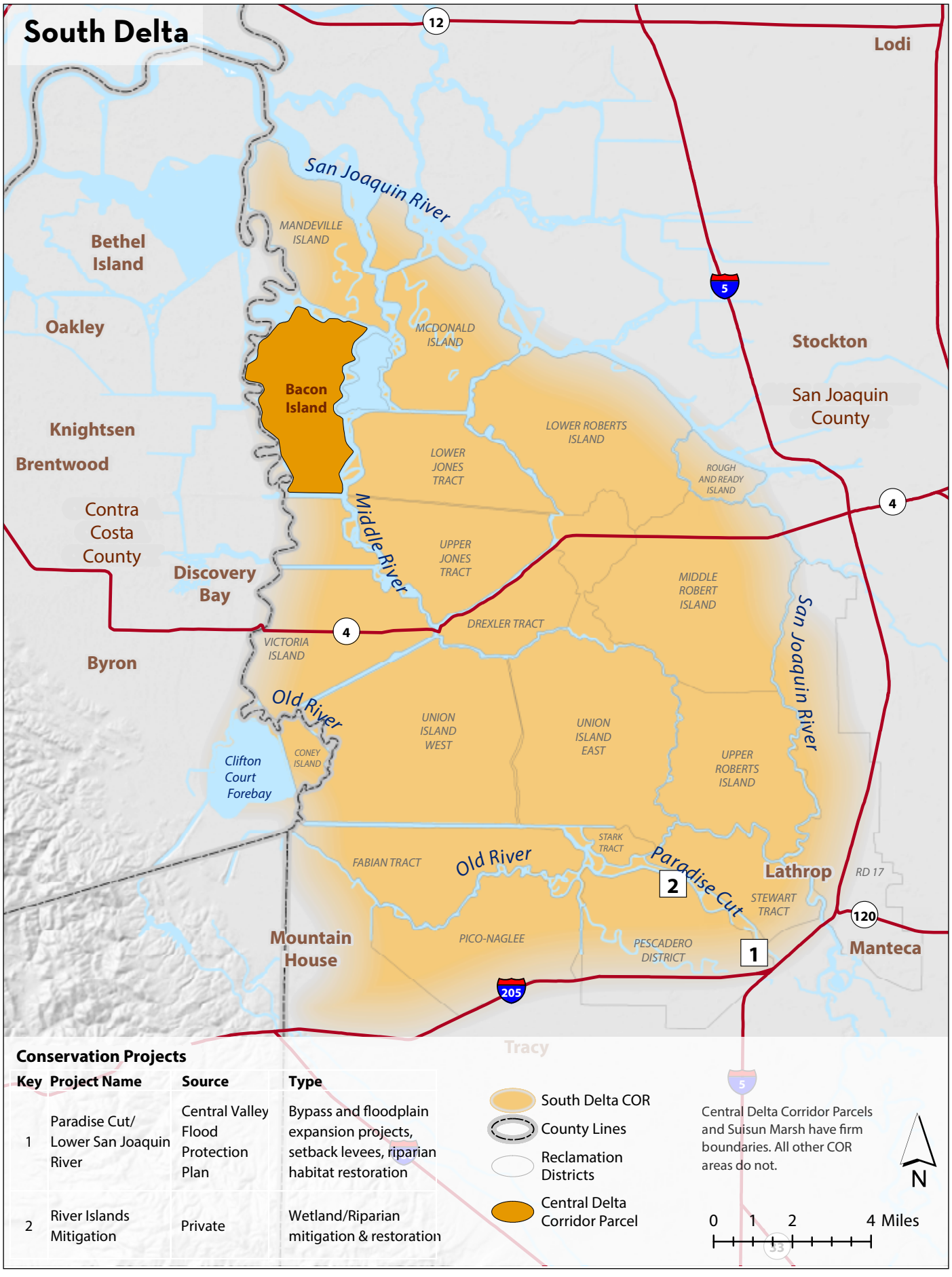
Central Valley Flood Protection Plan
www.water.ca.gov/cvfmp/docs/CVFPP-2017-CVFPP-Update-Draft.pdf.

Southport Setback Levee Project
http://resources.ca.gov/ecorestore/2017/05/southport-setback-levee-project-breaks-ground-in-west-sacramento/

Stone Lakes National Wildlife Refuge
www.fws.gov/refuge/stone_lakes/.

For expanded, more detailed descriptions of these conservation opportunity regions, see Appendix X.

For more detailed descriptions of these conservation opportunity regions, see Appendix 2.



Map: CDFW, 2018

Guide to Planning Tools

Open Standards

The Open Standards for the Practice of Conservation (Open Standards) provide a well-established conceptual framework and tool set for conservation project planning, implementation, and monitoring. The California Department of Fish and Wildlife employed this practice in developing the 2015 *California Wildlife Action Plan*.

The five main Open Standards process steps are: 1) conceptualize the project; 2) develop a formal action plan; 3) implement actions; 4) analyze, use, and adapt; and 5) capture and share learning. These steps align closely with adaptive management frameworks. The Open Standards also offer a software tool called Miradi for use throughout the planning process. The tool allows users to create conceptual models; analyze factors in light of their impact on the conservation targets (e.g., specific ecosystem types, species, human-oriented benefits) and desired outcomes; and create implementation, management, and monitoring plans and project budgets.

The Open Standards' concepts are applicable at any stage in the conservation process, and they allow planning teams to specifically consider the benefits of conservation to human communities and integrate socioeconomic aspects. Additional planning tools include an in-depth, rational analysis of actions to implement individual strategies called Results Chains. Use of Results Chains allows planning partners to evaluate whether actions are linked, focused, feasible, and appropriate for reaching the targeted goal.

The Open Standards also facilitate long-term planning in the context of climate change by encouraging planners to 1) understand and respond to existing and future impacts of climate change, alongside other conventional threats or pressures; and 2) develop and implement actions that do not erode options for responding to future climate change impacts.

Low pressure grade vehicles move dirt to increase elevations and recreate marsh plain on a Delta wetland restoration project benefitting wildlife. Photo courtesy: CDFW

The Open Standards represent the state-of-the-art in the conservation community's knowledge of the process for designing, managing, and monitoring conservation activities. Use of the practice can support the development of regional conservation strategies in the Delta by providing a consistent structure for conservation planning. Open Standards can be used in concert with scenario planning and structured decision-making, and decision support models such as Marxan. The Bay Area Conservation Lands Network successfully uses Marxan for prioritization of Bay Area conservation lands.

The Open Standards help conservation partnerships learn what works, what does not work, and why. Ultimately, this process allows conservation partnerships to adapt, improve their future efforts, and link to other efforts that use the same approach to planning.

See Quick Links p. 188 for access to these tools.

The Open Standards involves five main process steps:

1. Conceptualize Project

The first steps to conceptualize a program or project involve defining the vision and geographic, temporary, and sociopolitical scope; selection of the planning and implementation team and their roles and responsibilities; identification of conservation target (species, habitat, or ecosystem biodiversity) and human wellbeing aims (aims are focus items, such as reestablishing fluvial processes along streams, integrating recreation and other human benefits into conservation outcomes, or incorporating agricultural sustainability into Delta landscape-scale conservation); description of the current status of these aims; identification of direct threats, pressures, or contributing factors with regard to key ecological, biophysical, or human wellbeing attributes; and performing a situation analysis. This involves creating a conceptual model of how all key factors—including threats, enabling conditions, and potential opportunities—affect the aims. A built-in technique for evaluating and ranking factors helps to identify critical threats/pressures for which priority goals and strategies can then be determined.

2. Develop a Formal Action Plan

With a conceptual understanding of the underlying assumptions of how pressures and contributing factors influence the aims, the next process step is to develop goals for each aim and identify key factors and strategies to reach the identified goals. Linking the strategies to the desired goals and ultimate outcomes allows the determination of key intervention points and related actionable objectives that may involve intermediate outcomes on the path to reaching a desired goal. Performing this in-depth, rational analysis of individual strategies allows the evaluation of whether they are linked, focused, feasible, and appropriate for reaching the targeted goal. By following "if, then" logic steps along a "results chain," this evaluation will ultimately result in prioritization of strategies and related actions.

3. Implement Actions and Monitoring

With the set of priority strategies in mind, the next step is to develop short- and long-term work plans and timelines for implementing and monitoring actions. This can then support the solicitation of necessary implementation funds. In addition to, or as part of, the work plan, it is critical to develop a monitoring plan with identified indicators, performance measures and metrics to evaluate the progress toward goals, or the status and trends of aims. Incorporating targeted, goal-oriented assessment in the project budget increases the likelihood of funding support for the adaptive management and monitoring aspect of the program or project.

4. Analyze, Use, Adapt

Once actions and monitoring have been implemented, a system for handling the project data has to be made available to support data analysis. In this respect, shared, easy access data management portals have been shown to be successful tools. Project results and assumptions, and operational and financial data, are then analyzed at set intervals over time, followed by documented discussions and decisions that may or may not lead to the revision of project plans at given points in time.

5. Capture and Share Learning

Key results and lessons are documented throughout program or project implementation to serve as the foundation for sharing insights and knowledge gained throughout. Depending on identified key audiences, communication strategies can be developed and executed. It is important to create a learning environment where regular feedback can be shared formally or informally, regular evaluations that demonstrate a commitment to learning are carried out, and a safe environment for experimentation is provided, allowing sharing of successes and failures with other teams.

Measuring salmon carcasses as they complete their life cycle after habitat restoration work in Putah Creek, one example of checking on conservation outcomes. Photo: Robin Meadows

Guide to Planning Tools - continued

Scenario Planning

Scenario planning is a strategic way to plan. It helps to achieve desired outcomes over the long term by evaluating the consequences of alternative pathways to achieve a defined goal. Also called scenario thinking, or scenario analysis, it is a structured way for agencies, organizations, or partnerships to think about how a variety of strategies and actions will likely affect the future by developing and evaluating a small number of scenarios. Scenarios are essentially stories of how the future might unfold and how this might affect the issues at hand over the short and long term.

To develop and evaluate a suite of representative scenarios to reach a goal, potential prejudgments and preconceived notions influencing the decision-making process need to be brought to light and acknowledged by the partnership. In the first step of scenario planning, participants are asked to recognize and let go of prior misunderstandings to identify known facts (see Figure 6.3 – Step 1 – Rules of the game). This helps uncover what can and cannot be controlled.

In the second step, recognizing what participants cannot control will help them to identify factors that can be influenced by the actions proposed to reach desired outcomes. In addition, identifying the main drivers and related key uncertainties (Figure 6.3 – Step 2) helps to uncover the potential for affecting them. As participants clarify misunderstandings, prejudgments, and key uncertainties, and begin to understand likely difficulties and divergent viewpoints, they will build trust (see Table 6.1 for Delta examples).

The three to five scenarios developed in Step 2 are to be presented as sequential stories. Each scenario then serves to "visualize" the possible steps toward achieving a goal and potential pitfalls to reaching them relative to the existing uncertainties. These

Table 6.1: Examples of prejudices and key uncertainties affecting successful conservation implementation in the Delta.

Misunderstandings – Prejudgments – Key Uncertainties	Controllable?	Potential Approach/Solution
Delta conservation is independent from other land uses	yes	Good neighbor practices
People do not benefit from Delta conservation	yes	Multi-benefit conservation
Conservation area managers are bad neighbors	yes	Good neighbor practices
Delta conservation is incompatible with agriculture	yes	Wildlife-friendly agriculture
People's needs don't matter to conservation decision makers	yes	Multi-benefit conservation
Conservation areas do not offer opportunities for recreation	yes	Multi-benefit conservation
Impacts of conservation (e.g., tidal wetland flooding) will negatively affect other land uses, especially agriculture (e.g., levee seepage affecting prime agricultural soils)	yes	Multi-benefit conservation
Status quo of subsidence is not a problem and does not have to be addressed through change in agricultural practices	yes	Education and outreach on carbon farming to reverse subsidence
Conservation areas invite threatened and endangered species that could spread into neighboring lands.	yes	Employ Safe Harbor Agreements/ Neighboring Landowner agreements.
Climate change effects will change the Delta ecosystems	somewhat	Maintaining or increasing ecosystem and infrastructure resilience through restoring ecosystem function and establishing transition zones
Will Delta stakeholders be able to move Delta conservation forward in collaboration?	yes	Outreach and inclusive planning partnerships

Photo: Rick Lewis

See Quick Links p. 188 for access to these tools.

scenarios can then be individually evaluated and ranked. Evaluation of their strengths, weaknesses, opportunities, and threats—scenario by scenario—allows identification of the most promising options for moving forward (Figure 6.3 – Step 3). Once the most promising options rise to the top, the partnership can develop SMART objectives (specific, measurable, attainable, result-oriented, and time-bound), followed by implementation of related actions (Figure 6.3 – Step 4).

Scenario planning in conservation is a vital tool that enables planners to consider landscape-scale and long-term dynamics. For example, it could be used to help anticipate impacts of short- and long-term changes (e.g., land use or climate change, respectively) on ecosystems, species, infrastructure, water management, agricultural practices, and recreation, and then to evaluate them together as part of the long-term conservation-planning picture.[19] A scenario planning approach could be integrated within structured decision making (see page 188). It could also incorporate long-term adaptive management planning, and consideration of funding needs when anticipating how near-term conservation actions may evolve into the future. Scenario planning can also integrate open standards (see page 184) into the "conceptualize-project" step to evaluate several possible options for reaching the desired outcomes within varied timelines.

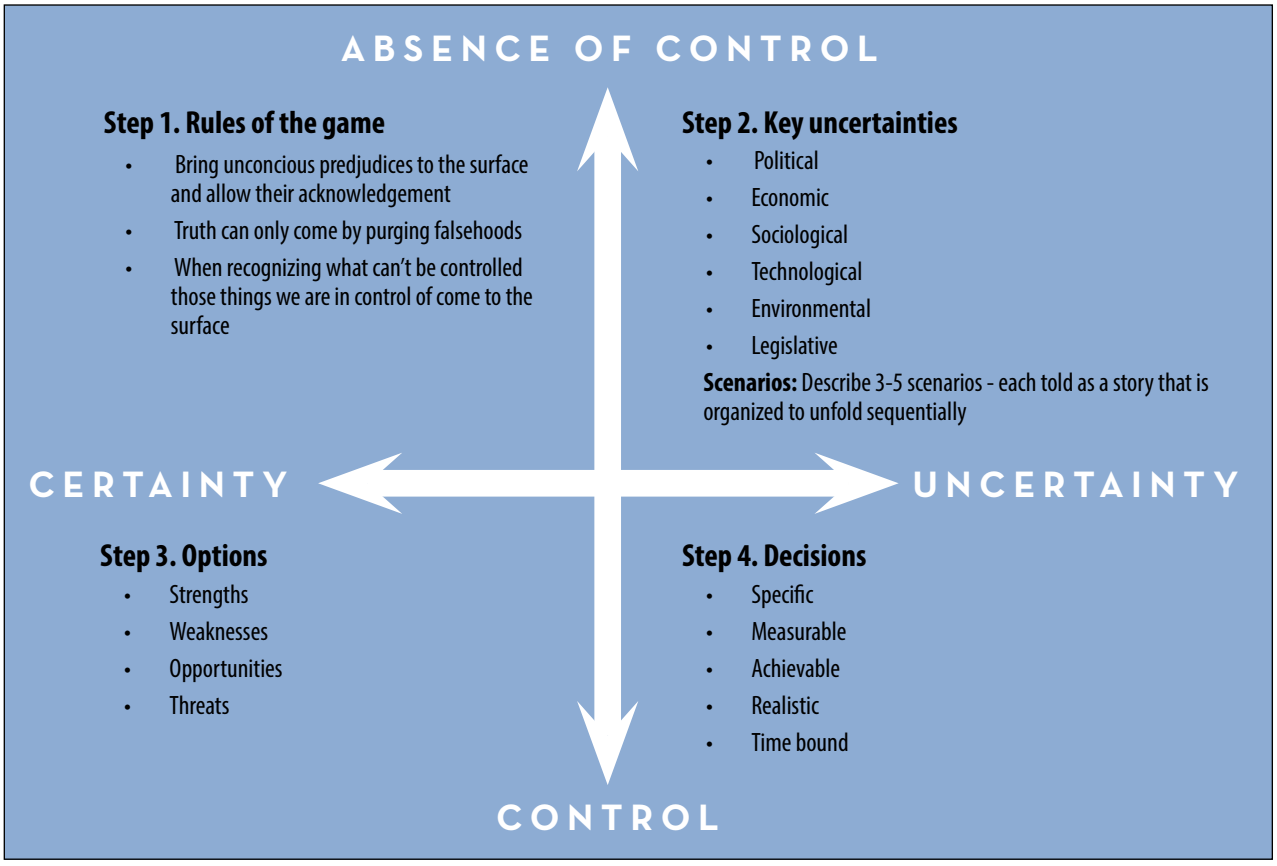


Figure 6.3. *Key considerations in the scenario planning process with levels of certainty and control. Source: Brefi Group Limited, www.brefigroup.co.uk*

Guide to Planning Tools - continued

Structured Decision-Making

Resource management and conservation investment decisions involve complexity and uncertainty. Regional conservation partnerships will therefore have to deliberate on a wide range of factors with complex links between ecosystem function, existing land uses, and local communities. These factors include 1) multiple objectives and stakeholder perspectives; 2) overlapping jurisdictions of local, state, and federal agencies; 3) short- and long-term effects of land use and climate change on regional sustainability and ecosystem function; 4) cumulative effects of all factors combined over time and space; and 5) high levels of uncertainty. All these necessary considerations create an intricate web of potentially competing or confounding factors when planning conservation. As a result, the decisions made by a regional partnership must consider a combination of subjective judgments made by experts about the potential consequences of proposed alternatives, as well as difficult, value-based judgments about priorities, preferences, and risk tolerance. In the case of the Delta, these decisions are associated with high-stakes economic, environmental, social, and political implications; and technical, public, and political interests will closely scrutinize them. Arriving at the best decision is even more difficult because stakeholders participating in a regional conservation partnership are usually working with limited resources. For example, government agencies are increasingly required to do more with less, on short timelines, and with rising expectations for quality, consistency, and transparent decision-making.

Structured decision-making is a process based in decision theory and risk analysis. It offers an organized and transparent approach to identifying and evaluating alternatives that integrates science and policy explicitly; and it focuses on engaging stakeholders, experts, and decision-makers in productive decision-oriented analysis and dialogue. The dialogue established by this approach allows participants to deal proactively with complex problems and judgments by following a decision-focused roadmap for integrating activities related to planning, analysis, and consultation (see Figure 6.4).

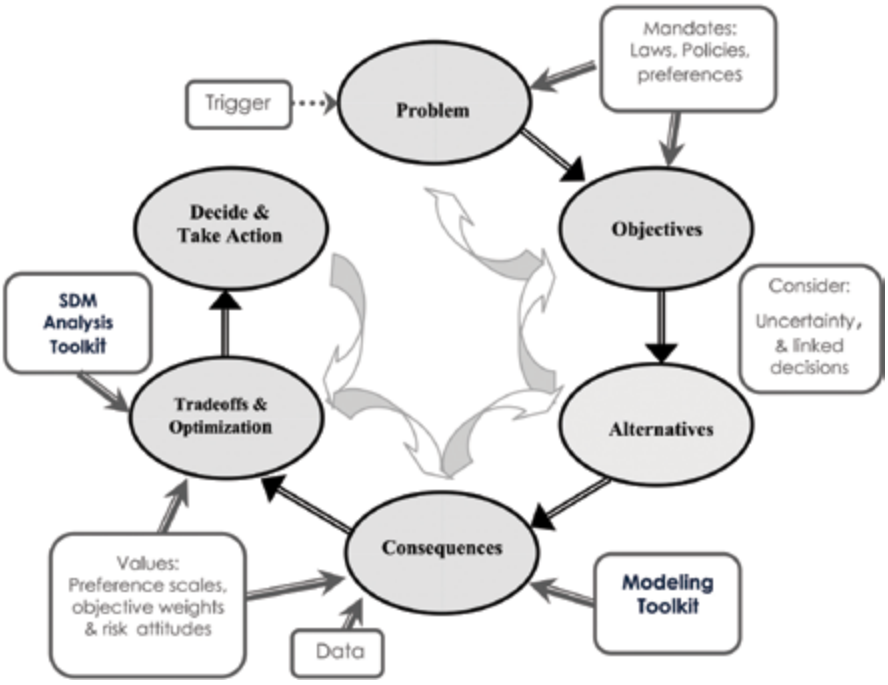


Figure 6.4. *Structured Decision-Making Steps*

Structured decision-making incorporates a simple set of concepts and helpful steps for problem solving focused on achieving fundamental goals/objectives. Within this approach, every decision consists of several primary elements: management goals/objectives, decision options (alternatives), and predictions of decision outcomes (Consequences). As a result, making decisions based on clearly articulated fundamental goals/objectives includes crucial concepts in structured decision making such as dealing explicitly with uncertainty and responding transparently to legal mandates and public preferences or values in decision-making. Structured decision-making is often incorporated in adaptive management.[20]

Scenario planning results directly contribute to the "alternatives" and "consequences" steps of the structured decision-making cycle. Individual planners and land managers, or regional conservation partnerships, can use these and other tools to plan a strategic, coordinated approach to conservation. Prioritizing conservation actions based on the likelihood of long-term effectiveness in achieving objectives highlights the potential for outcomes to evolve over time, and the short- and long-term cost effectiveness of projects. By regularly re-evaluating factors, scenarios, strategies, and decisions over time, conservation partners will better understand how early projections played out and how to adjust management actions of conservation lands over time.

QUICK LINKS

Open Standards Practice for Conservation (Miradi software)
www.miradi.org/open-standards/

Scenario planning
http://sloanreview.mit.edu/article/scenario-planning-a-tool-for-strategic-thinking/

Scenario planning for climate change adaptation
http://scc.ca.gov/climate-change/climate-change-projects/#slr-adaptation

Structured Decision Making
www.fws.gov/science/doc/structured_decision_making_factsheet.pdf

CODA

Delta Conservation Framework Guiding Principles

Developed by Stakeholders in 2016 Workshops

Guiding Principles for the Framework

1. PEOPLE AND PLACE: Recognize the Delta as an evolving place with unique agricultural, cultural, recreational, and natural resource values. Section II outlines related goals and strategies to this guiding principle, and section V offers information on permitting and potential funding.

   a. Seek integrated, collaborative conservation and land management solutions while being sensitive to specific local, cultural, and environmental circumstances.

   b. Consider geographic setting and context in order to select the appropriate conservation strategies within individual regions and their social and biological legacies.

   c. Use available public lands suitable for achieving conservation objectives, as well as available incentives for willing private landowners to preserve land.

   d. Implement good neighbor policies and other stewardship practices (particularly as outlined in ALS Strategies 3, 7, 9, 12, 13, 14, 15, 16, 17, 18, 19, and 23 by the Agricultural Lands Stewardship Workgroup).

   e. Integrate ecological, social, and economic resilience into Delta conservation goals.

   f. Consider conservation values of agricultural and urban lands, where appropriate.

   g. Promote agricultural and socioeconomic research in the Delta to continue to inform conservation planning and implementation.

   h. Coordinate conservation policy, planning, and implementation among agencies and stakeholders.

2. BUILD COMMUNITY AND FOSTER PUBLIC EDUCATION AND OUTREACH: Support outreach, education, and communication across interests, where participants are encouraged to hear all perspectives, interact with respect and humility, and shift focus away from strict traditional roles toward a better understanding of the big picture to promote multi-benefit solutions. Section II outlines related strategies to this guiding principle, and section V offers information on potential funding.

   a. Foster communication and education that focuses on the role each individual can play to improve the Delta.

   b. Conduct regular public outreach and engagement with Delta stakeholders to plan, implement, and evaluate Delta conservation efforts.

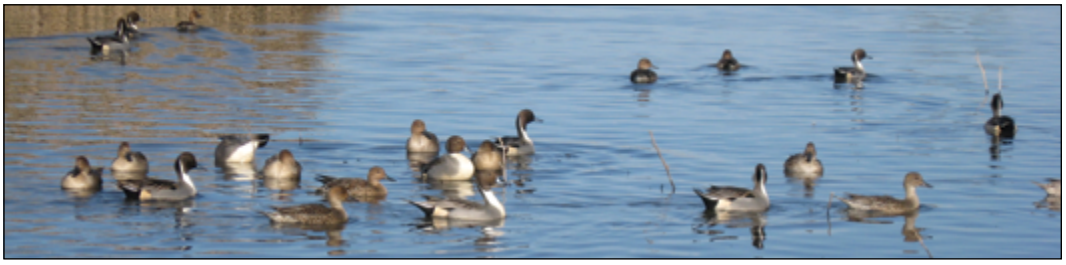
   c. Promote early and consistent coordination among resource agencies, practitioners, local residents, land- and business owners, and other stakeholders to develop regional conservation strategies, related funding support, and general regional permitting frameworks.

   d. Expand planning efforts to include multiple sectors and stakeholders and ensure broad consensus.

   e. Seek a better understanding of each other's needs and interests, such as ensuring economic vitality and investing in local interests while finding solutions to benefit wildlife.

   f. Support Delta outreach and education campaigns that teach the importance, status, and value of the Delta at local, state, and national levels, with a strong focus on younger generations.

continued



Pintails in Susiun Marsh. Photo: Cliff Feldheim

Guiding Principles for the Framework - continued

3. MULTIPLE BENEFITS: Integrate conservation with other land use practices, where possible, to provide simultaneous benefits for wildlife and people at a landscape scale over the long term. Section II outlines related goals and strategies to this guiding principle, and section V offers information on permitting and potential funding.

   a. Foster more natural hydrologic processes and use conservation to sequester carbon and reverse subsidence (sinking land) to benefit people and the Delta ecosystem.

   b. Evaluate the current geographic distribution of natural and agricultural ecosystems across the Delta landscapes in developing regional conservation strategies. Consider how the strategy fits into the broader landscape level mosaic of land uses of the Delta (e.g. sandhill crane foraging and roosting sites in close proximity within the natural-agricultural interface).

   c. Reduce the abundance and occurrence of noxious invasive species, where possible, to benefit ecological communities, enhance recreation, and benefit agriculture.

   d. Coordinate flood projects with restoration projects through a landscape-level floodplain restoration planning approach to achieve multiple benefits

4. PROCESS-BASED ECOSYSTEM CONSERVATION: Focus conservation practices on reestablishing natural ecological processes and promoting the functions and adaptive capacity of Delta ecosystems, rather than restoring the Delta to pre-Gold Rush Era conditions. Section III outlines related goals and strategies to this guiding principle, and section V offers information on permitting and potential funding.

   a. Protect, enhance, or restore critical ecosystem processes with a focus on complexity and diversity, to promote resilience and adaptability.

   b. Create functional redundancy by replicating landscape elements across space and by increasing linkages among landscape elements to support wildlife movement.

   c. Provide ecosystem and wildlife connectivity across the landscape and through time.

   d. Design and coordinate conservation projects and regional conservation strategies as part of a larger mosaic at the landscape scale, with consideration of the position, future trajectories, and existing and historical biological conditions of projects.

   e. Where feasible, conserve large areas, with a long time period in mind.

   f. Promote biodiversity in human-dominated landscapes according to the principles of reconciliation ecology and a focus on tying conservation efforts to benefits of wildlife-friendly agricultural lands and urban areas as part of the larger landscape mosaic.

5. PROMOTE ECOSYSTEM SERVICES: Highlight the societal values of the many services healthy ecosystems provide to humans by emphasizing these services as benefits to society. Delta ecosystem services include open space, opportunities for outdoor recreation and tourism, pollination services, flood protection, clean water, clean air, biodiversity, and others. Sections II and III outline related goals and strategies to this guiding principle, and section V offers information on permitting and potential funding

   a. Evaluate and communicate the societal values of ecosystems to humans in the context of conservation.

   b. Educate the public about how healthy ecosystems benefit them through the many services they provide.

continued

Guiding Principles for the Framework - continued

6. DECISIONS GROUNDED IN SCIENCE: In light of continuing ecosystem stressors and accelerating changes from climate shifts and other drivers, as well as changeable socioeconomic conditions, utilize scientific approaches to inform and evaluate conservation practices and projects and conservation-related human needs. Section IV outlines related goals and strategies to this guiding principle.

   a. Conduct research and adaptive management, including modeling, ecological monitoring, and evaluation at project-specific and regional scales to continually improve the scientific basis of planning and management decisions and measuring the achievement of goals over time.

   b. Understand long-term agricultural and other socioeconomic trends and goals, and evaluate those in light of impending changes from sea level rise, conservation goals, and other uses.

   c. Weigh long-term gains against potential short-term impacts, ecologically, socially, and economically.

   d. Recognize a larger landscape-scale, long-term framework, where small pieces are implemented in stages to increase cost-effectiveness, and give opportunities for checks and improvements along the way.

   e. Utilize conservation planning tools and processes based in social sciences, such as the Open Standards for the Practice of Conservation and Structured Decision Making.

7. INCREASED EFFICIENCY: Utilize processes that minimize project costs, and provide consistent and integrated tools to support decision-making, evaluation of success, environmental compliance, and permitting; build on past planning documents and existing efforts. Sections IV and V outline related goals and strategies to this guiding principle.

   a. Use standard approaches for achieving goals and implementing multi-benefit objectives aimed at maintaining, enhancing, or restoring system-wide aquatic, fluvial, transitional, and terrestrial ecosystem functions, while benefiting people.

   b. Utilize opportunities for infrastructure upgrades, such as setback levees or fish screens, to achieve ecological benefits, where possible.

   c. Find mechanisms to improve the efficiency of environmental compliance and permitting requirements by working directly with regulatory agencies.

8. ACKNOWLEDGEMENT OF LONG-TERM FUNDING NEEDS: Recognition that long-term funding is necessary for successful Delta conservation and management through 2050 (see Section V for more details on funding; Section VI for more information on implementation).

   a. Explore opportunities for stable long-term funding sources to develop and implement conservation projects in the Delta.

   b. Utilize endowments for long-term operations and management of conservation lands, when possible.

   c. Through legislation, appropriation, or ballot initiatives, secure state funding for long-term operations and management of publically owned wildlife areas and ecological reserves and federal funding for long-term management of national wildlife refuges and other federally-owned lands.

   d. Promote programs that provide incentives for wildlife-friendly farming practices and landowners who achieve conservation objectives on their lands, such as Habitat Exchanges (see Section II for more information).

Endangered kit foxes. Photo: CDFW

Acknowledgements

The California Department of Fish and Wildlife acknowledges and appreciates the support of the Sacramento-San Joaquin Delta Conservancy beginning with the 2016 public workshops. The Delta Conservancy facilitated communication with Delta stakeholders through the use of it's conference room, the Delta Restoration Network contact list, funding for professional facilitation services, and engagement in each of the public workshops.

The Department of Fish and Wildlife would also like to thank all 2016-18 workshop participants and 2017 reviewers of the Delta Conservation Framework public draft.

Editors Note: The Delta Conservation Framework is a living document, written by several authors, assembled from myriad sources using many different languages (legal, policy, scientific, bureaucratic etc), and gathering input from stakeholder workshops, and public reviews over a long period of time. Stylistically, norms relating to consistency in the use of grammar, capitalization, or acronyms may have been stretched to make it more readable from many starting points.



CALIFORNIA
DEPARTMENT OF
FISH & WILDLIFE