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Acronyms

ACOE	U.S. Army Corps of Engineers
ADA	Americans with Disabilities Act
AHPA	Archaeological and Historic Preservation Act
ARPA	Archaeological Resources Protection Act
BLM	Bureau of Land Management
CALFED	California Bay-Delta Program
CCP	Comprehensive Conservation Plan
CDFG	California Department of Fish and Game (also, DFG)
CDPR	California Department of Parks and Recreation
CSU Chico	California State University at Chico
CFR	Code of Federal Regulations
CWA	California Waterfowl Association
DFG	California Department of Fish and Game (also, CDFG)
DOI	Department of the Interior
DU	Ducks Unlimited
DWR	Department of Water Resources
EA	Environmental Assessment
EE	Environmental Education
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FR	Federal Register
FTE	Full-time Equivalent
FWS	U.S. Fish and Wildlife Service (also, Service)
FY	Fiscal Year
GIS	Global Information System
GPS	Global Positioning System
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
IPM	Integrated Pest Management
LWD	Large Woody Debris
MMS	Maintenance Management System
MDN	Marine Derived Nitrogen
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
PRBO	PRBO Conservation Science
PUP	Pesticide Use Permit
RMIS	Refuge Management Information System
RP	River Partners

RONS	Refuge Operating Needs System
Service	U.S. Fish and Wildlife Service (also, FWS)
SoC	Species of Concern
SRA	Shaded Riverine Aquatic habitat
SRCAF	Sacramento River Conservation Area Forum
SUP	Special Use Permit
T&E	Threatened and Endangered Species
TNC	The Nature Conservancy
UC Davis	University of California at Davis
USFWS	U.S. Fish and Wildlife Service (also, Service)
USGS	U.S. Geological Service

Chapter 1. Introduction and Background

Introduction

The Sacramento River National Wildlife Refuge (Refuge) is located in the Sacramento Valley of north-central California and was proposed to acquire 18,000 acres from Red Bluff to Colusa. The Refuge currently meanders along 77 miles of California's largest waterway, the Sacramento River, between Red Bluff and Princeton (Figure 1). Its many units are located along both sides of the river and serve to protect and provide a wide variety of riparian habitats for birds, fish, and other wildlife. The Refuge is one of many partners protecting and restoring riparian habitat along the Sacramento River and its watershed.

This document is a Comprehensive Conservation Plan (CCP) designed to guide management of the Refuge for the next 15 years. Guidance within the CCP will be in the form of goals, objectives, strategies, and compatibility determinations. The purposes of this CCP are to:

- Provide a clear statement of direction for the future management of the Refuge;
- Provide long-term continuity in Refuge management;
- Communicate the U.S. Fish and Wildlife Service's (Service) management priorities for the Refuge to their partners, neighbors, visitors, and the general public;
- Provide an opportunity for the public to help shape the future management of the Refuge;
- Ensure that management programs on the Refuge are consistent with the mandates of the National Wildlife Refuge System (Refuge System) and the purposes for which the Refuge was established;
- Ensure that the management of the Refuge is consistent with Federal, State, and local plans; and
- Provide a basis for budget requests to support the Refuge's needs for staffing, operations, maintenance, and capital improvements.

This CCP provides a description of the desired future conditions on the Refuge and long-range guidance to accomplish the purposes for which the Refuge was established. The CCP and accompanying Environmental Assessment (EA) address Service legal mandates, policies, goals, and National Environmental Policy Act (NEPA) compliance. A range of administrative, habitat management, and

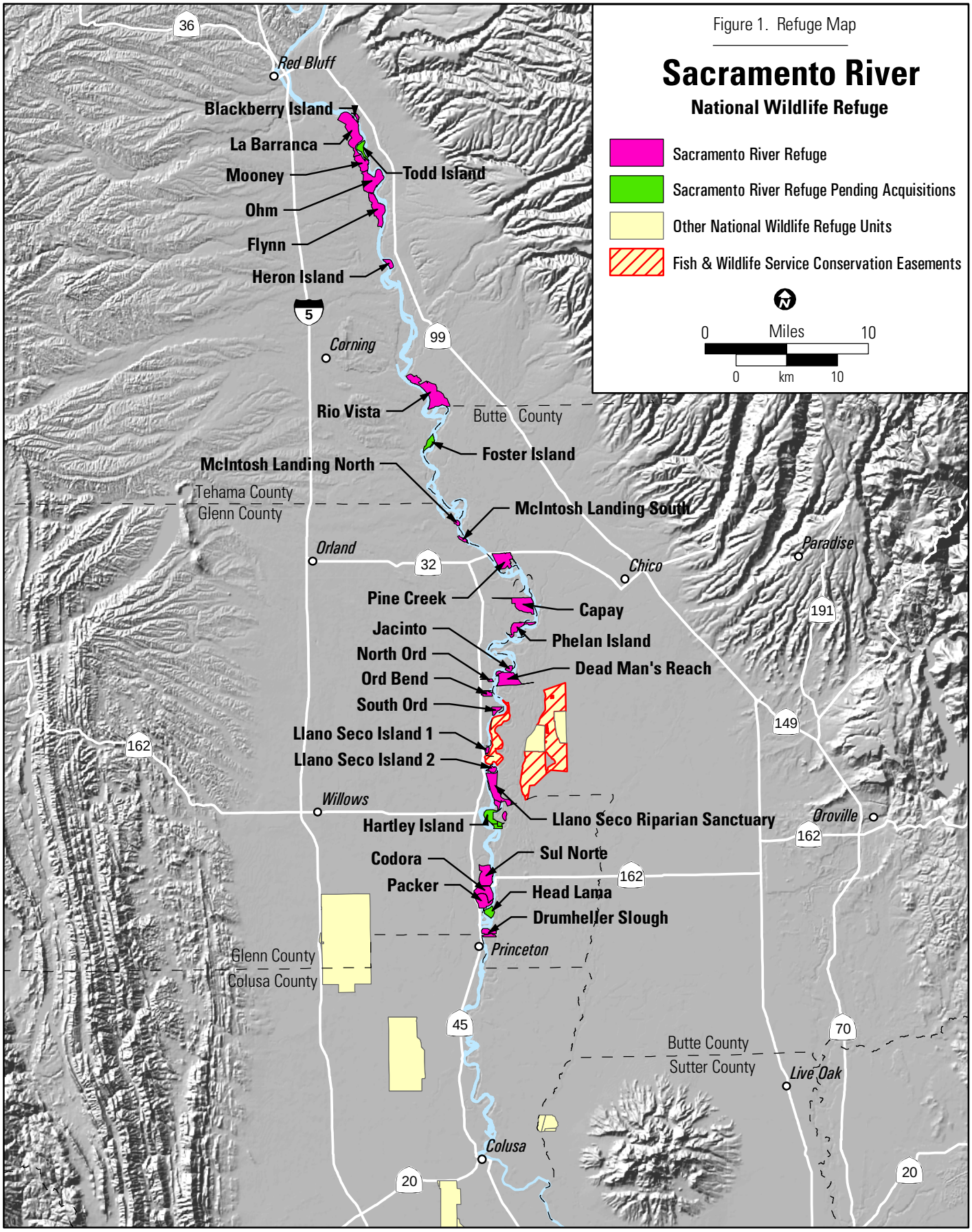


Figure 1. Refuge Map

visitor services alternatives that consider issues and opportunities on the Refuge were analyzed in the draft EA (Appendix A). This document presents the Service's plan for future management of the Refuge.

The CCP is accompanied by four new plans: a Hunting Plan (Appendix C), Fishing Plan (Appendix D), Fire Management Plan (Appendix E), and Integrated Pest Management Plans (Appendices P & Q). Other existing plans that will remain in place include a Habitat Management Plan, Cultural Resource Management Plan, and Restoration and Enhancement Plan.

The CCP serves as a management tool for the Refuge staff. It will guide management decisions, and describe strategies for achieving Refuge goals and objectives over a 15-year period. It is divided into six chapters: Chapter 1, Introduction; Chapter 2, Planning Process; Chapter 3, Refuge Environment; Chapter 4, Current Refuge Management and Programs; Chapter 5, Planned Refuge Management and Programs; and Chapter 6, Plan Implementation.

Need for This CCP

The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) (Improvement Act) requires that all Federal refuges be managed in accordance with an approved CCP by 2012. This plan provides the necessary guidance as the Refuge has no integrated plan that guides the management of all of its resources and uses. The Service has prepared this CCP to meet the dual needs of complying with the Improvement Act and providing long-term integrated management guidance for the Refuge.

Legal and Policy Guidance

National Wildlife Refuges are guided by the mission and goals of the Refuge System, purposes of the Refuge, Service policy, laws, and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the Improvement Act, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual. The Refuge Recreation Act of 1962, as amended, authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use when such uses did not interfere with the area's primary purpose.

The Improvement Act:

- Identified a new mission statement for the Refuge System;
- Established six priority public uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation);
- Emphasized conservation and enhancement of the quality and diversity of fish and wildlife habitat;
- Stressed the importance of partnerships with Federal and State agencies, Tribes, non-governmental organizations, industry, and the general public;
- Mandated public involvement in decisions on the acquisition and management of refuges; and
- Required, prior to acquisition of new refuge lands, identification of existing compatible wildlife-dependent uses that would be permitted to continue on an interim basis pending completion of comprehensive conservation planning.

The Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a CCP for each refuge by the year 2012; and provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas.

The Improvement Act also establishes a formal process for determining whether uses are "compatible" with the refuge's purposes. Federal law requires that before any uses, including priority public uses, are allowed on the refuge, a compatibility determination must be made. A compatible use is defined as a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the purposes of the refuge. Sound professional judgment is defined as a finding, determination, or decision that is consistent with the principles of sound fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), and applicable laws. The Service strives to provide priority public uses when they are compatible. If financial resources are not available to design, operate, and maintain a priority use, the refuge manager will take reasonable steps to obtain outside assistance from the State and other conservation interests. Compatibility determinations are included in this document (Appendix B). These were finalized at the same time as the CCP.

In addition, the Improvement Act directs the Service to "ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans..." The policy is an additional directive for refuge managers to follow while achieving Refuge purpose(s) and System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on Refuges and associated ecosystems. Further, it provides refuge managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions; and where appropriate and in concert with refuge purposes and System mission, restore lost or severely degraded components. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuges' contribution to biological integrity, diversity, and environmental health at multiple landscape scales.

While the Refuge System mission and the purposes for which the Refuge was established provide the foundation for management, National Wildlife Refuges are also governed by other Federal laws, Executive Orders, treaties, interstate compacts, regulations and conservation initiatives pertaining to the conservation and protection of natural and cultural resources (Appendix M). Some of these include: Floodplain Management (EEO 11988), Protection of Wetlands (EO 11990), Management of General Public Use of National Wildlife Refuge System (EO 12996), Environmental Justice in Minority Populations and Low-Income Populations (EO 12898), Endangered Species Act of 1973, as amended, Emergency Wetlands Resources Act of 1986, Fish and Wildlife Act of 1956, National Historic Preservation Act of 1966, as amended, Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186), Migratory Bird Treaty Act of 1918, the Fish and Wildlife Conservation Act of 1980, as amended, Neotropical Migratory Bird Conservation Act of 2000, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, Riparian Bird Conservation Plan (Riparian Habitat Joint Venture / California Partners in Flight), North American Bird Conservation Initiative, and the North American Waterbird Conservation Plan.

The U.S. Fish and Wildlife Service

The mission of the Service is: "working with others to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people."

The Service is the primary Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. Although the Service shares this responsibility with other Federal, State, Tribal, local, and private entities, the Service has specific responsibilities for migratory birds, threatened and endangered species, anadromous and interjurisdictional fish, and certain marine mammals. These are referred to as Federal trust species. The Service also manages the Refuge System, national fish hatcheries, enforces Federal wildlife laws and international treaties on importing and exporting wildlife, assists State fish and wildlife programs, and helps other countries develop wildlife conservation programs.

The National Wildlife Refuge System

The Refuge System is the world's largest collection of lands and waters set aside specifically for the conservation of wildlife and ecosystem protection. The Refuge System consists of over 540 national wildlife refuges that provide important habitat for native plants and many species of mammals, birds, fish, and threatened and endangered species. The mission of the Refuge System, as stated in the Improvement Act, is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (Improvement Act, 1997).

Gadwall
Photo by Steve Emmons

The goals of the Refuge System are to:

- Preserve, restore, and enhance in their natural ecosystems (when practicable) all species of animals and plants that are endangered or threatened with becoming endangered;
- Perpetuate the migratory bird resource;
- Preserve a natural diversity and abundance of fauna and flora on refuge lands; and
- Provide an understanding and appreciation of fish and wildlife ecology and the human role in the environment and to provide refuge visitors with high-quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife to the extent that these activities are compatible with the purposes for which the refuge was established.

In addition, the guiding principles of the Refuge System are:

- We are land stewards, guided by Aldo Leopold's teachings that land is a community of life and that love and respect for the land is an extension of ethics. We seek to reflect that land ethic in our stewardship and to instill it in others;
- Wild lands and the perpetuation of diverse and abundant wildlife are essential to the quality of the American life;
- We are public servants. We owe our employers, the American people, hard work, integrity, fairness, and a voice in the protection of their trust resources;
- Management, ranging from preservation to active manipulation of habitats and populations, is necessary to achieve Refuge System and U.S. Fish and Wildlife Service missions;
- Wildlife-dependent uses involving hunting, fishing, wildlife observation, photography, interpretation, and education, when compatible, are legitimate and appropriate uses of the Refuge System;
- Partnerships with those who want to help us meet our mission are welcome and indeed essential;
- Employees are our most valuable resource. They are respected and deserve an empowering, mentoring, and caring work environment; and
- We respect the rights, beliefs, and opinions of our neighbors.

The Sacramento National Wildlife Refuge Complex

For thousands of years the Sacramento Valley has provided a winter haven for ducks, geese, and swans. Waterfowl migrate here by the millions from as far away as the Arctic regions of Alaska, Canada, and Siberia. The five national wildlife refuges and three wildlife management areas of the Sacramento Refuge Complex represent an island of habitat in a sea of Sacramento Valley agriculture. This

valley represents one of the most important wintering areas for waterfowl along the Pacific Flyway.

The Sacramento National Wildlife Refuge Complex (Complex) represents a small portion of the vast seasonal wetlands and grasslands that once existed in the Sacramento Valley. Millions of waterfowl migrated south in the Pacific Flyway to winter in the valley among resident waterbirds, deer, elk, pronghorn, and grizzly bear. With the development of agriculture during the late 1800's and early 1900's, natural habitat was replaced with rice and other crops. Waterfowl substituted these farm crops for their original wetland foods, causing serious crop losses for farmers.

Today, 95 percent of California's wetlands are gone, along with the pronghorn and grizzly bear. Constructed levees now confine the river for irrigation and flood control, preventing the natural flooding and formation of new wetlands. Despite these changes, the birds continue to fly their ancient migration routes along the Pacific Flyway and crowd into the remaining wintering habitat. The Refuges provide a significant amount of the wintering habitat that supports waterfowl and other migratory birds in the Sacramento Valley.

Four of the five refuges of the Complex are almost entirely human made. In 1937, when Sacramento National Wildlife Refuge was established, managers and biologists worked to transform many of the Refuge's dry, alkaline lands into productive managed marshes. Additional Refuges were created in the 1950’s through the 1980’s, forming the Sacramento Refuge Complex.

Four of the five Refuges were created to provide wintering habitat for waterfowl and reduce crop damage. These Refuges--Sacramento, Delevan, Colusa, Sutter, and Butte Sink National Wildlife Management Area--consist of wetland, grassland, and riparian habitats. The Refuge staff maintains more than 32,000 acres of wetlands and uplands on the Complex. Water regimes are managed to mimic the Sacramento River's historic flood cycle. The Refuges' seasonal marshes are drained during late spring and summer to encourage plant growth on the moist, exposed soil. Re-flooding in the fall makes seeds and plants available for wildlife. Water management, prescribed burns, discing, and mowing are some of the techniques used to create and maintain wetland habitats.

The fifth Refuge, Sacramento River Refuge, was established in 1989 to help protect and restore riparian habitat along the Sacramento River as it meanders through the Sacramento Valley from Red Bluff to Colusa.

The Sacramento River National Wildlife Refuge

Sacramento River Refuge is located in the Sacramento Valley of north-central California and is part of the Sacramento Refuge Complex (Figure 1). The Refuge was established in 1989 by the authority provided under the Endangered Species Act of 1973, Emergency Wetlands Resources Act of 1986, and the Fish and Wildlife Act of 1956. The Service proposed acquisition of up to 18,000 acres of land to establish the Sacramento River Refuge (USFWS 1989). The area considered for acquisition is primarily located in the Sacramento River's 100-year meander zone between Red Bluff and Colusa, in Tehama, Butte, Glenn, and Colusa counties (Figure 1). The Refuge is currently composed of 26 properties (units) along a 77-mile stretch of the Sacramento River between the cities of Red Bluff and Princeton (Table 1). Though adjacent to the Sacramento River Refuge, the Llano Seco Unit and Llano Seco Unit Sanctuary (Figure 1) were acquired through a separate authority, the North American Wetlands Conservation Act of 1989, and are considered part of the North Central Valley Wildlife Management Area. Therefore, the Llano Seco Unit and Llano Seco Unit Sanctuary and the conservation easements east of Angel Slough on Llano Seco are not evaluated in this plan. These units and easements will be included in the CCP separately developed for the North Central Valley Wildlife Management Area.

As of June 2005, the Refuge consisted of 10,304 acres of riparian and agricultural habitats owned by the Service and 1,281 acres of riparian habitats in conservation easement owned by Llano Seco Ranch. Riparian and agricultural habitats at the Refuge include sand and gravel bars, willow scrub, cottonwood forest, herblands, mixed riparian forest, valley oak woodlands and savannas, grasslands, freshwater wetlands, pastures, cover crops (i.e., winter wheat, safflower, corn, bell beans), almond and walnut orchards.

Sacramento River
Photo by Greg Golet

Table 1. Sacramento River National Wildlife Refuge: Location and Size, June 2005[1].

Refuge Unit Name	River Mile	County	Acres	Date Acquired
La Barranca	239R	Tehama	1,066	1989, 1991
Blackberry Island	239L	Tehama	52	2002
Todd Island[2]	238R	Tehama	185	BLM owned
Mooney	236R	Tehama	342	1994
Ohm	234R	Tehama	757	1989, 1991
Flynn	232R	Tehama	630	1990, 1998
Heron Island	228L	Tehama	126	1990
Rio Vista	217L	Tehama	1,149	1991
Foster Island[2]	211R	Glenn	174	BLM owned
McIntosh Landing North	202R	Glenn	63	1994
McIntosh Landing South	201R	Glenn	67	1994
Pine Creek	199L	Butte	564	1995, 2003
Capay	194R	Glenn	666	1999
Phelan Island	191R	Glenn	308	1991
Jacinto	187R	Glenn	69	1996
Dead Man's Reach	186L	Butte/Glenn	637	1999
North Ord	185R	Glenn	29	2002
Ord Bend	184R	Glenn	111	1995
South Ord	182R	Glenn	122	1999
Llano Seco Riparian Sanctuary and Islands	177L/R	Butte	906	1991
Hartley Island[3]	173L	Butte	487	2004 (67 acres), 420 acres privately owned
Sul Norte	168R	Glenn	590	1990, 1991
Codora	167R	Glenn	399	1994
Packer	168R	Glenn	404	1997
Head Lama[3]	166L	Glenn	177	Privately owned
Drumheller Slough	165L	Glenn	224	1998, 1999
Refuge Total Fee Acres			**10,304**	
Llano Seco Riparian Easement	*138L*	*Butte*	*1,281*	*1991*

[1] Acres represent original acquired acres and do not indicate eroded and accreted land. [2] Currently owned by BLM and included in total refuge acreage. [3] Privately owned and in acquisition process (included in total acreage).

The Great Central Valley, which encompasses the Sacramento Valley, is an extensive agricultural area that was once characterized by diverse types of natural vegetation that provided habitat for a great number of plant and animal species. Most of the streams and tributaries supported Chinook salmon runs, the forests were important songbird breeding areas, and the wetlands were major waterfowl wintering areas. Currently, lands that surround the Refuge mostly consist of orchards and irrigated rice lands with some livestock, safflower, barley, wheat, and alfalfa crops. Topography is flat with a gentle slope to the south. The predominant soil type occurs in mixed alluvium and includes fluvial gravel and sands and various Columbia loams.

Numerous plans and initiatives have identified riparian habitat along the Sacramento River as critically important for various endangered and threatened species, fisheries, migratory birds, plants, and to the functional processes of the river ecosystem. There has been an 85 percent reduction of riparian vegetation throughout the Sacramento Valley and foothills region, and probably in excess of a 95 percent reduction along this area's major river systems (Thompson 1961). The relatively small amount of remaining riparian forest provides a strikingly disproportionate amount of habitat value for wildlife when compared with what is needed for healthy fish and wildlife populations. The Refuge was established to preserve, restore, and enhance riparian habitat for threatened and endangered species, breeding and wintering migratory birds, anadromous fish, resident species, and native plants. The Refuge is managed to maintain, enhance and restore habitats for these species. To the extent possible, habitat is managed for natural diversity of indigenous flora and fauna. Riparian forests are being restored by converting flood-prone agricultural lands along the Sacramento River in cooperation with The Nature Conservancy (TNC), River Partners (RP), and local farmers.

Public access is currently limited to the Todd and Foster Island units (BLM properties currently in the acquisition process) and the Packer Unit. Currently, all types of river access recreational uses are allowed on Todd and Foster Islands under the multiple use polices of BLM. The Packer Unit provides an unimproved access point for bank fishing and small boat access to Packer Lake.

Refuge Units

The Refuge is comprised of 26 different units, each having its own specific projects and management needs. Though some units are adjacent to one another, most are geographically separate. Some units solely consist of pre-existing native riparian habitats; some are being restored to riparian habitats, while others may remain in agricultural production until restoration plans can be finalized. A brief summary of size, location, and composition of each unit can be found in the Refuge Unit Descriptions section of Chapter 3.

Land Acquisition

The area approved for acquisition to meet the 18,000-acre goal of the Refuge is located along the Sacramento River, generally within the 100-year meander zone, between Red Bluff and Colusa, as outlined in the Middle Sacramento River Refuge Feasibility Study (USFWS 1987) and the Environmental Assessment–Proposed Sacramento River National Wildlife Refuge (USFWS 1989). Acquisition is conducted on a willing-seller basis only. The refuge staff evaluates the properties to determine if the land will help to meet the conservation goals and objectives of the Refuge. Appraisals are done in accordance with standard appraisal procedures in order to determine fair market value of the proposed area. The appraisers are contracted by the Service. The approved appraisal is the basis upon which negotiations with the landowner and a Realty Specialist are initiated. If the landowner agrees and is willing, the Service will offer to purchase the property depending on funding availability. Funding typically comes from the Land and Water Conservation Fund (LWCF), CALFED program, or private donations. The history of land acquisition on the Refuge is illustrated in Table 1.

Oil and Gas Extraction

There is one natural gas well located within the boundaries of the Sacramento River Refuge. The well is located on the Sul Norte Unit, where it has operated until recently. As part of the transfer agreement, private interests retained the mineral rights. Access to and operation of the gas well is regulated by the refuge manager by special conditions set forth in a Special Use Permit required under the title agreement.

Refuge Purposes

The Service acquires Refuge System lands under a variety of legislative acts and administrative orders. Usually the transfer and acquisition authorities used to obtain the lands have one or more purposes for which land can be transferred or acquired. These purposes, along with the Refuge System mission, form the standard for determining if proposed refuge uses are compatible.

Sacramento River
USFWS Photo

The Refuge purposes are:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4)
"... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

The Refuge Vision

A vision statement is developed or revised for each individual refuge unit as part of the CCP process. Vision statements are grounded in the unifying mission of the Refuge System, and describe the desired future conditions of the refuge unit in the long term (more than 15 years), based on the refuge's specific purposes, the resources present on the refuge, and any other relevant mandates. This CCP incorporates the following vision statement for the Sacramento River Refuge.

> "The Sacramento River National Wildlife Refuge will create a linked network of up to 18,000 acres of floodplain forests, wetlands, grasslands, and aquatic habitats stretching over 100 miles from Red Bluff to Colusa. These refuge lands will fulfill the needs of fish, wildlife, and plants that are native to the Sacramento River ecosystem. Through innovative revegetation, the Refuge will serve as an anchor for biodiversity and a model for riparian habitat restoration throughout the Central Valley. We will forge habitat, conservation, and management links with other public and private conservation land managers.
>
> The Sacramento River National Wildlife Refuge is committed to the preservation, conservation, and enhancement of a quality river environment for the American people along the Sacramento River. In this pursuit, we will work with partners to provide a wide range of environmental education programs and promote high quality wildlife-dependent recreational opportunities to build a refuge support base and attract new visitors. Compatible wildlife-dependent recreational opportunities for hunting, fishing, wildlife observation and photography, environmental education and interpretation will be provided on the Refuge.
>
> Just as the floodplain along the Sacramento River has been important to agriculture, it is also an important natural corridor for migratory birds, anadromous fish, and threatened and endangered species. Encouraging an understanding and appreciation for the Sacramento River will be a focus of the Sacramento River National Wildlife Refuge for generations to come."

Existing and New Partnerships

In "Fulfilling the Promise" (USFWS 1999) the Service identified the need to forge new and non-traditional alliances and strengthen existing partnerships with States, Tribes, non-profit organizations and academia to broaden citizen and community understanding of and support for the National Wildlife Refuge System. The Service recognizes that strong citizen support benefits the Refuge System. Involving citizen groups in Refuge resource and management issues and decisions helps managers gain an understanding of public concerns. Partners yield support for Refuge activities and programs, raise funds for projects, are activists on behalf of wildlife and the Refuge System, and provide support on important wildlife and natural resource issues.

A variety of people including, but not limited to, scientists, birders, anglers, hunters, farmers, outdoor enthusiasts and students are keenly interested in the management of Sacramento River Refuge, its fish and wildlife species, and its plants and habitats; this is illustrated by the number of visitors the Refuge receives and the partnerships that have already developed. New partnerships will be formed with interested organizations, local civic groups, community schools, Federal and State governments, and other civic organizations as funding and staff become available.

The Service is a signatory to a Memorandum of Agreement (MOA) between local, State and Federal agencies involved with riparian habitat restoration. The MOA is the result of years of effort and is focused on implementing the Sacramento River Conservation Area Handbook. The Handbook addresses both the biological basis and the institutional framework for restoration work along the river and builds on the concepts originally set forth in the 1989 Upper Sacramento River Fisheries and Riparian Habitat Management Plan, prepared under California State Senate Bill 1086. The Sacramento River Refuge is included within the geographic area and the refuge staff coordinates activities with the non-profit Sacramento River Conservation Area Forum.

The Sacramento River Refuge has a Memorandum of Understanding (MOU) with the California Department of Fish and Game (CDFG) and the California Department of Parks and Recreation (CDPR) for cooperative land management along the Sacramento River (USFWS et al 2001). The purpose of the MOU is to formally document an agreement to mutually manage, monitor, restore, and enhance lands managed for fish, wildlife, and plants along the Sacramento River in Tehama, Butte, Glenn, and Colusa counties. An additional purpose is to regularly communicate between agencies to prevent duplicating or

prescribing conflicting land management and acquisition efforts. The affected area includes all lands owned and managed as the Sacramento River Refuge, Sacramento River Wildlife Area, and State Parks located along the Sacramento River in the designated counties. These lands have been identified in several documents as providing essential habitat for numerous species of fish and wildlife including many threatened and endangered species. The Service, Department, and State Parks mutually agree to manage these lands for the conservation of biological, cultural, and scenic values, and for promoting compatible wildlife-dependent recreational opportunities. The Sacramento River Refuge has entered into Cooperative Land Management Agreements (CLMA) with TNC, River Partners, Ohm, and Llano Seco Rancho for selected units within and adjacent to the Refuge. The CLMA agreements are authorized by the Code of Federal Regulations as follows: "Cooperative agreements with persons for crop cultivation, haying, grazing, or the harvest of vegetative products, including plant life, growing with or without cultivation on wildlife refuge areas, may be executed on a share-in-kind basis when such agreements are in aid of or benefit to the wildlife management of the area" (50 CFR 29.2).

The Service and the Refuge also have agreements with the California Department of Forestry and Fire Protection and several volunteer fire departments to assist with fire suppression on refuge lands.

The Refuge is part of a mosaic of public and private land along the Sacramento River corridor. To maximize conservation efforts along the river, the Refuge has coordinated its CCP process with other ongoing planning efforts. This includes participating on the steering committee for CDFG's Sacramento River Wildlife Area Comprehensive Management Plan. In addition the Refuge coordinated with the CDPR's plan for Bidwell-Sacramento River State Park. Coordination with these agencies, Refuge partners (Table 2), and the local community was vital during the preparation of the CCP and will continue to be important in the ongoing management of the Refuge.

Table 2. Partnerships in habitat acquisition, restoration, and management.

Partner Organization Name	Areas of Expertise / Information and Services Provided
U.S. Fish and Wildlife Service [1]	National Wildlife Refuge management and science, endangered species conservation, land acquisition, habitat restoration funding, and migratory bird management
The Nature Conservancy [2]	Land acquisition, agricultural lands management, riparian restoration, land stewardship and science, cooperative land management at Llano Seco
River Partners [2]	Agricultural lands management, riparian restoration, land stewardship and science
California State University, Chico [3]	Natural and cultural resources science through professional experts, professors, and graduate students
Natural Resources Conservation Service, Chico Soil Survey [1]	Soil science, soil maps and interpretation, landscape interpretation
PRBO (PRBO Conservation Science) [2]	Avian ecology, conservation and management, status of Sacramento River avifauna
California Department of Water Resources [3]	Fluvial geology, geologic maps, landscape interpretation
U.S. Bureau of Reclamation [1]	Land acquisition and riparian vegetation, savanna/grassland, and freshwater wetland restoration funding
Parrott Investment Company [4]	Llano Seco Ranch history and management, cooperative land management at Llano Seco
California Department of Fish and Game [3]	Rare, threatened and endangered species conservation, anadromous fish and fisheries science and conservation, law enforcement, land acquisition, and cooperative land management at Llano Seco
National Oceanographic and Atmospheric Administration, Fisheries [1]	Anadromous fish and fisheries science and conservation
Sacramento River Preservation Trust [2]	Sacramento River conservation issues
Ducks Unlimited [2]	Freshwater wetland and grassland habitat restoration funding
California Waterfowl Association [2]	Freshwater wetland habitat restoration funding
California Department of Parks and Recreation	Public use, law enforcement, ecology, land acquisition, facilities and access
Sacramento River Conservation Area Forum	Forum for public information

[1] Federal government.

[2] Private non-profit conservation organizations.

[3] State of California.

[4] Private

Ecosystem Context

The Great Central Valley consists of four physiographic regions: the Sacramento Valley, the San Joaquin Valley, the Tulare Basin, and the Sacramento-San Joaquin Delta (Warner and Hendrix 1985). The Sacramento River and the San Joaquin River watersheds drain into San Francisco Bay via the Delta (Figure 2). The Sacramento River is the largest river in California. Above Red Bluff, the Sacramento River forms a V-shaped canyon by down-cutting through the Cascade Mountain Range. Below Colusa, the river is completely confined within narrow channels by bank stabilization. The middle Sacramento River, which occurs between Red Bluff and Colusa, represents an alluvial river ecosystem that is characterized by the physical processes of flooding, erosion, deposition, and channel movement (i.e., sinuous meandering). Oxbow lakes and abandoned channels form when the sinuous loops of a meandering river are cut off from the main channel. Operation of Shasta Dam for water delivery and flood control has altered the frequency, duration, and magnitude of flooding on the Sacramento River floodplain. However, relatively moderate bank stabilization occurs between Red Bluff and Princeton and here alluvial river processes still influence portions of the landscape.

The Sacramento River floodplain is often described in three relative positions: the low, mid, and high floodplain. The low floodplain occurs next to the river, below the mean high water mark. This zone is characterized by frequent erosion and deposition of gravels and sands (point bars are common). The mid floodplain occupies the 100-year meander belt, above the ordinary high water mark. This zone is frequently flooded and is also characterized by erosion and deposition (steep vertical banks are common). Natural levees of great proportions developed in this zone. The high floodplain occurs in the 500-year meander belt. This zone is occasionally flooded and often located off of the main river channel.

Four geologic formations are identified for the middle Sacramento River (Harwood and Helley 1982). The Tehama Formation is the oldest and is relatively resistant to the erosive forces of the river (Buer et al. 1989). The Tehama Formation provides geologic control because river meandering is impeded. The Red Bluff and River Bank formations are younger and less resistant to erosion (Brice 1977; California Department of Water Resources 1994). The most extensive geology on the Sacramento River is associated with the Modesto Formation. The Modesto Formation generally occupies the mid floodplain and is characterized by unstratified Columbia loam soils with various amounts of sand and silt (California Department of Water Resources, Northern District 1980, 1984). Channel deposits, known as xerofluvial

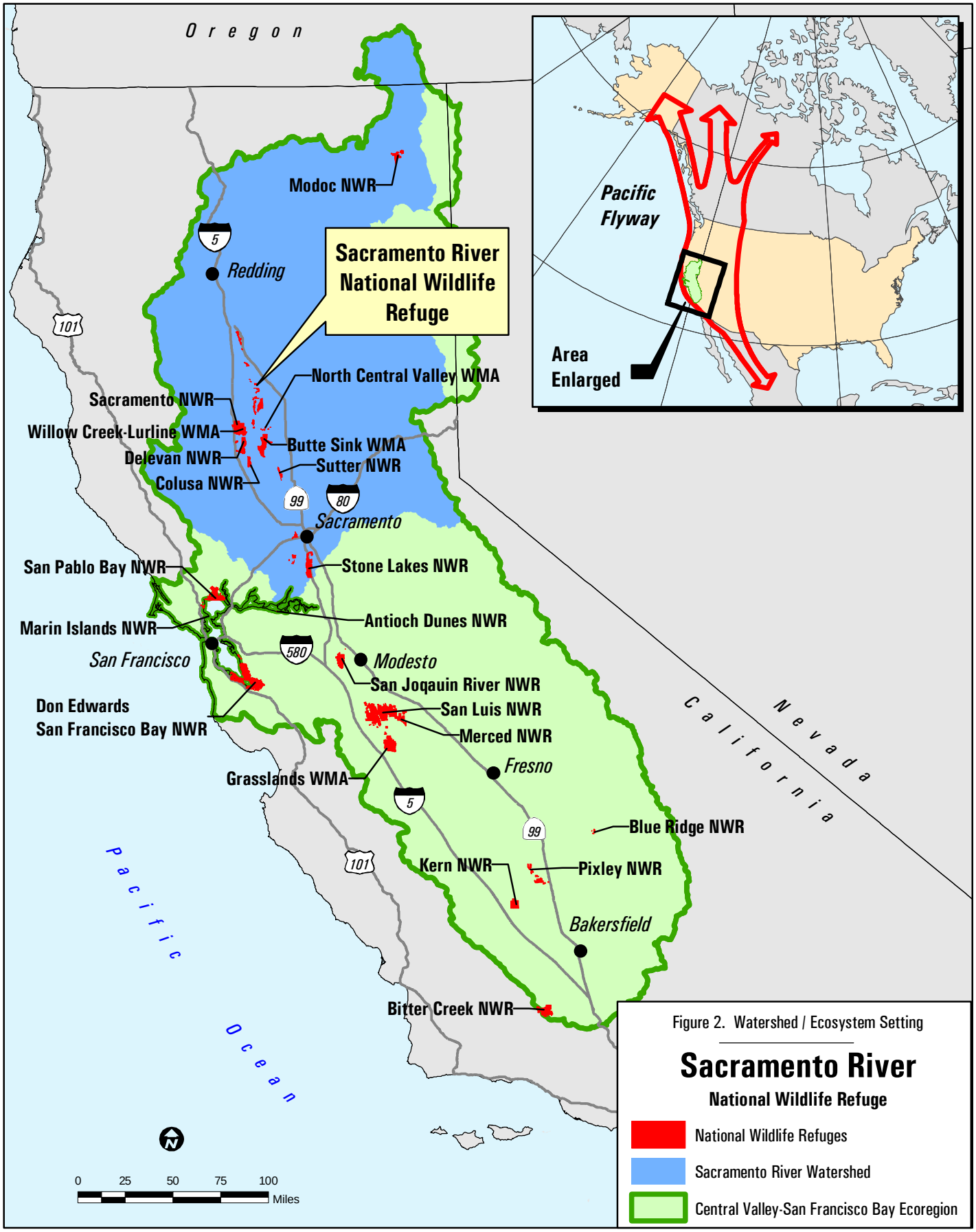


Figure 2. Watershed / Ecosystem Setting

Sacramento River
National Wildlife Refuge

gravels and sands, and mixed alluvium characterize low floodplain geology (California Department of Water Resources 1994, Helley and Harwood 1985, Saucedo and Wagner 1992).

Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological process and biota. Habitat includes water, food, and areas or territories necessary for reproduction and survival. Therefore, riparian habitat includes the various forms of vegetation, wetlands, banks, and sand and gravel bars along the river. Middle Sacramento River vegetation includes herbaceous scrublands (mugwort, tarweed-buckwheat), willow scrub, cottonwood forest, mixed riparian forest, valley oak woodland and savanna, elderberry savanna, grassland, and freshwater wetlands. These wetlands include the main channel, tributaries, sloughs, abandoned channels, oxbow lakes, and ponds. The Geographic Information Center at California State University, Chico has developed vegetation categories, which the California Department of Water Resources is using. Since these are partners of Sacramento River Refuge, the Refuge is adopting their system. These categories are described in detail in Chapter 3.

A diversity of fish and wildlife are associated with the Sacramento River alluvial ecosystem. The Sacramento River is the only river in the Pacific with four runs of Chinook salmon: winter-run, spring-run, fall-run and late fall run (Figure 3). Anadromous fish use the tributaries, main channel, floodplain, sloughs, oxbow lakes, delta, estuary, bay, and open ocean at various points in there life history (Croot and Marcolis 1991). A wide range of migratory and resident songbirds and waterfowl use the Sacramento River riparian habitats because of the great diversity of soil substrate, vegetation structure, and types of wetlands. Neotropical migratory landbirds breed in various habitats along the river (Figure 4) and winter in Central America, while northern breeding waterfowl use flooded river habitats in the winter (Gaines 1977; Small et al. 2000).

Oxbow Lake Habitat
Photo by Joe Silveira

Figure 3. Life History Characteristics of Four Races of Chinook Salmon in the Central Valley of California.

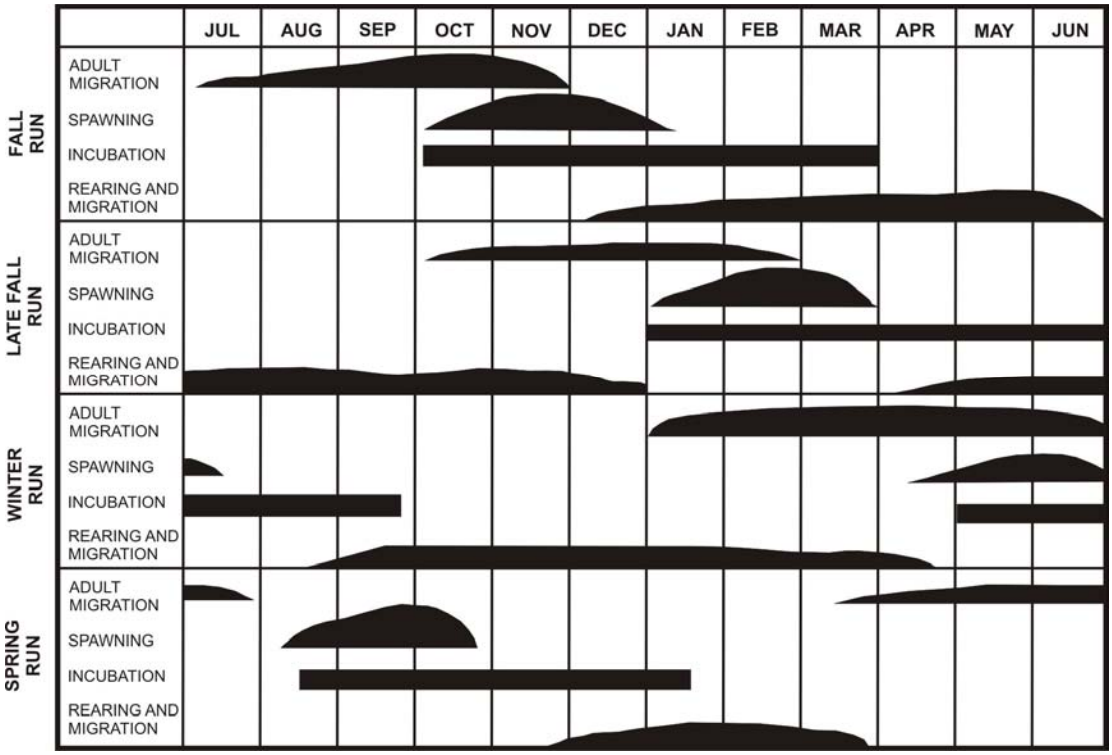
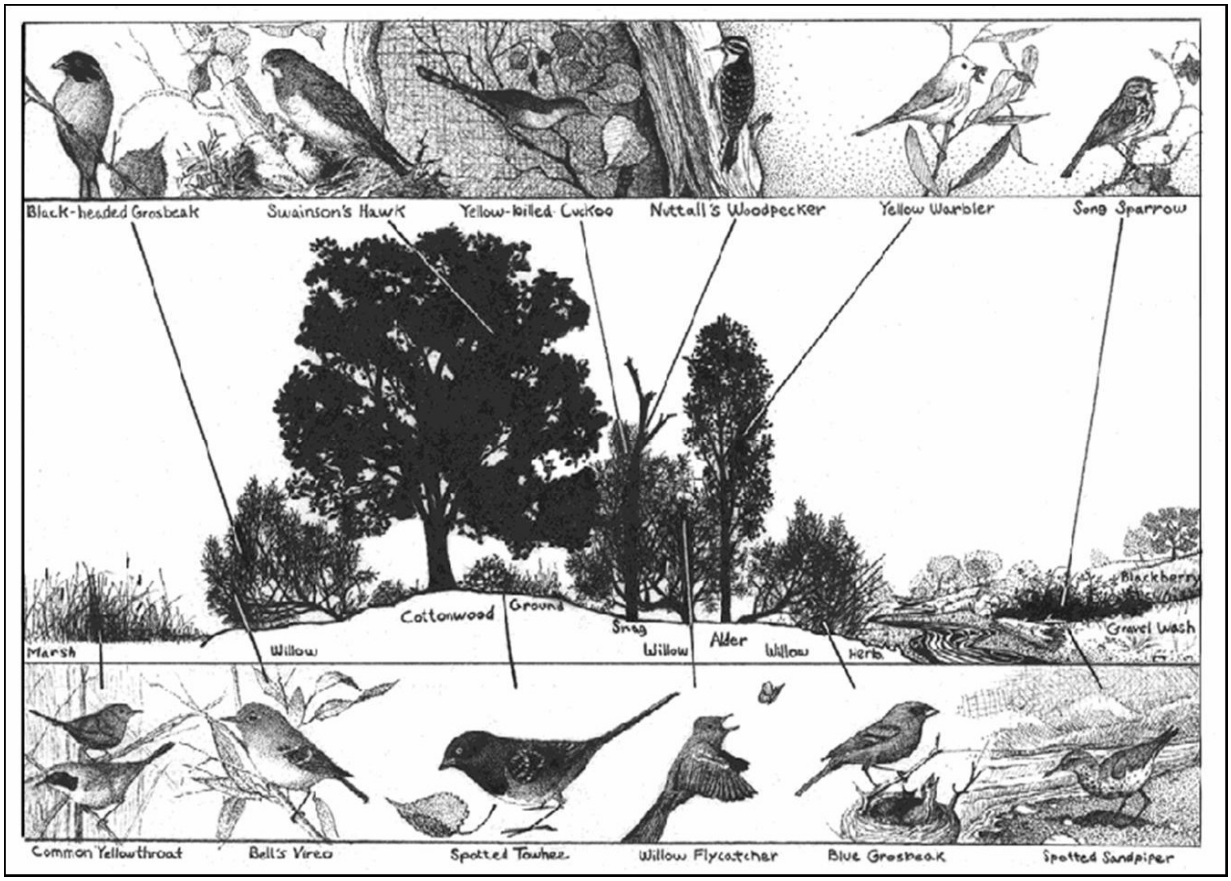


Figure 4. Riparian Bird Focal Species.



Riparian Habitat Joint Venture (2004) illustration depicting the diversity, complexity, and structure of riparian habitat. Note that the steep cut banks critical for establishing bank swallow colonies are not pictured. Illustration by Zac Denning.

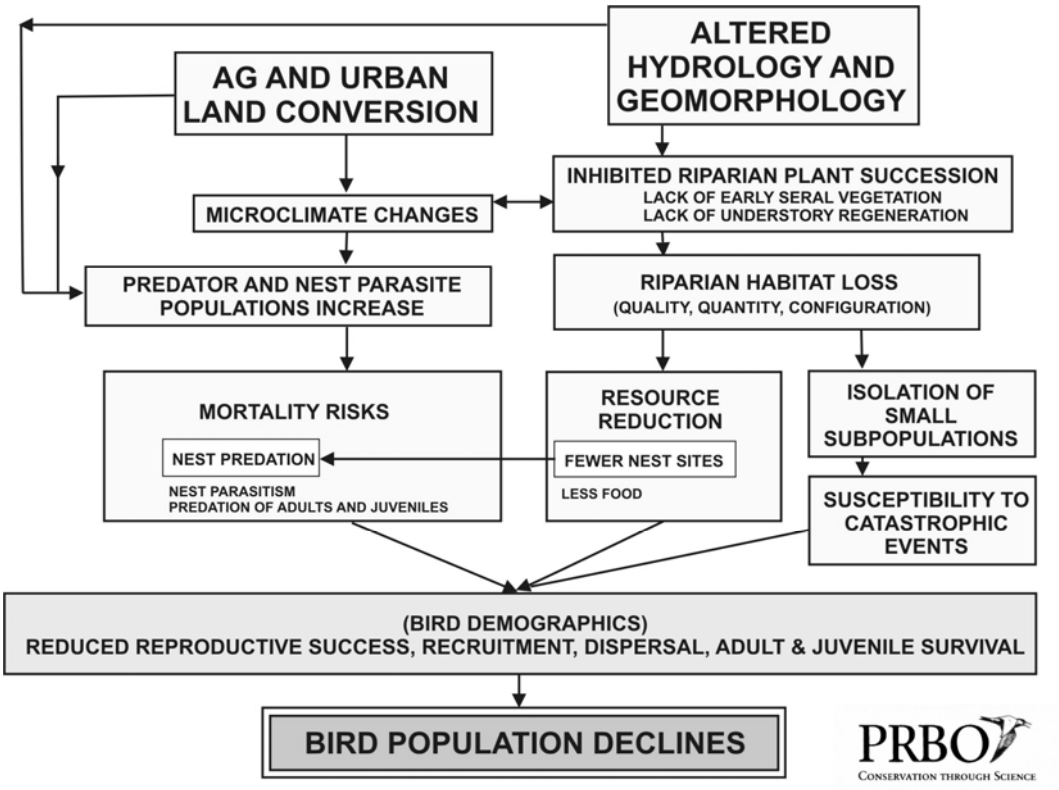
Threats and Opportunities

The Sacramento Refuge Complex serves as part of the last safety net to support biological diversity of the Great Central Valley. Only two percent of the original Great Central Valley riparian habitats remain. Forest clearing began in the mid 1800s along the Sacramento River (Katibah 1989; Scott and Marquiss 1989; Thompson 1961), first for dry land farming and later, for irrigated agriculture. Wood was used to power steamboats that carried agricultural products to San Francisco markets. Shasta and Keswick dams stored water for agriculture and urban uses, and provided flood control and hydrologic power. Construction of private and public levees and bank revetment (e.g., rip-rap) resulted in various degrees of channel constriction that separated the river channel from the floodplain (California Department of Water Resources, Northern District 1980, 1984).

While little remains of the original Sacramento River riparian habitats, bank stabilization, water diversion projects, and other activities that cause fragmentation of riparian habitats and loss of connectivity between the channel and floodplain continue. Runoff of sediments, pesticides, and herbicides also result in reduced ecologic functions and habitat loss of aquatic resources. These have the potential to cause further degradations in habitat quality. The cumulative effects of land and water resource development activities have caused simplification of the remaining wildlife habitats within the ecosystem, resulting in both direct and indirect negative impacts to habitat and fish and wildlife populations.

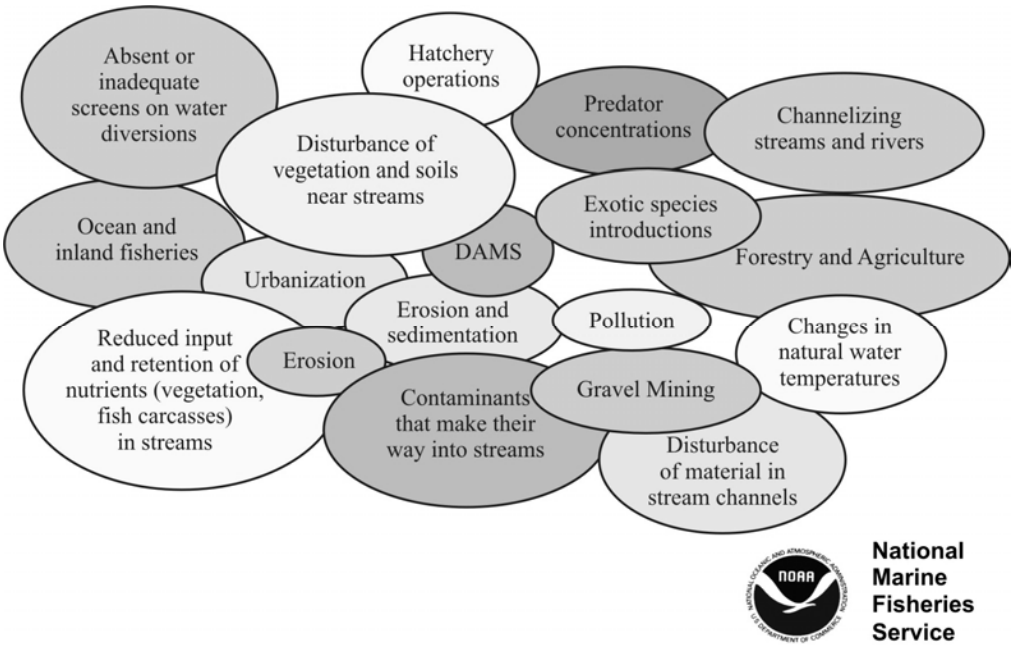
The species most adversely affected are those dependent upon the Sacramento River and riparian habitats during all or a portion of their life history (National Oceanic and Atmospheric Administration–National Marine Fisheries Service 1997; Riparian Habitat Joint Venture 2004). Riparian forest and habitat succession have been attenuated by dams and the resulting altered hydrograph, bank protection, and deforestation. This has led to severely reduced diversity, quantity, and quality of habitat for breeding migratory and resident birds (Riparian Habitat Joint Venture 2004; Small et al. 1999, 2000). Poor habitat complexity and structure have eliminated or reduced nesting habitat while increasing nest parasite and predator populations (Figure 5). Rip-rap and levees have reduced the number and size of bank swallow colonies along the middle portion of the Sacramento River. The least Bell's vireo no longer breeds in northern California, and the warbling vireo has been extirpated (completely eliminated) as a breeding bird from the middle Sacramento River (Grinnell 1915, 1918, Gaines 1974, 1977). The western yellow-billed cuckoo is threatened by loss of mature cottonwood forests adjacent to mature mid-story habitats (Gaines 1974). Species dependent on mature valley oak forests, such as the acorn woodpecker, are absent from the majority of their historic range due to the near complete loss of this habitat type (refer to Holland and Roye 1989; Holmes et al. 1915; and, Bureau of Soils 1913 for historic distribution of valley oak forest and savanna/Columbia soil in the Sacramento Valley).

Figure 5. Potential Effects of Altered Hydrology on Breeding Bird Populations.



Chinook salmon and steelhead (salmonids) use the channel for migration and spawning. Dams, bank revetment, and deforestation have resulted in declining anadromous salmonid populations (NOAA-NMFS 1997), (Figure 6). Dams block fish passage and prevent spawning gravel from moving downstream. During periods of excessive runoff, silt accumulates in gravel, which starves eggs of oxygen. Rip-rap and forest clearing near the channel reduces the amount of large woody debris (LWD) that enters the channel (USFWS 2000). LWD is an important substrate for a fishery food-web. LWD also widens the channel and reduces down-cutting, creates aquatic habitat diversity, provides escape cover, and traps spawning gravel and fish carcasses (USFWS 2000). Salmonid fish carcasses are important sources of marine derived nitrogen which is critical to the productivity of the Sacramento River ecosystem. Forest clearing also reduces the number of overhanging trees that create Shaded Riverine Aquatic Habitat, which reduces water temperatures.

Figure 6. Contributing Factors for the Decline in Anadromous Salmonids of the Pacific (NOAA-NMFS).



Good opportunities for riparian land acquisition and restoration exist primarily within flood-prone agricultural lands located in the lower portions of the floodplain. The relatively high costs of maintaining these orchards have made it beneficial for farmers to sell these lands and concentrate their agricultural operations above the lower floodplain. Some farmers have noticed reduced flood impacts to orchards located behind restoration sites, where snags, logs, brush, gravel, and sand are filtered by the restoration site.

Conservation Priorities and Initiatives

The conservation priorities for federally listed endangered and threatened species and migratory birds that occur at Sacramento River Refuge are frequently reinforced by the designation of critical habitat, recovery plans, and conservation plans. A draft recovery plan has been completed for the Sacramento River winter-run Chinook salmon (NOAA-NMFS 1997), and the Refuge lies within the designated critical habitat for Sacramento River winter-run Chinook salmon (federally listed endangered species), Central Valley spring-run Chinook salmon (federally listed threatened species), and Central Valley, California steelhead (federally listed threatened species). A recovery plan has also been completed for the Valley elderberry longhorn beetle (federally listed threatened species). Population and habitat conservation initiatives and plans exist for migratory waterfowl (North American Waterfowl Management Plan 1986, North American Waterfowl and Wetlands Conservation Act of 1986; Central Valley

Habitat Joint Venture 1990) and migratory and resident landbirds (Riparian Habitat Joint Venture 2004). Appendix M contains a list of other laws and executive orders that may affect the CCP or the Service's implementation of the CCP. It also contains an overview of polices and plans that are relevant to Sacramento River Refuge.

The implementation of conservation plans requires the cooperation of a variety of Federal, State, local, and private interests. Most conservation implementation projects involve the local community, including farmers, farm suppliers, and schools. Local support is essential, not only to facilitate the conversion of agricultural land to wildlife habitat, but also for the long-term interest of Refuge conservation programs. Therefore, the Refuge and its partners engage the local community whenever possible. Some of our partners are listed in Table 2.

Wilderness Review

As part of the CCP process, lands within the boundaries of Sacramento River Refuge were reviewed for wilderness suitability. No lands were found suitable for designation as Wilderness as defined in the Wilderness Act of 1964.

Sacramento River Refuge does not contain 5,000 contiguous roadless acres, nor does the Refuge have any units of sufficient size to make their preservation practicable as Wilderness. The lands of the Refuge have been substantially affected by humans, particularly through agriculture and regulation of the flows of the Sacramento River. As a result of the extensive modification of natural habitats and ongoing manipulation of natural processes, adopting a wilderness management approach at the Refuge would not facilitate the restoration of a pristine or pre-settlement condition, which is a goal of wilderness designation.

Acorn Woodpecker
Photo by Steve Emmons

Refuge River Jurisdiction

Navigability and jurisdiction on and under water bodies, including lakes, rivers, and streams, is a complex and confusing issue. In California, the precedents have been established through a combination of legislation and court decisions.

The following text in italics is excerpted in part from a Formal Opinion of State Attorney General Dan Lungren dated November 12, 1997 (No. 97-307):

> *The state (in Harbor and Navigation Code Section 240) recognizes the paramount authority of the United States over navigable waters and applies its regulations to navigation on such waters only insofar as the regulations do not conflict with the admiralty and maritime jurisdiction and laws of the United States. The public's right to use navigable waterways includes their use for boating and recreation; indeed, waters capable of use for recreational boating are deemed navigable. (People ex rel. Baker v. Mack (1971) 19 Cal. A; 3d 1040.). The public's right to use navigable waters for boating and recreation is not only guaranteed by the state Constitution, it is also guaranteed by the Legislature (Gov. Code Section 39933), and the right is inherent in the public trust under which the navigable waters are held. (See Marks v. Whitney (1971) 6 Cal.3d 251; People b. California Fish Co., supra, 166 Cal. At 598-599; 79 Ops. Cal Atty. Gen.133, 135-146 (1996).)*

"The State of California owns and administers several different types of interests in rivers and streams with the state's borders by virtue of being the sovereign representative of the people. These rights are the property of the state, and the state's powers with respect to these property rights are similar in certain ways to the rights of private property owners, but are governed by the law of public trust. The Public Trust Doctrine, as it affects these rights, is designed to protect the rights of the public to use watercourses for commerce, navigation, fisheries, recreation, open space, preservation of ecological units in their natural state, and similar uses for which those lands are uniquely suited" (California's Rivers, A Public Trust Report, California State Lands Commission 1993).

The state lays claim to the beds of all nontidal, navigable rivers and streams up to the ordinary low water mark. In addition, the state claims a right often termed a "public trust easement" in the area between the ordinary low water mark and ordinary high water mark.

The Service has statutory authority under the Improvement Act to regulate activities that occur on water bodies "within" refuge units. The Service, in terms of its refuge administration regulations, has effectively defined this authority to apply to areas the United States holds in fee or to the extent of the interest held by the United States.

Federal Courts have clarified these issues in regards to Federal agencies (i.e., National Parks, National Forests, and National Wildlife Refuges) that own and manage lands that encompass portions of water bodies (lakes or rivers). The Federal Courts have consistently maintained that Federal agencies have jurisdiction over recreational uses on these water bodies when the water body is integral to the primary purposes for which the park, forest, or wildlife refuge was established.

For example, in the U.S. v. Hells Canyon Guide Service case, the District Court maintained that the Property Clause of the Constitution gave the government power "to regulate conduct on non-federal land (the Snake River that runs through the National Forest) when reasonably necessary to protect adjacent Federal property or navigable waters." In addition, this case stated "Congress' power over Federal lands includes the authority to regulate activities on non-federal waters in order to protect the archaeological, ecological, historical and recreational values on the lands" (United States v. Hells Canyon Guide Service; U.S. District Court of Oregon, Civil No. 79-743; 5-6; 1979).

In the court decision in U.S. v. Brown, the Circuit Court wrote, "…we view the congressional power over Federal lands to include the authority to regulate activities on non-federal public waters in order to protect wildlife and visitors on the lands" (United States v. Brown 552 F.2d 822; 8th Cir. 1977).

Finally in the U.S. v. Armstrong case the Circuit Court upheld a conviction against Armstrong and Brown who were conducting a commercial business without a permit within a National Park. In this case, the Circuit Court relied on a U.S. Supreme Court precedent stating, "In Kleppe v. New Mexico, 426 U.S. 529, 546(1976), the Supreme Court held that the Congress may make those rules regarding non-federal lands as are necessary to accomplish its goals with respect to Federal lands" (United States v. Armstrong; No. 99-1190; 8th Cir. 1999).

The meandering nature of the Sacramento River has played a critical role in establishing the Refuge and is a necessary component for the Refuge to meet its purposes. Moreover, regardless of jurisdiction,

the Refuge's first priority is to work with the State of California and local counties to ensure that public trust rights are protected while meeting the Refuge goals and objectives.

In closing, it is the policy of the Sacramento River Refuge to recognize the rights of the public to use, consistent with State and Federal laws, the waters below the ordinary low water mark and the "public trust easement" in the area between the ordinary low water mark and ordinary high water mark. Accordingly, the public uses in these areas will be outlined and evaluated in this CCP, the Environmental Assessment, and associated Compatibility Determinations.

California hibiscus
Photo by Joe Silveira

Chapter 2. The Planning Process

Introduction

The CCP for the Sacramento River Refuge is intended to comply with the requirements of the Improvement Act and the National Environmental Protection Act (NEPA). Refuge planning policy guided the process and development of the CCP, as outlined in Part 602, Chapters 1, 3, and 4 of the U.S. Fish and Wildlife Service Manual (May 2000).

Service policy, the Improvement Act, and NEPA provide specific guidance for the planning process, such as seeking public involvement in the preparation of the Environmental Assessment (EA) document. The development and analysis of "reasonable" management alternatives within the EA include a "no action" alternative that reflects current conditions and management strategies on the Refuge. Management alternatives were developed as part of this planning process and can be found in Appendix A: Environment Assessment.

The planning process for this CCP began in March 2001 with pre-planning meetings and coordination. CCP teams were formed. For the first few months, the core team met weekly in order to expedite the start of the public scoping process and benefit from the existing assistant refuge manager's institutional knowledge prior to his transfer to New Mexico in June 2001.

Initially, members of the Refuge staff and planning team identified a preliminary list of issues, concerns, and opportunities that were derived from wildlife and habitat monitoring and field experience with the past management and history of the Refuge. Early in the process, visitor services, especially hunting and fishing, were identified as primary issues. This preliminary list was expanded during public scoping and then refined and finalized through the planning process to generate the vision, goals, objectives, and strategies for the Refuge. Throughout this process, close coordination with the CDFG was emphasized to coordinate the CCP and their parallel wildlife management planning efforts for the Sacramento River.

The following describes the comprehensive conservation planning process for the Refuge:

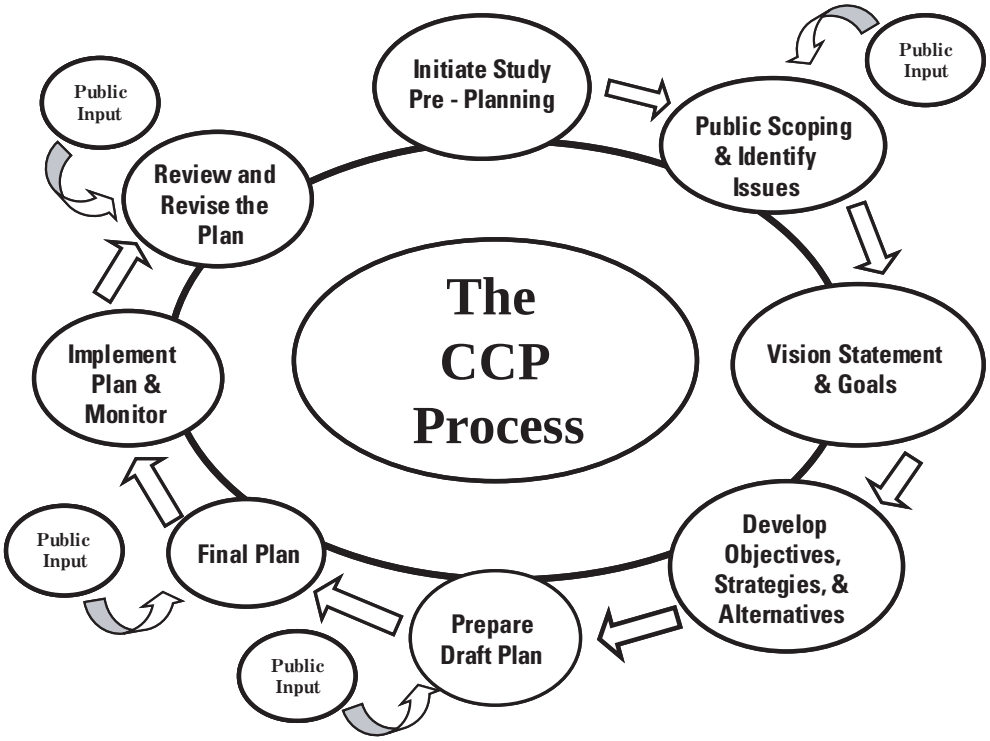
The Planning Process

Part of comprehensive conservation planning includes preparation of a NEPA document. Key steps in the CCP planning process and the parallel NEPA process include:

1. Preplanning and Team formation
2. Public Scoping
3. Identifying issues, opportunities, and concerns
4. Defining and revising vision statement and Refuge goals
5. Developing and assessing alternatives
6. Identifying the preferred alternative plan
7. Draft CCP and EA
8. Revising draft documents and releasing final CCP
9. Implementing the CCP
10. Monitoring / Feedback (Adaptive Management)

Figure 7 shows the overall CCP planning steps and process in a linear cycle. The following sections provide additional detail on individual steps in the planning process.

Figure 7. The CCP Process.



Planning Hierarchy

The Service planning hierarchy that determines the direction of the goals, objectives and strategies is a natural progression from the general to the specific. Described as a linear process, the planning hierarchy is, in reality, a multi-dimensional flow that is linked by the Refuge purposes, missions, laws, mandates, and other statutory requirements (Figure 8).

- The Refuge purposes provide direction for the Refuge.
- A Refuge vision broadly reflects the refuge purpose(s), the Refuge System mission and goals, other statutory requirements, and larger-scale plans as appropriate.
- Goals then define general targets in support of the vision.
- Objectives direct effort into incremental and measurable steps toward achieving those goals.
- Strategies identify specific tools to accomplish objectives.

In practice, the process of developing vision, goals, and objectives is repetitive and dynamic. During the planning process or as new information becomes available, the plan continues to develop.

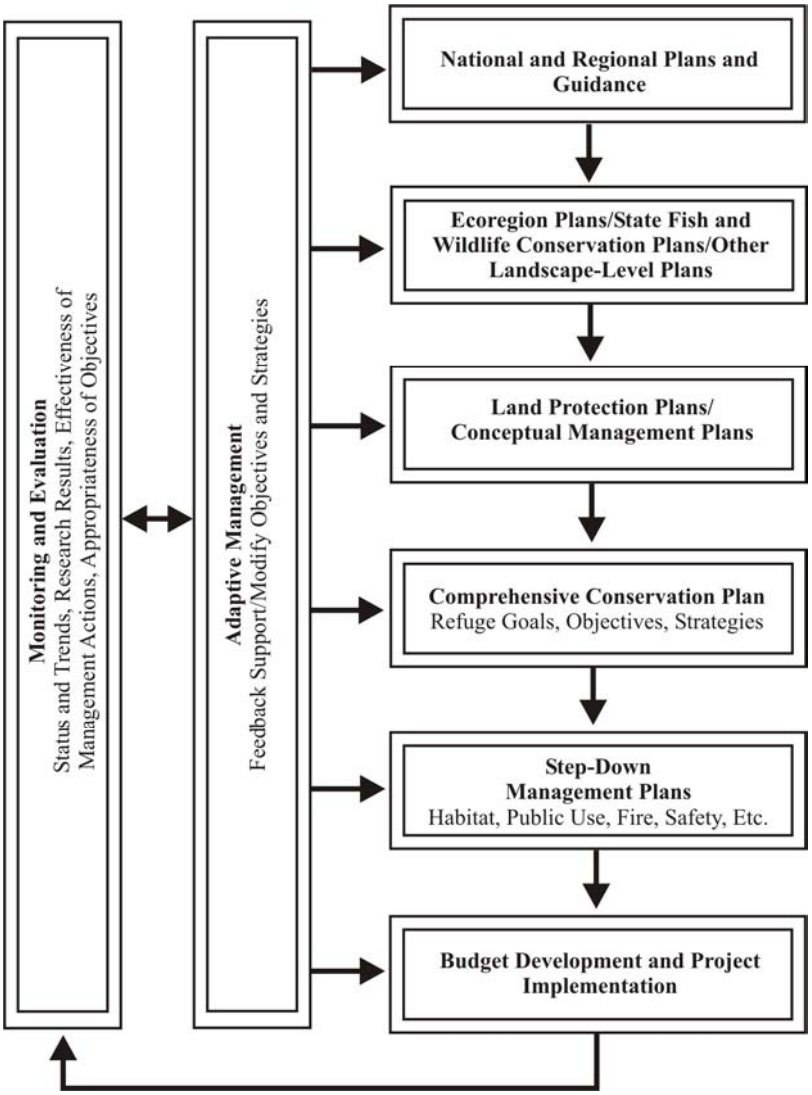
The Planning Team

The CCP process requires close teamwork with the staff, planners, and other partners to accomplish the necessary planning steps, tasks, and work to generate the CCP document and associated EA. Two teams were formed:

Core Team

The core team is the working/production entity of the CCP. The members are responsible for researching and generating the contents of the CCP document and participate in the entire planning process. The team consists of Refuge staff, planners, and Geographic Information System personnel. The Sacramento River Refuge core team, facilitated by the refuge planner, meets regularly to discuss and work on the various steps and sections of the CCP. The team members also work independently in producing their respective CCP sections, based on their area of expertise. Multi-tasking by team members is a standard requirement since work on the CCP occurs in addition to their regular workload. (Appendix K).

Figure 8. Relationships between Service, System and other planning efforts.



Expanded Team

The expanded team is the advisory and coordination forum of the CCP. It is significant for this Refuge because of the Refuge's basis and history of working in close partnership with other local, State, Federal, and private agencies and organizations concerned with the Sacramento River and its watershed. The Sacramento River Refuge expanded team is composed of the Core team, other Service and Federal personnel, and State of California personnel to provide overview, discussion, and coordination during the planning process. (Appendix K).

Pre-Planning

Pre-Planning involved formation of the planning teams, development of the CCP schedule, and gathering data. The teams determined procedures, work allocations, and outreach strategies. They also created a preliminary mailing list.

Public Involvement in Planning

Public involvement is an important and necessary component of the CCP and NEPA process. Public scoping meetings allow the Service to provide updated information about the Refuge System and the Refuge itself. Most important, these meetings allow the Refuge staff to hear public comments, concerns, and opportunities. These public meetings provide valuable discussions and identify important issues regarding the Refuge and the surrounding region.

The Refuge hosted four public scoping meetings in different towns in May and June 2001 (Table 3). Each meeting began with a presentation introducing the Refuge and the Service staff, provided an open forum for public comment, and ended with a breakout session consisting of various tables with people and information available to address Refuge management, wildlife and habitat, and public use. A separate table was set up to handle questions about a separate EA document for planned Refuge restoration efforts. In addition to comments made and noted on flip charts at the meetings, comments were also received by postcard mailers, email, and letters. These comments were analyzed and used to further identify Refuge issues and revise CCP strategies (Table 4).

Public Scoping Meetings. June, 2001
USFWS Photo

Table 3. Public Scoping Meetings.

Meeting Date	Location	Attendance
30 May 2001	Willows, CA	23
04 June 2001	Chico, CA	55
05 June 2001	Red Bluff, CA	13
06 June 2001	Colusa, CA	8

Table 4. Refuge Issues Identified Through Public Comment.

Refuge Issue Category	Number of Comments Received (283[1])
Public Use Issues	**63**
Big 6 Uses	36
Camping	7
Biking	5
Public Use Issues	30
Public Access Issues	**69**
Hunting/Fishing Access	17
River Access/Boat Ramps	9
Disabled Access	4
Refuge Access Issues	43
Management Issues	**83**
LE/Fire	14
Agricultural/Adjacent Land Owner Concerns	18
Refuge Management Issues	51
Outreach/Informational Issues	16
Flood & Erosion Management Issues	**11**
Opinions / Questions	**41**

[1] Total number of comments received. Numbers within Refuge issue categories do not equal the total comments received since many comments covered multiple categories.

Public Outreach

During the planning process, the Refuge staff continued to actively participate with the various working groups and agency teams concerning the Sacramento River. The staff also met with various interest and local groups to explain the Refuge and the planning process, and to listen to their concerns.

An information letter called "Planning Updates" was also mailed to the public. These periodic publications were created to provide the public with up-to-date Refuge information and progress on the CCP process. The Planning Updates were also made available on the Refuge, Region webpage, and at various outreach meetings. Appendix J contains a list of individuals and organizations that were notified or were sent a copy of the Draft CCP, were sent planning updates, or attended scoping meetings.

Issues, Concerns, and Opportunities

Through the scoping process and team discussions, the planning team identified issues, concerns, and opportunities. Over 170 people attended the four public scoping sessions held in May and June 2001. The public provided over 280 comments as of October 2001 (Table 4) for consideration in identifying issues and opportunities for the CCP. The team categorized the comments into five main areas of interest: public use, public access, management, flood and erosion control, and general opinions and questions.

Public use issue categories included wildlife-dependant activities which include hunting, fishing, camping on gravel bars, biking and other types of recreation. Out of 32 comments received about hunting, 3 opposed and 29 supported opening the Refuge to hunting. Three comments specifically stated the need for areas on the Refuge for bank fishing. Three comments suggested limiting or controlling motor and off-road vehicles, while 1 comment suggested allowing motor and off-road vehicles on the Refuge. Having a place to conduct dog trials or dog training was also requested by 3 comments.

The public access issue categories included access for hunting and fishing, access to the river, access for disabled people, and other Refuge access issues. Out of 69 comments received only 2 comments opposed allowing access to the Refuge while the rest overwhelmingly supported opening the Refuge.

Management issue categories included law enforcement/fire management issues, agriculture/adjacent land owner issues, and Refuge management concerns. Some of the Refuge management concern comments included how to manage the Refuge, what techniques to use to manage and what the management priorities should be. Many of the comments received in the outreach and informational issue category were requests for information including several types of brochures, posting signs on the Refuge, and providing access to wildlife survey data. This category also included requests for special events and more education programs.

The flood control and erosion management issue categories included flood control, levee maintenance, and bank stabilization. The opinions/questions/other issues category had comments that ranged from questions about the CCP process to stating personal opinions on a wide variety of topics.

The team also noted resource issues and opportunities that were identified during the scoping process. All comments and issues were reviewed and compiled; the CCP teams consulted them during the process of creating and refining the Refuge's CCP vision, goals, objectives, and strategies.

Development of the Refuge Vision

A vision statement is developed or reviewed for each individual refuge unit as part of the CCP process. Vision statements are grounded in the unifying mission of the National Wildlife Refuge System, and describe the desired future conditions of the refuge unit in the long term (more than 15 years). They are based on the refuge's specific purposes, the resources present on the refuge, and any other relevant mandates. Please refer to Chapter 1 for the Refuge vision statement.

Determining the Refuge Goals, Objectives, and Strategies

The purpose for creating the Refuge is established by law (Chapter 1). The Improvement Act directs that the planning effort develop and revise the management focus of the Refuge within the Service's planning framework, which includes: the Service mission, the Refuge System mission, ecosystem guidelines, and refuge purposes. This is accomplished during the CCP process through the development of goals, objectives, and strategies.

Goals
Goals describe the desired future conditions of a refuge in succinct statements. Each one translates to one or more objectives that define these conditions in measurable terms. A well-written goal directs work toward achieving a refuge's vision and ultimately the purpose(s) of a refuge. Collectively, a set of goals is a framework within which to make decisions. The existing interim Refuge goals are as follows.

Interim Refuge Goals:
- Provide natural habitats and management to restore and perpetuate endangered or threatened species, or species of special concern.
- Preserve a natural diversity and abundance of flora and fauna.
- Provide opportunities for the understanding and appreciation of wildlife ecology and the human role in the environment; and provide high-quality wildlife dependent recreation, education, and research.
- Provide a diversity of riparian and wetland habitats for an abundance of migratory birds, particularly waterfowl and other water birds.

Through the CCP process these interim goals were evaluated and revised and are stated in Chapter 5.

Objectives, Rationale, and Strategies
Once the Refuge goals are reviewed and revised then various objectives, a rationale, and strategies are determined to accomplish each of the goals.

Objectives: Objectives are incremental steps we take to achieve a goal. They are derived from goals and provide a foundation for determining strategies, monitoring refuge accomplishments, and evaluating success. The number of objectives per goal will vary, but should be those necessary to satisfy the goal. Where there are many, an implementation schedule may be developed. All objectives must possess the following five properties: specific, measurable, achievable, results-oriented, and time-fixed.

Rationale: Each objective should document the rationale for forming the objective. The degree of documentation will vary, but at a minimum, it should include logic, assumptions, and sources of information. This promotes informed debate on the objective's merits, provides continuity in management through

staff turnover, and allows reevaluation of the objective as new information becomes available.

Strategy: A specific action, tool, technique, or combination of actions, tools, and techniques used to meet an objective. Multiple strategies can be used to support an objective.

Development of the Refuge Management Alternatives

The development of alternatives, assessment of their environmental effects, and the identification of the preferred management alternative are fully described in the EA (Appendix A). Alternatives were developed to represent reasonable options that address the specific Refuge issues and challenges. A "no action" or continuation of current management alternative is required by NEPA. A range of other alternatives were studied and are briefly described as follows.

Alternative A: No Action

Under the Alternative A: No Action, the Refuge would continue to be managed as it has in the recent past. The focus of the Refuge would remain the same: to provide fish and wildlife habitat and maintain current active management practices; and to restore the 9 units identified in the 2002 Environmental Assessment for Proposed Restoration Activities on Sacramento River National Wildlife Refuge for migratory birds and threatened and endangered species. The Refuge would remain closed to visitor services other than the limited existing opportunities of fishing at Packer Lake. Current staffing and funding levels would remain the same. Recent management has followed existing step down management plans:

- Environmental Assessment for Proposed Restoration Activities on Sacramento River National Wildlife Refuge
- Fire Management Plan for Sacramento River National Wildlife Refuge
- Annual Habitat Management Plan for Sacramento River National Wildlife Refuge
- Cultural Resource Overview and Management Plan

Alternative B: Optimize Habitat Restoration and Public Use (Proposed Action)

Under this Alternative, the Refuge would use active (also known as cultural) and passive management practices to achieve and maintain full restoration/enhancement of all units where appropriate, as funding becomes available. The agricultural program would be phased out as restoration

funding becomes available. The Refuge would employ both cultivation and natural recruitment restoration techniques as determined by site conditions. Public use opportunities would be optimized to allow for a balance of wildlife-dependent public uses (hunting, fishing, wildlife observation and photography, interpretation and environmental education) throughout the entire Refuge in coordination with other agencies and programs. Staffing and funding levels would need to increase to implement this alternative.

Alternative C: Accelerated Habitat Restoration and Maximize Public Use
Under this Alternative, the Refuge focus would use active and passive management practices to achieve and maintain full restoration of all units. The agricultural program would cease immediately and remaining orchards would be removed. Restoration of these sites would be implemented as funding becomes available. Public use opportunities would be maximized to allow for all wildlife-dependent public uses throughout the majority of Refuge. The staff would manage cooperatively with other agencies and organizations, and focus resources and facilities to accommodate uses and demands. In addition, staffing and funding levels would need to substantially increase to implement the alternative.

Selection of the Refuge Proposed Action
The alternatives were analyzed in the EA (Appendix A and EA Appendix 1) to determine their effects on the Refuge environment. Based on this analysis, we have selected Alternative B as the proposed action because it best achieves the Refuge goals, purposes, and Refuge System and Service missions.

Alternative B is founded upon the existing cooperative management programs, with enhancements in habitat and monitoring programs and an integration of a cooperative visitor services program that includes hunting, fishing, wildlife observation and photography, interpretation, and environmental education. Cooperative management refers to the current practice of working closely with State and other river partners to provide protected and enhanced habitat along with visitor service opportunities and adjacent land uses on publicly owned properties. Please refer to Chapters 5 and 6 which describes this management plan.

Plan Implementation

The Draft CCP and EA were provided for public review and comment during July and August, 2004. The Service responded to these comments (Appendix R), finalized the document and released it to the public. The Refuge will implement the plan and associated step-down plans (Chapters 5 and 6) over the next 15-years, as funding permits.

Chapter 3. The Refuge Environment

Geographic/Ecosystem Setting

The Sacramento River runs through the center of California's Sacramento Valley, beginning in the volcanic tablelands of Shasta County and ending in the broad alluvial basins of Colusa, Sutter and Yolo Counties (Helly and Harwood 1985; Warner and Hendrix 1985). Just downstream of Shasta Dam, the Sacramento River is mostly confined by stable geologic formations, resulting in a narrow riparian corridor of trees and other vegetation adjacent to the river itself. As it travels south from Red Bluff towards Chico, the river begins to meander over a broad alluvial floodplain, which is constrained by more erosion-resistant geologic formations. Here, the river still receives water from many tributaries. As it travels south from Chico toward Colusa, the river receives water only from the Stony Creek tributary. During high flows, the river in this reach will drain into sloughs that empty into the large basins that flank its sides. Setback levees and weirs control the release of flood waters into these basins, but in areas where there is no bank revetment the river meanders and creates areas of riparian vegetation. South of Colusa, the river is confined to its main channel by tight levees, and high flows are diverted through weirs and into bypass channels designed to prevent flooding of agricultural lands and urban areas. The resulting riparian vegetation is confined to narrow strips along these levees.

The Sacramento River Ecosystem

The major physical factors effecting the development and persistence of riparian habitats along the Sacramento River are geology, hydrology, and the resulting meander of the channel. Flood events erode the river bank and deposit sand and silt on the floodplain. Over time the river channel migrates through unconsolidated alluvium and is slowed or restricted by the less erodible geologic material, constantly modifying the alluvial floodplain. Various ages and types of riparian habitats develop and exist on the floodplain.

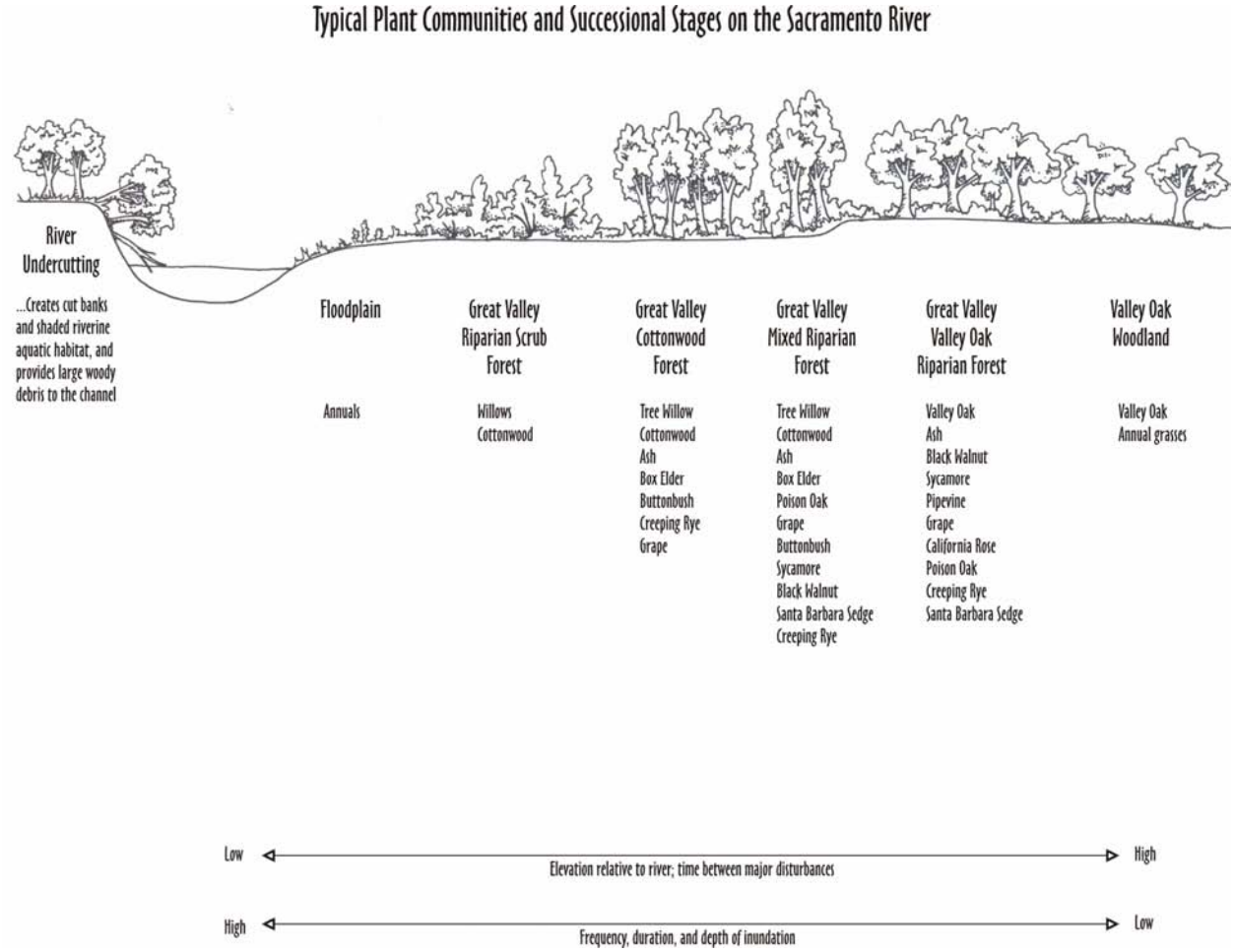
Early successional vegetation species are established when germination conditions are triggered by a moist open site, such as a newly created sandbar. Species, such as willows and

cottonwoods, tend to have rapid growth rates that result in quick root establishment to the water table. Eventually, the presence of these early colonizers slows flood flows and encourages the accumulation of silt over time. These finer soils can retain moisture longer than the underlying sand and gravel, and create a favorable environment for the germination of other trees, such as box elder and Oregon ash. As deposits accumulate and increase the level of the river bed, species that are less tolerant of frequent flooding begin to colonize, such as sycamore, black walnut, and finally, valley oak (Figure 9).

Natural processes such as flood events, erosion, channel migration and fire play an important role in creating various ages and kinds of riparian habitats. The presence of fire in the landscape has been one of the major evolutionary factors determining the composition of flora throughout California. Lightning is the most common natural ignition source. Generated by summer thunderstorms, lightning is responsible for much of the wildland fires that occur throughout western United States each year. Fire, flood, and drought all played an important role in plant succession prior to settlement of the area.

Phelan Island
Photo by Skip Jones

Figure 9. Typical Plant Communities and Successional Stages on the Sacramento River.



These different, yet intertwined plant communities provide important habitat for breeding, migrating, wintering, and local wildlife (Conrad et al. 1977; Gaines 1974, 1977; Roberts et al. 1977). For example, gravel bars are important to nesting killdeer, spotted sandpipers, and lesser nighthawks. Areas of young, dense willow scrub host large numbers of invertebrates, which are an abundant food source for landbirds, such as the nesting blue grosbeak. The cottonwood riparian forest that evolves from riparian scrub provides dense canopy cover and commonly hosts a wide array of local and migrant birds, including the western yellow-billed cuckoo, and nesting eagles, osprey, and Swainson's hawks. As the cottonwood forest matures and diversifies, it becomes mixed riparian forest. Here, the dense mixture of trees and shrubs are often covered with the vines of wild grape and pipevine, supporting many other bird species. The more mature valley oak riparian forest is drier and has a closed canopy and often, dense understory, which also provides

diversity of avian habitats. Valley oak woodland, found on the higher floodplain terraces, has a much more open understory, and provides excellent foraging and roosting habitat for many avian species, and nesting habitat for owls, woodpeckers, and bluebirds. Newly eroded cut banks are essential to providing nest sites for bank swallows. Heavily shaded banks provide cover and maintain suitable water temperatures for juvenile salmon. Sloughs and side channels provide more static conditions required by northwestern pond turtles. These are just several examples of the diversity and abundance of species that Sacramento River riparian habitats support and illustrate the complexity and importance of the system.

Physical Environment

Climate and Air Quality

The climate of California's northern Central Valley is classified as Mediterranean, with cool, wet winters and hot, dry summers. Rainfall is fairly well distributed throughout the winter, occurring in steady, but gentle, two- or three-day storms. The annual average precipitation is 16-18 inches. Heavy fog is common during the winter months, while thunderstorms, hail, and snow are rare occurrences. The mean annual temperature is 61.7^{0}F with extremes of 118^{0}F and 15^{0}F. The south winds are associated with storms in the winter and cooling trends in the summer. North winds are usually dry following winter storms, and hot and dry in the summer.

The Refuge is in California's Sacramento Valley Air Basin. The Sacramento Valley Air Basin occupies 15,043 square miles and includes Butte, Colusa, Glenn, Sacramento, Shasta, Sutter, Tehama, Yolo, and Yuba counties, the western urbanized portion of Placer County, and the eastern portion of Solano County. The Tehama County Air Pollution Control District, Butte County Air Quality Management District, Colusa County Air Pollution Control District, and the Glenn County Air Pollution Control District are the agencies responsible for ensuring compliance with Federal and State air quality standards in the basin where the Refuge is located.

The Federal and State governments have each established ambient air quality standards for several pollutants. Most standards have been set to protect public health. However, standards for some pollutants are based on other values, such as protecting crops and materials and avoiding nuisance

conditions. Currently, Butte County is federally classified as a non-attainment area for ground-level ozone. Non-attainment areas are defined as any area that does not meet ambient air quality standards for a pollutant. In addition, Tehama, Butte, and Glenn Counties are classified by the State of California as non-attainment areas for ozone and particulate matter (PM10) standards. In fact, only three counties in the entire state are not classified as non-attainment areas for PM10. Being classified as a non-attainment area means that the state must develop an implementation plan to outline methods for reaching identified air quality standards. Permitting, scheduling, and restrictions on some activities may be required. Currently, individual counties require smoke management plans and limit acreage burned on prescribed burns conducted by the refuge.

Ozone, the main component of photochemical smog, is formed through a complex series of chemical reactions between reactive organic gasses (ROG) and nitrogen oxides (NOx). On-road motor vehicles and other mobile sources are the largest contributors to NOx emissions in the Sacramento Valley. On-road motor vehicles, area-wide sources, and stationary sources are significant contributors to ROG emissions. Once formed, ozone remains in the atmosphere for 1 or 2 days. As a result, ozone is a regional pollutant and often impacts a large area. Ozone's main effects include damage to vegetation, chemical deterioration of various materials, and irritation and damage to the human respiratory system.

PM10 is produced by stationary point sources such as fuel combustion and industrial processes, fugitive sources, such as roadway dust from paved and unpaved roads, wind erosion from open land, and transportation sources, such as automobiles. The primary sources of PM10 in the Sacramento Valley are fugitive dust from paved and unpaved roads and agricultural operations, and smoke from residential wood combustion and seasonal agricultural burning. Soil type and soil moisture content are important factors in PM10 emissions. Federal and State PM10 standards are designed to prevent respiratory disease and protect visibility.

Certain land uses are considered more sensitive to air pollution than others. Locations, such as schools, hospitals, and convalescent homes, are labeled sensitive receptors because their occupants (the young, old, and infirm) are more susceptible to respiratory infections and other air quality-related health problems than the general public. Residential

areas are also considered to be sensitive receptors because residents tend to be home for extended periods of time, resulting in sustained exposure to any pollutants present.

Geology, Hydrology, and Soils
The area of the Refuge between Red Bluff and Chico Landing is underlain by sedimentary and volcanic deposits associated with the Tehama, Tuscan, and Red Bluff formations (Harwood and Helley 1982; Helley and Harwood 1985). On top of these formations lie terrace deposits, such as Riverbank and Modesto formations, as well as paleochannel deposits, alluvial fans, meanderbelt deposits, and basin and marsh deposits (Department of Water Resources 1994; Robertson 1987). The Modesto and Riverbank deposits flank the river in steps away from the channel, and tend to erode at lower rates than the other young deposits. These areas tend to form higher, more consolidated banks, and have a high proportion of Class I agricultural soils, including the Columbia and Vina loams.

There are many tributaries that enter the Sacramento River through the Refuge properties located north of Chico, including Coyote Creek, Oat Creek, Elder Creek and Hoag Slough. Although this area has a large number of tributaries, the overall hydrology has been greatly changed due to the presence of Shasta Dam. Bank erosion rates have declined, likely due to reduced peak flow and increased bank protection. In the Refuge project area, Red Bluff to Colusa, the Sacramento River is characterized by three general levels of bank protection; however, U.S. Army Corps of Engineers and California Department of Water Resources rip-rap occurs in isolated stretches throughout this area. First, from Red Bluff to Ord Bend, bank protection consists of small private levees discontinuously protecting individual private properties. The Corps of Engineers Sacramento River Bank Protection Program levee system begins at the left bank at Ord Bend and at the right bank about seven miles below. Second, from this point downstream, the Corps of Engineers project levees are continuous. Third, the levees constrict just below Princeton, greatly reducing the formation of point bars and terraces, which in turn affect the regeneration of cottonwood and willow forests.

Refuge properties that lie between Chico Landing and Colusa are bounded on the west by terrace deposits (Modesto Formation) and on the east by paleochannel deposits of a much older river system. This stretch of the river has only one main

tributary, Stony Creek, which enters the river through the Phelan Island Unit. South of Stony Creek, the river has historically overflowed its banks on both sides of the river during floods (Thompson 1961), resulting in clay-lined basins to the west and east of the river. Today, weirs and channels convey floodwaters into the Butte Sink and the Sutter/Yolo bypasses. The natural, loamy levees that have gradually developed along the river separate the main channel from these basins on its sides. Sediment texture is finer, with more silty and sandy banks compared to the more gravelly banks found in the northern reach (US Army Corps of Engineers 1988). This reach of the river meanders, though it has become less sinuous since 1896.

Contaminants and Water Quality

The Refuge lies within the jurisdiction of the Central Valley Regional Water Quality Control Board, which established beneficial uses and water quality objectives for surface water and groundwater in the Water Quality Control Plan (Basin Plan) for the region (Central Valley Regional Water Quality Control Board 1998). Because the Sacramento River originates as snowmelt, it is of excellent water quality; therefore, it supports all existing beneficial uses of the Basin Plan, including domestic, agricultural, and industrial water supply; recreation; wildlife habitat; cold and warm freshwater fish habitat; and migration and spawning for salmonid fisheries. The water is considered soft, moderately alkaline, and low in dissolved solids, with high turbidity during peak runoff periods. The Sacramento River is listed as impaired on the U.S. Environmental Protection Agency's (EPA) Section 303 (d) list of water bodies for the pesticide diazinon, and trace metals (including mercury, cadmium, copper, and zinc). A contaminants investigation occurring at other refuges of the Sacramento Refuge Complex discovered the following pesticides in Refuge wetlands: atrazine, dieldrin, DDT, heptachlor, heptachlor epoxide, n-butyl pthalate diazinon, n-butyl pthalate trifluralin, trifluralin, trifluralinatrazine, and trifluralindiazinon (USGS 1992). The Refuges do not use these chemicals; however, these preliminary results are not surprising because all of the refuges in the Complex are adjacent to and surrounded by agriculture, where pesticides and herbicides are regularly applied for crop production. These elevated concentrations were only slightly greater than Service guidelines for possible effects on wildlife (USGS 1992).

Biological Resources

Vegetation
The Refuge currently consists of 10,304 acres (Chapter 1, Table 1) of agricultural, wetland, grassland, and riparian habitats. Agricultural areas include walnut and almond orchards, pasture, and row crops; currently, accounting for 26% of refuge lands. Riparian habitats include open water, oxbow wetlands, gravel and sand bars, herbland cover, blackberry scrub, Great Valley riparian scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Valley oak, Valley freshwater marsh, giant reed, disturbed, and restored riparian.

Eddy Lake on the Sacramento River Refuge
Photo by Joe Silveira

Distribution of these habitats can be seen in Figures 11-23 and a list of plant species occurring on the Refuge is located in Appendix G. Descriptions of agricultural and riparian habitats and their associated plant/wildlife species are as follows.

Agricultural
Walnut orchards account for about 60 percent of the Refuge's agricultural acreage. Almond, row crop, and pasture make up the remaining 40 percent of the agricultural acreage. Walnut and almond orchards are farmed under cooperative agreements with local farmers and land managers, and are maintained using current farming techniques that include mowing, irrigation, pesticide and herbicide use, and mechanical harvest.

Orchards support a limited amount of wildlife, including nesting mourning doves, western bluebirds, scrub jays, northern flickers, lazuli buntings, and non-native such as European starlings and house finches. Black-tailed hares, California voles, and pocket gophers are also present in orchards. Areas of row crop and pasture can support abundant wildlife during brief periods, such as black-tailed hares, house mice, California voles, California ground squirrels, pocket gophers, brewer's blackbirds, house finches, and mourning doves.

Riparian Habitats

In conformance with the descriptions used by the Geographic Information Center at California State University, Chico (2002) for mapping the riparian vegetation of the Sacramento River, Refuge "riparian" habitats are referred to as: open water, oxbow wetlands, gravel and sand bars, herbland cover, blackberry scrub, Great Valley riparian scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Valley oak, Valley freshwater marsh, giant reed, disturbed, and restored riparian.

Open water constitutes water, either standing or moving, and does not necessarily include vegetation. These areas support many fish species, including salmon, steelhead, and sturgeon, as well as avian species such as American white pelican, double-crested cormorant, osprey, kingfisher, and common merganser.

Gravel and sand bars appear as open, unvegetated areas in aerial photos, but ground inspection reveals several annual and short-lived perennial species of sun-loving herbs, grasses, and aromatic subshrubs. The vegetation cover is less than 50 percent. Species such as killdeer, spotted sandpiper, and lesser nighthawk commonly use these areas.

Herbland cover is composed of annual and perennial grasses and forbs, and is enclosed by other riparian vegetation or the stream channel. Species such as lazuli bunting, blue grosbeak, and common yellowthroat frequently nest in these areas.

Blackberry scrub is vegetation where 80 percent or more of the coverage is blackberry shrubs. Blackberry shrubs are important escape cover for California quail, and are used for perches by a variety of songbirds.

Great Valley riparian scrub forms from primary succession processes where vegetation becomes established in areas where erosion and sedimentation of deposits have occurred (Holland 1986; Holland and Roye 1989). Vegetation includes streamside thickets dominated by sandbar or gravel bar willows, or by other fast growing shrubs and vines. It is also commonly populated by cottonwood, California rose, Mexican tea, and wild grape. Typical inhabitants include the black-chinned hummingbird, willow flycatcher, Pacific-slope flycatcher, mourning dove, and black phoebe.

Great Valley cottonwood riparian forest consists of cottonwoods that are at least one year old and account for 80 percent or greater of the canopy coverage. Cottonwood forests are an early successional stage riparian vegetation type and consist of primarily of mature Fremont cottonwood trees and sparse understory (Holland 1986; Holland and Roye 1989). They can also include one or more species of willows and have a dense understory of Oregon ash, box elder, wild grape, and various herbs and grasses. Within this habitat type, species such as the bald eagle, western yellow-billed cuckoo, and Pacific-slope flycatcher nest and forage.

Great Valley mixed riparian forest (MRF) is a vegetation type consisting of later successional species, such as valley oak (Holland 1986; Holland and Roye 1989). Valley oak accounts for less than 60 percent of the canopy coverage with black walnut, Oregon ash, and western sycamore also present. Willows and cottonwood may also be present in relatively low abundance. The dense understory often consists of Oregon ash, box elder, poison oak, and wild grape. Due to the dense canopy and understory, a large variety of migratory and resident bird species use this habitat, such as the western yellow-billed cuckoo, yellow-rumped warbler, black-headed grosbeak, and spotted towhee. Since MRF frequently edges oxbows and sloughs, it attracts a large array of species that are “wetland-related”, including the northwestern pond turtle, great blue heron, great egret, double-crested cormorant, wood duck, yellow-breasted chat, common yellowthroat, and song sparrow.

The valley oak riparian forest (VORF) consists of vegetation with at least 60 percent valley oak canopy. Restricted to the highest parts of the floodplain, VORF occurs in areas that are more distant from or higher than the active river channel. This habitat type is a medium-to-tall deciduous, closed-canopy forest dominated by valley oak and may include Oregon ash, black

walnut, and western sycamore. The understory includes California pipevine, virgin's bower, California blackberry, California wildrose, poison oak, and blue wild-rye (Holland 1986). Common species found here include the red-shouldered hawk, great-horned owl, western screech-owl, acorn woodpecker, Bewick's wren, bushtit, and scrub-jay. Historically an extensive habitat, it has been greatly reduced by agriculture and firewood harvesting and is now only limited and scattered in occurrence.

Valley Oak Woodland
Photo by Joe Silveira

Valley oak woodland (VOW) is found on deep, well-drained alluvial soils, far back from or high above the active river channel (Holland 1986). VOW is an open, winter-deciduous savanna dominated by widely spaced oaks, blue elderberry, and coyote-brush, with an understory of grasses and forbs. VOW often intergrades with VORF. Due to its more open nature, VOW attracts different avian species than VORF, such as the Swainson's hawk, American kestrel, western kingbird, loggerhead shrike, yellow-billed magpie, and western meadowlark. VOW once occupied thousands of acres in the Great Central Valley. It occurred on the best agricultural soils (Columbia and Vina type) that covered thousands of acres in the Great Valley (Bureau of Soils 913; Holland 1986; Holmes et al. 1915; Watson et al. 1929). Consequently, valley oak woodlands are among the most reduced natural habitat type in California.

Valley freshwater marsh is dominated by perennial emergent monocots, a type of marsh vegetation. Cattails or tules usually

are the dominants, often forming monotonous stands that are sparingly populated with additional species, such as rushes and sedges. Coverage may be very high, approaching 100 percent. Typical riparian areas that support freshwater marsh include the main channel, tributaries, sloughs, abandoned channel, oxbow lakes, and ponds. These areas attract an array of wetland-dependent species such as mallard, wood duck, black-crowned night-heron, great egret, great blue heron, American bittern, northwestern-pond turtle and giant garter snake. Giant reed (*Arundo donax,* locally referred to as bamboo) is a grass that is less than 8 meters in height. It is a highly invasive plant that reduces and replaces native species. Giant reed provides a very low quality habitat for wildlife species.

Disturbed habitats include areas that are undergoing major disturbances and are now either completely devoid of riparian vegetation or contain only small remnants of it.

Fish and Wildlife

Many kinds of birds use the Refuge at various times throughout the year, such as gulls, terns, wading birds, diving birds, waterfowl, shorebirds, raptors, game birds, and a variety of landbirds. Also present are mammalian, amphibian, reptile, fish, and invertebrate species. While many species are common year-round, others are here only during migration, for the winter, or during spring and summer months to breed. Appendix G contains a complete list of fish and wildlife species that occur and potentially occur on the Sacramento River Refuge. An overview of wildlife use of the Refuge follows.

Waterfowl

The primary waterfowl use of the Refuge is by wintering birds during the months of August through March. Peak wintering populations in the Sacramento Valley occur during November through January, when several million ducks may be present. A small percentage remains through the spring and summer months to nest. On the Refuge, populations peak during flood events when much of the floodplain is underwater. During these periods, the quantity of habitat is increased, previously unavailable resources become available, and the area can support thousands of ducks. Common wintering duck species include the northern pintail, mallard, American wigeon, green-winged teal, gadwall, northern shoveler, wood duck, ring-necked duck, common goldeneye, and common merganser. Goose species consist mostly of small numbers of the western Canada goose, with occasional white-fronted geese. The

primary summer nesting species include the mallard, wood duck, and common merganser, and lesser numbers of cinnamon teal and western Canada goose.

Wood duck
USFWS Photo

Shorebirds
The greatest numbers of shorebirds use the Refuge during fall and spring migrations, with populations peaking in April when thousands of sandpipers pass through the Refuge on their way to the northern breeding grounds. Common fall and spring migrants include western and least sandpipers, dunlin, long-billed dowitcher, and greater yellowlegs. Killdeer and spotted sandpipers nest on gravel bars along the river's edge.

Wading/diving birds
Many wading and diving birds use the Refuge year-round, utilizing all wetland and some riparian habitat types for foraging, roosting, and nesting. Great blue heron, great egret, and double-crested cormorant rookeries have been found in mixed riparian forests near the main channel and along oxbows and sloughs. Year-round species include great blue herons, great, snowy and cattle egrets, green herons, American bitterns, black-crowned night-herons, Virginia rails, soras, common moorhens, American coots, pied-billed and western grebes, and double-crested cormorants. Other waterbirds use Refuge wetlands at various times throughout the year, such as Clark's grebes, eared grebes, and American white pelicans.

Raptors

Many species of raptors (birds of prey) are found along the Sacramento River at the edge of riparian habitat adjacent to agricultural lands. Raptor abundance is greatest in the winter because of the high numbers of red-tailed hawks that winter in the Sacramento Valley. Other common wintering species include barn owl, western screech-owl, and great horned owl, but American bald eagle and turkey vulture are also present in relatively large numbers. White-tailed kite and peregrine falcon are also present during the winter. Local breeding raptors include the American kestrel, turkey vulture, osprey, northern harrier, red-shouldered hawk, Swainson's hawk, red-tailed hawk, barn owl, western screech-owl, and great horned owl.

Game birds

Game birds occupy various habitats along the Sacramento River. The mourning dove commonly nests in riparian forests and orchards and forages on gravel bars. California quail are common residents in the herbaceous layer of various riparian habitats and blackberry thickets. Wild turkeys use large trees for escape and roost and nest in dense herbaceous vegetation. Non-native ring-necked pheasants nest in dense herbaceous vegetation and feed and roost in various riparian habitats.

Gulls/terns

Ring-billed and herring gulls are common during fall and into spring. Forster's and Caspian terns are often seen in small numbers in migration during the spring and fall.

Landbirds

The Refuge provides a variety of habitats for a great diversity of migratory and resident landbirds (Chapter 1, Figure 4). Habitat diversity, structural complexity, and proximity to wetlands are important habitat features. The Sacramento River is an important migration corridor that provides stopover resting and feeding habitat for landbirds that breed in the nearby foothills and mountains. The river is also an important breeding area for migratory and resident songbirds and other landbirds. Species include the western yellow-billed cuckoo, lesser nighthawk, black-chinned and Anna's hummingbirds, belted kingfisher, acorn, Nuttall's and downy woodpeckers, northern flicker, olive-sided, willow, and Pacific-slope flycatchers, western wood-pewee, black phoebe, western kingbird, tree, violet-green, northern rough-winged, bank, and cliff swallows, scrub jay, yellow-billed magpie, oak titmouse, bushtit, white-breasted nuthatch, Bewick's and marsh wrens,

ruby-crowned kinglet, western bluebird, Swainson's and hermit thrushes, northern mockingbird, loggerhead shrike, orange-crowned, Nashville, yellow, yellow-rumped and Wilson's warblers, common yellowthroat, yellow-breasted chat, western tanager, black-headed and blue grosbeaks, lazuli bunting, spotted and California towhee, lark, fox, song, Lincoln's, golden-crowned, and white-crowned sparrows, dark-eyed junco, red-winged, yellow-headed and Brewer's blackbirds, western meadowlark, brown-headed cowbird, northern oriole, purple finch, and lesser and American goldfinches. Many of these species are priority or focal species in conservation plans or on Federal or State priority species lists (Table 5). Non-native European starling, rock pigeon, and house sparrow are common.

Willow flycatcher
Photo by Steve Emmons

Mammals

Many mammalian species are year-round residents of the Refuge. Native beavers, mink, and river otters and non-native muskrats occur along the riparian zone and associated wetlands and waterways. Other native species occurring in riparian habitat along the Sacramento River include the broad-footed mole, ornate shrew, big brown bat, Brazilian free-tailed bat, California myotis, Townsend's big-eared bat, black-tailed hare, desert cottontail, California vole, deer mouse, porcupine, Botta's pocket gopher, western gray squirrel, beechy ground

squirrel, western harvest mouse, coyote, gray fox, long-tailed weasel, mountain lion, raccoon, ringtail, striped skunk, and black-tailed deer. Occasionally, black bear are observed along the northern end of middle Sacramento River. Non-native species include the Virginia opossum, black rat, Norway rat, house mouse, and feral house cat.

Amphibians and Reptiles

Reptiles are common residents in riparian and adjacent areas. They include the western rattlesnake, common garter snake, gopher snake, western yellowbelly racer, common kingsnake, western fence lizard, and alligator lizard. A few species, such as giant garter snake and northwestern pond turtle, are wetland-dependent residents. The western toad and Pacific tree frog are the only amphibians known to occur on the Refuge. Non-native species include the American bullfrog and red-eared slider.

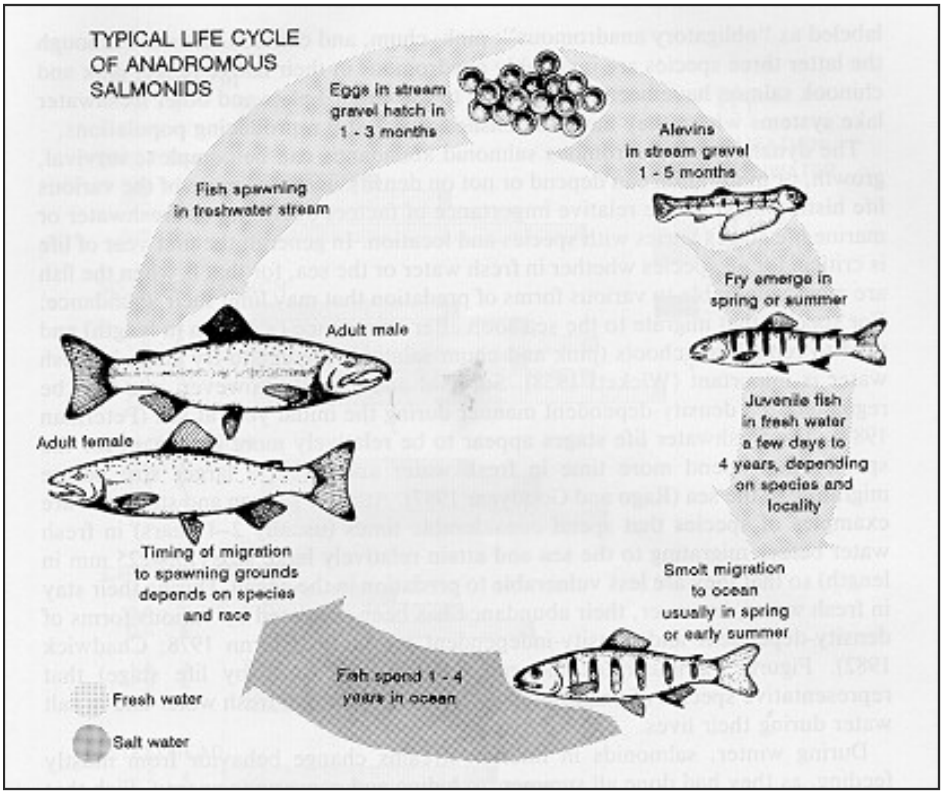
Western pond turtle
USFWS Photo

Fish

Fish species occur at the Refuge in the main channel, sloughs, oxbow lakes, and on the inundated floodplain. The Sacramento River is important to native anadromous fish, including green and white sturgeon, pacific and river lamprey, steelhead, and four distinct runs of Chinook salmon (Moyle 2002), (Chapter 1, Figure 3). Three of the four Chinook salmon runs are considered unique Evolutionary Significant Units (ESU). These include the Sacramento River winter-run ESU, Central Valley spring-run ESU, and Central Valley fall-run and late-fall-run ESU Chinook salmon (Moyle 2002). The Central Valley ESU steelhead is also a unique race (Moyle 2002). Anadromous fish are migratory, using the open ocean, bays, estuaries, deltas, main river channels, floodplains, and tributaries. Anadromous fish

spawn in freshwater environments and spend their adult life in marine environments. The typical life cycle for Sacramento River Chinook salmon is illustrated in Figure 10.

Figure 10. Typical Life Cycle of Anadromous Salmonids.



Other native fish include blackfish, California roach, hardhead, hitch, the endemic Sacramento splittail, Sacramento squawfish, speckled dace, Sacramento sucker, threespine stickleback, redear sunfish, Sacramento perch, prickly sculpin, riffle sculpin, and staghorn sculpin (Moyle 2002). Non-native species include anadromous American shad, threadfin shad, and stripped bass (Moyle 2002). Non-native warm-water species include carp, golden shiner, channel and white catfish, black, brown and yellow bullhead, mosquito fish, Mississippi silverfish, black and white crappie, bluegill, green sunfish, largemouth, smallmouth and spotted bass, and bigscale logperch (Moyle 2002).

Invertebrates

Invertebrate populations are greatest and most diverse in aquatic habitats, and provide an important food base for many fish and wildlife species both aquatic and terrestrial. Common aquatic invertebrates include water fleas, snails, clams, dragonflies, damselflies, water boatmen, backswimmers, beetles, midges, mosquitoes, worms, clams, snails, and crayfish.

Terrestrial invertebrates are an important food base for many migratory and resident bird species, and include species such as grasshoppers, beetles, butterflies, moths, and ants.

Threatened and Endangered Species

The Sacramento River Refuge provides breeding, rearing, migratory staging, and wintering habitat for Federal and State threatened and endangered species and species of special status. A list of these species is presented in Table 5.

Chinook salmon, Sacramento River winter-run ESU (Federal and State-listed endangered species) only occurs in the Sacramento River watershed in California and most spawning is limited to the main stem of the Sacramento River. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta and upstream into the Sacramento River from December through July. Downstream migration of juvenile winter-run Chinook salmon occurs from November through May. They rear as fry along the entire Refuge and also migrate past the Refuge as smolts. Winter-run Chinook salmon can rear in the following areas on the Sacramento River: above Red Bluff Diversion Dam (moving downstream as smolts), and probably in the lower river between river mile 70 and 164 (moving downstream as fry). Water temperatures determine juvenile rearing locations and river conditions strongly influence movement. Critical Habitat for the Sacramento River winter-run Chinook salmon was designated June 16, 1993 (58 CFR 33212, June 16, 1993). Critical habitat includes the river bottom and riparian zone, which are those terrestrial areas that directly affect a freshwater aquatic ecosystem. Critical Habitat for this ESU includes the Sacramento River from Keswick Dam to Chipps Island, all the waters westward from Chipps Island to the Carquinez Strait Bridge, all the waters of San Pablo Bay, and all the waters of the San Francisco Bay north of the San Francisco Bay–Oakland.

Table 5. Special status wildlife species occurring or potentially occurring at Sacramento River Refuge.

Species		Status		
		CNPS	State	Federal
Plants				
Silky cryptantha	*Cryptantha crinita*	CNPS 1		FSC
Sanford's arrowhead	*Sagittaria sanfordii*	CNPS 1		FSC
Rose mallow	*Hibiscus lasiocarpus*	CNPS 2		
Fox sedge	*Carex vulpinoidea*	CNPS 2		
Four-angled spikerush	*Eleocharis quadrangulata*	CNPS 2		
Columbian watermeal	*Wolffia brasiliensis*	CNPS 2		
Insects				
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*			FT
Fish				
River lamprey	*Lampreta ayresi*		CSC	FSC
Pacific lamprey	*Lampetra tridentate*			FSC
Green sturgeon	*Ascipenser medirostris*		CSC	CS
Chinook salmon, Central Valley Spring.-run	*Oncorhynchus tschawytscha*		CT	FT
Chinook salmon, Sacramento River Winter-run	*Oncorhynchus tschawytscha*		CE	FE
Chinook salmon, Central Valley Fall/late Fall-run	*Oncorhynchus tschawytscha*		CSC	CS
Central Valley steelhead	*Oncorhynchus mykiss*			FT
Pink salmon	*Oncorhynchus gorbuscha*		CSC	
Chum salmon	*Oncorhynchus keta*		CSC	
Coho salmon	*Oncorhynchus kisutch*		CSC	
Sacramento splittail	*Pogonichthys macrolepidotus*		CSC	FSC
Hardhead	*Mylopharadon conocephalus*		CSC	
Sacramento perch	*Archoplites interruptus*		CSC	FSC
Amphibians & Reptiles				
Giant garter snake	*Thamnophis gigas*		CT	FT
Northwestern pond turtle	*Clemmys marmoratta marmoratta*		CSC	FSC
Birds				
American white pelican	*Pelecanus erythrorhynchos*		CSC	
Double-crested cormorant	*Phalacrocorax auritus*		CSC	
American bittern	*Botaurus lentiginosus*			FSC
Least bittern	*Ixobrychus exilis*		CSC	
Barrow's goldeneye	*Bucephala islandica*		CSC	
Bald eagle	*Haliaeetus leucecophalus*		CE	FT
Golden eagle	*Aquila chrysaetos*		CSC	PR
Osprey	*Pandion haliaetus*		CSC	

Species		Status		
		CNPS	State	Federal
Northern harrier	*Circus cyaneus*		CSC	
Cooper's Hawk	*Accipiter cooperii*		CSC	
American Peregrine Falcon	*Falco peregrinus anatum*		SFP, CE	FSC, BCC
Merlin	*Falco columbarius*		CSC	
Sharp-shinned hawk	*Accipiter striatus*		CSC	
Swainson's hawk	*Buteo swainsoni*		CT	FSC, BCC
White-tailed kite	*Elanus leucurus*			FSC
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*		CE	CS, BCC
Long-eared owl	*Asio otus*		CSC	
Vaux's swift	*Chaetura vauxi*		CSC	FSC
Lewis' woodpecker	*Melanerpes lewis*			FSC
Nuttall's woodpecker	*Picoides nuttallii*			FSC
Red-breasted sapsucker	*Sphyrapicus ruber*			FSC
Willow flycatcher	*Empidonax traillii*		CE	FSC
Bank swallow	*Riparia riparia*		CT	FSC
Oak titmouse	*Parus inornatus*			FSC
Loggerhead shrike	*Lanius ludovicianus*		CSC	FSC, BCC
Least Bell's Vireo (extirpated)	*Vireo bellii pusillus*		CE	FE
Yellow warbler	*Dendroica petechia bewersterii*		CSC	
Yellow-breasted chat	*Icteria virens*		CSC	
Tricolored blackbird	*Agelaius tricolor*		CSC	FSC, BCC
Lawrence's goldfinch	*Carduelis lawrencei*			FSC, BCC
Mammals				
Townsend's big-eared bat	*Corynorhinus towsendii pallescens*		CSC	FSC
Western mastiff bat	*Eumops perotis californicus*		CSC	FSC
Pallid bat	*Antrozous pallidus*		CSC	
Yuma bat	*Myotis yumanensis*			FSC
Ringtail	*Bassariscus astutus*		SFP	

Status Key:

California Native Plant Society:

CSP 1 - Plants rare, threatened, or endangered in California and elsewhere; CSP 2 - Plants rare, threatened, or endangered in California but more common elsewhere

State of California:

CE - State-listed, Endangered, CT - State-listed, Threatened, CSC - State Species of Special Concern, SFP - State Fully Protected

Federal:

FE - Federally-listed, Endangered, FT - Federally-listed, Threatened, CS – Candidate Species, FSC - Federal Species of Concern, PR - Protected under Golden Eagle Protection Act, BCC – Birds of Conservation Concern

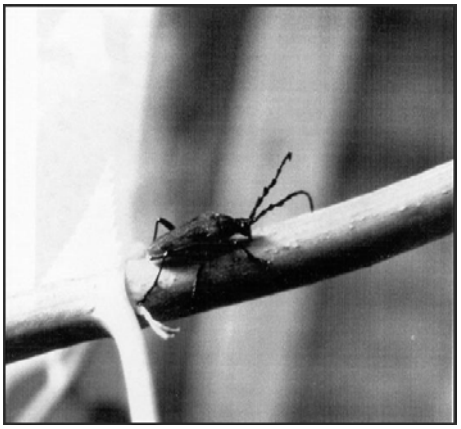
Chinook salmon, Central Valley spring-run ESU (Federal and State-listed threatened species) occurs in the main stem of the Sacramento River, and the Mill Creek, Deer Creek, Big Chico Creek, and Butte Creek tributaries. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta, upstream into the Sacramento River from March through September. Downstream migration of juvenile spring-run Chinook salmon occurs from March through June, while yearlings move downstream from November through April. Most spawning occurs in headwater tributary streams. Critical habitat for this ESU is under development.

Chinook Salmon
Photo by USFWS

Chinook salmon, Central Valley fall-run ESU and late-fall-run ESU (Federal candidate species and State species of concern) occur in the main stem and tributaries of the Sacramento River. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta, upstream into the Sacramento River from July through December and spawn from October through December. Spawning occurs on the mainstem of the Sacramento River, including below the Red Bluff Diversion Dam. Late-fall-run Chinook salmon occur on the main stem of the Sacramento River. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta, upstream into the Sacramento River from October through April and spawn from January through April. Spawning occurs above the Red Bluff Diversion Dam and lower tributaries of the middle and upper Sacramento River.

Steelhead, Central Valley ESU (federally listed threatened species) is an anadromous form of rainbow trout, which has traditionally supported a major sport fishery in the Sacramento

River system. The historical range of steelhead in the Central Valley has been reduced by dams and water diversions that now restrict the species to the lower portions of major rivers where habitat is less favorable for steelhead spawning and rearing. They use the Sacramento River as a migration corridor to and from spawning grounds in the mainstem of the river above the Red Bluff Diversion Dam, the tributary streams, and the Coleman National Fish Hatchery. They are present in the Sacramento River year-round, either as smolts migrating downstream or adults migrating upstream or downstream. Upstream migration begins in July, peaks in the fall, and continues through February or March. Most spawning occurs from January through March. Juvenile migration generally occurs during the spring and early summer after at least one year of rearing in upstream areas. Populations have greatly declined over much of the species' range, including the Sacramento River basin, due to blockage of upstream migration by dams and flood control projects, agricultural and municipal diversions, harmful temperatures in the Sacramento River, reduced availability of spawning gravels, and toxic discharges. Designation of river reaches as Critical Habitat is being considered for this ESU.



Valley Elderberry Longhorn Beetle
USFWS Photo

The Valley elderberry longhorn beetle (federally listed threatened species) is found only in association with its host plant, the blue elderberry. These beetles are endemic to riparian habitat of the Sacramento and San Joaquin valleys. Adults feed on foliage from March through June, during which time they mate and the females lay their eggs. Eggs are laid on leaves, branches, bark crevices, and trunks and hatch within a few days. Larvae bore through the stem pith, creating a pupation gallery. After one to two years, the larva chews a hole

to the stem surface and returns to the chamber to pupate (Halstead and Oldham 1990). When the host plant begins to flower, the pupa emerges as an adult and exits the chamber through a characteristic exit hole. Upon emergence, the adults occupy foliage, flowers, and stems of the host plant.

The bald eagle (federally listed threatened species and State-listed endangered species) nests in Lake, Mendocino, Trinity, Siskiyou, Modoc, Shasta, Tehama, Lassen, Plumus and Butte counties, and in the Lake Tahoe Basin. The bald eagle occurs throughout the year at and in the vicinity of Sacramento River Refuge, and is known to breed here. Individuals forage and roost throughout the northern Sacramento Valley in locations supporting various permanent and temporary wetlands. Eagles occur in areas that have relatively large, open roost trees. Suitable perch trees occur along the Sacramento River throughout the project sites and vicinity. Bald eagles are most common on the Refuge in winter.

The western yellow-billed cuckoo (Federal candidate species, State-listed threatened species, and FWS Bird of Conservation Concern) breeding range in California includes lower Colorado, Kern and Sacramento rivers. Surveys for the western yellow-billed cuckoo identified a breeding range on the middle Sacramento River between Red Bluff and Meridian, just southeast of Colusa. The cuckoo was located on the Sacramento River Refuge during recent surveys. The cuckoo nests in larger trees, such as Fremont's cottonwood, located in close proximity to foraging habitat (mixed riparian forest and willow and herbaceous scrublands).

The least Bell's vireo (Federal and State-listed endangered species) and willow flycatcher (State-listed endangered species) nests and forages in willow scrub vegetation. The vireo has been extirpated (eliminated) from northern California and the willow flycatcher no longer breeds on the Sacramento River.

The bank swallow (State-listed threatened species) is a colonial nesting species which makes nest burrows in the steep cut banks of the Sacramento River. Annual erosion of mid and high floodplain elevation banks of Columbia silty-loam and Columbia sandy-loam is necessary for colony establishment. The largest populations occur along the middle Sacramento River, from Red Bluff to Colusa, and survey results have shown the importance of Sacramento River Refuge to the bank swallow. The largest Sacramento River bank swallow colony occurs at

the Flynn Unit, where a Refuge levee was removed leading to the formation of a large cut bank.

Bank Swallows
Photo by Steve Emmons

Swainson's hawk (State-listed threatened species) breeds in North America and winters in Mexico, Central America, and South America. They nest in trees along riparian corridors or in isolated trees or small groves near suitable foraging habitat. Foraging habitat consists of grassland vegetation and short herbaceous croplands. Swainson's hawks have been observed perched in valley oak trees and flying in broad circles along the Sacramento River between Red Bluff and Colusa. They are known to nest in the vicinity of the Llano Seco Unit and the Sul Norte Unit. Large numbers have been observed at Llano Seco Ranch during fall migration (early to mid-October).

The giant garter snake (federally listed endangered species and State-listed threatened species) historically ranged from the Sacramento/San Joaquin Delta to the south end of the Tulare Lake Basin. The present distribution is from Chico to central Fresno County. The giant garter snake requires freshwater wetlands, such as marshes and low gradient streams. Permanent wetlands are of particular importance, as they provide habitat over the summer and early fall, when seasonal wetlands are dry. The giant garter snake is not associated with swift streams and rivers, such as the Sacramento River. They have adapted to drainage and irrigation systems, especially those associated with rice cultivation; therefore, they may occur in agricultural areas at the Refuge, along the river below Chico.

Species have become threatened and endangered on the Sacramento River largely due to habitat loss and degradation. Fisheries habitat includes sufficient water flows and temperatures for fish to complete life history stages. It includes a meandering river that recruits spawning gravels and large woody debris and provides shaded riverine aquatic habitat and a topographically-connected main channel/floodplain system. Avian habitat also includes all of the various riparian vegetation and habitat types, such as gravel bars, sand bars, erodible vertical river banks, willow scrub, herbland, tall mature cottonwood forests, mixed riparian forests, valley oak riparian forests, and valley oak and elderberry savannas. These vegetation types occur in various aged stands and in various sized patches of various densities. The combination of riparian vegetation types and their structure create a rich mosaic of habitat for resident and migratory breeding and wintering birds.

Social and Economic Environment

Transportation
Major transportation routes in the vicinity of the Refuge include Interstate 5, State highways 99, 45, 162, 32, 20, and county routes 99W, A8 (Tyler Road), A9 (South Avenue), and A11 (Style Road). Bridges cross the Sacramento River at Red Bluff (Highway 99), Tehama – Los Molinos (A8), Woodson Bridge (A9), Hamilton City (Highway 32), Ord Bend (Ord Ferry Road), Butte City (Highway 162) – Codora Four Corners, and Colusa. Many small paved county roads provide for local transportation, offering service access to local agricultural activities. These, and the large interstate and highways, provide access to Refuge visitor contact stations, parking lots, and public and private boat launches. There are no alternative transportation systems that provide access to the Refuge units.

The Sacramento River is a navigable water within California and boating has been a traditional use. The jurisdiction of the Service regarding navigable waters within the Refuge is discussed in Chapter 1. Boating activities within the river are subject to existing State and Federal laws. No changes are proposed.

Employment
The employment base of the agricultural heartland is diversifying in Colusa, Glenn, and Tehama counties, but real

wages are decreasing in almost every sector (Collaborative Economics for New Valley Connexions 2001).

The following is an excerpt from The State of the Great Central Valley of California – Assessing the Region via Indicators (Munroe and Jackman 1999).

"Unemployment rates have persistently been higher in the Central Valley than in the state, typically by at least 3 percentage points. This is mainly attributable to the Central Valley's large share of jobs in agriculture, construction, and other sectors that have marked seasonal fluctuations.

In 1997, the Central Valley unemployment rate rose to almost 4 percentage points above the State's. The main reason for this was that the rate of job growth in the state in the period 1996-1997 was almost twice that of the Central Valley.

Unemployment rates in the Sacramento Region are markedly lower than in the San Joaquin Region and North Valley and are even decidedly lower than those of the state."

Local Economy

Agriculture is the dominant economic enterprise in the northern Sacramento Valley. The diversity of crops grown in the Sacramento Valley reflects the diversity of soils, climate, cultural and economic factors. Butte County's major crops include rice, almonds, prunes, and walnuts; Glenn County's include rice, almonds, prunes, alfalfa, and corn; Tehama County's include prunes, walnuts, olives, and pasture; and Colusa County's include rice, tomatoes, and almonds. Areas in proximity to the river mainly support tree crops. Countywide agricultural production values are $291.3 million for Butte; $280.9 million for Glenn; $110.7 million for Tehama; and $346 million for Colusa (California Department of Finance 2000).

As diverse as the crops they grow, these four counties also vary greatly in their demographics. Butte County has a population of more than 205,400 (year 2000), with the largest employment sectors being trade, services, and state/local government. Agriculture employs 3,000 people in Butte County. Glenn County has a population of 26,900, with State/local government as its largest employment sector, and agriculture its second (employing 1,520 people). Tehama County's population is 56,700, and its major employment sectors are trade services

and State/local government. Agriculture employs 1,440 people in Tehama County. Colusa County has a population of 19,150, with agriculture as its largest employment sector (employing about 2,540 people), and State/local government its second.

Land Use and Zoning
The Refuge is bordered by private lands, as well as Federal and State owned public lands. Private lands are mostly agricultural land (orchards, row crops, rice), with some private duck-hunting clubs, farmsteads, businesses, trailer parks, and isolated homes.

Each of the four counties in which the Refuge acquisition boundary is located has its own General Plan that outlines land use policies. The portions of Butte, Glenn, Tehama, and Colusa Counties' General Plans that relate to Refuge management are summarized in Appendix M.

Demographics
Until recently, demographic data had not been analyzed to depict the profile of potential visitors to the Sacramento River Refuge by county. In January 2002, TNC facilitated The Sacramento River Public Recreation Access Study (EDAW 2003). The primary purpose of the study was to "…assess existing and potential public recreation uses, access, needs, and opportunities along the Sacramento River between Red Bluff and Colusa." The goals of the study were to 1) identify and characterize existing public access opportunities and needs associated with public recreation facilities and infrastructure… and 2) to identify and make recommendations for future public recreation access opportunities and management programs…" The study areas were developed so that data would be meaningful and useful to the partners that are developing management plans.

The tables that are the most applicable to the CCP are included in Appendix N. Two study areas are portrayed (EDAW Table 4.1-1): 1) the local study area comprising Tehama, Butte, Glenn, and Colusa counties and 2) the regional study area encompassing 20 adjacent counties where there is reasonable likelihood of recreational visitation.

EDAW Tables 4.1-3,-4,-5 and-6 (Appendix N) depict a profile of the potential local refuge visitor as predominately Caucasian, 31-50 years of age, some college education/trade school education with a household income under $20,000 to $40,000

(median income $31-35,000). The current population in the local four counties is expected to grow by 55 percent, in contrast to the adjacent 20 counties, which are expected to grow by 25 percent (Appendix N EDAW Table 4.1-2). There is a significant Hispanic population, including one-half of the residents of Colusa County, and about one-third of the residents of Glenn County. The local area residents tended to have lower household income brackets than their regional counterparts.

The U.S. Department of Housing and Urban Development (HUD) defines low income as 80% of the median family income for the area, subject to adjustment for areas with unusually high or low incomes or housing costs. The 1999 estimated median family income was $31,206 in Tehama County, $31,924 in Butte County, $32,107 in Glenn County, and $35,062 in Colusa County (California Employment Development Department 2000).

Osprey
Photo by Steve Emmons

Cultural Resources

From the late Pleistocene, more than 10,000 years ago, through the late Holocene, to present time humans have occupied northern California and utilized its generous natural resources. Many diverse and complex cultures developed during this time, culminating in the Native American Tribes recorded by early ethnographers.

Wintun (Nomlaki) occupied both banks of the Sacramento River and the valley and foothills west of the River. The northwest Maidu lived in the valley, east of the River, along Butte and Big Chico Creeks, and had territories extending into

the eastern foothills and mountains. The southern-most Yana tribe (Yahi) occupied lands east of the River, north of the Big Chico Creek. The territories of these tribes overlapped seasonally. For example, during the summer months the Nomlaki moved from the alluvial plain of the Sacramento River onto the alluvial fan of adjacent eastern foothills, while Yahi and northwest Maidu moved east, into the southern Cascade and northern Sierra Nevada Mountains, respectively. These people fished for Chinook salmon and hunted for tule elk, pronghorn antelope, black-tailed deer, rabbits, California quail, and waterfowl. They also harvested acorns and a variety of seeds, roots, tubers, and bulbs from native plants (Goldschmidt 1978; Johnson 1978; Riddlell 1978).

Euro-American contact with native tribes in the region began with the Spanish Moraga expedition of 1808. In the 1820's fur trappers, such as Jedediah Smith, were working in the area. By the 1830's smallpox and malaria had decimated the native population. The following decades brought increasing colonization of the area and the beginnings of the modern agricultural pattern.

American colonization of the Sacramento Valley began during the Mexican Rancho era. John Bidwell, Peter Lassen, and John Parrot were among those awarded a Mexican Land Grant, which included Rancho del Arroyo Chico, Rancho Bosquejo, and Rancho Llano Seco, respectively. Statehood came soon after gold was discovered by James Marshall at Sutter's Mill on the American River. Thousands of fortune seekers immigrated to California and those supplying goods and services to the miners realized economic success. The early ranches and farms provided vital agricultural commodities which helped expand settlement. People and freight were transported by wagon and steamboat. Thirteen ferries were located at the Sacramento River between Red Bluff and Colusa. River travel by steamboat was a practical mode of transportation because river boats could efficiently transport agricultural freight and the valley oak forests and woodlands supplied and abundance of fuel to power these paddle-wheeled steam boats. Ferries, river boat landings, and bridges all played a key roll in the locations of towns and the development of a system of roads. Improved roads and the railroad system eventually replaced river boat travel.

Agriculture was first and foremost the central economic force in the Sacramento Valley. Dry land grain farming was the earliest

agricultural practice. Row crops, orchards, rice, and irrigated pasture flourished when abundant water from the Sacramento River and its tributaries irrigated the fertile alluvial soils of the floodplain and basins. Water was distributed to farms through a system of river and stream diversions and water delivery canals. The development of the centrifugal pump in the early 20th century facilitated the expansion of irrigated lands through ground water pumping. Finally, State and Federal water projects for land reclamation, irrigation and urban water supply, and flood control allowed for further agricultural and urban expansion and the industries which followed.

Information obtained from Service Region 1 cultural resources division staff and the Northeast Information Center of the California Historical Information System at California State University (CSU) Chico verified that the areas bordering the Sacramento River are considered sensitive for both prehistoric and historic cultural resources. Additionally, these areas may be used as traditional cultural properties (USFWS 2002b). The cultural resources investigations conducted to date include three narrow surveys that examined small portions of the Ohm, Pine Creek, and Phelan Island units. Two cultural resource sites have been formally recorded within Refuge boundaries, and the site locations are being protected in conformance with Federal law.

The CSU Chico Research Foundation Archaeological Research Program (ARP) conducted an archeological study of the middle Sacramento River floodplain in 2002, leading to the comprehensive Cultural Resource Overview and Management Plan – Sacramento River Conservation Area (White et al. 2003). The project consisted of five tasks: 1) Intensive Archaeological Survey of selected portions of the Refuge; 2) compilation of a Geoarchaeological Model and Field Test of the model; 3) completion of a Final Archaeological Overview, Assessment, and Management Plan; 4) completion of a Public Report of Findings; and 5) administration and management.
The project area consisted of a series of parcels totaling about 11,500 acres adjoining the Sacramento River, spanning Tehama, Glenn, Butte, and Colusa counties between Red Bluff and Colusa, California. The study completed an archaeological survey, assisting the Service in meeting cultural resource inventory mandates as specified in Sections 106 and 110 of the National Historic Preservation Act. The final overview, assessment, and management plan provides a summary of the status of known cultural resources, a sensitivity study for

resources yet- to-be identified, and general plans for future scientific investigations, public interpretation of archaeological and paleo-environmental findings, and administration and coordination for future actions which may affect cultural resources. The Public Report of Findings will assist the Service to address the Department of Interior recommendations for public outreach and dissemination of scientific results.

Research conducted for the project was performed at a level sufficient to understand the cultural resources found on individual parcels within the context of broader regional patterns. A goal of the project was to accurately predict the nature, extent, and distribution of resources within the parcels that formed the focus of the study. To achieve this goal we assessed the nature, extent, and distribution of archaeological resources across a broader area. This was accomplished by conducting an inventory and summarizing available records of archaeological resources in the Sacramento River corridor in the vicinity of the project area (White et al. 2003).

Public Use

Trends

The ability to compare the population and social trends with existing recreation facilities using the Sacramento River Public Recreation Access Study (SRPRAS) is invaluable in making projections about future recreational needs on the Sacramento River Refuge. SRPRAS reviewed three studies that provided significant information about recreation use, needs, and trends analysis: Sacramento River Recreation Survey (DWR 1980), Public Opinions and Attitudes on Recreation in California (California DPR 1998), and Outdoor Recreation in American Life: A National Assessment of Demand and Supply (Cordell et al. 1999). Appendix N contains table summaries that represent a cross section of applicable information available in the study.

The DWR report indicated that users of the Sacramento River were generally local and that 77 percent of the study sample resided in eight counties: Shasta, Tehama, Glenn, Butte, Glenn, Colusa, Sutter, Yolo, and Sacramento. The types of activities reported by visitors using the upper Sacramento River were: relaxing (49 percent), fishing (47 percent), power-boating (34 percent), camping (30 percent), canoeing (23 percent), tubing (22 percent), swimming/beach use (22 percent), picnicking (15 percent), and special events (8 percent) (Appendix N, EDAW Table 4.2-1). Visitors used the sections from the Red Bluff

Diversion Dam to Hamilton City Bridge and Chico Landing to Meridian Bridge, rather than Hamilton City Bridge to Chico Landing section (Appendix N, EDAW Table 4.2-2). Generally, day and overnight use were evenly split (Appendix N, EDAW Table 4.2-3); day use visitors stayed 3-4 hours while overnight visitors stayed 3-4 days (Appendix N, EDAW Table 4.2-4).

The California DPR report (1998) covers a broader 24-county area and assesses 43 recreational activities. Three priority wildlife-dependent activities were surveyed and ranked, although the nature study category could include educational/interpretive activities (Table 6).

Table 6. Ranks of three wildlife dependent activities (EDAW Table 4.2-5).

	Rank	Participation	Average days
Nature study, wildlife viewing	12	59%	19.35
Fishing	16	39.8%	6.43
Hunting	39	8%	1.35

Walking was ranked number one with 90 percent participating 83.56 days per year (Appendix N, EDAW Table 4.2-6). When comparing geographic sub-areas, power boating and hunting were more prevalent in the local counties and general nature study and fishing were relatively the same across the areas (Appendix N, EDAW Table 4.2-7). At least 67 percent of the respondents visited natural and undeveloped area several times a year or more (Appendix N, EDAW Table 4.2-8). The most important factors influencing enjoyment of recreational activities were being in the outdoors (87.4 percent), relaxing (77.3 percent), and beauty of the area (76.7 percent); meeting new people (16 percent) ranked last (Appendix N, EDAW Table 4.2-9).

Recreation trends in the U.S. are found in Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends (Cordell et al. 1999). Projections were made nationally for four U.S. regions, with California included in the Pacific coast region. Trends for the Pacific region indicate wildlife viewing and nature study are expected to increase by 65 percent and double the number of days per year per person in

the next 40 years. Fishing is expected to increase, while hunting is expected to decrease (Appendix N, EDAW Table 4.2-11).

EDAW's Table 2.1, Facilities Amenities Matrix by River Mile (Appendix N), and Table 2.2, Facilities Amenities Matrix by Agency (Appendix N), provide valuable information about facilities location and ownership. These matrices are valuable to coordinate public access and activities with the appropriate agency and help determine the visitor use needs.

The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation – California (Survey) is as also a very valuable resource to help predict recreation trends (USDOI et al. 2001). This comprehensive publication provides information about the numbers of U.S. anglers, hunters, and wildlife-watchers by state. The Survey has been completed since 1955, yet over time, the methodology has changed making only the 1991, 1996, and 2001 Surveys directly comparable. Appendix N contains tables and charts that represent some California summary survey comparison highlights. For more detailed information, refer to the U.S. Census data that can be found at: http://www.census.gov/prod/2002pubs/fhw01-ca.pdf.

Kayaking on the Sacramento River
Photo by Joe Silveira

Environmental Education
Environmental education is comprised of teacher or leader-conducted activities that are intended to actively involve students or others in hands-on activities. These activities are designed to promote discovery and fact-finding, develop problem-solving skills, and lead to personal involvement and action. The Fish and Wildlife Service Manual states,

"Environmental education should be curriculum based and can provide interdisciplinary opportunities, linking the natural world with subject areas such as math, science, social studies, and language arts." The Service focuses on kindergarten through twelfth grade students. See Chapter 4 for the current environmental education activities that occur on the Refuge.

Interpretation
Interpretation involves participants of all ages who learn about the complex issues confronting fish and wildlife resource management as they voluntarily engage in stimulating and enjoyable activities. First-hand experience with the environment is emphasized although presentations, audiovisual media, and exhibits are often necessary components of the interpretive program. See Chapter 4 for the current interpretive activities that occur on Refuge.

Refuge Unit Descriptions
The Refuge is comprised of 26 different units (Table 1, Chapter 1), each having its own specific projects, goals, and management needs. A brief summary of size, location, and land use/composition of each unit follows, beginning with the northern-most unit (La Barranca) and ending with the southern-most unit (Drumheller Slough). Llano Seco Ranch Riparian Easement, a conservation easement on private property, is also described.

La Barranca
The La Barranca Unit is 1,066 acres and is located between river miles 240.5 and 236.5. The first 247 acres were acquired in 1989, and the remaining 819 acres in 1991.

The unit's 399 acres of walnut and 84 fallow acres are managed via an agreement with a local farmer. Approximately 200 acres of the walnuts will be removed in 2005, in order to prepare for potential riparian restoration efforts in 2005. Of the current 193 restored riparian acres, 36 were planted in 1997 and 96 were planted in 2001. In winter 2002/03, 61 acres were planted and will receive irrigation, and chemical/physical treatments until 2006. The 367 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, riparian scrub, and gravel bar (Figure 11).

A feasibility study, funded through the Anadromous Fish Restoration Program (AFRP) and Central Valley Project Improvement Act (CVPIA), was conducted between 2001 and

2002. The purpose of the study was to focus on the potential impacts of fish entrapment on native fishes and alternatives for floodplain restoration in areas of past gravel mining operations. The Refuge, Red Bluff Fish and Wildlife Office, and River Partners received funding through AFRP in 2003 to conduct environmental compliance for analysis of restoration alternatives identified in the study including levee removal, gravel pit re-grading and riparian restoration of existing farm lands. This site is subject to further site-specific NEPA processes outside of this document.

PRBO (PRBO Conservation Science) monitors portions of the unit for avian use. Special wildlife use includes nesting osprey, bank swallow colonies, and bald eagle roosts. Special vegetation profiles include sand/gravel terrace with naked buckwheat, Kellog's tarplant, telegraph plant, and Oregon tarweed and Valley elderberry-oak savanna.

Blackberry Island
Acquired in 2002, the Blackberry Island Unit is 52 acres and is located between river miles 240 and 239.5.

The unit's 52 acres of pre-existing riparian habitats consist mostly of herbland cover, gravel/sandbars, and mixed riparian forest with some riparian scrub (Figure 11).

Special wildlife use includes neo-tropical migratory birds. Special vegetation profiles include a mature sycamore forest.

Todd Island
Todd Island, located between river miles 238 and 236, is currently owned and managed by the Bureau of Land Management (BLM). The Island's 185 acres of pre-existing riparian habitats consist of a mixture of cottonwood riparian forest, mixed riparian forest, non-native herb lands and gravel bar habitat (Figure 11).

Special wildlife use includes western yellow-billed cuckoo and salmonid spawning habitat in the main channel.
Public use via boat access is currently allowed on the Island. The Service is currently in discussion with BLM to incorporate this property as part of the Refuge. If this occurs, the proposed uses will be consistent with current BLM public use activities, including hunting, fishing, wildlife observation and photography, and interpretation and environmental education.

Mooney
Acquired in 1994, the Mooney Unit is 342 acres and is located between river miles 236.5 and 235.

The unit's 342 acres of pre-existing riparian habitats consist mostly of mixed riparian forest (dominated by invasive black walnut), cottonwood riparian forest, and herbland cover (Figure 11).

Special vegetation profiles include mid-terrace mixed riparian forest and large western sycamores.

Public use on this unit is currently limited to an existing "life-use reservation" granted to two individuals as part of the property deed, which includes hunting and picnicking rights.

Current management activities include a Cooperative Land Management Agreement (CLMA) with a local rancher for seasonal cattle grazing to control nonnative annual grasses and forbs. A portion of the unit is cooperatively monitored by PRBO for avian use.

Ohm
The Ohm Unit is 757 acres and is located between river miles 235 and 233. The first 504 acres were acquired in 1989, and the remaining 253 acres in 1991. Approximately 155 of the original 757 acres are now located on the east bank after the river changed course and cut through the northeast portion of the unit. As of June 2005, the ownership of the eastern portion of the unit (lands east of the Sacramento River) is currently under ownership dispute with an adjacent landowner. That portion is identified on the maps in Chapter 5.

The unit's 201 restored riparian acres were planted to mixed riparian forest in 2004, and will receive irrigation and chemical/physical treatments until 2007. The 556 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, gravel bar, and non-native grassland (Figure 12).

Some portions of the unit are cooperatively monitored by PRBO for avian use. Current management activities include seasonal cattle grazing to control nonnative annual grasses and forbs through a CLMA with a local cattle ranch. In 2003, a permanent gravel fire break 2,300 feet in length was

constructed as part of the Wildland Urban Interface (WUI) fire prevention program.

Special wildlife use includes fall-migrant yellow warbler and willow flycatcher, bank swallow colonies, and river otters. Special vegetation profiles include low-terrace sandbar willow, and mid-terrace mixed riparian forest.

Flynn
The Flynn Unit is 630 acres and is located between river miles 233 and 230.5. The first 545 acres were acquired in 1990, and the remaining 85 acres in 1998.

Of the unit's 401 restored riparian acres, 70 were planted in 1996, 82 in 1997, 164 in 1998, and 85 in 2000. The 229 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, riparian scrub, and gravel bar (Figure 12).

California Quail
Photo by Steve Emmons

Some portions of the unit are cooperatively monitored by PRBO for avian use. Special wildlife use includes breeding lazuli buntings, common yellowthroats, a heron/egret rookery, western yellow-billed cuckoos, California quail, and the largest known bank swallow colony on the Sacramento River. Special vegetation profile includes mid-terrace mixed riparian forest.

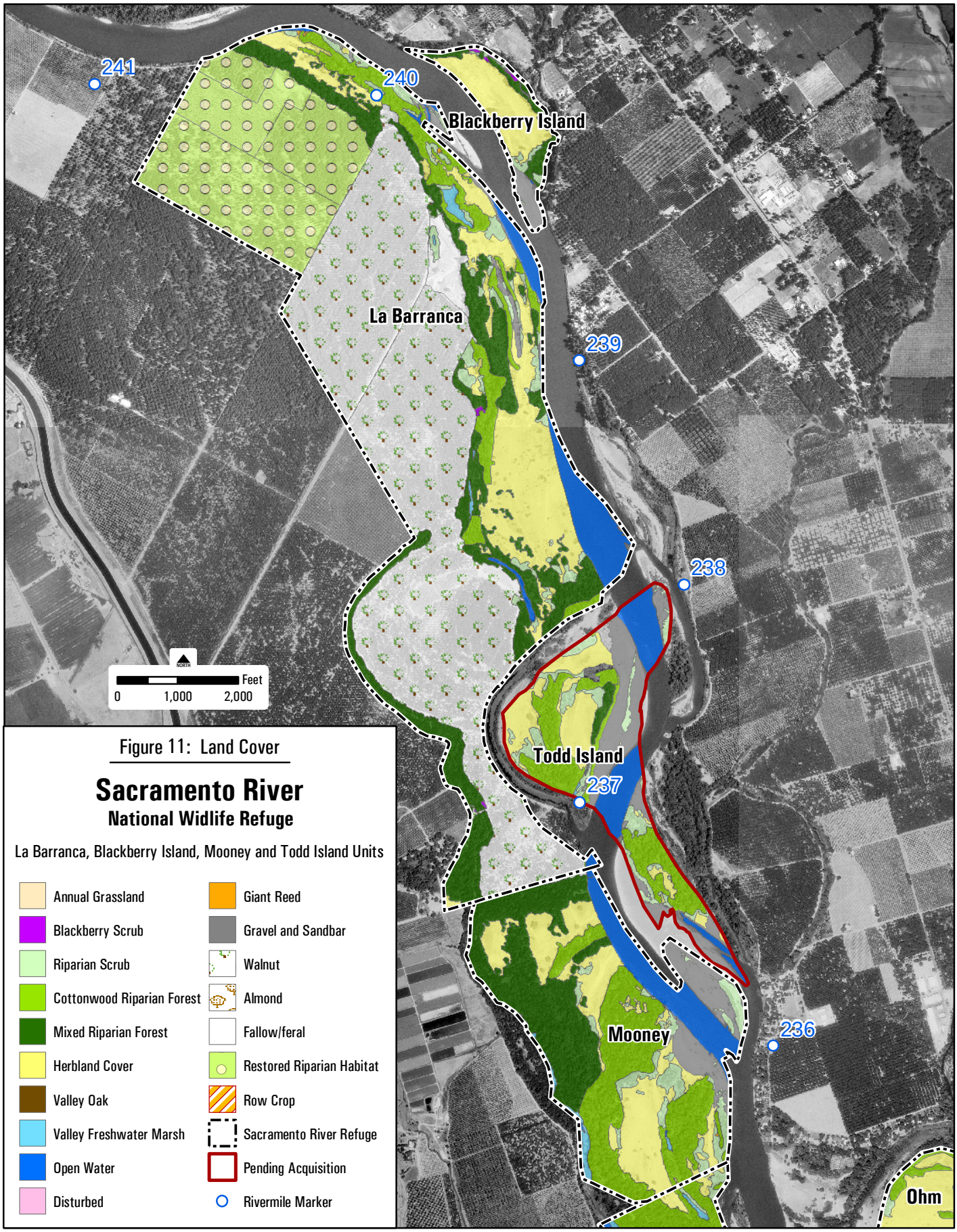


Figure 11: Land Cover

Sacramento River
National Widlife Refuge

La Barranca, Blackberry Island, Mooney and Todd Island Units

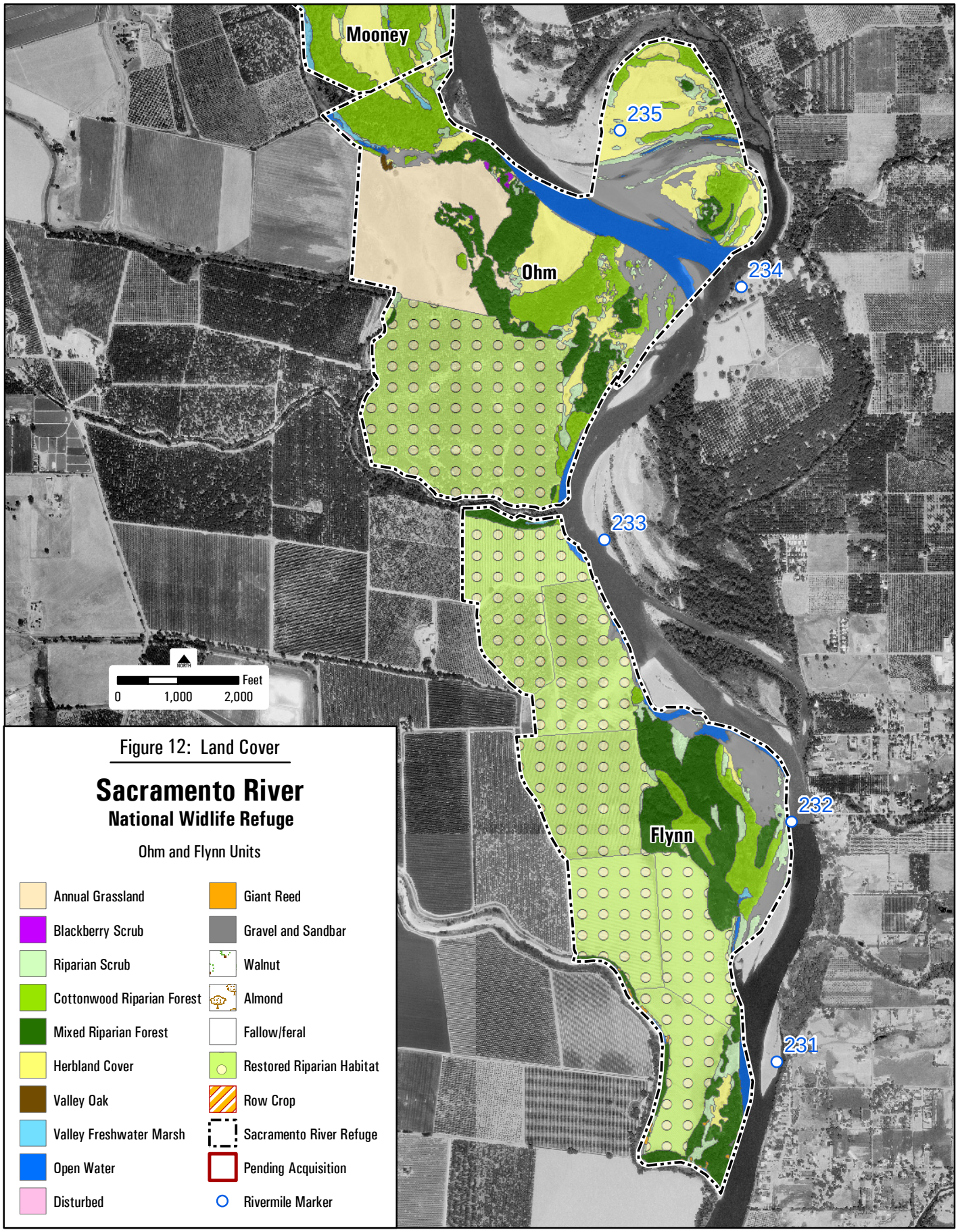


Figure 12: Land Cover

Sacramento River
National Widlife Refuge

Ohm and Flynn Units

Heron Island
Acquired in 1990, the Heron Island Unit is 126 acres and is located between river miles 228.5 and 228.3.

The majority of the unit is abandoned English walnut, and the remaining 60 acres is a mixture of mixed riparian forest, cottonwood riparian forest, riparian scrub, and open water (Figure 13). The walnut acreage is unmanaged and is being allowed to undergo natural recruitment, letting natural vegetation restore the site.

This unit is accessible to Refuge personnel by boat only. Special wildlife use includes a bank swallow colony. Special vegetation profiles include very large valley oak and western sycamore specimens. Small patches of perennial pepperweed were identified in 2002, posing significant management challenges due to the difficulty of access for vegetation control.

Rio Vista
Acquired in 1991, the Rio Vista Unit (Figure 14) is 1,149 acres and is located between river miles 218 and 215.5. This unit is bordered on the north by South Ave (A-9) and on the south by the Merrill's Landing Unit of the CDFG Sacramento River Wildlife Area.

The unit's 86 acres of pre-existing riparian habitats consist mainly of mixed riparian forest, with some cottonwood riparian forest and riparian scrub.

Restoration of mixed riparian forest began in 1993 with 27 acres, and continued with 108 acres in 1994, 122 acres in 1995, 139 acres in 1996, 146 acres in 1997, 146 acres in 1998, 228 acres in 1999, and 75 acres in 2000. In 2001, 72 acres were restored to valley oak and elderberry savanna.

Some portions of the unit are cooperatively monitored by PRBO for avian use. Special wildlife use includes nesting blue grosbeaks. Special vegetation profiles include natural regeneration of valley oaks and blue elderberry.

In 2003, 14,250 feet of permanent gravel fire breaks were constructed as part of the WUI fire prevention program to protect adjacent residences and a RV park.

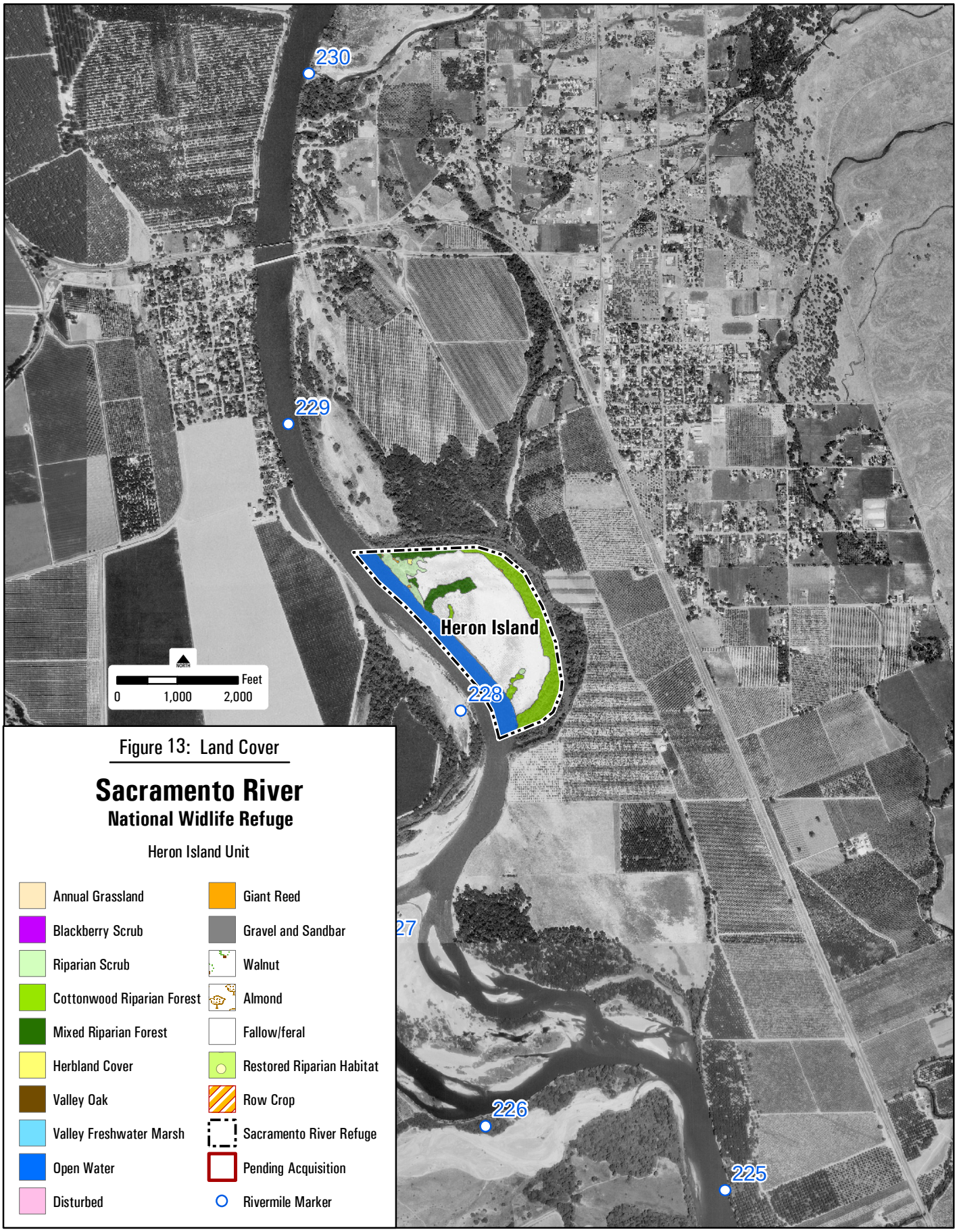


Figure 13: Land Cover

Sacramento River
National Widlife Refuge

Heron Island Unit

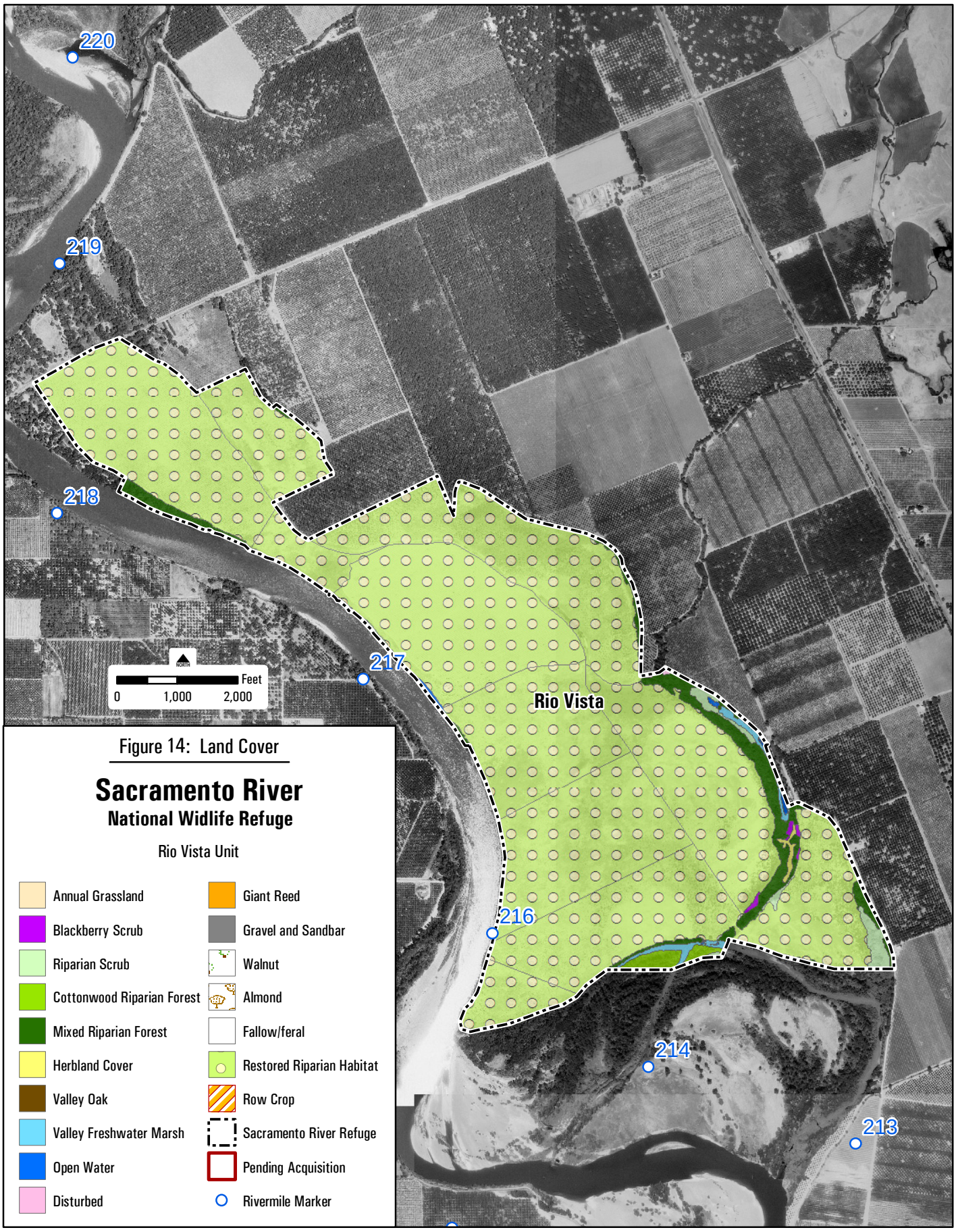


Figure 14: Land Cover

Sacramento River
National Widlife Refuge

Rio Vista Unit

In 2003, at the request of Tehama County Public Works, the Refuge and TNC hired a private environmental engineering consultant to conduct a feasibility study evaluating the potential for floodplain topography restoration and localized flood reduction near South Ave (A-9). The feasibility study was completed in 2004 and the swale restoration will be completed in 2005.

Foster Island
Foster Island, located between river miles 211.5 and 210, is currently owned and managed by BLM. The Island's approximately 174 acres of pre-existing riparian habitats consist of mixed riparian forest, nonnative herblands and gravel bar (Figure 15).

This property is accessible by boat only. The Service and BLM are currently discussing incorporation of this property as part of the Refuge. If this occurs, the proposed uses will be consistent with current BLM public use activities including hunting, fishing, wildlife observation and photography, and interpretation and environmental education.

McIntosh Landing North
Acquired in 1994, the McIntosh Landing North Unit is 63 acres and is located between river miles 202.5 and 201.8.

The unit originally consisted of 63 acres of pre-existing riparian habitats, but has lost about 11 of these acres to erosion (Figure 16). The remaining 52 acres is not actively managed.

McIntosh Landing South
Acquired in 1994, the McIntosh Landing South Unit is 67 acres and is located between river miles 201.5 and 201.

The unit originally consisted of 50 acres of walnut orchard and 17 acres of pre-existing mixed riparian forest, but has lost about half of these acres to erosion (Figure 16). A CLMA to manage the abandoned orchard was developed in 2002 with the River Partners. Due to its proximity to the J-levee upstream of Hamilton City, land use changes are not currently being considered for this unit.

Special wildlife use includes multiple bank swallow colonies.

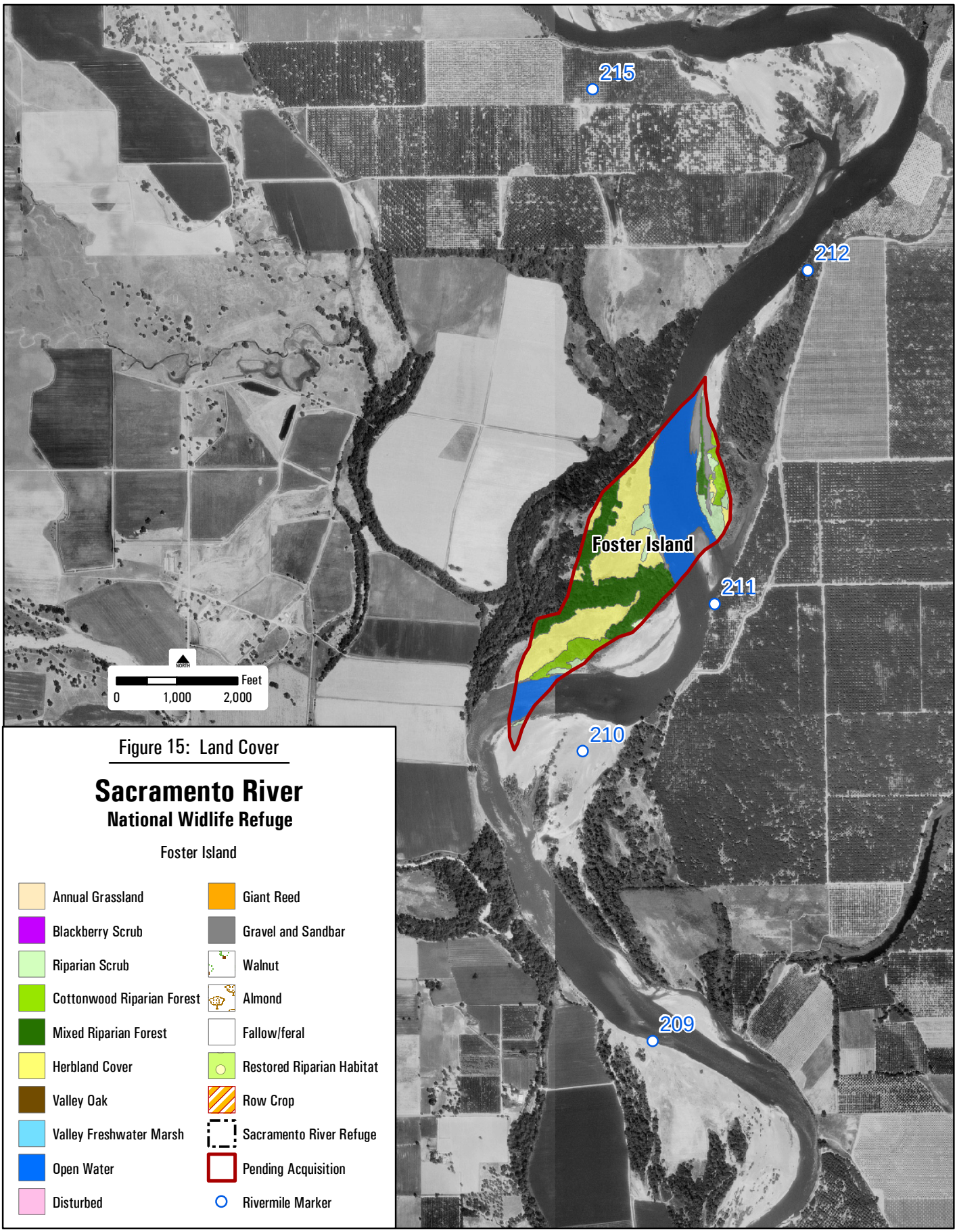


Figure 15: Land Cover

Sacramento River
National Widlife Refuge

Foster Island

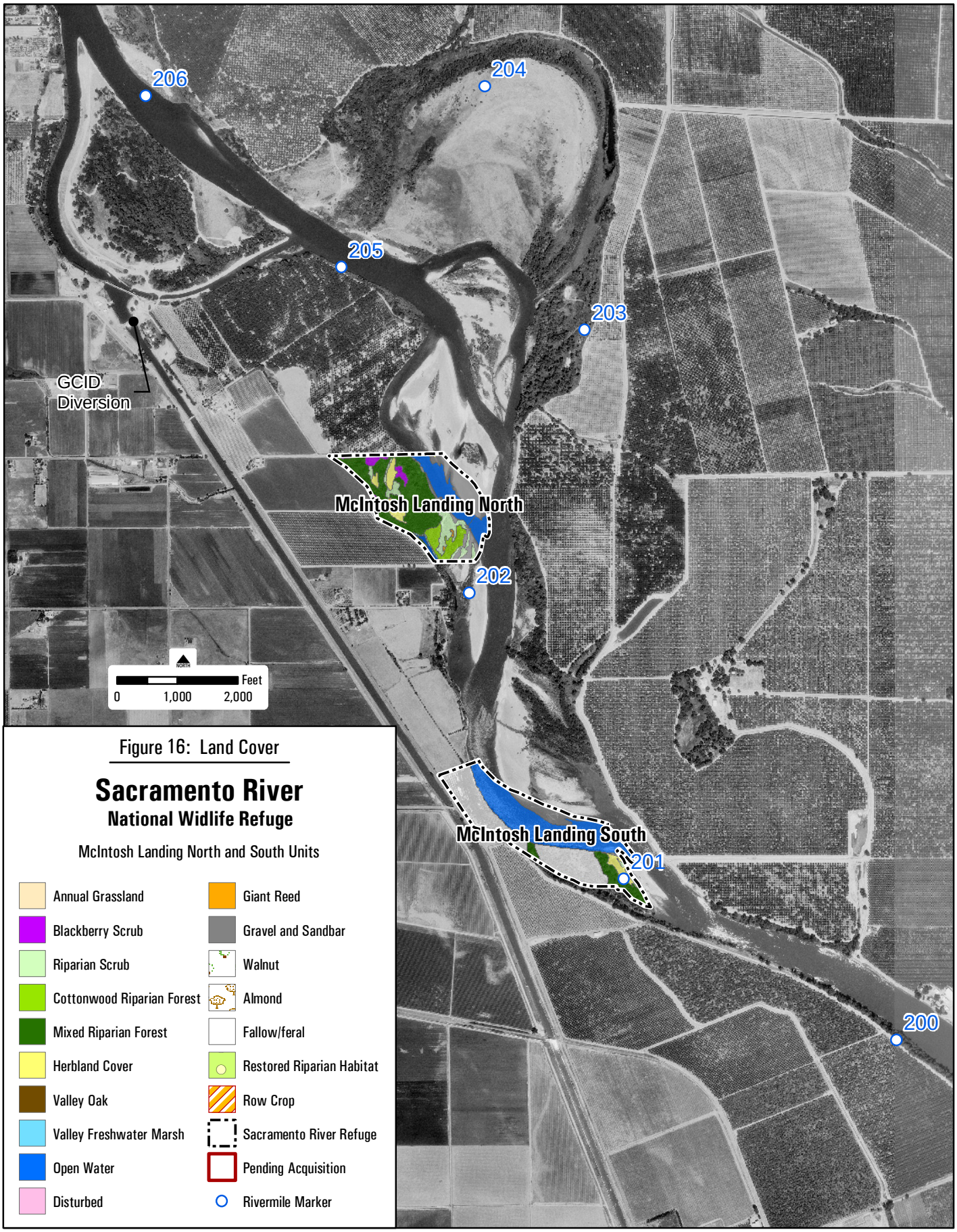


Figure 16: Land Cover

Sacramento River
National Widlife Refuge

McIntosh Landing North and South Units

Pine Creek

The Pine Creek Unit is 564 acres and is located between river miles 198.5 and 198. The first 404 acres were acquired in 1995, and the remaining 160 acres in 2003. This unit is bordered on the north by Highway 32 and on the south by the Pine Creek Unit of the CDFG Sacramento River Wildlife Area.

Restoration of mixed riparian forest began in 1998 with 80 acres, and continued with 211 acres in 1999 and 68 acres in 2004. Only those planted in 2004 still receive irrigation or chemical/physical treatments, which will discontinue in 2007. In 2004, 141 acres were restored to native grass and receive no irrigation, but will receive chemical/physical treatments until 2007. Eighteen acres remain fallow. The 34 acres of pre-existing riparian habitats consist of cottonwood riparian forest and riparian scrub (Figure 17).

A swale restoration project was completed in 2004 to assist movement of flood flows across the unit and protect Highway 32. Restoration of these swale banks and island deposit zones to valley oak woodland will occur fall 2005 (4 acres) and will receive irrigation and chemical/physical treatments until 2007.

WUI fuel reduction projects to remove old orchard stumps discarded along the levee, understory vegetation south of the private residences, and an abandoned barn were completed in 2003.

Special wildlife use includes juvenile salmonid rearing habitat in adjacent Pine Creek.

Capay

Acquired in 1999, the Capay Unit is 666 acres and is located between river miles 194 and 193. This unit is bordered on the north by County Road 23 and the Pine Creek Unit of the CDFG Sacramento River Wildlife Area.

The unit's 575 acres of agricultural lands are currently managed as both irrigated and dry land row crops under a CLMA with TNC. The 91 acres of pre-existing riparian habitat is mostly cottonwood riparian forest (Figure 18).

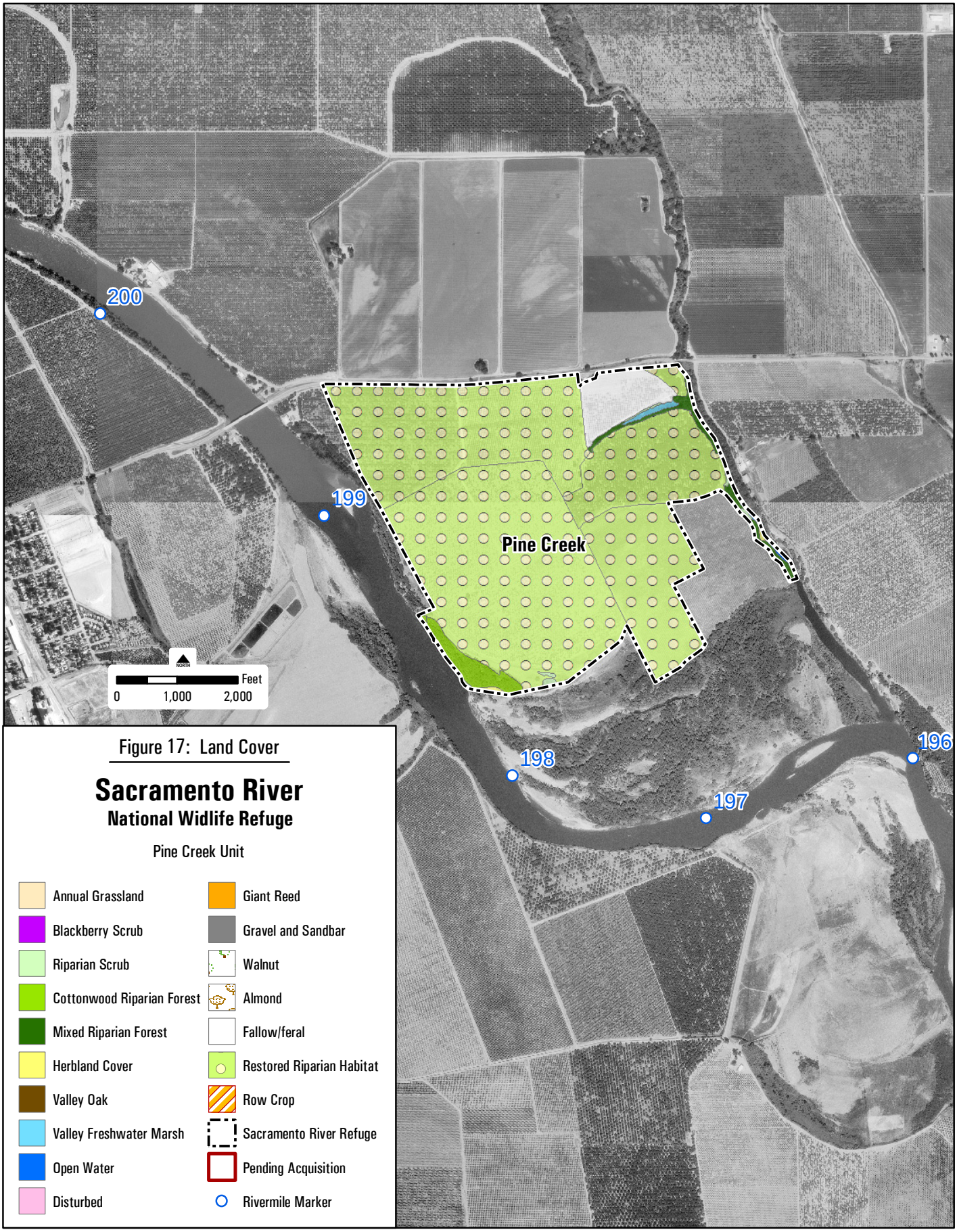


Figure 17: Land Cover

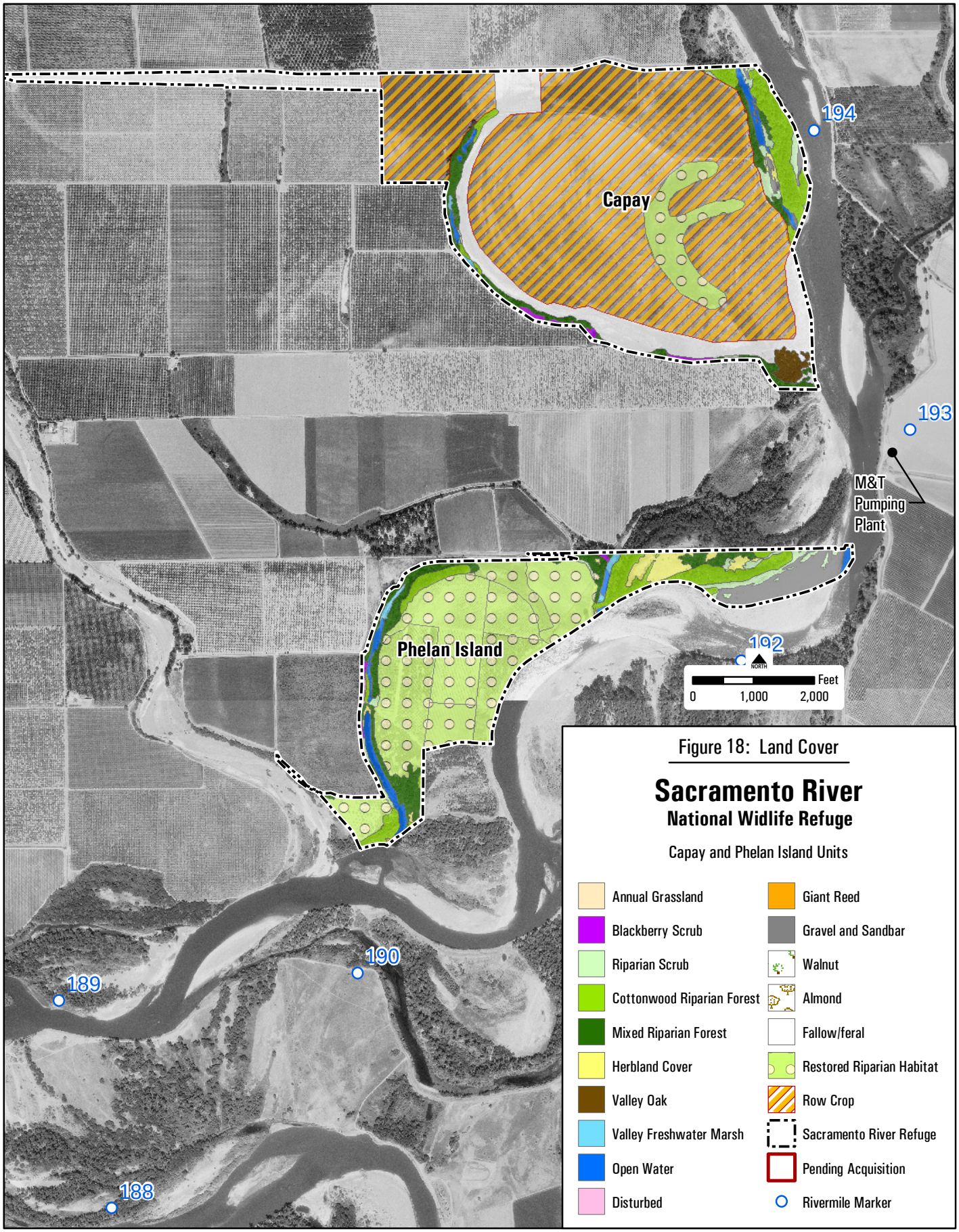


Figure 18: Land Cover

Sacramento River
National Widlife Refuge

Capay and Phelan Island Units

Special wildlife use includes breeding yellow warblers and a bank swallow colony. Special vegetation profiles include a high diversity of herbaceous plant species.

Phelan Island
Acquired in 1991, the Phelan Island Unit is 308 acres and is located between river miles 191.5 and 190.5.

Restoration of mixed riparian forest began in 1995 with 11 acres, and continued with 12 acres in 1997, 24 acres in 1998, 57 acres in 1999, and 82 acres in 2001. The 122 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, and open water (Sam Slough) (Figure 18).

Some portions of the unit are cooperatively monitored by PRBO for avian use. Special wildlife use includes northwestern pond turtles in Sam Slough, breeding lazuli buntings, western yellow-billed cuckoos, and blue and black-headed grosbeaks. Special vegetation profiles adjacent to the Refuge include DWR mitigation plantings of mixed riparian forest at River Unit planted in 1991, and valley oak/elderberry forest at Sam Slough Unit planted in 1992.

Jacinto
Acquired in 1996, the Jacinto Unit is 69 acres and is located between river miles 186.5 and 186.

The unit's 10 acres of walnut are managed through a CLMA with River Partners and a tenant farmer. The 59 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, riparian scrub, and gravel/sand bar (Figure 19).

Special vegetation profiles include an old growth cottonwood stand and giant reed (*Arundo*).

Dead Man's Reach
Acquired in 1999, the Dead Man's Reach Unit is 637 acres and is located between river miles 186.5 and 185.

The unit's 323 acres of walnut, 243 acres of almond, and 4 fallow acres are managed through a CLMA by a tenant farmer. Almond management will be discontinued in 2005 in order to prepare for riparian restoration efforts. The 67 acres of pre-

existing riparian habitats consist mostly of mixed riparian forest, riparian scrub, and gravel bar (Figure 19).

North Ord
Acquired in 2002, the North Ord Unit is 29 acres and is located between river miles 185 and 185.5.

The unit's 26 fallow/feral acres consist mostly of abandoned walnut orchard. The 3 acres of pre-existing riparian habitats consist mostly of mixed riparian forest and riparian scrub (Figure 19).

Ord Bend
Acquired in 1995, the Ord Bend Unit is 111 acres and is located between river miles 184 and 183.7. This unit is bordered by Ord Ferry Road on the north and is directly south of the Ord Bend County Park.

The unit's 96 restored riparian acres were planted in 1999. Most of these acres were restored to valley oak savanna, with some areas of mixed riparian forest and native grassland. The 15 acres of pre-existing riparian habitats consist mostly of riparian scrub, open water and blackberry (Figure 19).

Special wildlife use includes waterbird use on the Army Corps of Engineer's (ACOE) borrow site on Stony Creek tributary, and a Valley elderberry longhorn beetle exit hole sighting (first fresh exit hole observed on the Refuge). Special vegetation profiles include a high terrace, most of which is outside of the 100-year flood plain.

In 2003, 5,150 feet of permanent gravel fire breaks were constructed as part of the WUI fire prevention program to protect adjacent residences, agricultural structures and a wood treatment plant. These fires breaks also serve as buffers to reduce the impacts of depredation on agriculture and pesticide drift. The Refuge also coordinates with the local fire and levee district on annual levee maintenance projects.

South Ord
Acquired in 1999, the South Ord Unit is 122 acres and is located between river miles 183.5 and 183. The South Ord Unit is bordered to the north by the Oxbow Unit of the CDFG Sacramento River Wildlife Area.

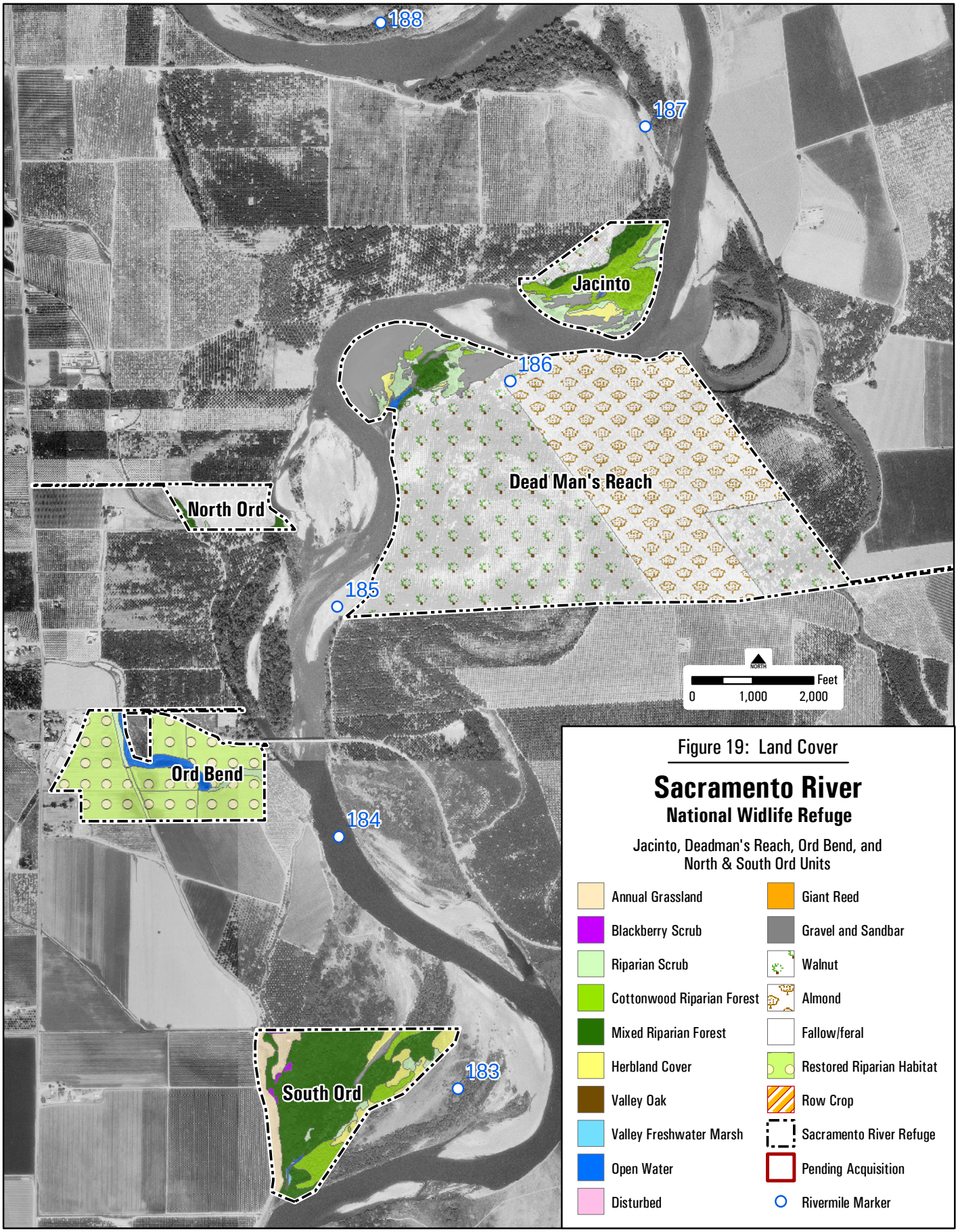


Figure 19: Land Cover

Sacramento River
National Widlife Refuge

Jacinto, Deadman's Reach, Ord Bend, and North & South Ord Units

The unit's 122 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, and herbland cover (Figure 19). Some chemical and physical manipulations may be required on about 10 acres to maintain flow through a drain (part of deed requirements).

Some portions of the unit are cooperatively monitored by PRBO for avian use.

Llano Seco Riparian Sanctuary and Islands 1 and 2
Acquired in 1991, the Llano Seco Riparian Sanctuary and Llano Seco Islands 1 and 2 consist of 906 acres and are located between river miles 183.5 and 175.5. Llano Seco Island 1 is bordered to the north by the Oxbow Unit of the CDFG Sacramento River Wildlife Area.

The unit's 520 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, riparian scrub, and gravel bar. The unit's remaining 386 acres are composed of 206 fallow acres and 180 acres of row crop; this area is being evaluated for riparian restoration through a feasibility study funded by CalFed (Figure 20).

Special wildlife use includes California quail in mixed riparian forest at Goodman opening, multiple bank swallow colonies, and yellow-billed cuckoo sightings. Special vegetation profiles include a natural succession from wheat cropping at Goodman opening into blue elderberry, coyote bush, creeping wild-rye grasses, mugwort, and box elder.

Hartley Island
The Hartley Island Unit is 487 acres and is located between river miles 174.5 and 172.5 (Figure 21). Hartley Island is bordered to the north by the Oxbow Unit of the CDFG Sacramento River Wildlife Area. Sixty-seven acres of this property were acquired in 2003. The remaining 420 acres are privately owned and are currently in the acquisition process.

Of the 420 acres currently under private ownership, 237 are walnut that are managed by a contracted farmer, and the remaining 183 acres are pre-existing riparian habitats composed mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, and gravel bar

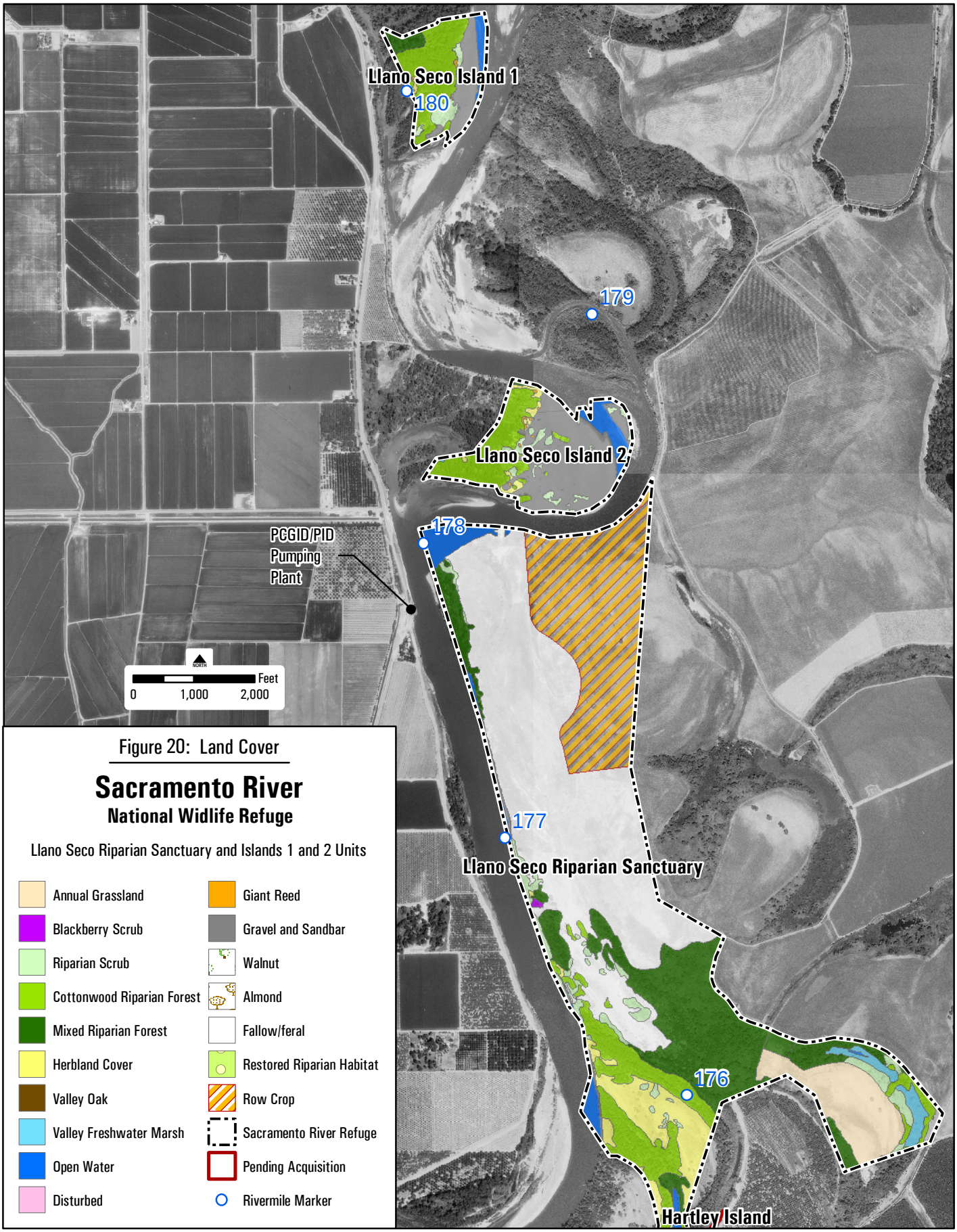


Figure 20: Land Cover

Sacramento River
National Widlife Refuge

Llano Seco Riparian Sanctuary and Islands 1 and 2 Units

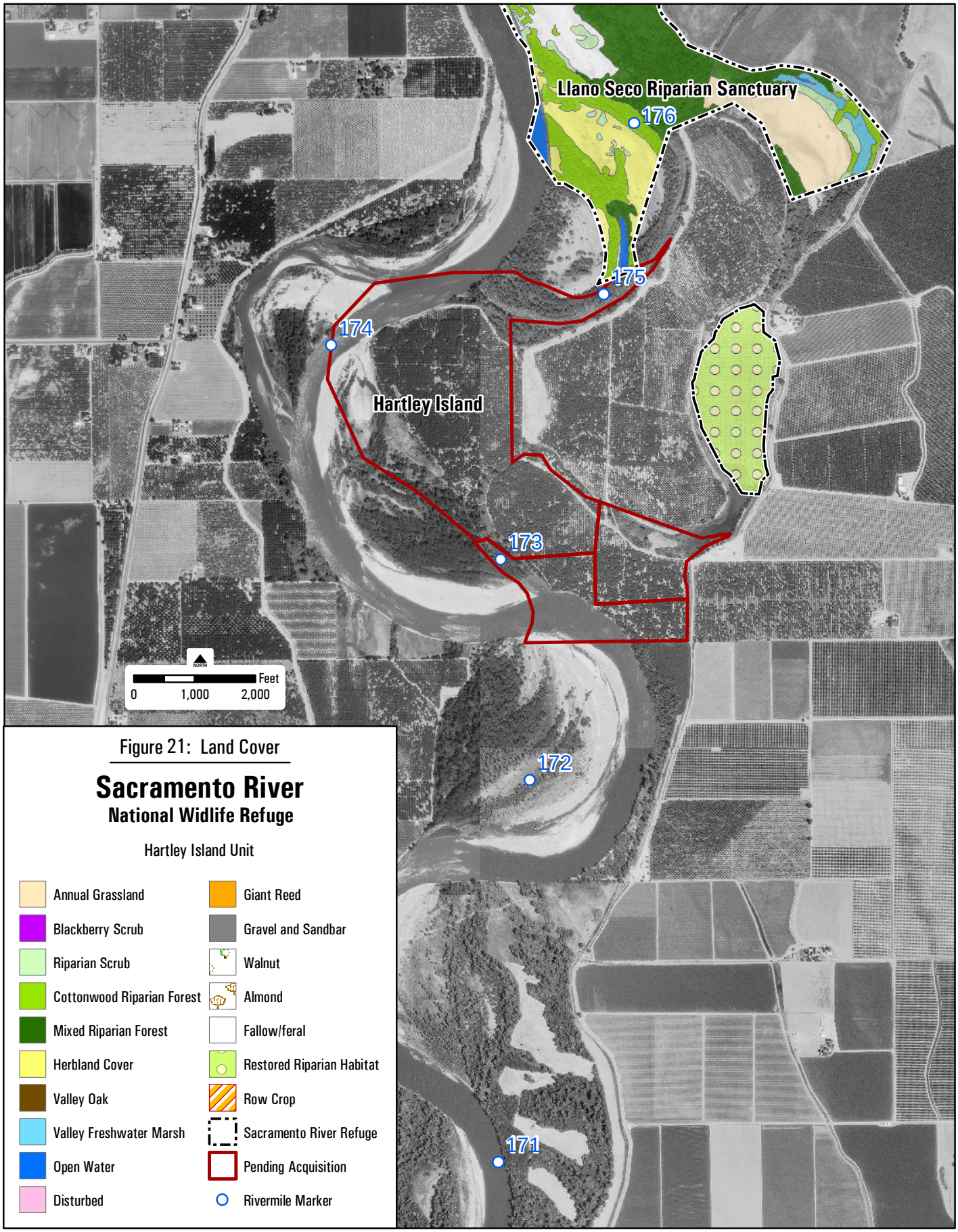


Figure 21: Land Cover

Sacramento River
National Widlife Refuge

Hartley Island Unit

- Annual Grassland
- Blackberry Scrub
- Riparian Scrub
- Cottonwood Riparian Forest
- Mixed Riparian Forest
- Herbland Cover
- Valley Oak
- Valley Freshwater Marsh
- Open Water
- Disturbed
- Giant Reed
- Gravel and Sandbar
- Walnut
- Almond
- Fallow/feral
- Restored Riparian Habitat
- Row Crop
- Sacramento River Refuge
- Pending Acquisition
- Rivermile Marker

Of the 67 acres that are currently owned by the Refuge, 63 were restored to mixed riparian forest in 2004, and 4 are pre-existing riparian habitats.

Sul Norte
The Sul Norte Unit, acquired in 1990/91, is 590 acres and is located between river miles 170 and 168.5. This unit is bordered on the north by the Beehive Bend Unit of the CDFG Sacramento River Wildlife Area and on the south by the Highway 162 viaduct.

In 1998, 241 restored riparian acres were planted into mixed riparian forest and savanna. This was replanted again in 2000. In 1999, a research project to determine the feasibility of natural recruitment on mid-terrace floodplain soils was conducted on 20 acres (Peterson 2002). This restoration technique proved to be unsuccessful due to competition with nonnative invasive weeds and human-made changes in the hydrograph; in 2003 these acres (in addition to 49 acres in 2002) were restored to riparian habitat as described in the report "Hydraulic Analysis of Riparian Habitat Conservation on the Sacramento River from Princeton to Beehive Bend" (Ayres Associates 2001. In 2002, 86 acres were restored to native grass. Restoration completed in 2002 and 2003 will receive irrigation and/or chemical/physical treatments until 2006 and 2007, respectively. The 192 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, and gravel bar (Figure 22).

Some portions of the unit are cooperatively monitored by PRBO for avian use. Special wildlife use includes ring-tailed cats, river otters, breeding yellow warblers, western yellow-billed cuckoos, and a bank swallow colony. Special vegetation profiles include low-mid and high terrace forest types, as well as natural regeneration of valley oak in former prune orchard (2000 restoration site).

Codora
Acquired in 1994, the Codora Unit is 399 acres and is located between river miles 168 and 167. This unit is bordered on the west by Highway 45 and to the north by the Highway 162 viaduct.

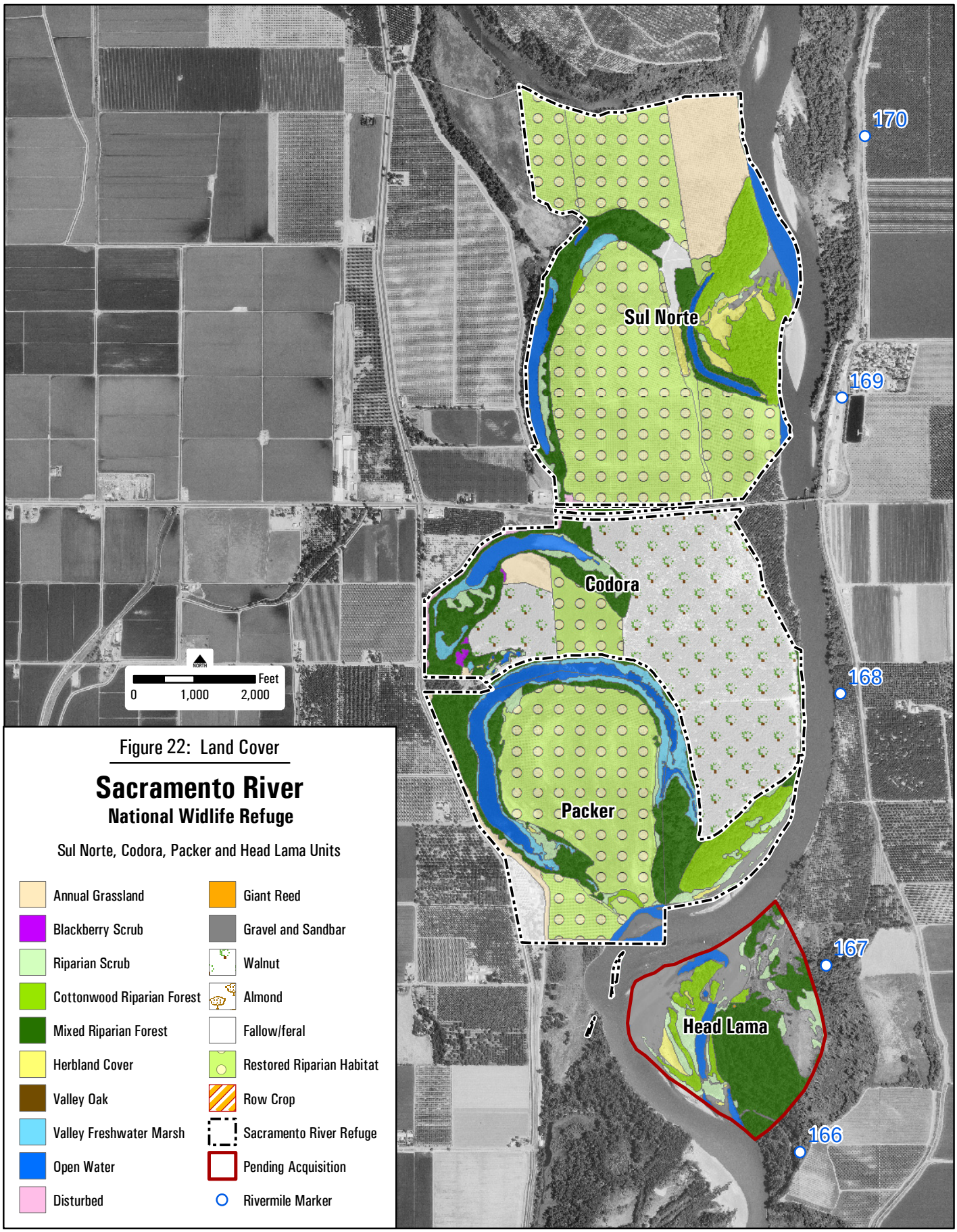


Figure 22: Land Cover

Sacramento River
National Widlife Refuge

Sul Norte, Codora, Packer and Head Lama Units

The unit's 269 acres of walnut acres are managed under a CLMA with TNC and leased to a tenant farmer. The current 28 restored riparian acres were allowed to undergo natural recruitment in 1996, and receive no irrigation or chemical/physical treatments. The 102 acres of pre-existing riparian habitats consist mostly of mixed riparian forest and open water (Figure 22).

Some portions of the unit are cooperatively monitored by PRBO for avian use. Special vegetation profiles include the natural regeneration of 28 acres of arroyo willow, cottonwood, and box elder, which germinated in 1996, after last being row cropped in 1995.

Packer
Acquired in 1997, the Packer Unit is 404 acres and is located between river miles 168 and 167. This unit is bordered on the west by Highway 45 and to the south by Princeton Unit of the CDFG Sacramento River Wildlife Area.

In 1999, 174 acres were restored to mixed riparian forest. The 215 acres of pre-existing riparian habitats consists mostly of mixed riparian forest, open water (Packer Lake), cottonwood riparian forest, and riparian scrub (Figure 22).

Some portions of the unit are cooperatively monitored by PRBO for avian use. Special wildlife use includes black-crowned night-heron roosts and wood ducks on Packer Lake. Special vegetation profiles include valley oak regeneration on low bench on the southwest side of Packer Lake.

A WUI project was implemented in 2002 to reduce the threat of wildfire on neighboring properties. The project included physical manipulation (fuels reduction) and construction of a permanent fire break.

Packer Lake was opened to public fishing in 2001 (U.S. Fish and Wildlife Service 2001). The Refuge plans to work with the State of California, Department of Boating & Waterways to modify the boat launch area at the Packer Unit to improve safety for anglers and other visitors.

Head Lama
The Head Lama Unit is 177 acres and is located between river miles 167 and 166. This unit is privately owned and is currently in the acquisition process.

The unit's 177 acres of pre-existing riparian habitats consist mostly of mixed riparian forest, cottonwood riparian forest, riparian scrub, gravel bar, and some herbland cover (Figure 22).

Drumheller Slough
The Drumheller Slough Unit is 224 acres and is located between river miles 165 and 164.5. The first 72 acres were acquired in 1998, and the remaining 152 acres in 1999. This unit is bisected by County Road 60 and bordered by the Princeton Unit of the CDFG Sacramento River Wildlife Area to the south.

The 24 acres of pre-existing riparian habitats consist mostly of mixed riparian forest (Figure 23). The unit's remaining 200 acres are currently being managed under a CLMA with River Partners and leased to local growers for dry land row crops.

Special vegetation profiles include blue elderberry bushes planted as a Valley elderberry longhorn beetle mitigation site and Drumheller slough giant garter snake mitigation site.

Sacramento River
Photo by Perry Grissom

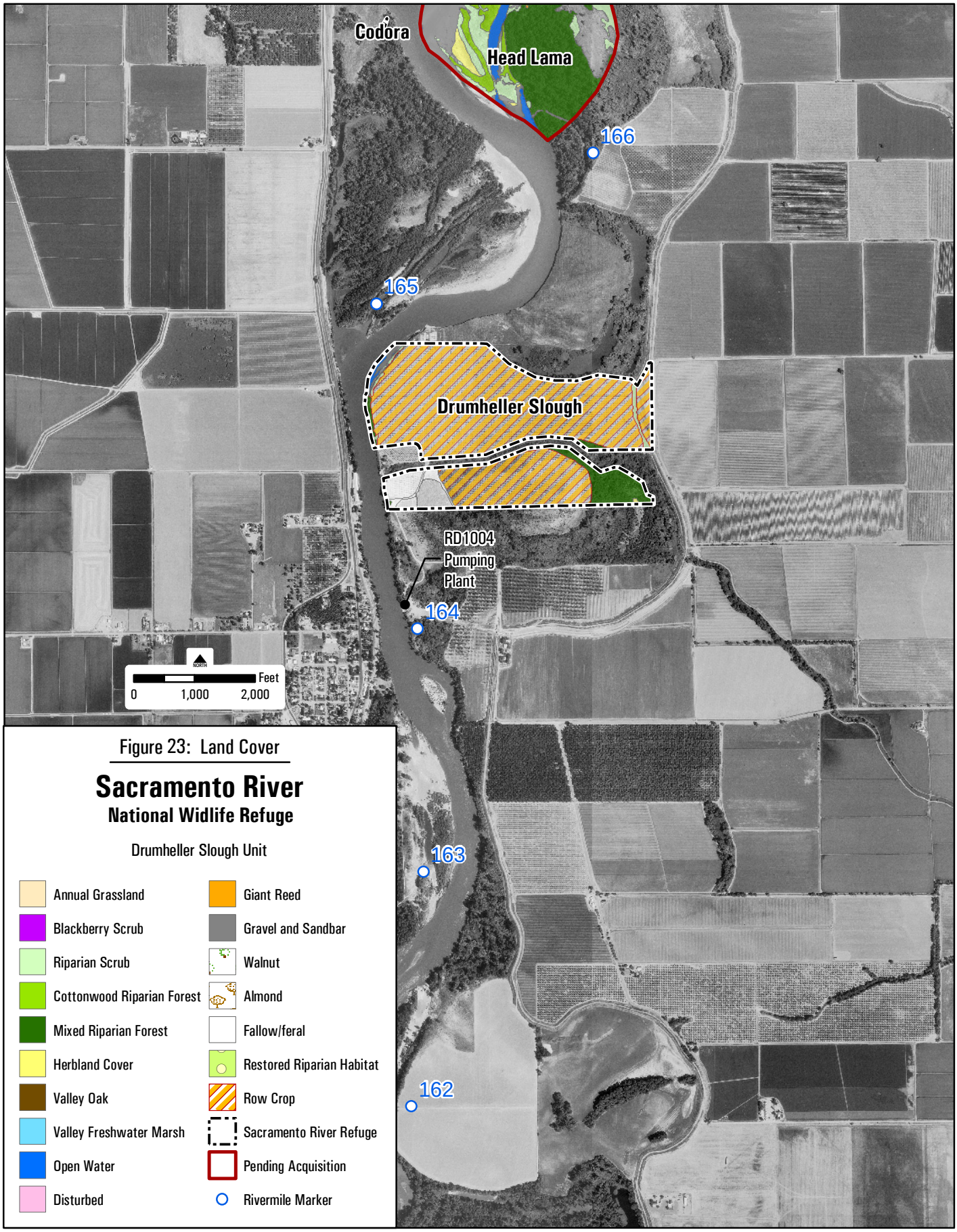


Figure 23: Land Cover

Sacramento River
National Widlife Refuge

Drumheller Slough Unit

Llano Seco Riparian Easement
Acquired in 1991, the Llano Seco Ranch Riparian Easement consists of 1,281 acres located between river miles 183 and 178 (Figure 24). This conservation easement is located on private property and is bordered to the north by the Ord Ferry Bridge and to the south by the Llano Seco Unit, Riparian Sanctuary.

The 1,281 acres of pre-existing riparian habitats and fallow grain lands consist of non-native grassland, mixed riparian forest, cottonwood riparian forest, elderberry savanna, herbland cover, riparian scrub, and sand and gravel bar. There are three oxbow lakes here: The Lagoon, Duck Lake, and Goose Lake.

Special wildlife use includes California quail at the edge of oxbow lakes and seasonal winter waterfowl use, primarily mallard and wood duck, of the oxbow lakes. A relatively large bank swallow colony occurs at Ryan' Island, nesting yellow-billed cuckoo have been observed at the Lagoon, Goose Lake, and at least two points in between, and Swainson's hawk have also been observed at Goose Lake. Special vegetation profiles includes minor natural succession of cottonwood, box elder, and elderberry at Ryan's Island, three locations of mature elderberry savanna, and old-growth sandbar willow scrub at mid-elevation floodplain.

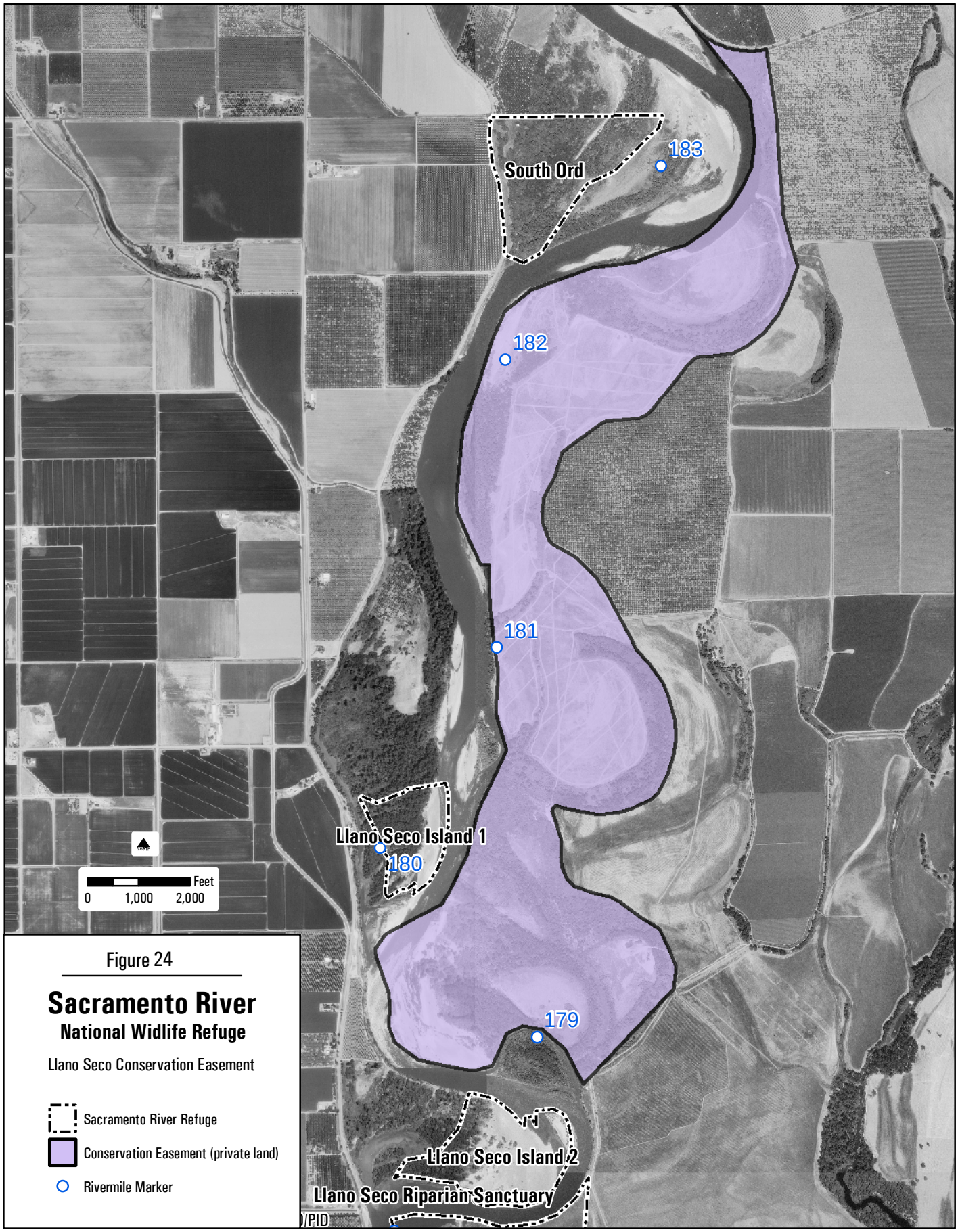


Figure 24

Sacramento River
National Widlife Refuge

Llano Seco Conservation Easement

Chapter 4. Current Refuge Management and Programs

Habitat Management

Refuge management is guided and tracked by annual habitat management plans (e.g., USFWS 2002a). The habitat management plan is a database which identifies individual cells within each unit of the Refuge. These cells consist of tracts of land which have common management issues, conditions, and activities. The habitat management plan identifies the problems and needs of each cell and specifies rehabilitation and other activities to address these concerns. Habitat management plans are created annually, and with the participation and input from the refuge manager, biologist, outdoor recreation planner, irrigator, fire management officer, law enforcement officer, and work leader, begin with a tour of each cell of each unit of the Refuge to access the current habitat and facilities conditions and results of management actions. The habitat management plan is a vital link in adaptive management because it provides a way to track the results of management decisions and associated actions. For example, if it is noted that a certain management action did not yield the expected results, changes are made to the management plan to modify that management activity. Management activities include facilities maintenance (e.g., roads, fire breaks, fences, gates, boundary signs), vegetation management (i.e., herbicide application, prescribed fire and grazing, mowing and discing, irrigation), vegetation, plant, and wildlife inventory and monitoring surveys, habitat restoration and restoration monitoring, public use monitoring and facilities maintenance, and law enforcement issues.

The 1,281-acre Llano Seco Ranch Riparian Easement is not included in the annual habitat management plan. However, the Refuge does manage the Llano Seco Ranch Riparian Easement. The refuge manager monitors easement compliance; the wildlife biologist conducts regular refuge wildlife surveys and surveys for special status species as part of the refuge wildlife inventory and monitoring program; and, the manager, biologist, and fire management officer provide technical assistance for habitat management such as grazing, burning, and fire breaks.

Habitat Restoration
Photo by Skip Jones

Water Management
Water management varies from intensive to occasional, depending on the type of habitat and/or the stage of restoration. Most Refuge units have riparian water rights. During the first three years of restoration efforts, riparian habitats are intensively managed. Nearly all irrigation water is pumped from wells and delivered by the use of ditches, irrigation pipe, and t-tape. Irrigation is maintained for three years following planting activities. Once established, riparian habitats are allowed to undergo natural succession and require no irrigation. Following restoration, wells are abandoned according to county ordinances, in order to ensure against ground water contamination.

Most agricultural habitats are not managed directly by refuge personnel. Farmers or cooperative land managers enter into agreements with the Service to irrigate orchards or row crops.

Riverbank Management
The Refuge staff coordinates with Ecological Services from the Sacramento Fish and Wildlife Office, NOAA-NMFS, the Army Corps of Engineers (ACOE), California Fish and Game, State Reclamation Board, and other stakeholders to investigate and evaluate river bank stabilization issues for best management options for the Refuge and other public interests. Bank protection is an ongoing aspect of the Sacramento River Flood Control Project for the purpose of public safety and economic considerations. Bank stabilization work is clearly related to flood control and water diversion needs and therefore, the

Refuge does not oppose work if such opposition would have an impact on public safety. The Service's local refuge manager and Fish and Wildlife Ecological Services staff in Sacramento coordinates with the ACOE, State Reclamation Board and affected groups on this matter, on a continual basis.

Technical Analysis

In the event that a bank stabilization, topographic or re-vegetation restoration project is identified that directly effects the management of the refuge or adjacent landowners, the Refuge will work with government agencies and stakeholders to initiate the first steps in addressing these issues. The first step would be to conduct a feasibility study which identifies the problem and those that may be affected, forming a technical advisory committee of stakeholders and independent experts, development of a range of possible alternatives, preliminary analysis of those alternatives. The final product of the feasibility study will include a report of the findings and recommendations for further analysis under the National Environmental Policy Act (NEPA). Examples of feasibility studies conducted on refuge project either completed or ongoing include: La Barranca Ecosystem Restoration Flood Reduction Project, Rio Vista Ecosystem Restoration Flood Reduction Project, M&T Pumping Plant Protection Project, and the Llano Seco Riparian Sanctuary Restoration and PCGID/PID Pumping Plant Protection Project.

Once the findings of the feasibility study are complete, the refuge and stakeholders must conduct further analysis under NEPA to refine and further analyze the alternatives and potential impacts. Depending on the scope of work, this NEPA analysis will either be completed by refuge staff or contractors.

Depending on the outcome of the NEPA analysis, funding for and implementation of the project may proceed. A project proposal, developed from the analysis, will be submitted to appropriate funding sources by the refuge, a conservation agency, the lead government agency, or other project proponents. Regardless of who may be the grant applicant, continued coordination with adjacent landowners and other stakeholders will be required.

The cooperative project at the Llano Seco Riparian Sanctuary/PCGID/PID Pumping Plan is example of an on-going process to develop a feasibility study and NEPA document. Refuge staff and PCGID/PID staff are cooperating

on a CALFED funded feasibility study to develop ways to protect the pumping plant from river meander and re-vegetate the riparian sanctuary. The results from the feasibility study will be used by the decision-makers within the respective organizations. The refuge staff will continue to work on this project.

It is important that the Refuge promote recruitment of fish and wildlife habitat while considering impacts on public safety, water conveyance, and public use opportunities. Habitat protection programs would have minimal influence on the merits or direction of bank stabilization projects. The major issues of concern to the Service are the retention of existing riparian vegetation, protection of spawning and rearing habitat for anadromous fish, and maintenance of habitat for the threatened valley longhorn elderberry beetle and migratory birds. The river processes that result in river meander and bank erosion also provide nesting habitat for the state-listed bank swallow, recruitment of spawning gravel and large woody debris (LWD) for threatened and endangered anadromous fish, and provide conditions conducive to allow native scrub habitats and communities to restore themselves naturally.

Control of Invasive Exotic Species

It is necessary to control certain plant and animal species that have undesirable effects on Refuge animals, plants, and habitats. The primary effect is competition with native plants for space, sunlight, nutrients, and water. The distribution and abundance of native plants which are important to wildlife as food, shelter, and nesting areas declines and wildlife habitat suffers. A list of invasive exotic plants which occur at SacramentoRefuge Complex is presented in Table 7. Currently, the Refuge in cooperation with The Nature Conservancy and River Partners is mapping and treating with herbicides perennial pepperweed throughout the Refuge and tree-of-heaven at the La Barranca Unit and Rio Vista Unit. Species which have the greatest impacts to Refuge habitats are given the highest priority for control. These impacts include rate of invasion, local and total area affected, and life history (i.e., rhizomatous, perennial species which also produce abundant fertile seeds spread rapidly and pose the greatest threats to habitat). Also needing attention are the “pest species” that affect agricultural practices on the Refuge. Various methods are used to control the effects of undesirable plant and pest species, including mowing, discing, tilling, herbicide/pesticide application, fire, grazing, and irrigation.

Table 7. Invasive Exotic Plant Species at Sacramento National Wildlife Refuge Complex.

Species [1]	Common Name	Habitat [2]	Location [3]
ASTERACEAE [Compositae]	**SUNFLOWER FAMILY**		
Centaurea solstitialis	YELLOW STAR-THISTLE	Grassland, fields, levees, roadsides, ditchbanks	S, C, B, Su
Lactuca serriola	PRICKLY LETTUCE	Grassland, fields, levees, roadsides, ditchbanks	S, C, B, Su
Xanthium strumarium	ROUGH COCKLEBUR	SFM, riparian habitats, vernal pools	S, C, B, Su
BRASSICACEAE [Cruciferae]	**MUSTARD FAMILY**		
Lepidium latifolium	BROAD-LEAVED PEPPERWEED	SFM, riparian habitats, fields, levees, ditch banks	S [6], C, B, Su
CHENOPODIACEAE	**GOOSEFOOT FAMILY**		
Salsola soda	FLESHY-LEAVED RUSSIAN-THISTLE	Alkali meadows, non-native alkali grassland	C
CONVOLVULACEAE	**MORNING-GLORY FAMILY**		
Convolvulus arvensis	BINDWEED	Vernal pools	B
FABACEAE	**LEGUME FAMILY**		
Robinia pseudoacacia	BLACK LOCUST	Riparian Forest	S
HALORAGACEAE	**WATER-MILFOIL FAMILY**		
Myriophyllum aquaticum	PARROT'S-FEATHER	Wetlands, ditches	B
JUGLANDACEAE	**WALNUT FAMILY**		
Juglans californica var. *hindsii* [4]	NORTHERN CALIFORNIA BLACK WALNUT	Riparian Forest	S
MORACEAE	**MULBERRY FAMILY**		
Ficus carica	FIG	Riparian Forest	S
MYRTACEAE	**MYRTLE FAMILY**		
Eucalyptus camaldulensis	RIVER RED GUM	Various	C
ONAGRACEAE	**EVENING-PRIMROSE FAMILY**		
Ludwigia peploides ssp. peploides	YELLOW WATERWEED	Wetlands, ditches	S, C, B, Su
Ludwigia peploides ssp. *montevidensis*	MONTEVIDEO WATERWEED	Wetlands, ditches	S

Species [1]	Common Name	Habitat [2]	Location [3]
PHYTOLACCACEAE	**POKEWEED FAMILY**		
Phytolacca americana	AMERICAN POKEWEED	Riparian, disturbed	S
SCROPHULARIACEAE	**FIGWORT FAMILY**		
Kickxia elatine	SHARP-LEAVED FLUELLIN	Various disturbed	S, B
SIMAROUBACEAE	**QUASSIA FAMILY**		S, C, B, Su
Ailanthus altissima	TREE-OF-HEAVEN	Riparian Forest	S [6]
TAMARICACEAE	**TAMARISK FAMILY**		
Tamarix parviflora	SMALL-FLOWERED TAMARISK	Riparian habitats	S
Tamarix ramosissima	SALT-CEDAR	Riparian habitats	S
POACEAE [*Gramineae*]	**GRASS FAMILY**		
Arundo donax	GIANT-REED	Riparian habitats, ditches	S, C
Crypsis schoenoides [5]	SWAMP-TIMOTHY	Vernal pools	C
Crypsis vaginiflora [5]	AFRICAN PRICKLEGRASS	Vernal pools	C
Cynodon dactyton	BERMUDA-GRASS	Various	S, C, B, Su
Elytrigia pontica ssp. *Pontica*	TALL WHEATGRASS	Alkali meadows	C
Phalaris aquatica	HARDING-GRASS, PERLA-GRASS	Alkali meadows	C, B
Lolium multiflorum	ANNUAL RYEGRASS	Various	S, C, B, Su
Sorghum halepense	JOHNSONGRASS	Upland and wetland edges (fields, ditches, roadsides)	S, C, B, Su
Taeniatherum caput-medusae	MEDUSA-HEAD	Uplands	S, B

[1] Non-native plants are indicated by an italic, non-serif typeface (Arial font). Severe problem plants indicated by underline.
[2] SFM – Seasonal-flooded Marsh.
[3] S – Sacramento River, C – Colusa Basin, B – Butte Basin, Su– Sutter Basin
[4] Feral hybrid with commercial English walnut (*J. regia*).
[5] Highly invasive species of most vernal pool types in the Great Valley.
[6] Monitored on the Refuge and treated with herbicides by The Nature Conservancy, River Partners, and Refuge staff.

During restoration efforts, riparian habitats undergo intensive weed control so that invasive species, such as Johnson grass, do not out-compete the newly planted species. Weed control in these areas usually consists of a combination of mowing, tilling, hand-removal, and herbicide application. This is continued for three-to-five years following planting. Riparian habitats, once established, require very little or no plant/pest control, except as noted below. Occasionally, established riparian habitats are burned, sprayed or grazed to maintain roads/trails, control undesirable under story (i.e. starthistle, pepperweed) and overstory plant species (i.e. tree of heaven, fig, and black walnut), and encourage the growth of native plants. A few units are grazed on an annual basis to help maintain the native species that occur there.

Many Refuge properties are or will be undergoing restoration into native grasslands. Prior to planting, initial site preparation may involve weed control by use of fire, herbicides, and/or cover-cropping. Following planting, weed control is necessary for two-to-three years by use of herbicides and mowing, after which it is no longer necessary.

Most agricultural habitats are not managed directly by Refuge personnel. Farmers or land managers are contracted by the Service to maintain orchards or row crops. Chemical use on these properties complies with Service integrated pest management policies.

The Service pest management policy goal (30 AM 12.1) is to eliminate the unnecessary use of pesticides through the use of Integrated Pest Management (IPM). IPM uses a combination of biological, physical, cultural, and chemical control methods (30 AM 12.5). This approach notes environmental hazards, efficacy, costs, and vulnerability of the pest.

When plants or animals are considered a pest, they are subject to control on national wildlife refuges if: the pest organism represents a threat to human health, well-being, or private property; the acceptable level of damage by the pest has been exceeded; State or local governments have designated the pest as noxious; the pest organism is detrimental to primary refuge objectives; and the planned control program will not conflict with the attainment of Refuge objectives or the purposes for which the Refuge is managed (7 RM 14.2).

Mosquitoes

The Refuge is striving to responsibly address risks to public health and safety and to protect trust resources from mosquito-borne diseases and the impacts of mosquito pesticides on wildlife and the ecosystem. The Refuge staff work cooperatively with the local Mosquito and Vector Control districts (districts) in the management of mosquito populations on the Refuge. The Refuge has developed a draft Integrated Pest Management Plan for Mosquito Abatement on the Sacramento Refuge Complex (Appendix P). The plan advocates a process to control mosquitoes, when necessary, using the least toxic methods first (i.e. wetland management techniques, biological controls) and only using chemical pesticides if those methods are ineffective.

The Service policy dictates that Pesticide Use Proposals (PUPs) must be developed and reviewed prior to the application of any pesticide. This process is conducted on an annual basis with the districts. All PUPs are reviewed by the refuge manager for consistency with Departmental, Service, regional, and State policies.

Mosquito species found in the Central Valley include important vectors of potentially lethal diseases, including encephalitis and West Nile Virus.

Vegetation Management

Riparian Grassland/Savannah Units

Grasslands are managed using physical and chemical manipulations to improve the quality of existing habitat and to aid in the restoration of native grasslands. In areas undergoing restoration to native grassland, there may be discing, burning, herbicide application, and/or cover cropping to control weed species pre- and post-planting and during initial establishment. Existing or restored grassland areas may be invigorated or maintained in good condition with burning, grazing and/or treatment with herbicides to control invasive plant species.

Native Grass Restoration
Photo by Joe Silveira

Riparian Forest Units

Riparian habitats, including riparian scrub, cottonwood riparian forest, mixed-riparian forest, and valley oak woodland are managed using a variety of techniques to promote growth and succession in order to provide a diverse habitat base for riparian-dependent wildlife. For all pre-existing riparian habitats, there are generally no chemical or physical manipulation needs except to control the occasional invasion of undesirable nonnative species, and also for road maintenance. Areas of early-stage riparian restoration are more intensively-managed, receiving chemical (herbicides), physical (tilling, mowing) manipulations or burning to prepare restoration sites and for ongoing weed control (three-to-five years post-planting). These areas also receive irrigation for about three years after planting. Occasionally, these early-stage riparian habitats are burned, sprayed or grazed to control weed species (i.e. starthistle, pepperweed) and encourage the growth of native plants. A few units are grazed on an annual basis to help control nonnative annuals and maintain the native species that occur there.

Croplands

There are a few areas of the Refuge that consist of row crops. Cropland areas are managed by private farmers through a Cooperative Land Management Agreement (CLMA), and are maintained to promote weed-control until habitat restoration plans can be put into effect. Common row crops are safflower,

beans, wheat, and corn. These areas usually receive physical and chemical manipulations, as well as irrigation. Grazing in an additional technique used to promote weed control. There are 108 acres of pasture on the Ohm Unit and 342 acres of pasture and riparian forest on the Mooney Unit that are seasonally grazed and managed by a contract farmer, with seasonal grazing applications.

Orchardlands

Approximately 1,481 acres of Refuge lands consist of orchards (almonds and walnuts). These areas are managed by private farmers through CLMAs, and are maintained until adequate funding is available to implement habitat restoration plans. The majority of these sites were evaluated in the Final Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge (USFWS 2002b). Orchards receive physical (mowing, pruning) and limited chemical (herbicide and pesticide) manipulations, as well as irrigation. There are some areas of walnut orchard (McIntosh Landing South) that receive no traditional orchard management as they have become unproductive, and are awaiting restoration. The Heron Island Unit has approximately 66 acres of abandoned English walnut orchard that has undergone natural recruitment and receives no traditional orchard management. Prior to restoration, orchards are cleared, brush is chipped for co-generation and stumps are ground, and irrigation systems are often re-used for restoration efforts.

Cooperative Land Management Agreements/Cooperative Agreements

The Refuge Administration Act, 16 U.S.C. 715i, regarding administration of refuges, authorizes the Secretary of Interior to enter into agreements with public and private agencies and individuals. Such agreements are also approved under the National Wildlife Refuge System Improvement Act (Public Law 105-57-Oct. 9, 1997).

Part 29.2 of Title 50, Code of Federal Regulations, entitled "Cooperative Land Management" provides: Cooperative agreements with persons for crop cultivation, haying, grazing, or the harvest of vegetative products, including plant life, growing with or without cultivation on wildlife refuge areas may be executed on a share-in-kind basis when such agreements are in aid or benefit to the wildlife management of the area.

At Sacramento River Refuge, cooperators provide valuable resources to the Refuge by restoring riparian habitat and managing the restoration sites. Together, the cooperator and the Refuge provide the most efficient means for habitat restoration.

Farmers and private nonprofit conservation organizations have shown a willingness to work with the Service and have the expertise and resources necessary to cooperatively assist in management of Sacramento River Refuge. The completion of defined land management activities by the cooperators will provide direct and substantial overall benefits to Refuge habitat and the associated wildlife.

In addition to CLMAs, the Refuge has also developed memorandum of understandings (MOUs) with state resources agencies in order to coordinate management decisions on Federal and State conservation lands. Other cooperative agreements include contracts with private nonprofit conservation groups for the purpose of implementing restoration projects.

Habitat Restoration

Habitat Restoration is a term that refers to the conversion of former agricultural or other lands with low wildlife-use value into habitats that provide increased resources for endangered species, migratory birds, anadromous fish, and/or native plants. The Sacramento River Refuge acquires some lands with marginal value to wildlife, and often finds it necessary to pursue some type of restoration activity to help meet the goals of the Refuge. Restoration techniques vary greatly by habitat types, and are covered separately for grasslands/savannah and riparian habitats. Approximately 2,372 acres of land on 9 existing units within the Sacramento River Refuge will be planted or allowed to revegetate with native vegetation. These areas were analyzed in the Final Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge (USFWS 2002b) and the results are incorporated herein by reference.

<u>Riparian Grassland/Savannah Restoration</u>

Grassland/savannah restoration projects consist mainly of native grasses, forbs, and shrub plantings on areas that are considered poor soils and deeper water tables. Planting native grass minimizes the invasion of nonnative species, enhances habitat for a variety of species, limits erosion, and provides less

hazardous fire conditions (Efseaff et al. 2001). Savannah shrubs are planted at low densities to provide foraging structure, and nesting and escape cover for native wildlife. Many Refuge properties are or will be undergoing restoration into native grasslands and savannah habitats. Initial site preparation starts with weed control by use of fire, herbicides, and/or cover-cropping. After planting native grass seed, weed control is necessary for another two-to-three years by use of herbicides and mechanical manipulation.

Native Grass Restoration
Photo by Joe Silveira

Riparian Forest Restoration

Riparian restoration projects begin with site-specific analyses to determine the most likely historic plant community distributions. Soils, topography, hydrology, surrounding vegetation, wildlife, and neighboring lands are all taken into account when creating a restoration plan for a specific site. The restoration plan outlines planting design, plant material collection and propagation, field preparation, irrigation, planting techniques, maintenance, and monitoring. After the initial removal of undesirable vegetation, such as almonds, prunes, or walnuts, the site is tilled and undergoes weed control, which may include burning and/or herbicide applications. Planting is then completed and irrigation systems put into place. Maintenance is necessary for three-to-five years following planting, which includes irrigation and weed control.

Fish and Wildlife Management

Fish and wildlife management is accomplished through habitat restoration, enhancement, and management. Habitat restoration and management can improve the overall health and productivity of fish and wildlife populations by increasing water, food, breeding, staging, winter areas, cover and shelter. Habitat and management needs can be designed to benefit certain target species or multiple species.

Migratory Bird Management

Migratory bird management at the Refuge involves riparian restoration, habitat restoration, and vegetation management. Riparian birds have special habitat requirements, which include various types of riparian vegetation, such as willow scrub, cottonwood forests, and valley oak. They also have habitat structure requirements, which include various tree and shrub densities, canopy layers, and forest understory plant species. The Riparian Bird Conservation Plan (Riparian Habitat Joint Venture 2004) focal species represent the range of habitat requirements for riparian birds (Chapter 1, Figure 4). The Southern Pacific Coast Regional Shorebird Plan (Hickey et. al 2003) also provides a list of important shorebird species and habitat management needs in the Central Valley of California. By addressing the habitat and management needs of focal species and special status species (Table 8), the Refuge provides suitable habitat for all riparian birds. The results of monitoring bird use at restoration sites are used to assess habitat restoration success and improve restoration designs. Baseline surveys for bird species composition are conducted prior to restoration by the Refuge, TNC, or PRBO. PRBO has conducted extensive breeding status surveys at the Refuge in remnant riparian habitats, restored habitats, and agricultural lands (Small et al. 1999, 2000). These surveys result in adaptive management strategies whereby survey information is applied to improve restoration designs to yield higher quality habitats for birds.

Threatened and Endangered Species Management

Sacramento Refuge Complex has an Intra-agency Formal Section 7 entitled Consultation on Management, Operations, and Maintenance of the Sacramento Refuge Complex, Willows, California dated April 1999 (USFWS 1998). This document reviews refuge habitat management activities throughout the Complex, which affect or may affect Federal endangered or threatened species, proposed endangered or threatened species, or candidates for listing and/or their habitat. Often, the

Refuge implements restoration and management activities to restore or enhance special status species habitat. Habitat and management needs for threatened and endangered species are presented in Table 8.

Sacramento River Refuge provides habitat for a number of threatened, endangered, and sensitive species. The Refuge has consulted with Ecological Services on operations and maintenance activities of the Complex. The resulting biological opinion stated these activities would not jeopardize continuing existence of any federally-listed endangered or threatened species on the Complex. Service policy requires incorporation of State threatened and endangered species into any planning activities.

The Refuge manages for Chinook salmon (Sacramento River winter-run ESU, Central Valley spring-run ESU, Central Valley fall-run and late-fall-run ESU), and Steelhead (Central Valley ESU) by providing and enhancing anadromous salmonid habitat. Suitable habitats are created through riparian forest restoration and the restoration of river channel and floodplain connectivity. Trees planted on the banks of the river provide shaded riverine aquatic (SRA) habitat and future sources of large woody debris (LWD). Selective levee removal allows the channel to meander providing new spawning areas and recruiting spawning gravel from the river banks into the channel (refer to Fisheries Management below and Chapter 5).

Because it is found only in association with the blue elderberry plant, management for the Valley elderberry longhorn beetle is accomplished through the management of its host plant. Elderberry plants occur throughout the Refuge in natural riparian forests and are being planted at restoration sites in mixed-riparian forest and elderberry savanna. To date, the Refuge and cooperators have planted over 76,500 elderberry plants on 2,960 acres of the Refuge. All elderberry shrubs larger than one-inch in diameter are considered habitat for this species. Elderberry bushes are not planted within 100 feet of the Refuge boundary next to private agricultural operations. Any elderberry stems or plants that must be removed are laid beneath living elderberry plants to allow any possible elderberry beetle inhabitants to find a new elderberry host plant upon emergence.

Table 8. Habitat restoration and management for selected special status wildlife species occurring or potentially occurring at Sacramento River Refuge.

Special Status Species [1]	Habitat Needs [2]	Management Needs
Winter-run Chinook salmon (FE, CE), spring-run Chinook salmon (FT, CT), steelhead –Central Valley evolutionarily significant unit– (FT), fall-run Chinook salmon (FC), late fall-run Chinook salmon (FC, CSC)	Main channel of Sacramento River and tributaries and middle Sacramento River floodplain: Great Valley willow scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest	Spawning gravel recruitment from eroded river banks, large woody debris in main channel, shaded riverine aquatic habitat, functional floodplain connected to main channel, marine derived nutrients, 56 degrees F max temperature for growth
Least Bell's Vireo (FE, CE) extirpated from Sacramento River	Great Valley willow scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest	Dense forest or scrub
Bank Swallow (CT) nesting	High floodplain river bank	Erodible, steep Columbia silt-loam type soils
Western Yellow-billed Cuckoo (FC, CE, BCC) nesting	Great Valley willow scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest	Mature cottonwood forest, early to late successional stages of mixed forests
Willow Flycatcher (CE) fall/spring migrant	Great Valley willow scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest	Dense forest or scrub
American Bald Eagle (FT) wintering	Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, Valley freshwater marsh	Large roost trees near water
Swainson's Hawk (CT, BCC) nesting	Great Valley valley oak woodland/savanna	Large nesting trees near grasslands and open agriculture fields
Valley elderberry longhorn beetle (FT)	Great Valley mixed riparian forest, elderberry savanna	Mature elderberry shrubs, stems > 1 inch diameter
Giant garter snake (FT)	Valley freshwater marsh	Stable slow water such as sloughs with steep banks and bulrush cover

[1] Codes: FE = Federal endangered; FT = Federal threatened; FC = Federal candidate; CE = California endangered; CT = California threatened; CSC = California Species of Concern. [2] Potential natural terrestrial vegetation (after Holland 1986).

The bald eagle uses the Sacramento River and vicinity for nesting, foraging, and perching. Restoring Refuge agricultural lands to cottonwood and mixed-riparian forests will provide increased habitat for this species.

Breeding western yellow-billed cuckoos have been found on the Refuge in recent surveys. Cuckoos need to have larger nesting trees located in close proximity to foraging areas. Restoring Refuge agricultural lands to willow scrub, cottonwood, and mixed-riparian forests will provide increased nesting and foraging habitat.

The least Bell's vireo and willow flycatcher need willow scrub vegetation for nesting and foraging. By restoring agricultural lands to early successional stage riparian habitat, such as willow scrub, the Refuge can provide nesting and foraging habitat for these species.

Bank swallow nesting colonies are found each year on many of the cut banks of the Refuge. In order to provide suitable nesting habitat, the Service will continue to coordinate efforts to remove Refuge levees and other bank stabilization that were constructed on private property prior to Refuge acquisition. Refuge levee and bank revetment (reinforcement) removal will expose additional mid and high floodplain elevation banks to the forces of annual erosion and provide important nesting substrate for colony establishment. The Service also participates with the CDFG in the annual bank swallow survey. The survey is designed to estimate the size and location of bank swallow colonies in the State.

Swainson's hawks need large nesting trees near suitable open foraging areas. By restoring mixed riparian forest, valley oak woodland and savannah, and grasslands, the Refuge will provide nesting, roosting, and foraging habitat for this species.

The giant garter snake is found in stable, slow water areas not typically associated with the main channel of the Sacramento River. They are, however, found in drainage and irrigation systems, and potentially in slow backwaters and freshwater marsh. Refuge management activities which occur in potential habitat of the giant garter snake follow specific measures to avoid disturbance to the species and its habitat, including areas where they hibernate.

Fisheries Management

Important habitat areas for Chinook salmon and other native fish have a floodplain that is connected to the main channel of the river and include features such as spawning gravel in about three feet of water, cool water temperatures, and good water quality for egg development. Other important features include shaded riverine aquatic (SRA) habitat and large woody debris (LWD). The LWD provides habitat structure while trapping spawning gravel and anadromous fish carcasses, the latter serving as a source of marine-derived nitrogen. The Refuge provides suitable habitats by restoring agricultural lands to riparian forests, and by restoring the river channel and floodplain connectivity. By planting trees along the banks of the river, the Refuge can provide SRA habitat and LWD. By removing selected levees, the Refuge can provide new spawning areas and recruit spawning gravel from the river banks into the channel as the channel meanders. The Service has removed private levees at the Flynn Unit and Rio Vista Unit, which resulted in floodplain and main channel connectivity. Fall-run Chinook salmon have spawned in areas of the channel at the Flynn Unit that were once inside the old Shasta View Farms levee. The Service and its partners continue to investigate the feasibility of filling gravel pits and removing other private levees.

Game Management

Game species commonly occurring on the Refuge include mourning doves, California quail, wild turkeys, ring-necked pheasants, various waterfowl species, and black-tailed deer. These species need foraging, nesting, and escape habitats to be within close proximity, and are attracted to the edges where these habitats meet. Most restoration designs offer a mosaic of habitat types, which provide dense nesting and escape cover close to open foraging areas. Any specific management actions relating to resident game animals are coordinated with the CDFG. Specific game management issues are considered in the Sacramento River Refuge Hunting Plan (Appendix C).

Mule Deer
Photo by Steve Emmons

Monitoring, Research, and Investigations

Monitoring and research projects are conducted by Refuge biological staff or cooperatively with principle investigators from government agencies, universities, and private conservation organizations. Monitoring and research are the foundation for Refuge management decisions. At the Refuge level, data collected during wildlife surveys are used to help determine the distribution and abundance of wildlife, and the strengths and weaknesses of habitat associated with specific species. This information is stored, tracked, and analyzed in a database and then used to develop annual habitat management plans, where projects designed to rehabilitate, enhance, and restore wildlife habitat are identified, project implementation is tracked and management actions are evaluated. Sacramento River Refuge is often a component of much larger projects that may include the entire Sacramento River landscape or the known range of a species. This level of monitoring or research helps define the Refuge's role and importance in conservation of certain species or habitat and also factors into management decisions.

Over 30 research projects have been proposed and are under way at Sacramento River Refuge (Appendix O). Research proposals are evaluated by Refuge staff to assure that the research is compatible with the Refuge and that some aspect of the results will facilitate Refuge wildlife and habitat management. A Special Use Permit (SUP) is issued to each research investigator. The SUP identifies and describes individual research projects, provides contact information, identifies where research activities will take place, and describes special conditions to assure the health and safety of the Refuge environment and those who visit the Refuge. Researchers have come from universities such as California State University Chico, the University of California (UC) Berkeley, UC Davis, UC Santa Cruz, and the University of Denver. Private non-profit conservation organizations, such as TNC, PRBO and River Partners, are providing important management-oriented research and monitoring, the results of which, help guide riparian habitat restoration. Federal and State agencies, such as the U.S. Geological Survey (USGS), USFWS, California Department of Water Resources, and CDFG also conduct research along the river and at the Refuge. Researchers investigate a wide range of biological and physical phenomenon. These include topics on wildlife biology (distribution/abundance, reproductive success, predation, impacts from contaminants), vegetation analysis (growth rates,

species composition, succession, and exotic species impacts), water quality, soils analysis and hydrology. Knowledge gained through research is an essential element in riparian habitat restoration and Refuge management.

Wildlife Disease Monitoring and Treatment
Wildlife disease monitoring is conducted opportunistically during site visits, field inspections, and wildlife surveys. Follow-up treatment includes carcass retrieval, documentation of site and carcass conditions, and either carcass disposal or shipment to the USGS National Wildlife Health Center, located in Madison, Wisconsin, where the carcass is tested to determine the cause of death. When appropriate, results are shared with other Service divisions (Law Enforcement, National Forensics Laboratory at Ashland, Oregon) and CDFG (game wardens, Wildlife Investigations Laboratory at Rancho Cordova).

The maintenance and biological staff monitor wetlands and track any mortality that may indicate a disease outbreak. When disease occurrence is suspected, the wetland unit is thoroughly surveyed, and all carcasses are collected and incinerated. Specimen carcasses are sent to a Service disease laboratory for analysis.

Other Wildlife Management Activities
Barn owl nest boxes are installed at restoration sites for rodent control. TNC and River Partners have used local schools and Boy Scout groups to construct and install the boxes. The Corning High School Biology Department conducts annual maintenance on owl boxes at the Rio Vista Unit. They also collect data on the species composition of owl prey items found in the owl pellets.

Volunteers at the Packer Unit installed and maintain wood duck nest boxes. To date, the data collection reveals poor nest success due to high predation from ringtail.

Cooperation with Adjacent Landowners
The Refuge is part of a mosaic of public and private land along the Sacramento River corridor. The private lands include both farms and natural riparian habitat along the river in the vicinity of the Refuge. These private lands are an important part of the river system that supports the wide range of wildlife species and provides for economic vitality through agricultural production. To maximize our conservation efforts along the river, the Refuge encourages and supports the cooperative

approach to problem solving by working with neighbors on common issues.

It is important to communicate with our neighbors to help identify any issues at an early stage and attempt to resolve any conflicts that may exist. The Refuge will continue to participate in the Sacramento River Conservation Area Forum (SRCAF). The SRCAF is a multi-organization effort to restore the ecosystem along the river. In order to ensure that the actions of the various agencies are compatible and consistent and to maximize the effectiveness of individual actions, there is a need for ongoing management coordination. This coordination includes both public agencies and private landowners and interests.

The primary contact for the cooperation with adjacent landowners is the refuge manager.

Fire Prevention and Hazard Reduction

Fire prevention and fire hazard reduction programs will be focused near homes, farms, businesses and developed areas. The Wildland Urban Interface (WUI) program is a national fire management program designed to reduce the potential for wildfire damage in urban and suburban areas. The program is part of a national stimulus package to encourage local contractors to implement wildfire hazard reduction projects on Federal lands. Development of site specific projects includes involvement from local landowners, County and State fire fighting departments, the refuge manager, and the complex fire management officer. Projects include, but are not limited to, permanent fire breaks, selective cutting along boundaries and developed areas, prescribed burns for fuel reduction, and cooperative agreements with local fire districts for wildfire suppression.

The refuge has averaged a little over 2 fires per year over the last 10 years, burning an average of about 9 acres per year. Refuge fire crews have also responded to several wildfires adjacent to refuge property. All fires have been human-caused, with the most frequent cause of fires being burning of levees or fields on adjacent lands (12 fires of 24 recorded in 15 years). Other causes have included powerline arcing, welding, fireworks, campfires, intentionally-ignited stolen car, vehicle exhaust, and an escaped prescribed fire.

Permanent Fire Break on Ord Bend Unit
Photo by Perry Grissom

Law Enforcement and Resource Protection

The staff of the Sacramento River Refuge recognizes the obligation that has been entrusted to them--the care of valuable natural and cultural resources--and they take this responsibility very seriously.

Law enforcement on the Refuge is used both for protection and for prevention. Used for protection, law enforcement safeguards the visiting public, staff, facilities, and natural and cultural resources from criminal action, accidents, vandalism, and negligence. Used as prevention, law enforcement inhibits incidents from occurring by providing a law enforcement presence.

The Sacramento Refuge Complex has a law enforcement staff that consists of one full-time refuge officer and two dual-function officers. These officers are responsible for all law enforcement issues on Sacramento River, Sacramento, Delevan, Colusa, Sutter, and Butte Sink Refuges. The dual-function officers conduct law enforcement as a “collateral duty” in addition to their primary responsibility, such as an assistant refuge manager or fire management officer.

The refuge officers are responsible for coordinating their activities and cooperating with other local, State, and Federal law enforcement officials.

Cultural Resource Management

Cultural resource sites have been documented and recorded in the National Register of Historic Places. All cultural resource site locations are kept confidential and are monitored on a regular basis.

The CSU Chico Research Foundation Archaeological Research Program (ARP) conducted an archeological study of the middle Sacramento River floodplain in 2002, leading to the comprehensive Cultural Resource Overview and Management Plan – Sacramento River Conservation Area (White et al. 2003). The project area consisted of a series of parcels totaling about 11,500 acres adjoining the Sacramento River, spanning Tehama, Glenn, Butte, and Colusa counties between Red Bluff and Colusa, California. The study completed an archaeological survey, assisting the Service in meeting cultural resource inventory mandates as specified in Sections 106 and 110 of the National Historic Preservation Act. The final overview, assessment, and management plan provides a summary of the status of known cultural resources, a sensitivity study for resources yet-to-be identified, and general plans for future scientific investigations, public interpretation of archaeological and paleo-environmental findings, and administration and coordination for future actions which may affect cultural resources. The Public Report of Findings will assist the Service to address the Department of Interior recommendations for public outreach and dissemination of scientific results.

Facilities Maintenance

The Refuge shop, office (shop and office are located on the North Central Valley Wildlife Management Area), and visitor parking areas require frequent maintenance and repair. Currently, the Refuge has one engineering equipment operator for maintenance and operations. Many of the Refuge units have been managed by cooperators in the recent past, alleviating many maintenance responsibilities for the Refuge. As these units reach the end of their restoration contracts and the cooperators begin to cease maintenance operations, Refuge maintenance responsibilities will continue to grow (posting, re-posting, fencing, weed control, mowing, wildfire prevention, and road maintenance).

General road maintenance, including grading and mowing, is required on a number of the Refuge units to provide safe access through the Refuge for researchers, law enforcement activities, and educational field trips. Some additional upland areas

require mowing to reduce fire hazards, provide weed suppression, and provide access for maintenance or monitoring projects during the spring and summer months.

In order to maintain the integrity of Refuge, it is critical to reduce trespass, dumping, and poaching on Refuge lands. It is the intent of the Service to maintain a positive working relationship with neighbors to reduce trespass, vandalism, and theft on adjacent landowner properties (Chapter 5 Objective 3.2). To achieve these goals, the Refuge has begun the process of fencing, signing, and gating the Refuge boundaries. This infrastructure will help to alleviate trespass problems identified by many neighboring landowners. Annually, most Refuge units will require installation of some new posts due to vandalism and river processes. In addition, as Refuge units are opened to public use, it will be necessary to inform the public of the permitted activities on each unit. This will require installation of information signs and maintained on each Refuge unit.

Safety

Safety is important both for the Sacramento River Refuge staff and for visitors. Monthly staff safety meetings are held at the Sacramento Refuge Complex office. The intent of the meetings is to update and train personnel, as well as to resolve any safety concerns that arise. Sample topics include: Lyme's Disease, West Nile Virus, and Hantavirus Safety, Tractor Safety, Hazardous Dump Sites, Boating Safety, CPR/First Aid, Hypothermia, Poisonous Plants, Defensive Driving, Heat Stress, and Respiratory Safety.

Visitor Programs and Facilities

Visitor Services and Management Policy

There are a variety of sources for policy and guidance to manage public use programs on Refuges. The USFWS Refuge Manual, Chapter 8, provides Service policy on management of public use programs, including public relations, outdoor classrooms, educational assistance, interpretation, hunting, sport fishing, photography, volunteers, etc. Currently, the Refuge Manual is being revised and published as the USFWS Manual. The USFWS Manual 605 FW will provide updated policy and guidance. The Region One Visitor Services & Communication Office and the Office of Diversity and Civil Rights are additional sources for guidance and coordination.

In October 1984, the Service published "National Public Use Requirements" to help field stations, including refuges, to plan, implement, and evaluate public use programs. The established requirements are: set public use goals, project a positive attitude, welcome and orient visitors, develop key resource awareness, provide observation opportunities, maintain quality hunting program, maintain a quality fishing program and provide public assistance.

Environmental Education

Many of the Refuge's environmental education activities are carried out in cooperation with partners. The Phelan Island and Ord Bend units are the most commonly used by the Refuge partners. Since all Refuge units are closed to public access, except for Packer Lake, groups are required to request access. This request process is implemented by completing a Sacramento River Refuge Event Notification Form. Some of the Refuge's partners include: TNC, PRBO, River Partners, FARMS Leadership Program, and Sacramento River Preservation Trust. During 2002, there were about 300 visits by students ranging from local universities to elementary classes visiting the Refuge.

Fishing

Public fishing access is offered only on the Packer Unit, which is two miles north of Princeton. Due to historical fishing on Packer Lake, an Environmental Assessment, Compatibility Determination and Section 7 were completed to continue use (U.S. Fish and Wildlife Service 2001).

Packer Lake is a remnant oxbow of the Sacramento River and can only be accessed via a primitive road that travels about ¼ mile on a flood control levee. Anglers fish the lake primarily during the spring and early summer for bluegill, bass, and crappie. About 50 angler visits occurred in 2002. The primitiveness of the levee access road and boat launch area has served to limit the size of boats to "car tops" i.e. jon boats, canoes, 10-14' aluminum boats. The lake level drops in the summer, making access and boat fishing very difficult. Overgrown vegetation and the presence of poison oak limits bank fishing on the west shoreline. Fishing is open year-round, only during daylight hours. All fishing activities are subject to the CDFG Sport Fishing Regulations.

Outreach
Refuge related information has been provided at annual local events, such as International Migratory Bird Day, the Snow Goose Festival, State of the Sacramento River Conference, National Wildlife Refuge Week, the Salmon Festival and the Endangered Species Fair. During 2002, approximately 15,400 individuals attended the presentations and saw exhibits at these events. Also, two news releases were circulated and one television appearance occurred.

Refuge Complex staff maintains the web site: www.sacramentovalleyrefuges.fws.gov. Events, flyers, Environmental Assessments, and information about the Refuge are posted on the web site.

Refuge Fee Program
Currently, there is no fee program for the Sacramento River Refuge.

Hunting
Currently, hunting is not allowed on the Sacramento River Refuge.

Chapter 5. Planned Refuge Management and Programs

Overview of Refuge Management Goals, Objectives, and Strategies

One of the most important parts of the CCP process is the development and refinement of the refuge vision and goals. This section contains the primary goals that will define the management direction of the Refuge for the next 15 years. In addition, as part of the CCP each refuge is expected to develop objectives and strategies that, together, will help achieve the goals. *Goals* are broad statements of the desired future conditions for refuge resources. Refuge goals may or may not be feasible within the 15-year time frame of the CCP. Whenever possible, *objectives* are quantified statements of a standard to be achieved or work to be accomplished. They should be specific, measurable, achievable, results-oriented, and time-fixed, and should be feasible within the 15-year lifespan of the CCP. *Strategies* are specific actions, tools, or techniques that contribute toward accomplishing the objective. In some cases, strategies describe specific projects in enough detail to assess funding and staffing needs.

The four goals of the Sacramento River Refuge are outlined below to provide a context for the proposed management direction.

Goal 1: Wildlife and Habitat Goal

> Contribute to the recovery of endangered and threatened species and provide a natural diversity and abundance of migratory birds and anadromous fish through the restoration and management of viable riparian habitats along the Sacramento River using the principles of landscape ecology.

Goal 2: Visitor Services Goal

> Encourage visitors of all ages and abilities to enjoy wildlife-dependent recreational and educational opportunities and experience, appreciate, and understand the Refuge history, riparian ecosystem, fish, and wildlife.

Goal 3: Partnership Goal

Promote partnerships to preserve, restore, and enhance a diverse, healthy and productive riparian ecosystem in which the Sacramento River Refuge plays a key role.

Goal 4: Resource Protection Goal

Adequately protect all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuge from those of malicious intent, in an effective and professional manner.

Organization

Each objective and each strategy are given a unique numeric code for easy reference. Objectives have a two-digit code (e.g., 1.1, 1.2, 2.1, 2.2). The first digit corresponds to the goal to which the objective applies. The second digit is sequential. Similarly, each strategy has a three-digit code (e.g., 1.1.1, 1.1.2, 2.1.1, 2.1.2). The first and second digits refer to the appropriate goal and objective, respectively. The third is sequential. Strategies are sometimes grouped by subtopic.

Refuge Management Goals, Objectives, and Strategies

Goal 1: Wildlife and Habitat

Contribute to the recovery of endangered and threatened species and provide a natural diversity and abundance of migratory birds and anadromous fish through the restoration and management of riparian habitats along the Sacramento River using the principles of landscape ecology.

Overview of Landscape Ecology Approach

The Improvement Act requires the maintenance of the Refuge System's biological integrity, diversity, and environmental health. This is best achieved by applying the principles of landscape ecology to refuge management.

Landscape ecology is a sub-discipline of ecology, which focuses on spatial relationships and interactions between patterns and processes. This emerging science integrates hydrology, geology, geomorphology, soil science, vegetation science, wildlife science, economics, sociology, law, engineering and land use planning to conserve, enhance, restore and protect the sustainability of ecosystems on the land. Landscape ecology encompasses natural, physical, biological, and human-

influenced features and processes that shape the environment. Over time, natural patterns of climate, hydrology, geology, soils, vegetation, and wildlife resulted in a rich natural diversity. Human cultural practices associated with modern civilization have greatly altered natural physical processes, resulting in declining biological diversity. The lower Sacramento River is an example of this, where the natural hydrograph of the river has been greatly modified by Shasta Dam and numerous flood control levee and bank revetment projects, native vegetation has been cleared, and local topography has been leveled (Buer et al. 1989; Moyle 2002; Small et al. 2000). This has necessitated riparian restoration through revegetation (Alpert et al. 1999; Griggs 1993a, b; Griggs and Peterson 1997, Peterson 2002). Restoring populations of indigenous plant and animal species requires investigation of broad scale natural processes, such as hydrology, geology, soils, and local plant ecotypes and their application to restoration sites (Jackson et al. 1995; Silveira et al. 2003; Pickett et al. 1992).

Existing and future habitat restoration fulfills the Service's congressional mandate to preserve, restore, and enhance riparian habitat for threatened and endangered species, songbirds, waterfowl, other migratory birds, anadromous fish, resident riparian wildlife, and plants. Native indigenous plants and rare natural communities have benefited from the increase in acreage of scrub, forest, woodland, savannah, grassland, and wetland communities throughout the Sacramento River Refuge. Habitat restoration has promoted greater species diversity, provided a buffer from adjacent land uses, and increased natural communities.

The success of habitat restoration has been monitored in several ways by several different researchers on the Refuge. PRBO has been monitoring riparian restoration sites on the Sacramento River (including sites on the Refuge) since 1993. This monitoring has shown that riparian bird diversity increased significantly over time as the restoration matured. Furthermore, bird diversity approached what was observed in remnant riparian areas along the river when restoration sites were greater than five years old (Small et al. 2000). This intensive monitoring has also helped modify the way our restoration sites are planted.

Small et al. (2003) also reports that monitoring has demonstrated that by planting an understory component at the restoration sites, the total number of species has more than

doubled. A more diverse bird community, however, may not necessarily equate to a healthy one in terms of recruitment and survival. Measuring nest success at restored and remnant forest sites showed that for lazuli bunting and spotted towhee success was similar, and for black-headed grosbeak success was higher on the restored plots. These results are evidence that the restoration is working well for birds.

River Partners (2004) determined elderberry shrubs planted in riparian restoration sites on the Refuge successfully increased habitat for valley elderberry longhorn beetle habitat, especially at sites that are adjacent to established elderberry shrubs. Stillwater Sciences (2003) has demonstrated that there is more bat activity over older restoration sites than younger sites and the most bat activity on the river is at the densest forest with the largest number of trees. Restoration has also contributed to the complexity of the aquatic environment by providing cover, food, and other habitat components for fish.

Physical and biological processes affect the distribution, abundance, and structure of riparian vegetation over time. Vegetation refers to the species of plants, their frequency, density, and spatial distribution in a specific area and time. Habitat refers to the components of vegetation and other landscape characteristics which are used by wildlife and plants. These landscape characteristics include gravel, specific soil textures, soil chemistry, moisture, minerals and nutrients, slope aspect, aridity/humidity, radiation, current velocity, temperature, etc. Riparian vegetation and habitat are constantly changing in distribution and abundance due to river meandering caused by flooding, erosion, and deposition. Erosion and deposition provide an open substrate upon which seeds and acorns can germinate and become established. Characteristics of vegetation, such as canopy cover, species frequency, and density, influence the distribution of plants which grow under the tree canopy. These vegetation characteristics also influence the distribution of wildlife. Conversely, animals, especially plant-eating and seed-eating mammals and certain insects, affect plant growth and survival.

Plants and wildlife occupy various stages of plant succession (e.g., wildflowers in early forest succession, closed canopy valley oaks in late forest succession resting), which characterize habitats, for specific activities (e.g., feeding, nesting) during specific periods of their life history (e.g., courtship, breeding, nesting, fledging, migration). Some late successional stages are

dominated by undesirable plant species. For these reasons, vegetation must be managed to restore habitat to an earlier successional stage that is occupied and used by a diversity of native, indigenous species. Desirable late successional stages composed of indigenous plants used by native fish and wildlife can be restored through active refuge management.

The principles of landscape ecology (Strategy 1.1.1) will help the Refuge achieve the following objectives and strategies for the wildlife and habitat goal.

Objective 1.1: Riparian Vegetation and Habitat
Prepare and implement site assessment and restoration plans to restore an additional 3,255 acres of riparian vegetation and habitats (Great Valley willow scrub, Great Valley cottonwood forest, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, Valley oak savannah, elderberry savanna, and grassland, herbland, and wetland), as well as maintain existing and newly restored riparian habitats for riparian-dependent species by 2015.

Rationale: Riparian forests and other riparian plant communities of California's Great Central Valley provide habitat for a diversity of resident and migratory terrestrial and aquatic wildlife, including rare and endangered species (Gaines 1974, 1977; Moyle 2002; Riparian Habitat Joint Venture 2004; Roberts et al. 1977; Small et al. 2000) The Partners in Flight North American Landbird Conservation Plan (Rich et. al 2004), and the California Partners in Flight/Riparian Habitat Joint Venture Riparian Bird Conservation Plan (2004), and the Southern Pacific Coast Regional Shorebird Plan (2003) identify focal species and habitat conservation and restoration needs for Central Valley birds.

Wetlands and riparian forests once covered about 5 million acres of the Central Valley before intensive settlement began in the late 1800's. Flood-control and subsequent conversion of natural wetlands to agricultural production have reduced these habitats to less than one-tenth their former extent (Dahl 1990). CDFG considers Great Valley willow scrub, Great Valley cottonwood forest, Great Valley mixed riparian forest, Great Valley oak riparian forest, Valley oak and elderberry savannas, and many grassland and freshwater wetland vegetation types to be rare plant communities (Holland 1986; Holland and Roye 1989). Less than 2 percent of the pre-1850 acreage of riparian forest remain, with virtually all of the Valley oak forest type gone (Bay Institute 1998). Out of 418,916 hectares of potential riparian

habitat in the Central Valley of California, only 51,927 hectares is currently forested (RHJV 2004). In addition, less than 1 percent of California's original grasslands remain (Huenneke, 1989).

Few sites on the Refuge offer conditions for successful passive restoration because of the altered hydrograph, existing weed community, and lack of native seed sources. At most sites, natural recruitment would likely include many nonnative plant species of lower habitat value for target wildlife species. As a result, modern agricultural techniques are used for restoration on Sacramento River Refuge.

Riparian restoration and management are necessary to expand and provide habitat for species associated with the Sacramento River. Opportunities for willow scrub, cottonwood, mixed riparian, Valley oak riparian forest, and associated grassland and herbland habitats exist at the mid-elevation floodplain of the Sacramento River. Opportunities exist for valley oak woodland and savanna, and associated grassland habitats, at the high-elevation floodplain of the Sacramento River. Table 9 lists the acres proposed for restoration on each Refuge unit.

Riparian Vegetation and Habitat Strategies:

1.1.1: Develop a site assessment and restoration plan for each of the restoration sites on the additional 3,255 acres of riparian habitat. Each plan will identify the site characteristics using the principles of landscape ecology (bullets listed below) and determine the site-specific restoration criteria (species composition, etc.).

The first step for each site assessment is planning, during which time site-specific data and information (e.g., background studies on hydrology, geomorphology, soils, vegetation, wildlife, cultural resources) is collected and a detailed restoration design is developed. The restoration design includes species to be planted, plant densities, frequencies, and plant and vegetation patterns. The overall pattern will be a mosaic of riparian communities including freshwater wetland, grassland, herbland, savannah, scrubland, and forest vegetation. This information is included in a unit plan, which is developed for each restoration site. Site planning can take up to 2 years to complete.

Table 9. Anticipated Restoration and Public Use Matrix.

Unit Name	Total Acres[1]	Acres Riparian Habitat[2]		Permitted Public Use[4]			Public Access/Facilities						Anticipated Year Open to Public
		Existing Riparian	Future (active ag) or Current Restoration[3]	Big 5[5]	Big 6[6]	Sanctuary[7]	Walking Trail	Portable Toilet	Info Sign / Brochures	Parking Area[8]	Boat Access Only	Primitive Boat Launch	
Blackberry Island	52	52		●							●		2005
La Barranca	1066	368	193		●						●		2005
			505		●						●		2009
Todd Island	185	185			●						●		2005
Mooney	342	342			●[9]						●[9]		2005
Ohm	757	519				●							Closed
		111				●[10]							Closed
		62			●[9]								2005
		65			●						●		2005
Flynn	630	573		●							●		2005
		57			●						●		2005
Heron Island	126	126			●						●		2005
Rio Vista	1149	231		●			●	●	●	●			2005
		577			●		●		●		●		2005
		341				●							Closed
Foster Island	174	174			●						●		2005
McIntosh Landing North	63	57				●							Closed
		6			●						●		2005
McIntosh Landing South	67	40	27			●							Closed
Pine Creek	564	336		●			●	●	●	●			2005
			228	●					●	●			2006
Capay	666	91			●		●		●	●			2005
			575		●		●	●	●	●			2009
Phelan Island	308	308			●						●		2005
Jacinto	69	59			●						●		2005
			10		●						●		2010
Dead Man's Reach	637	66			●						●		2005
			571	●							●		2009
North Ord	29	29				●							Closed
Ord Bend	111	111		●			●	●	●	●			2005
South Ord	122	122			●						●		2005
Llano Seco Riparian Sanctuary	751	364	387			●							Closed
Llano Seco Island I	56	56			●						●		2005
Llano Seco Island II	99	99			●						●		2005
Hartley Island	487		67			●							Closed
		183	237		●						●		2010
Sul Norte	590	389			●		●						2005
			157		●								2006
			44	●			●	●	●	●			2005
Codora	399		245	●			●	●	●	●			2010
		126	28	●			●	●	●	●			2010
Packer	404	393		●			●	●	●	●		●	2005
		11			●						●		2005
Head Lama	177	76			●						●		2006
		101				●							Closed
Drumheller Slough	224	15	209		●				●	●			2008/9

[1]Total acreages include all acres within original acquisition boundary, including those that have eroded. [2]See habitat maps for further details, includes accreted acres. [3]Closed to the public until management is complete. [4]Permitted Public Use applies to areas above ordinary high water mark. [5]Big 5 includes fishing, wildlife observation, photography, interpretation, and environmental education. [6]Big 6 includes hunting, fishing, wildlife observation, photography, interpretation, and environmental education. [7]Sanctuary denotes areas closed to all public use. [8]Units with parking areas also have river access, except for the Ord Bend Unit. [9]Area closed to waterfowl hunting, open to other hunting and Big 6 uses. [10]Area of disputed ownership.

To develop site-specific restoration criteria, the following principles of landscape ecology are used:

- Partnerships: Use expertise, knowledge, and information from various partners and cooperators to implement ecological restoration (Griggs 1993a; Efseaff et al. 2003; Golet et al. 2003; Silveira et al. 2003).
- Hydrology: Use California Department of Water Resources (Northern District, Red Bluff) and other sources of information (Ayers Associates 1997, Ayers Associates 2001a, 2001b, 2002; Leopold and Maddock 1953; O'Neil et al. 1997; Silveira et al. 2003; U.S. Army Corps of Engineers 1995) to identify and describe the hydrology of the river reach that each restoration site occupies. Through partnerships with The Nature Conservancy (TNC) and River Partners, implement hydrological modeling for specific reaches of the river to provide quality riparian habitat and maintain the integrity of the flood control system. Coordinate activities with the State Reclamation Board.
- Geology: Use California Department of Water Resources (Northern District, Red Bluff) geological information, including historic and predicted channel meander data and other sources of geological information, to select appropriate restoration locations (California Department of Water Resources, Northern District 1980, 1984; California Department of Water Resources 1994; California Division of Mines and Geology 1977; Harwood and Helley 1982; Helley and Harwood 1985; Jennings and Strand 1960; Saucedo and Wagner 1992; Silveira et al. 2003; Strand 1962).
- Soils: Use the most recent soil survey information from the Natural Resources Conservation Service to determine appropriate plant community attributions for restoration (Arroues 1982; Begg 1968; Bureau of Soils 1913; Burkett et al. in prep; Gowans 1967; Holmes et al. 1915; Jenny 1941; Silveira et al. 2003; Watson et al. 1929). Through partnerships with TNC and River Partners, dig soil pits and auger soil cores to determine the distribution of soil texture at each restoration site.
- Vegetation (Plant Community): Locate remnant stands and patches of vegetation and determine soil-topography-hydrology associations (Silveira et al. 2003) to determine appropriate plant communities. Use the resulting soil-topography polygons to construct potential natural vegetation maps (Griggs et al. 1992) and restoration design and layout.
- Plant Materials: Through partnerships with TNC and River Partners, collect local plant ecotypes for use at restoration sites (Clausen et al. 1948; Keeley 1993; Longcore et al. 2000; Rice and Knapp 2000; Montalvo and Ellstrand 2000; Silveira et al. 2003).

- Conduct baseline monitoring and surveys of sites to be restored, as well as nearby reference sites that are on similar soils containing remnant natural vegetation (Burkett in prep; Oswald and Ahart 1994). Identify native plant and wildlife through surveys (Silveira et al. 2003, Small et al. 2000). Describe vegetation with measures of species composition, distribution, configuration, frequency, density, age, and structure.
- Conduct a literature review, a records search for historic documents, maps, and air photography, and interviews with individuals with knowledge of pre-agriculture/flood control state of the restoration site (Silveira et al. 2003).
- Conduct research investigations through partnerships to expand knowledge of various scale factors which influence riparian ecosystem health. Research is used to modify and adapt riparian habitat restoration and management based on the best and most complete quantitative information (Golet et al. 2003).

Plants for Riparian Restoration
Photo by Joe Silveira

The site-specific restoration plans will be written according to the results of the site assessments which determine the type of restoration that can be accomplished at each site. The two sub-strategies described below provide additional components that will be included in the restoration plan for mid- and high-elevation riparian, freshwater wetlands, and threatened and endangered species.

Sub-strategy 1: Restore mid- and high-elevation floodplain riparian vegetation and habitat, which includes, but is not limited to, Great Valley willow scrub, Great Valley cottonwood forest, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, Valley oak woodland, Valley oak and Elderberry savanna, and various herbaceous vegetation types and Great Valley freshwater wetlands.

- Determine the spatial distribution and size of various mid- and high-elevation floodplain riparian vegetation types and wetland channels and basins to be restored by using the principles of landscape ecology.
- Restore mid- and high-elevation floodplain riparian vegetation types and habitat and implement restoration of freshwater wetlands. Besides revegetation, restoration includes reconstruction of topographic features, such as channels, oxbows, and basins.
- Conduct and evaluate results of annual vegetation surveys of restored riparian habitats for three-to-five years to assess restoration success and incorporate adaptive management strategies to improve restoration success and efficiency.
- Conduct and evaluate long-term vegetation surveys of restored riparian habitats to monitor riparian restoration success and vegetation succession patterns of various mid- and high-elevation floodplain riparian vegetation types. Include nearby reference sites of the various natural riparian vegetation to compare canopy cover, species composition, and frequency and density of plants.
- Manage vegetation for a variety of successional stages; identify vegetation thresholds for desired successional stages, species composition, population levels of native species, and control of exotic species that trigger management response (i.e., grazing, burning, herbicides, and other mechanical methods).
- Conduct and evaluate the results of prescribed fire research in various mid-and high-elevation floodplain riparian vegetation and habitat types.
- Conduct and evaluate prescribed grazing research in various mid-and high-elevation floodplain riparian vegetation and habitat types.

Sub-strategy 2: Ensure that the following threatened and endangered species habitat requirements are incorporated into the restoration plan, as appropriate.

- Restore mid-elevation riparian habitats, especially willow scrub vegetation, to partially fulfill needs to reintroduce the least Bell's vireo to the middle Sacramento River.
- Implement restoration of mixed riparian forest, valley oak woodland, valley oak savanna, and elderberry savanna to provide mature elderberry shrubs, which are the host plant for valley elderberry longhorn beetle.

- Conduct feasibility studies, associated hydrologic investigations, and NEPA documentation to remove privately constructed levees and other bank stabilization features on Refuge land to allow natural erosion and restoration of bank nesting habitat for bank swallows.
- Chinook salmon, Sacramento River winter-run ESU (Anadromous Fisheries and Native Fisheries Objective 1.7).
- Chinook salmon, Central Valley spring-run ESU (Objective 1.7).
- Steelhead, Central Valley spring-run ESU (Objective 1.7).
- Chinook salmon, Central Valley fall-run and late-fall-run ESU (Objective 1.7).
- Restore breeding, roosting and foraging habitat for the American bald eagle along the middle Sacramento River through restoration of mid- and high-elevation riparian forests. Provide and maintain late successional stage vegetation with large trees, such as valley oak, western sycamore, and Fremont's cottonwood.
- Restore freshwater wetlands to provide slow, stable, and relatively warm water habitat (e.g. backwater sloughs, seasonal wetlands and irrigation and drainage ditches) for giant garter snake.
- Maintain areas and protect slough and canal banks for GGS hibernation areas.
- Implement best management practices as outlined in the Section 7 for operation and maintenance when working around GGS habitat.
- Restore mid- and high-elevation floodplain vegetation, especially mature cottonwood and mixed-riparian forests, with closed canopy forests and in close proximity to early successional habitats for western yellow-billed cuckoo.
- Restore mid-elevation riparian breeding habitats, especially dense willow scrub vegetation for the willow flycatcher.
- Restore mid- and high-elevation riparian forests, especially those with large trees, such as valley oak, western sycamore, and Fremont's cottonwood for the Swainson's hawk.

1.1.2: Maintain cooperative land management agreements (CLMA) to administer the agricultural and restoration programs on Refuge lands.

- Use the expertise of the local agricultural industry to manage orchards and contribute to the local economy until restoration planning is completed and funding is secured.
- Work with partners to develop ecologically sound restoration methods.
- Implement integrated pest management practices for nonnative weed control as site preparation prior to restoration.

1.1.3: Maintain, monitor and evaluate existing restoration sites to provide high quality fish and wildlife habitat. Evaluate past and present restoration techniques and results to build upon the knowledge available for future restoration efforts.

- Identify habitat needs for the preservation and restoration of riparian habitat for threatened and endangered species, migratory birds, anadromous fish, and resident riparian wildlife and plants.
- Monitor habitat restoration efforts and document fish and wildlife response for future restoration planning.
- Implement adaptive management techniques according to monitoring results and cause and effect relationships.

1.1.4: Continue exploring potential habitat restoration sites and implementing restoration techniques using landscape ecology along the Sacramento River Refuge.

- Implement riparian restoration on Refuge units described in the 2002 Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge (Ryan, Ohm, Haleakala, Pine Creek, Capay - Kaiser, Phelan Island, Deadman's Reach-Koehnen, Hartley Island, and Drumheller Slough-Stone units).
- Conduct feasibility studies with regulatory agencies and community stakeholders to investigate riparian restoration opportunities on the Sacramento River Refuge (La Barranca, Rio Vista, Llano Seco Riparian Sanctuary and PCGID/PID Pumping Plant, and M&T Pumping Plant Facility).
- Apply for restoration funding through Federal, State, and local conservation grant initiatives.
- Continue to work with willing sellers on acquisition of critical floodplain properties within the Sacramento River Refuge approved boundaries.

Objective 1.2: Floodplain and River Processes

Promote recruitment of fish and wildlife habitat by investigating riverbank stabilization, Refuge levees, and floodplain topography for best management options. During this investigation, the Refuge will consider impacts on public safety, agriculture, and water conveyance. This investigation will be conducted on 11 Refuge units (La Barranca, Ohm, Flynn, Rio Vista, McIntosh Landing South, Pine Creek, Capay, Deadman's Reach, Llano Seco Riparian Sanctuary, Sul Norte, and Drumheller Slough) and a written report will be created by 2015.

In the event that a bank stabilization, topographic or re-vegetation restoration project is identified that directly effects the management of the refuge or adjacent landowners, the refuge will work with government agencies and stakeholders to initiate the first steps in addressing these issues. The first step would be to conduct a feasibility study which identifies the problem and those that may be affected; this may involve forming a technical advisory committee of stakeholders and independent experts, development of a range of possible alternatives, preliminary analysis of those alternatives. The final product of the feasibility study will include a report of the findings and recommendations for further analysis under the National Environmental Policy Act (NEPA). Examples of feasibility studies conducted on refuge projects either completed or ongoing include: La Barranca Ecosystem Restoration Flood Reduction Project, Rio Vista Ecosystem Restoration Flood Reduction Project, M&T Pumping Plant Protection Project, and the Llano Seco Riparian Sanctuary Restoration and PCGID/PID Pumping Plant Protection Project.

Once the findings of the feasibility study are complete, the refuge and stakeholders must conduct further analysis under NEPA to refine and analyze the alternatives and potential impacts. Depending on the scope of work and context and intensity of the proposed project, this analysis will either be completed by the refuge staff or private contractors. The NEPA analysis may involve a categorical exclusion, an Environmental Assessment, Finding of No Significant Impact, or an Environmental Impact Statement.

Depending on the outcome of the analysis of the proposed action alternative, funding for and implementation of the project may proceed. A project proposal, developed from the analysis, will be submitted to appropriate funding sources by the refuge, a conservation agency, the lead government agency, or other project proponents. Regardless of who may be the grant applicant, continued coordination with adjacent landowners and other stakeholders will be required.

Rationale: Migratory birds and native anadromous fish, especially Sacramento River Chinook salmon, have adapted to the natural process of erosion and deposition along the middle Sacramento River. The meandering processes along this stretch of the river create conditions that allow natural recruitment and succession of riparian vegetation and habitats to occur. Migratory birds and anadromous fish will respond positively to the resulting habitat features.

Loss of riparian habitat, levee construction, and bank protection have physically altered fish and wildlife habitat. This has resulted in negative affects to spawning and rearing habitats for Chinook salmon, steelhead, and other native fishes (NOAA-NMFS 1997; USFWS 2000). This has also resulted in declines in nesting and feeding habitats for breeding migratory and resident birds (Riparian Habitat Joint Venture 2004; Small et al. 1999, 2000). To address these problems in part, and where appropriate, the Refuge proposes to modify or remove existing privately-constructed levees and restore floodplain topography within Refuge boundaries. This will restore and also provide for long-term maintenance of physical processes and conditions for erosion, over-bank flooding, sediment deposition on the floodplain, and recruitment of LWD. LWD also traps sediments, including spawning gravel and fish carcasses, the primary source for MDN (USFWS 2000). These natural processes will enhance, restore, and maintain floodplain habitats for salmonids, other native fish (NOAA-NMFS 1997; USFWS 2000), and migratory landbirds and waterbirds, including species that breed, migrate and winter along the middle Sacramento River (Riparian Habitat Joint Venture 2004; Small et al. 1999, 2000)

As the Refuge and its partners restore riparian habitat and agricultural operations cease, the need for flood protection of these properties is reduced. Restoring floodplain hydrology (topography) on Refuge lands may also reduce flooding on neighboring agricultural operations. Floodplain hydrology is restored by removing or breaching levees and/or riprap (bank

revetment) that were constructed by the previous owners to protect agriculture. It is also restored through swale construction that recreates natural topography and allows Refuge lands to convey floodwaters and provide off-channel water storage during high water events as the Sacramento River overtops the its banks and spills into the floodplains.

At the same time, bank protection remains an ongoing aspect of the Sacramento River Flood Control Project and water diversion facilities. The Service recognizes the need to protect the integrity of the system of levees, weirs, water diversion facilities and overflow areas that facilitates public safety and agricultural operations.

Habitat protection programs may have minimal influence on the merits or direction of bank stabilization projects. The issues of concern to the Refuge are the retention of existing riparian vegetation, protection of spawning and rearing habitat for anadromous fish, and maintenance of habitat for the threatened valley elderberry longhorn beetle and migratory birds.

Floodplain and River Processes Strategies:

1.2.1: Modify privately constructed levees, restore or enhance topographic features, and other bank stabilization features on Refuge land if supported by feasibility studies, associated hydrologic investigations, and NEPA documentation.

1.2.2: Coordinate with the FWS-Ecological Services, U.S. Army Corps of Engineers, NOAA-Fisheries, State Reclamation Board, CDFG, irrigation districts, and affected groups about Refuge projects on a continual basis.

1.2.3: Work with Federal, State, county, levee and irrigation districts to investigate best management practices for habitat, water diversion, and flood management projects through technical studies and agency coordination.

1.2.4: Continue to protect and manage Refuge lands within the 100-year floodplain. This will facilitate natural geomorphic and hydrologic processes that create and maintain habitat features to which migratory birds and anadromous fish have adapted.

Objective 1.3: Threatened & Endangered Species
Evaluate the response of Federal and State threatened and endangered species to habitat restoration projects. Implement eight surveys by 2005 (least Bell's vireo, valley elderberry longhorn beetle, bald eagle, giant garter snake, bank swallow, western yellow-billed cuckoo, willow flycatcher, and Swainson's hawk) and four additional surveys by 2015 (winter-run Chinook salmon, spring-run Chinook salmon, fall-run and late-fall run Chinook salmon, and Central Valley ESU steelhead).

Rationale: Federally listed threatened and endangered species and candidate species are trust responsibilities under the jurisdiction of the Service. Threatened and endangered species and those proposed for Federal listing, are likely to become extinct due to environmental factors. State threatened and endangered species have been identified as Birds of Conservation Concern by the Service, and are trust responsibilities of the Service under the Migratory Bird Treaty Act. Populations are in decline due, in part, to habitat degradation and destruction. Monitoring is necessary to determine population distribution, abundance, and survival of species and identify habitat use and restoration and management needs.

Threatened & Endangered Species Strategies

1.3.1: Least Bell's vireo
- Cooperate with PRBO or other partners to conduct point-count and demographic surveys for the species.

1.3.2: Valley elderberry longhorn beetle (VELB)
- Conduct VELB monitoring to assess distribution, abundance, and habitat use. Coordinate activities with the Fish and Wildlife Service/Sacramento Field Office.
- Support VELB research by cooperators on the Refuge.

1.3.3: Chinook salmon, Sacramento River winter-run ESU (Anadromous Fisheries and Native Fisheries Objective 1.7).

1.3.4: Chinook salmon, Central Valley spring-run ESU (Objective 1.7).

1.3.5: Steelhead, Central Valley spring-run ESU (Objective 1.7).

1.3.6: Chinook salmon, Central Valley fall-run and late-fall-run ESU (Objective 1.7).

1.3.7: American bald eagle

- Identify locations where eagles are observed during proposed routine main channel surveys (Also strategies 1.4.4 and 1.5.3). Document refuge habitat use.

1.3.8: Giant garter snake (GGS)

- Conduct GGS surveys prior to habitat work, where hibernation areas may be disturbed.

1.3.9: Bank swallow

- Conduct an annual bank swallow survey in coordination with CDFG or other partners to monitor breeding colonies, habitat use on the Refuge, and population trends.
- Monitor Refuge restoration and management activities at bank swallow colonies to reduce disturbance.
- Monitor public use activities at bank swallow colonies and restrict use, if necessary, to reduce disturbance.

1.3.10: Western yellow-billed cuckoo

- Conduct periodic surveys at three-year intervals for western yellow-billed cuckoos at the Refuge to document their distribution, abundance, and habitat use. Coordinate surveys with other Service offices, CDFG, U.S. Geological Survey, and PRBO.

1.3.11: Willow flycatcher

- Cooperate with PRBO or other partners to conduct point-count and demographic surveys for the species.

1.3.12: Swainson's hawk

- Identify locations where Swainson's hawks are observed during proposed routine main channel surveys.
- Document Refuge habitat use for adaptive management purposes.

Objective 1.4: Migratory and Resident Landbirds

Enhance, restore and monitor breeding migratory and resident landbird populations to source population levels (40 percent recruitment) through habitat restoration on 3,255 acres by 2015. Source populations are those where recruitment (annual increase) is high enough to replace the local breeding population with a surplus, which can repopulate other areas. Source populations recruit at levels above 35 percent for most species.

Rationale: Migratory birds are trust species under the jurisdiction of the Service. Sacramento River Refuge was established under the authority of the Endangered Species Act for birds, such as the least Bell's vireo. Executive Order 13186 directs Federal agencies to ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as the Partners in Flight Riparian Bird Conservation Plan (Riparian Habitat Joint Venture 2004). The Refuge provides summer breeding, migration, and wintering habitat for migratory landbirds. Migratory landbird populations are in decline, due in part to habitat degradation and destruction, increased nest depredation and nest parasitism. Landbird monitoring is necessary to determine population status, assess population trends, determine causes for poor productivity, identify solutions, determine habitat restoration needs, and assess restoration success.

Yellow Warbler
Photo by Steve Emmons

Breeding Migratory and Resident Landbird Strategies

1.4.1: Implement restoration of mid- and high-elevation riparian vegetation and habitats. Use principles outlined in the California Partners in Flight/Riparian Habitat Joint Venture Riparian Bird Conservation Plan (2004), including habitat features that cover all of the 14 riparian bird focal species (Figure 4).

1.4.2: Coordinate with FWS Office of Migratory Bird Management, California Partners in Flight, the Riparian Habitat Joint Venture, PRBO, and other partners to periodically monitor the productivity of riparian focal species on restored and native riparian acres to evaluate and adapt restoration design and management to enhance conditions of focal species as needed.

1.4.3: Annually evaluate species diversity and abundance of breeding birds on acreage under active and planned restoration and adapt restoration design and management to enhance conditions of focal species as needed

1.4.4: Conduct Sacramento River main channel, fixed-route surveys for nesting osprey and other visible nesting species (e.g., kingfisher burrows). These cooperative Refuge surveys are conducted seasonally, four times a year, from Red Bluff to Colusa, and record all wildlife observed from the survey vessel (Also strategies 1.3.7 and 1.6.1).

Objective 1.5: Winter Migratory Landbirds
Implement monitoring surveys for wintering migratory landbird populations on up to 8,000 acres of riparian habitat on the Refuge by 2010.

Rationale: Migratory birds are Federal trust species under the jurisdiction of the Service. Migratory landbird populations are in decline, due in part to habitat degradation and destruction, increased nest depredation and nest parasitism. Landbird monitoring is necessary to determine population status, assess population trends, determine causes for poor productivity, identify solutions, determine habitat restoration needs, and assess restoration success. Sacramento River Refuge provides winter habitat for migratory landbirds.

Winter Migratory Landbirds Strategies
1.5.1: Coordinate with PRBO and other partners to conduct and evaluate winter landbird surveys.

1.5.2: Annually evaluate the use of various habitat types by wintering birds and adapt the restoration design and management to enhance use.

1.5.3: Conduct Sacramento River main channel, fixed-route surveys for wintering birds. These cooperative Refuge surveys are conducted seasonally, four times a year, from Red Bluff to Colusa, and record all wildlife observed from the survey vessel (Also strategies 1.3.7 and 1.6.1).

Objective 1.6: Waterfowl and other Waterbirds
Implement monitoring surveys for wintering and breeding waterfowl and shorebird populations and colonial nesting waterbirds on all main channel and floodplain wetland habitat on the Refuge. Survey, locate and map three egret, heron, and cormorant rookeries by 2008 and conduct five surveys by 2010.

Rationale: Migratory birds are Federal trust species under the jurisdiction of the Service. Many species of migratory and resident birds depend on wetlands for breeding and winter habitat. Freshwater wetlands have declined by 95 percent in the Central Valley. The North American Waterfowl Management Plan and the Central Valley Habitat Joint Venture Implementation Plan address population and habitat objectives for healthy waterfowl and shorebird populations. Sacramento River Refuge provides breeding and wintering habitat for waterfowl and other waterbirds. Population monitoring is necessary to determine population status, assess trends, and identify habitat use and restoration and management needs.

American wigeon
Photo by Steve Emmons

Waterfowl and other Waterbirds Strategies:

1.6.1: Conduct Sacramento River main channel, fixed-route surveys for waterfowl and other waterbirds. These cooperative Refuge surveys with TNC, CDFG, PRBO, and River Partners are conducted seasonally, four times a year, from Red Bluff to Colusa, and record all wildlife observed from the survey vessel (Also strategies 1.4.4 and 1.5.3).

1.6.2: Coordinate with FWS Office of Migratory Bird Management to conduct and report Sacramento River waterfowl populations during the midwinter waterfowl survey.

1.6.3: Conduct and evaluate the results of the annual colonial waterbird surveys to estimate breeding colony sizes and productivity.

1.6.4: Survey, locate, map and protect egret, heron and cormorant rookeries.

Objective 1.7: Anadromous Fisheries and Native Fisheries

Provide high quality habitat for native anadromous fish by enhancing and restoring 33.5 miles of shaded riverine aquatic (SRA) habitat for temperature control and future sources of large woody debris (LWD) by 2015. Where appropriate, enhance or restore floodplain topography and connectivity with the river at 11 units (La Barranca, Ohm, Flynn, Rio Vista, McIntosh Landing South, Pine Creek, Capay, Deadman's Reach, Llano Seco Riparian Sanctuary, Sul Norte, and Drumheller Slough) of the Refuge by 2015.

Rationale: The Service and the Refuge System each identify anadromous fish conservation in their mission statements. The Sacramento River is the only river in western North America which supports four distinct salmon runs making Chinook salmon and Central Valley steelhead important ecological, recreational, and commercial fisheries. Components of high quality habitat include mature riparian forests, SRA, LWD, floodplain connectivity (NOAA-NMFS) 1997; USFWS 2000) and restored or enhanced sloughs and oxbow wetlands. SRA habitat moderates water temperatures for immature salmonids and creates habitat for terrestrial and aquatic insects, which are a food source for salmonids and other native fishes (NOAA-NMFS 1997). LWD provides food substrate and escape cover for immature salmonids (USFWS 2000). It also traps spawning gravel, creating redd (nest) habitat for fall-run Chinook salmon

that spawn in the middle Sacramento River (USFWS 2000). LWD also creates plunge pool topography on the downstream side, which provides important microhabitat features that regulate temperatures, prey distribution, and cover. LWD traps anadromous fish carcasses, the source of marine-derived nitrogen (MDN) (USFWS 2000). MDN is important for maintaining the productivity of river systems, which continually drain nutrients downstream. An intact floodplain is important to immature salmonids and other native fishes that escape from large predatory fish in shallow waters. When inundated, the relatively warmer waters of the floodplain become very productive and produce an abundance of prey.

Anadromous Fisheries and Native Fisheries Strategies:

1.7.1: Implement restoration of mid- and high-elevation riparian forest to create 14,500 linear feet of SRA by 2015.

1.7.2: Restore mid- and high- elevation riparian forest to create a source of LWD.

1.7.3: Conduct feasibility studies, associated hydrologic investigations, and NEPA documentation to remove privately constructed levees on Refuge land. This, along with topographic restoration, will ensure floodplain connectivity with the main channel. Enhance 3,084 acres of floodplain connectivity at La Barranca by 2015. Enhance floodplain topography on additional 889 acres by 2015.

1.7.4: Ensure recruitment of spawning gravel necessary for creating redd habitat for fall-run Chinook salmon by conducting feasibility studies, associated hydrologic investigations, and NEPA documentation to remove privately-constructed levees or other bank stabilization features on Refuge land.

1.7.5: Enhance and restore slough and oxbow wetlands for Sacramento splittail and other native fishes that require a warmer temperature and slow moving water. Enhancement and restoration may include the removal of non-native fishes.

1.7.6: Coordinate research investigations and monitoring at the Refuge which focuses on population demographics, habitat use and requirements, and health of anadromous and other native fishes. Coordinate with CDFG fishery

investigations (Lower Stony Creek Fish Monitoring; Redd Surveys), USFWS–Red Bluff Fish and Wildlife Office population surveys (escape/passage at Red Bluff Diversion Dam), USFWS–California/Nevada Fish Health Center disease investigations and monitoring, NOAA–Fisheries investigations and universities conducting salmonid research (University of California, Davis; California State University, Chico) and research regarding other anadromous and native fish species.

Objective 1.8: Native Plant Species

On up to 9,000 acres of the Refuge, locate and map six populations of rare and important native plants by 2005 and 24 populations by 2010; maintain and enhance native plant populations through restoration and conservation of 3,225 acres; and restore two native wildflower patches by 2005 and up to 100 patches by 2010.

Rationale: Both the Fish and Wildlife Service and the Refuge System identify native plant conservation in their mission statements. Plants are important elements that add diversity and stability to the ecosystem. Plants have individual floristic attributes (e.g., host plants for insects and pollinators), as well as vegetation attributes (e.g., plant communities and habitat structure) that are necessary for ecosystem function and wildlife habitat.

Native Plant Species Strategies:

1.8.1: Use plant materials (i.e., cuttings, acorns, seeds) for restoration projects derived from local ecotypes of indigenous plant species and populations.

1.8.2: Identify, locate, map, and conserve (protect and manage) important native plant areas, including trees, shrubs, forbs, and grasses (e.g., native vegetation reference sites, La Barranca tarweed/buckwheat association and valley oak/elderberry savanna; Ohm sandbar vegetation; Pine Creek wildflower seed source site, Llano Seco valley oaks, native grass reference site, Eddy Lake oxbow vegetation, wildflower seed source sites; Sul Norte native herbaceous understory vegetation).

1.8.3: Annually evaluate plant species and associated vegetation for habitat management and research needs (i.e., grazing, burning, herbicides, and other mechanical methods).

1.8.4: Update and maintain the Refuge herbarium (plant specimen) collection.

1.8.5: Restore 100 additional patches of native wildflowers on the Refuge by 2010.

1.8.6: Support botanical research of taxonomic and physiological investigations on the Refuge by university cooperators.

Objective 1.9: Exotic, Invasive Species Control
Locate and map exotic invasive species on five units of the Refuge (Pine Creek, Phelan Island, Capay, La Barranca, and Drumheller Slough) by 2010. Implement control programs (treatment and monitoring) for exotic invasive species on 7 units of the Refuge (Pine Creek, Phelan Island, Capay, La Barranca, Drumheller Slough, Flynn, and Rio Vista) by 2010.

Rationale: Invasive non-indigenous (exotic) species have become the single greatest threat to the Refuge System and the Service's wildlife conservation mission. More than 8 million acres within the Refuge System are infested with invasive weeds (Audubon 2002). Invasive species cause widespread habitat degradation, compete with native species, and contribute significantly to the decline of trust species (USFWS 2002c). The National Strategy for Management of Invasive Species (USFWS 2002c) has been developed within the context of the National Invasive Species Management Plan as called for by Presidential Executive Order 13112, and functions as the internal guidance document for invasive species management throughout the Refuge System. This Plan has four goals: 1) Increase the awareness of the invasive species issue, both internally and externally, 2) Reduce the impacts of invasive species to allow the Refuge System to more effectively meet its fish and wildlife conservation mission and purpose, 3) Reduce invasive species impacts on the Refuge System's neighbors and communities, and 4) Promote and support the development and use of safe and effective integrated management techniques to deal with invasive species.

The Great Central Valley is occupied by a diversity and abundance of exotic, invasive species that are harmful because they crowd out or replace native species that are important to wildlife natural diversity and ecosystem function. These species often dominate old agricultural fields and restoration sites. In addition, some late successional stages of native vegetation are dominated by these undesirable species. For these reasons,

vegetation must be managed to control exotic, invasive species so that species composition favors a diversity and abundance of native, indigenous plants.

Exotic, Invasive Species Control Strategies:

1.9.1: Manage vegetation and habitat for desired species composition and population levels of native species. Annually evaluate invasive exotic species to be controlled (Table 7). Locate, map, and monitor exotic species that may trigger a management response (i.e., grazing, burning, herbicides, and other mechanical control methods).

1.9.2: Conduct and support research to evaluate techniques for controlling target invasive plant species including prescribed fire, grazing, herbicide treatment, mowing, disking, and weed mat tarping.

Objective 1.10: Wildlife and Cultural Sanctuary

Provide 2,043 acres (20 percent) of long-term sanctuary for general wildlife use and nesting, sensitive breeding colonies, plant populations, and cultural resource sites by 2005.

Rationale: Sanctuaries are areas on the Refuge that are closed to public use. They provide places where human-caused disturbances are reduced, thereby reducing the interruption of wildlife activities, such as foraging, breeding, resting, feeding nestlings, and other maintenance activities. This may be especially important during high refuge visitor use periods. Sanctuaries also are important to wildlife avoiding predation by other wild animals because they can devote less energy to avoiding humans and more to avoiding predators. Sanctuaries may become important nesting and fawning areas, as well as important areas for feeding and roosting.

Long-term sanctuaries are areas where wildlife concentrate and reproduce, resulting in increased populations that can lead to more wildlife-dependent public use in areas near the sanctuary. As a result, sanctuaries on public land play a key role in providing increased wildlife-dependent public use opportunities on adjacent public lands. In some cases, short-term sanctuaries may be established to protect a sensitive nesting colony or site. These seasonal sanctuaries may impose public access restrictions at some, but not necessarily all nesting colonies, such as heron/egret rookeries and bank swallow colonies, and at nesting sites for species with a low

tolerance for human disturbance, such as the American bald eagle, Swainson's hawk, and osprey.

Sanctuaries also protect sensitive cultural resources. Areas of significant occupation by Native Americans and areas containing significant cultural resources warrant long-term permanent protection. Cultural resource sanctuaries strictly limit the amount of human contact and potential for accidental and intentional vandalism, and show respect for past Native American cultures and customs.

A few of the sanctuaries were designated as areas of no public use based on management issues. These units are typically small in size, surrounded by private property, have poor access and may pose a safety concern. A list of some of the factors considered when determining the level of public use to be allowed on each refuge unit can be found in Appendix L.

Wildlife Sanctuary Strategies:

1.10.1: Provide long-term sanctuaries on about 20 percent of the Refuge to provide areas for wildlife to feed and rest with relatively little human disturbance.

1.10.2: Provide areas of short-term sanctuary to reduce human disturbance at sensitive fish, wildlife, vegetation, and plant sites during the breeding, rearing, and growing seasons.

1.10.3: Provide areas of long-term sanctuary that are closed to public use to provide permanent protection of sensitive cultural resources. These areas will be of sufficient size to provide a buffer to surrounding public uses.

Goal 2: Visitor Services

Encourage visitors of all ages and abilities to enjoy wildlife-dependent recreational and educational opportunities and experience, appreciate, and understand the Refuge history, riparian ecosystem, fish, and wildlife.

Percentages described in the following objectives and strategies represent current refuge acres and do not necessarily reflect the long-term outcome for visitor use on the Refuge. The process for determining visitor use on refuge units is outlined in Appendix L.

Objective 2.1: Hunting
Provide high quality opportunities for 1,500 annual hunting visits on 3,356 acres by 2005 and an additional 1,967 acres within two to 10 years, to total 5,323 acres (52 percent) (Table 9, Figure 29, Appendix L).

Rationale: Hunting is identified in the Improvement Act as a priority public use for refuges when it is compatible with other refuge purposes. As a result, the Refuge proposes dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey, and deer hunting, all of which are currently hunted on public land along the Sacramento River (Table 10). The hunting program will be conducted in a safe and cost-effective manner and will be carried out consistent with State regulations. The Hunting Plan (Appendix C) was developed to provide safe hunting opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses. Some visitor uses occur at different times of the year, therefore minimizing potential conflicts with hunters and other user groups (Figure 25). The Refuge hunting program will comply with the Code of Federal Regulations Title 50, 32.1 and be managed in accordance with Refuge Manual 8 RM 5, Hunting.

Northern Pintails
Photo by Steve Emmons

Hunting Strategies:

2.1.1: Implement the Sacramento River Refuge Hunting Plan by 2005.

2.1.2: Identify Refuge units open to hunting, target species, and Refuge-specific regulations through news releases, the Sacramento River Refuge general brochure, Sacramento Refuge Complex web site, and other publications by 2005.

2.1.3: Add the appropriate Sacramento River units to the information section of the CDFG regulations: Other Public Uses on State & Federal Areas for the 2005 hunting season.

2.1.4: Open Refuge hunt units to "scouting," including pre-season scouting.

2.1.5: Assess the need for turkey and deer hunting by permit only.

2.1.6: Continue to coordinate the Llano Seco Junior Pheasant Hunt with the Llano Seco Ranch, California Waterfowl Association, and CDFG.

2.1.7: Complete the Sacramento River Refuge general brochure by 2005. The brochure will include descriptions of Refuge units open to hunting, Refuge-specific hunting regulations, parking areas, and vehicle/boat/foot access.

2.1.8: Post laminated Boating Trail Guide by the California Department of Boating & Waterways at existing kiosks at public boat ramps, and give copies of the Boating Trail Guide to local sporting good stores, partners, and public agencies by 2005.

2.1.9: Develop hunting map flyer and disseminate in the Refuge Complex visitor center and on the website by 2005.

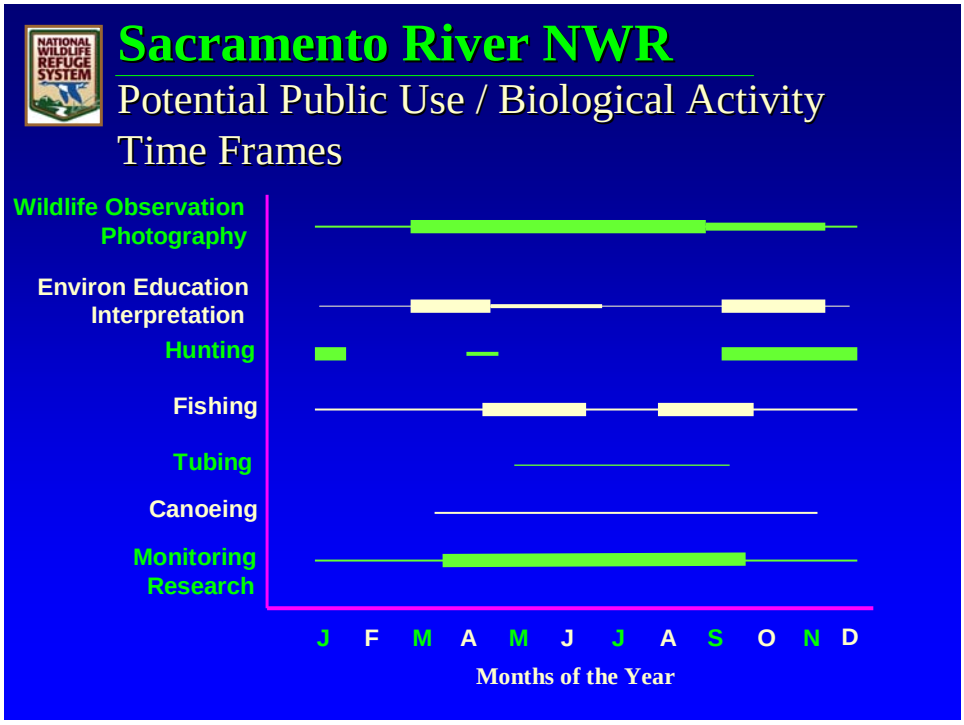
2.1.10: Construct and set information kiosks, entrance and public use signs and auto counters at vehicle access points on Capay, Sul Norte, and Drumheller Slough as units open to the public and funding becomes available.

Table 10.California Hunting Seasons 2003-2004

Species	Dates
Dove	September 1-15 and from second Saturday in November for 45 days
Waterfowl[1] – Ducks	Third Saturday in October for 33 days and from third Friday in November for 66 days
Waterfowl[1] – Geese	First Saturday in November extending 86 days
American Coot and Common Moorhen	Concurrent with duck season (and during split, if it occurs)
Pheasants	Second Saturday in November extending for 44 days
Quail – General	Third Saturday in October extending through the last Sunday in January
Quail – Archery	Third Saturday in August extending through the last Sunday in September
Snipe	Third Saturday in October extending for 107 days
Turkey – Fall	Second Saturday in November extending for 16 consecutive days
Turkey – Spring	Last Saturday in March, extending for 37 consecutive days
Deer – Archery (Zone C4, all units except Drumheller Unit)	Last Saturday in August extending for 16 consecutive days
Deer – General (Zone C4, all units except Drumheller Unit)	Third Saturday in September extending for 16 consecutive days
Deer – Archery (Zone D3, Drumheller Unit)	Third Saturday in August extending for 23 consecutive days
Deer –General (Zone D3, Drumheller Unit)	Fourth Saturday in September extending for 37 consecutive days
Deer –G1 Late Season (Zone C4, all units except Drumheller Unit)	Fourth Saturday in October extending for 9 consecutive days

[1]See current State regulations for special closures.

Figure 25. Potential Public Use / Biological Activity Time Frames



2.1.11: Provide a parking area, gate, and portable toilet on the Capay, Sul Norte, and Drumheller units, as units open to the public and funding becomes available.

2.1.12: Construct an accessible one-mile walking trail on Sul Norte as funding becomes available.

2.1.13: Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27).

2.1.14: Monitor hunting visits by personal contact by law enforcement officers, comment drop box (Capay, Sul Norte and Drumheller Slough units), Refuge web site e-mail, and vehicle counters at units with parking areas by 2005.

2.1.15: Complete random, weekly hunter field-checks to assess type and number of species harvested and compliance with all regulations.

2.1.16: Use the Sacramento Refuge Complex Refuge Hunting Program Working Group and the Disabled Access Working Group to develop and improve the Refuge hunting program.

2.1.17: Collect and annually report hunting visit data for the Refuge Management and Information System (RMIS), Public Education and Recreation section.

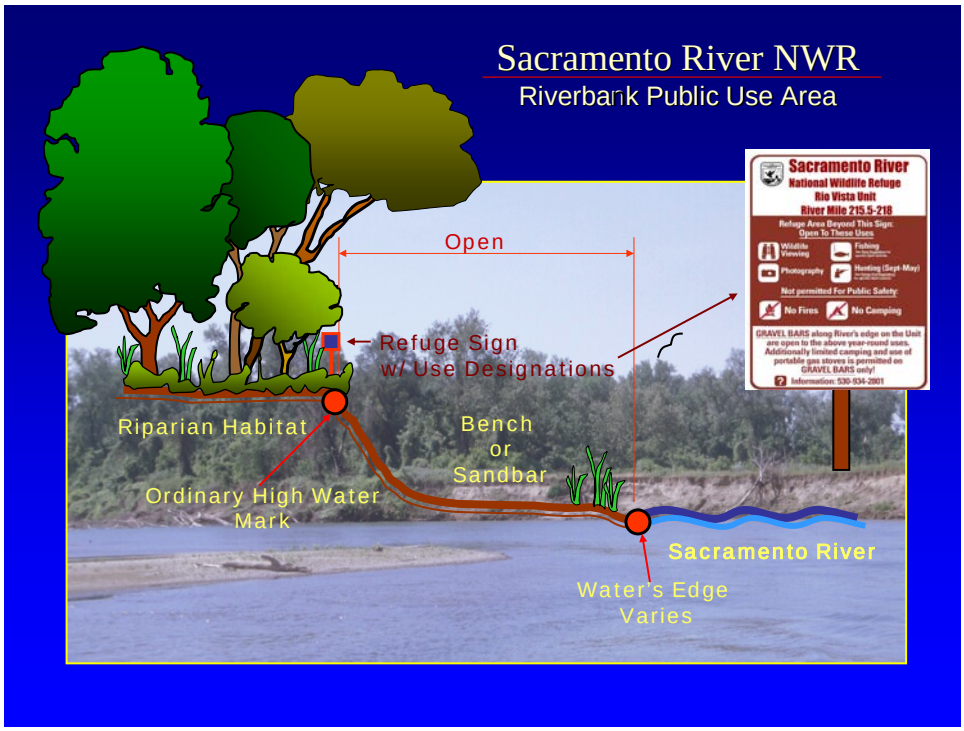
2.1.18: Use the CDFG deer tag data to complete the hunting sections of the RMIS annual report.

2.1.19: Work cooperatively with CDFG wardens to enforce State Fish and Game hunting laws and Refuge-specific regulations to provide a quality experience for all visitors.

Junior Pheasant Hunt
Photo by Joe Silveira

Figure 26. Sacramento River Refuge Public Use Sign.

Figure 27. Public Use Sign Placement.



Objective 2.2: Fishing

Open gravel bars, sloughs, oxbow lakes, and the inundated floodplain on all Refuge units to fishing. Provide 23 river-front miles for 1,000 annual fishing visits. By 2005, open all seasonally submerged areas below the ordinary high water mark to the public for fishing (Table 9, Appendix L).

Rationale: Fishing is identified in the Improvement Act as a priority use for refuges when compatible with other refuge purposes. The fishing program will be conducted in a safe and cost-effective manner and, to the extent that it is feasible, carried out in accordance with State regulations. The Fishing Plan (Appendix D) was developed to provide safe fishing opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses. The fishing program will comply with 50 CFR 32.4 and will be managed in accordance with Refuge Manual 8 RM 6, Sport Fishing.

Fishing opportunities in sloughs, oxbow lakes and on the inundated floodplain of Refuge lands will be limited since these habitat features are also limited. Fishing on Refuge land or from the bank is limited by the river's dynamic meander pattern, resulting in banks with steep slopes. Bank-fishing opportunities will occur where there is reasonable access and when it is safe for anglers. New boat ramps are not proposed due to problematic siltation, channel meander change, and high year-round maintenance costs. Seasonal flooding on most Refuge lands makes ADA accessible fishing access trails cost-prohibitive. ADA fishing access will be available in other areas on the river.

Fishing on the Sacramento River
Photo by Joe Silveira

Fishing Strategies:

2.2.1: Implement the Sacramento River Refuge Fishing Plan by 2005.

2.2.2: Identify Refuge units open to fishing in sloughs, oxbow lakes, and from gravel bars, and the Refuge-specific regulations, through news releases, the Sacramento River Refuge general brochure, Sacramento Refuge Complex web site, and publications by 2005.

2.2.3: Use the Red Bluff Diversion Dam fish-viewing plaza to provide visitors with information about the Sacramento River fishery and salmon migration.

2.2.4: Complete the Sacramento River Refuge general brochure by 2005. The brochure will include descriptions of Refuge units open to fishing, Refuge-specific fishing regulations, parking areas, and vehicle/boat/foot access.

2.2.5: Post laminated Boating Trail Guide by the California Department of Boating & Waterways at existing kiosks at public boat ramps, and give copies of the Boating Trail Guide to local sporting good stores, partners, and public agencies by 2005.

2.2.6: Construct and set information kiosks at Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, and Packer by 2005.

2.2.7: Maintain a one-mile bank fishing access trail on the Capay Unit and the boat launch area at Packer Unit.

2.2.8: Work with local resource agencies to provide fishing access and facilities for anglers with disabilities on adjacent compatible areas.

2.2.9: Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27).

2.2.10: Continue to request that anglers report catch and release of the threatened Sacramento splittail in Packer Lake by maintaining current regulations and posting.

2.2.11: Work cooperatively with CDFG to obtain creel census data on the river and enforce compliance with the State fishing regulations.

2.2.12: Collect and annually report fishing visits for the RMIS, Public Education and Recreation section.

2.2.13: Work cooperatively with CDFG Wardens to enforce State Fish and Game fishing laws and Refuge-specific regulation compliance and to provide a quality experience for all visitors.

Objective 2.3: Wildlife Observation and Photography
Provide quality opportunities for 1,000 wildlife viewing and photographic annual visits on 5,096 acres by 2005 and an additional 3,165 acres by 2015 to total 8,261 acres (80 percent).

Rationale: Wildlife viewing and photography are identified in the Improvement Act as a priority uses for refuges when they are compatible with other refuge purposes. As a result, the Refuge encourages first-hand opportunities to observe and photograph wildlife in their habitats. These activities will be managed to ensure that people have opportunities to observe wildlife in ways that do not disrupt wildlife or damage refuge habitats. Wildlife viewing and photography will be managed to foster a connection between visitors and natural resources.

Wildlife Observation on the Sacramento River
Photo by Joe Silveira

Wildlife Observation and Photography Strategies:

2.3.1: Use the Red Bluff Diversion Dam salmon-viewing plaza to provide visitors with information about the Sacramento River fishery and close up viewing and photographic opportunities of salmon during August-October.

2.3.2: Post laminated Boating Trail Guide by the California Department of Boating & Waterways at existing kiosks at public boat ramps, and give copies of the Boating Trail Guide to local sporting good stores, partners, and public agencies by 2005.

2.3.3: As units open to the public, develop and maintain a one-two mile walking trail on Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora and Packer units to provide wildlife viewing and photographic opportunities and to promote awareness about the value of riparian habitat, management efforts, and plant/wildlife identification tips.

2.3.4: Construct a wildlife viewing/photography blind on the Codora Unit, when it opens to the public.

2.3.5: Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27).

2.3.6: Collect and annually report wildlife observation and photography visits for the RMIS, Public Education and Recreation section.

2.3.7: Provide an entrance sign, parking area, information kiosk, public use signs, gate, auto counter, and portable toilet on the Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora, Packer, and Drumheller units, as units open to the public and funding becomes available.

Objective 2.4: Environmental Education

Develop an environmental education program by 2005 to service about 1,000 students annually. Develop an environmental education program that promotes in-depth study of the ecological principles that are associated with the Sacramento River watershed, riparian ecosystem, and the Refuge's natural, cultural, and historical resources. The education activities will be designed to develop awareness and understanding for Refuge resources and management activities.

Rationale: Environmental education is identified in the Improvement Act as a priority use for refuges when it is compatible with other refuge purposes. As a result, the Refuge encourages environmental education as a process of building knowledge in students. The Refuge staff will work with schools (K-12) to integrate environmental concepts and concerns into structured educational activities. These Refuge-lead or educator-conducted activities are intended to actively involve students or others in first-hand activities that promote discovery and fact-finding, develop problem-solving skills, and lead to personal involvement and action. Refuge staff will promote environmental education that: is aligned to the current Federal, State and local standards; is curriculum based that meets the goals of school districts adopted instructional standards; and provides interdisciplinary opportunities that link the natural world with all subject areas. The environmental education program will be managed in accordance of Refuge Manual 8 RM 3, Outdoor Classroom and Educational Assistance.

Environmental Education
Photo by Joe Silveira

Environmental Education Strategies:

2.4.1: Use the Sacramento Refuge Complex visitor center and its Discovery Room to provide presentations and exhibits about the Sacramento River Refuge purposes and management.

2.4.2: Develop a Discovery Pack with environmental education activities and on-site information for use by scheduled groups on walking trails.

2.4.3: Use California Waterfowl Association's wetland kits and the Songbird Blues and Bird of Two Worlds trunks to further educate students about wetlands and Neotropical migrants.

2.4.4: Continue to work cooperatively with PRBO and TNC to provide tours to school groups and develop an awareness of the purpose of the Refuge.

2.4.5: Continue assisting Chico Junior High School in implementing their Wetlands Unit, an in-depth study of wetlands and riparian habitats.

2.4.6: Develop educational materials that interpret the Sacramento River fishery and utilize Coleman National Fish Hatchery and the Northern Sacramento Valley Fisheries Office expertise.

2.4.7: Conduct or host at least 50 school groups each year utilizing the Rio Vista, Pine Creek, Phelan Island, Ord Bend, and Packer units.

2.4.8: Facilitate one annual resource-training workshop to provide educators and tour guides consistent and current information about the Refuge and management.

2.4.9: Coordinate one meeting each year with local groups that are involved with leading school groups. The goals of the meeting would be to update agencies on new issues and confirm education guidelines.

2.4.10: Continue to require all groups to complete the Environmental Education Program Reservation or the Event Notification Forms to schedule and record visitor use.

2.4.11: Continue to collect and report environmental education use data for the RMIS, Public Education and Recreation section annually.

Objective 2.5: Interpretation

Refuge staff will develop an interpretive program to service about 1,000 annual visits. The program will promote public awareness and support of the Refuge resources and management activities by 2005.

Rationale: Interpretation is identified in the Improvement Act as a priority use for refuges when it is compatible with other refuge purposes. As a result, the Refuge encourages interpretation as both an educational and recreational opportunity that is aimed at revealing relationships, examining systems, and exploring how the natural world and human activities are interconnected. Participants of all ages can voluntarily engage in stimulating and enjoyable activities as they learn about the refuge issues confronting fish and wildlife resource management. First-hand experiences with the environment will be emphasized, although presentations, audiovisual media, and exhibits will be necessary components of the Refuge interpretive program. The interpretive program will be managed in accordance of Refuge Manual 8RM 4, Interpretation.

Riparian Discovery Walk
Photo by Joe Silveira

Interpretation Strategies:

2.5.1: Use the Sacramento Refuge Complex visitor center to provide presentations and exhibits about the Refuge purposes and management.

2.5.2: Use the Woodson Bridge State Recreation Area's amphitheater and evening campfire program, during the summer, to promote the Refuge's goals and purposes (i.e., wildlife viewing opportunities, restoration, fisheries, etc.).

2.5.3: Promote awareness about the value of riparian habitat, management efforts, and plant/wildlife identification by utilizing the walking trails for public tours.

2.5.4: Develop a conceptual plan for a reservation-only group campsite at Deadman's Reach Unit, when the unit is opened to the public.

2.5.5: Conduct or host at least 50 tour groups each year utilizing the Rio Vista, Pine Creek, Phelan, Ord Bend, and Packer units.

2.5.6: Continue to collect and annually report public use data for the RMIS, Public Education and Recreation section.

Objective 2.6: Public Outreach

Develop an outreach program to attract about 5,500 total annual visits. The program will promote public awareness and understanding of the Refuge resources and management activities by 2005.

Rationale: The Refuge will develop an effective outreach program that will provide two-way communication between the Refuge and the public to establish a mutual understanding and promote involvement with the goal of improving joint stewardship of our natural resources. The outreach program will be designed to identify and understand the issues and target audiences, craft messages, select the most effective delivery techniques, and evaluate effectiveness. It will include education, interpretation, news media, information products and relations with nearby communities and local, State, Federal agencies. The refuge outreach program will follow the guidance of the National Outreach Strategy: A Master Plan for Communicating in the U.S. Fish and Wildlife Service, and

America's National Wildlife Refuge System: 100 on 100 Outreach Campaign.

Public Outreach Strategies:

2.6.1: Maintain the Sacramento Refuge Complex web site to promote current recreational and educational opportunities.

2.6.2: Continue to participate or provide information to local events, such as International Migratory Bird Day, Snow Goose Festival, Endangered Species Fair, and State of the Sacramento River Conference.

2.6.3: Provide a web site link to a composite Sacramento River map of multi-agency public uses and access when completed by California State University/Chico.

2.6.4: Host one annual workday/barbecue to clean up the river properties, promote awareness of Refuge management, and network with community members.

2.6.5: Provide interpretive boat tours of the Refuge for partners or scheduled groups annually.

2.6.6: Continue to collect and report public use data for the RMIS, Public Education and Recreation section.

2.6.7: Participate in fire prevention education efforts to reduce fire incidence and fire damage. Provide outreach about the role of fire and management uses of fire.

2.6.8: Write news releases for local and state newspapers and articles for magazines, when appropriate. Conduct television and radio interviews upon request.

Objective 2.7: Volunteers

Develop a volunteer program that consists of up to 12 volunteers that support and help implement the Refuges special events, restoration, and maintenance programs by 2005.

Rationale: The National Wildlife Refuge System Volunteer and Partnership Enhancement Act of 1998 (P.L. 105-242) strengthens the Refuge System's role in developing relationships with volunteers. Volunteers possess knowledge, skills, and abilities that can enhance the scope of refuge operations. Volunteers enrich Refuge staff with their gift of

time, skills, and energy. Refuge staff will initiate, support, and nurture relationships with volunteers so that they may continue to be an integral part of Refuge programs and management. The volunteer program will be managed in accordance with the Fish and Wildlife Service Manual, Part 150, Chapters 1-3, "Volunteer Services Program", and Part 240 Chapter 9 "Occupational Safety and Health, Volunteer and Youth Program".

Currently the Sacramento Refuge Complex volunteer program consists of 20 individuals that assist with biological, environmental education, interpretive, wildlife observation, hunting, and maintenance events and activities. Additional individuals are signed up for one-time events such as Brush Up Day of the hunting areas and trail maintenance by Audubon Society. The Refuge supports and participates in annual Eagle Scout projects.

Volunteer Strategies:

2.7.1: Use the Sacramento Refuge Complex volunteer coordinator to increase efforts of recruitment and training of volunteers.

2.7.2: Promote the Refuge through the Sacramento Refuge Complex bookstore, Altacal Audubon, Sacramento River Preservation Trust, and other informal partners.

2.7.3: Recruit volunteers through the Student Conservation Association, California Waterfowl Association Visitor Service Assistants, California State University Chico internship program, and other universities.

2.7.4: Recruit a variety of community groups and individuals (i.e. CSU/Chico, Butte College, Boy Scouts, Girl Scouts, Audubon, etc.) with diverse expertise and experiences to complete a variety of Refuge projects.

2.7.5: Host an annual volunteer recognition dinner for volunteers, local community leaders, and Refuge staff.

2.7.6: Facilitate volunteer training workshops to develop skills in: field equipment use (i.e. tractors and mowers); computer data entry software programs; teaching methods to assist with environmental education program; and other skills to facilitate Refuge-specific programs.

2.7.7: Continue to collect and annually report volunteer hours and projects for the Service's regional volunteer program report.

Goal 3: Partnerships

Promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive riparian ecosystem in which the Sacramento River Refuge plays a key role.

Objective 3.1: Partnerships
Create opportunities for 25 new and maintain existing partnerships among Federal, State, local agencies, organizations, schools, corporations, and private landowners to promote the understanding and conservation of the Sacramento River Refuge resources, activities, and management by 2015.

Rationale: The Refuge System recognizes that strong citizen support benefits the System. These benefits include the involvement and insight of citizen groups in Refuge resource and management issues and decisions, a process that helps managers gain an understanding of public concerns. Partners support Refuge activities and programs, raise funds for projects, are advocates on behalf of wildlife and the Refuge System, and provide support on important wildlife and natural resource issues. In "Fulfilling the Promise" the Service identified the need to forge new and non-traditional alliances and strengthen existing partnerships with States, Tribes, non-profit organizations and academia to broaden citizen and community understanding and support for the National Wildlife Refuge System.

A variety of people including, but not limited to, scientists, birders, anglers, hunters, farmers, outdoor enthusiasts and students have a great deal of interest in Sacramento River Refuge's management, fish and wildlife species, and habitats. The number of visitors to the Refuge and the partnerships that have already been developed (CCP, Chapter 1) are evidence of this growing interest. New partnerships will be formed with organizations, local civic groups, community schools, Federal and State governments, and other civic organizations, as funding and staff are available.

Partnership Strategies:

3.1.1: Maintain the Memorandum of Understanding (MOU) with CDFG and California Department of Parks and Recreation to mutually manage, monitor, restore and enhance lands for fish, wildlife, and plants along the Sacramento River.

3.1.2: Continue to work with TNC and River Partners through the use of the Cooperative Land Management Agreements.

3.1.3: Continue to coordinate Refuge activities with the Sacramento River Conservation Area Forum.

3.1.4: Work closely with California Department of Water Resources and State Reclamation Board staff on floodplain management issues. Provide each agency with copies of annual habitat management plans.

3.1.5: Maintain good relations and open communication with partners.

3.1.6: Actively look for partnering opportunities with local and regional hunting and fishing groups (e.g., California Waterfowl Association, United Sportsmen for Habitat and Access, Chico Fly Fishers).

3.1.7: Pursue opportunities to cost-share projects with other organizations.

3.1.8: Identify and promote new partnerships to support restoration, enhancement, and management of riparian habitat and its flora and fauna.

3.1.9: Expand opportunities with local Chambers of Commerce to participate in local events and improve dissemination of public recreation literature about the Refuge.

3.1.10: Stay actively involved in other neighboring Federal, State, and local planning processes to protect Refuge resources and foster cooperative management of those resources in the Sacramento River watershed.

3.3.11: Continue coordination with the American Bird Conservancy (ABC) to publicize the Refuge's designation as a Globally Important Bird Area.

3.3.12: Maintain agreements with CDF and local fire departments about fire suppression, and coordinate with them in prevention and hazard reduction work.

3.3.13: Host a Refuge open house or tour each year that will promote the Service and Refuge.

Objective 3.2: Cooperation with Adjacent Landowners:
By 2015, create opportunities for new and maintain existing partnerships with private landowners to promote cooperation and address mutual concerns.

Rationale: It is important to communicate with our neighbors to help identify any issues at an early stage and attempt to resolve any conflicts that may exist. The Refuge will continue to participate in the Sacramento River Conservation Area Forum (SRCAF). The SRCAF is a multi-organization effort to restore the ecosystem along the river. In order to ensure that the actions of the various agencies are compatible and consistent and to maximize the effectiveness of individual actions, there is a need for ongoing management coordination. This coordination includes both public agencies and private landowners and interests.

Private Landowner Cooperation Strategies:
3.2.1: Maintain contact with adjacent neighbors to discuss mutual concerns and opportunities.

3.2.2: Implement improvements and operational revisions to resolve issues with adjacent landowners that are compatible with the mission of the Service and purpose of the Refuge as well as consistent with the funding available to the Refuge.

3.2.3: Design habitat restoration projects to address considerations of adjoining landowners including but not limited to:

- Provision of access controls and access for emergency and utility services
- Consideration of appropriate fire access and breaks
- Consideration of appropriate buffers where new planting directly adjoins agricultural crops.
- Use of natural predation control strategies

3.2.4: Continue to consult with adjoining landowners as part of the development of plans for proposed restoration projects and other physical changes to the Refuge.

3.2.5: Continue to participate in the activities of the SRCAF including information presentations and solicitation of input regarding proposed restoration projects and other physical changes to the Refuge.

3.2.6: Commission field surveys as needed to identify specific property boundaries where uncertainty has contributed to substantive violations of Refuge regulations.

Goal 4: Resource Protection

Adequately protect all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuge from those of malicious intent, in an effective, professional manner.

Objective 4.1: Law Enforcement
Provide visitor safety, protect resources, and ensure compliance with regulations through law enforcement. Increase the number of law enforcement officers (from 1 to 2) and increase the monitoring of significant resource sites from quarterly to monthly by 2010.

Rationale: A common belief among neighboring landowners is that public ownership, easements, or access could result in increased vandalism and theft of agricultural equipment, poaching, and disregard of private property rights. A well-planned and coordinated program will be necessary to successfully address these concerns. The elongated and fragmented layout of the Refuge, which crosses through four counties, requires law enforcement coordination on the Federal, State, county, and local levels. Enforcement is further complicated because many units are accessible only by water.

Law Enforcement Strategies:
4.1.1: Develop MOUs with various law enforcement agencies to improve coordination, improve safety, and coordinate efforts in areas of special concern.

4.1.2: Conduct periodic patrols of the Refuge by boat.

4.1.3: Develop MOUs with state and local law enforcement agencies to implement river boat patrols to enforce State and Refuge regulations.

4.1.4: Allow only public use that is compatible with the primary objective of habitat management plans and is strictly controlled.

4.1.5: Permit boat access through Refuge lands that are open to the public during high water events; close to public entry and post all sensitive areas.

4.1.6: Establish public access near State parks and State wildlife areas where public use is a primary purpose.

4.1.7: Provide public education and signage as part of law enforcement programs and provide a sufficient level of law enforcement from various agencies to address these issues.

4.1.8: Employ two full-time park rangers (refuge law enforcement officers) and supplement their duty schedule with dual-function officers. The officers would also support the other refuges within the Sacramento Refuge Complex and coordinate their activities with other local, State, and Federal law enforcement agencies.

4.1.9: Ensure all officers are fully trained, equipped, and prepared to perform preventive refuge law enforcement duties.

4.1.10: Maintain a daily law enforcement presence to ensure that violations are deterred or successfully detected and violators are apprehended, charged, and prosecuted.

4.1.11: Encourage refuge officers to work closely with the game wardens from CDFG and deputy sheriffs from Tehama, Glenn, Butte, and Colusa counties.

4.1.12: Develop a Law Enforcement Plan for the Sacramento River Refuge.

4.1.13: Annually maintain boundary, closed area, and public use signs.

4.1.14: Conduct law enforcement patrols at all known archaeological sites on a regular basis to inspect for disturbance and illegal digging and looting.

4.1.15: Investigate fire causes and pursue fire trespass cases.

Objective 4.2: Safety
By 2005, provide Refuge facilities and lands that are safe for public use and management activities through annual inspections and routine maintenance.

Rationale: Visitor and staff safety is a high priority for the Refuge. Refuge lands stretch over 77-miles of the Sacramento River, so it is extremely important to have comprehensive safety strategies. Illegal activities, such as drug cultivation, poaching, vandalism, and vehicle stripping, are present on Refuge lands where there will be public activities. Strict law enforcement and the support of partners will be necessary to provide a safe environment for visitors and staff. The Refuge is committed to training staff in the most current safety standards and practices, maintaining facilities, coordinating with law enforcement partners, and providing an effective monitoring program to provide the safest environment possible.

Safety Strategies:
4.2.1: Administer and monitor required permits, licenses, and inspections on a repetitive basis under the Federal Facility Compliance Act and Service policy.

4.2.2: Promptly replace, upgrade, or temporarily close any facility that comprises public safety.

4.2.3: Minimize injuries to staff and visitors through preventive measures and be prepared to respond to injuries if they occur.

4.2.4: Ensure that safety procedures, designated personnel, and equipment and supplies (e.g., first aid kits and fire extinguishers) are in place and kept current.

4.2.5: Conduct monthly staff safety meetings covering pertinent topics and conduct annual safety inspections to ensure that Refuge facilities and lands are safe for public and staff use.

4.2.6: Train and refresh staff in CPR and basic first aid.

4.2.7: Maintain existing access roads and parking areas by grading, mowing, and replacing culverts, as needed, for public vehicle access, law enforcement, and habitat management activities.

4.2.8: Work with the State of California, Department of Boating & Waterways to modify the boat launch area at the Packer Unit to improve safety for anglers and other visitors.

4.2.9: Investigate the need for turn lanes on Highway 45 for the Packer unit, Highway 32 for the Pine Creek unit, South Avenue for the Rio Vista unit, and Ord Ferry Road for the Ord Bend unit.

4.210: Maintain secondary roads and pathways for public pedestrian traffic by grading, mowing and replacing culverts, as needed.

4.2.11 Help protect refuge visitors, neighbors, and employees through fire prevention, hazard reduction, and fire trespass programs.

Lesser goldfinch
Photo by Steve Emmons

Chapter 6. Management Plan Implementation

Implementation

The CCP will serve as the primary management reference document for Refuge planning, operations, and management for the next 15 years or until it is formally revised or amended within that period. The Service will implement the final CCP with assistance from existing and new partner agencies and organizations and from the public. The timing and achievement of the management strategies proposed in this document is contingent upon a variety of factors, including:

- Funding & Staffing
- Completion of Step-Down Plans
- Compliance Requirements
- Adaptive Management
- Monitoring

Each of these factors is briefly discussed as it applies to the CCP.

CCPs provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. Accordingly, the plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

Funding & Staffing

Currently, a large backlog of maintenance needs exist on the Refuge. The needs are recorded in the Maintenance Management System (MMS) for the Refuge System. Maintenance backlog projects include replacement of heavy equipment used for maintenance of Refuge facilities; replacement of an equipment storage building; improvements on parking lots and service roads; and replacement and upgrades for signs, gates, fences, and water control structures. A summary of these needs follows in Table 11.

Table 11. Maintenance Management System Backlog for Sacramento River Refuge.

MMS No.	Goal	Project Description	Project Cost
97007R	Goals 1,4	Replace habitat management equipment storage building	$120,000
03001M	Goals 1,4	Remove (abandon) 19 deep agricultural wells	$95,000
02001T	Goal 2	Replace entrance road and visitor parking on Rio Vista	$270,000
93002M	Goals 1,2,4	Replace 1945 CAT motor road grader	$167,000
00003M	Goals 1,2,4	Replace worn-out 1981 equipment stake bed truck	$56,000
00002M	Goals 1,2,4	Replace worn out maintenance utility truck	$30,000
00005M	Goals 1,2,4	Replace worn 1969 front-end loader	$105,000
97001R	Goals 2,4	Repost refuge boundaries	$30,000
00001M	Goal 2	Improve 1-mile fishing access road to Packer Lake	$110,000
03002M	Goals 1,4	Replace equipment storage building	$200,000
03005M	Goals 1,4	Remove South Ord barn	$25,000
93005M	Goals 1,4	Remove shop building on Heron Island Unit	$41,000
TOTAL			**$1,249,000**

We also use another database, the Refuge Operating Needs System (RONS). Table 12 reflects the Refuge's proposed projects, in priority order. Many of these "projects" involve increases to the Refuge's permanent staffing and funding to carry out the increased responsibilities outlined in the CCP. They also represent needs stemming from an increase in acreage and the maintenance of additional facilities. Each year RONS projects are submitted and compete with similar projects throughout the nation for Refuge funds.

Table 12. RONS Project Summary for Sacramento River Refuge, 2004.

RONS No.	Objective	Project Description	First Year Cost	Recurring Annual Cost	FTE[1]
00003	2.1, 2.2, 4.1,4.2	Protect Wildlife Resources (law enforcement officer)	$129,000	$64,000	1.0
00007	1.1, 1.9, 2.3, 4.2	Implement habitat management program (tractor operator)	$114,000	$49,000	1.0
01001	4.1	Purchase law enforcement vehicle	$35,000		
97007	4.2	Construct habitat management equipment storage building	$121,000[2]	$1,000	
03002	2.1-2.7, 3.1,4.2	Visitor Contact Station and Administrative Office	$332,000	$20,000	
03001	2.1-2.7, 3.1	Public use specialist	$197,000	$64,000	1.0
97010	1.1,1.2	Restore former riparian areas along the Sacramento River	$982,000	$8,000	
00005	2.1, 2.2, 2.3, 3.1	Implement habitat management program (office automation clerk)	$55,000	$22,000	.5
97012	1.1, 1.9, 4.2	Implement refuge habitat management program (term maintenance worker)	$118,000	$10,000	
00004	1.1, 1.9, 4.2	Manage refuge fire program (fire management officer)	$139,000	$74,000	1.0
97001	2.1, 2.2, 4.1	Post refuge boundaries	$35,000	$5,000	
00904	1.1, 1.3, 1.4, 1.5, 1.6, 1.8, 1.9	Gather and synthesize preplanning information, SRNWR	$73,000		
00001	3.1	Improve refuge management (De-complexing)	$185,000	$30,000	
TOTAL			**2,515,000**	**347,000**	**4.5**

[1] FTE = Full Time Equivalency Position. [2] New construction funding.

Access to Sacramento River Refuge is primarily by river via boat or public road via motor vehicle. The Refuge Roads Inventory (RRI) shows the refuge having 0.49 miles of public use roads, one parking lot, and zero bridges. No funding for roads has been allocated in the Refuge Roads Program (RRP) for the Sacramento River Refuge. Additional Maintenance Management System (MMS) projects eligible for RRP funding at the Refuge include #02001T to replace the entrance road and visitor parking on Rio Vista Unit for $270,000 and #00001M to improve one mile fishing access road on Packer Lake for $110,000 (Table 12). The Refuge does anticipate the need for additional transportation facilities during the 15 year life of this CCP.

Portions of the Sacramento River Refuge are in a Metropolitan Transportation Planning Organization (MTPO). The two MTPOs with jurisdiction over the Refuge are the Butte County Association of Governments and the Sacramento Area Council of Governments. Future transportation changes will be coordinated with the appropriate government entity. The results of the next RRI for the Refuge will be reported to the relevant MTPO as to the number and condition of the Refuge's transportation facilities.

The Service had a Federal Lands Highway Program created in the Transportation Equity Act for the 21st Century (TEA-21), the RRP. In order to be considered public roads, refuge roads must be opened to the general public during substantial parts of the year. Seasonal closures during nesting periods and inclement weather are permitted. However, roads only opened by permit to specific public interests, such as to hunters for specified hunting periods, are not considered public roads. Funds for refuge public use roads, parking lots, bridges, restrooms, and trails may be sought from the RRP. These funds can also be used for interpretive enhancements associated with these projects, as long as the costs for the interpretive facilities do not exceed 5 percent of the project budget.

RRP funds can be used as the non-Federal match for Federal Highway Administration funds available through state departments of transportation. Refuges can also use appropriated Service funds as the non-Federal match for these funds. This matching ability can be used to further compatible city, county, and state transportation and transit funds that could be spent on roads and transit projects adjacent to,

connecting to, or running through the refuge. Projects and partners will be identified that can take advantage of this funding.

The Refuge is managed as a satellite refuge within the Sacramento Refuge Complex. Complex staff provides administrative and logistical support to the satellite staff.

Table 13 outlines current staff and proposed additional staffing needed to fully implement this plan. If all positions were filled, the Refuge would be able to carry out all aspects of this plan to a reasonable standard. If some positions are not filled, all aspects of the Plan cannot be completed or those projects may be done over a longer period of time. At full staffing, the Refuge could be "de-complexed" from the Complex headquarters and operated as a "stand-alone" station. The Refuge will continue to be operated as a satellite refuge until the full staffing plan is realized. Staffing and funding are expected to be accomplished over the 15-year life of this plan.

Table 13. Staffing Plan.

Current Staffing Level	Post CCP Staffing Level
Refuge Manager GS-12	Refuge Manager GS-12
Wildlife Biologist GS-11	Wildlife Biologist GS-11
Engineering Equipment Operator WG-10	Engineering Equipment Operator WG-10
	Assistant Refuge Manager GS-9/11
	Tractor Operator WG-6/7
	Refuge Officer GS-7/9
	Public Use Specialist GS-7/9
	Administrative Support Assistant GS-7

With the existing staff and support from the Sacramento Refuge Complex, annual maintenance projects for habitat management and infrastructure will continue to degrade into maintenance backlogs. The current staffing of one engineering equipment operator will not be able to maintain high quality habitat or provide annual maintenance on firebreaks, roads, parking lots, signage, fencing, gates and other public use facilities for over 10,000 acres of refuge lands and the proposed public use. Under the current staff (including Complex support), Phase I implementation would include installing and maintaining boundary signing, minor facilities maintenance, and minor habitat management projects. New facilities and expanded law enforcement for public access would not be feasible. With the addition of a tractor operator and law enforcement officer and the continued support from the Complex, Phase II implementation would include maintenance of quality habitat and existing facilities, new construction and maintenance of basic public use facilities (parking lots, trails, and general information signs). A full time law enforcement officer presence would meet the needs for public safety and protect the properties of adjacent landowners. The addition of a public use specialist, administrative assistant and assistant refuge manager would allow Phase III or full implement of the CCP within 15 years. This staffing would make the Sacramento River Refuge self-sufficient, with only minor support from the Complex on Fire Program issues, law enforcement for special events, and larger construction projects. These projections assume that the Refuge will continue to be supported by our nonprofit conservation groups for habitat restoration and land acquisition, and cooperative management agreements through the state agencies' MOU.

Step-Down Management Plan Summaries

Some projects or types of projects require more in-depth planning than the CCP process is designed to provide; for these projects, the Service prepares step-down management plans. In essence, step-down management plans provide the additional planning details necessary to implement management strategies identified in a CCP. Included in this document are seven step down plans.

Hunting Plan

The purpose of the Hunting Plan (Appendix C) is to establish guidelines for hunting on the Sacramento River Refuge that will provide the public with a quality wildlife-dependent recreational experience, an opportunity to use a renewable

resource, and the ability to maintain wildlife populations at levels compatible with Refuge habitat. It was developed to provide safe hunting opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses. The plan will allow the hunting program to be conducted in a cost-effective manner, coordinated with the State. The hunting program will be reviewed annually by refuge staff during the Habitat Management Plan review conducted each spring. The activities within the Hunt Plan are evaluated within a compatibility determination located in Appendix B.

Fishing Plan
The purpose of the Fishing Plan (Appendix D) is to establish guidelines for sport fishing on the Sacramento River Refuge which will provide the public with a quality wildlife-dependent recreational experience and an opportunity to use a renewable resource. The fishing program will be reviewed annually by Refuge staff during the Habitat Management Plan reviews conducted each spring. The activities within the Fishing Plan are evaluated within a compatibility determination located in Appendix B.

Fire Management Plan
The Department of the Interior (DOI) fire management policy requires that all refuges with vegetation that can sustain fire must have a Fire Management Plan (FMP) (Appendix E) that details fire management guidelines for operational procedures and values to be protected/enhanced. The FMP for the Sacramento River Refuge provides guidance on preparedness, prescribed fire, wildland fire, and prevention. Values to be considered in the FMP include protection of Refuge resources and neighboring private properties, effects of burning on refuge habitats/biota, and firefighter safety. Refuge resources include properties, structures, cultural resources, trust species (including endangered, threatened, and species of special concern), and their associated habitats. The FMP will be reviewed periodically to ensure that the fire program is conducted in accordance with the Service's mission and the Refuge's purposes, goals, and objectives.

This plan is written to provide guidelines for appropriate suppression and prescribed fire programs at Sacramento River Refuge. Prescribed fires may be used to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research.

This plan will help achieve resource management objectives by enabling the Refuge to use prescribed fire, as one of several tools, to control non-native vegetation and reduce fire hazards in grassland and riparian habitats. It will be used in conjunction with other management tools that are currently applied on Refuge properties (i.e., grazing, mowing and herbicide applications) to meet resource objectives.

Draft Integrated Pest Management Plan
Sacramento Refuge Complex has developed a draft Integrated Pest Management (IPM) Plan for Mosquito Control (Appendix P) to address/reduce public nuisance and human health risk from mosquito-transmitted diseases. The purposes of this plan are: to identify mosquito control methods and materials currently approved for use on the Refuge Complex; identify use in an IPM program that is consistent with the goals of the Refuge Complex and minimizes public health risk from refuge-harbored mosquitoes; and provide long-term planning to meet the Service's goal of reducing effects of pesticide use on DOI trust resources to the greatest extent possible. This plan will be reviewed and updated to include new information and policy changes as needed.

A private consultant under contract with TNC has developed a draft IPM plan that specifically addresses walnut orchards as part of the Refuge's Cooperative Land Management Agreement (CLMA) with TNC (Appendix Q). Without immediate funds to restore the orchards to riparian habitat, it is important that the orchards be managed rather than abandoned. While the Service is obligated to both fulfill its primary mission and Refuge goals, failure to manage these orchards would provide a potential for pests, including insects, weeds, diseases, vertebrates, to build up and potentially cause off-site damage to neighboring walnut farmers along the River.

Habitat Management Plan
The Sacramento River Refuge staff have developed an annual Habitat Management Plan which guides the refuge manager in the decision making process. Each unit is visited annually by a team of managers, biologists, recreation planners, and maintenance workers to identify resource issues, develop a prioritized list of projects to address those issues, and monitor outcomes/responses. The database for this planning document is annually updated. The plan is based on an adaptive management philosophy that allows the team to assess habitat condition and wildlife use of the units annually and make

adjustments accordingly in order to meet Refuge goals and objectives.

Cultural Resource Management Plan
A cultural resource overview, and management plan was completed by the California State University Chico/Archaeological Research Program for the Sacramento River Conservation Area (White et al. 2003). Cultural resources on the Refuge will be managed according to the guidelines developed in this plan and under Federal regulations listed in the National Historic Preservation Act, Archeological Resources Protection Act, and Native American Graves Protection and Repatriation Act.

Restoration and Enhancement Plan
Prior to implementation of riparian restoration projects, a site-specific restoration plan is developed using the principles of landscape ecology. An initial site assessment, which focuses on soils, remnant vegetation, wildlife, flood frequency, and distance to ground water, is conducted in order to make informed decisions regarding restoration designs. A team of professionals, including a restoration ecologist, refuge biologist and refuge manager, develops a restoration plan which guides the management of the unit for the duration of the restoration project (two-to-five years). All restoration plans are sent to the State of California Reclamation Board for review and comments regarding impacts to the Sacramento River flood control system prior to project implementation.

Compatibility Determinations
Federal law and policy provide the direction and planning framework to protect the Refuge System from incompatible or harmful human activities and to insure that Americans can enjoy Refuge System lands and waters. The Improvement Act is the key legislation on managing public uses and compatibility.

Before activities or uses are allowed on a refuge, uses must be found to be "compatible" through a written compatibility determination. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the national wildlife refuge. Sound professional judgment is defined as a decision that is consistent with the principles of the fish and wildlife management and administration, available science and

resources, and adherence to the requirements of the Improvement Act, and other applicable laws. Wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety.

Compatibility determinations for hunting, fishing, wildlife observation, photography and interpretation, environmental education, camping and recreational boating, farming, grazing, and mosquito and other vector control are included in Appendix B.

Compliance Requirements

This CCP was developed to comply with all Federal laws, executive orders, and legislative acts to the extent possible. Some activities (particularly those that involve a major revision to an existing step-down management plan, or preparing a new one) would need to comply with additional laws or regulations besides NEPA and the Improvement Act.

Monitoring and Evaluation

The CCP is designed to be effective for a 15-year period. The plan will be reviewed and revised as required to ensure that established goals and objectives are still applicable and that the CCP is implemented as scheduled. The monitoring program will focus on issues involving public use activities, habitat management programs, wildlife inventory, and other monitoring and management activities. Monitoring and evaluation will use the adaptive management process. This process includes goal and objective setting, applying management tools and strategies followed by monitoring and analysis to measure achievement of objectives and refine management techniques.

Collection of baseline data on wildlife populations will continue. This data will be used to update existing species lists, wildlife habitat requirements, and seasonal use patterns. Migratory and resident birds, raptors, and species of management concern will be the focus of monitoring efforts.

Where information gaps exist, a concerted effort will be made to obtain information. With new information, goals and objectives may need modification. Public involvement will be encouraged during the evaluation process.

Monitoring of public use programs will involve the continued collection of visitor use statistics. Monitoring will be done to evaluate the effects of public use on Refuge habitat, wildlife populations, and visitor experience.

Adaptive Management

Adaptive management is the process of implementing policy decisions as scientifically-driven experiments that test predictions and assumptions about management plans, using the resulting information to improve the plans. Adaptive management provides the framework within which biological measures and public use can be evaluated by comparing the results of management to results expected from objectives. Management direction is periodically evaluated within a system that applies several options, monitors the objectives, and adapts original strategies to reach desired objectives. Habitat, wildlife, and public use management techniques and specific objectives would be regularly evaluated as results of a monitoring program and other new technology and information become available. These periodic evaluations would be used over time to adapt both the management objectives and strategies to better achieve management goals. Such a system embraces uncertainty, reduces option foreclosure, and provides new information for future decision-making while allowing resource use.

CCP Plan Amendment and Revision

The CCP is intended to evolve as the Refuge changes, and the Improvement Act specifically requires that CCPs be formally revised and updated at least every 15 years. The formal revision process would follow the same steps as the CCP creation process. In the meantime, the Service would be reviewing and updating this CCP periodically based on the results of the adaptive management program. While preparing annual work plans and updating the Refuge database, the refuge staff will also review the CCP. It may also be reviewed during routine inspections or programmatic evaluations. Results of any or all of these reviews may indicate a need to modify the plan. The goals described in this CCP would not change until they are reevaluated as part of the formal CCP revision process. However, the objectives and strategies may be revised to better address changing circumstances or to take advantage of increased knowledge of the resources on the Refuge. It is the intent of the Service to have the CCP apply to any new lands that may be acquired. If changes are required, the refuge

manager would determine the level of public involvement and associated NEPA documentation.

The intent of the CCP is for refuge objectives and strategies to be attained over the next 15 years. Management activities would be phased in over time and implementation is contingent upon and subject to results of monitoring and evaluation, funding through Congressional appropriations and other sources, and staffing.

Great Horned Owl
Photo by Steve Emmons

Appendix A. Environmental Assessment

The Environmental Assessment is under separate cover.

Copies of the Environmental Assessment are available for review at the Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, California 95988. (530) 934-2801.

Copies are also available via the internet at the following address http://sacramentovalleyrefuges.fws.gov

Appendix B. Compatibility Determinations

Compatibility Overview

Compatibility is a tool refuge managers use to ensure that recreation and other uses do not interfere with wildlife conservation – the primary focus of refuges. For purposes of this document, uses include any recreational, economic/commercial, pest/predator control, or other use of the refuge by the public or a non-Refuge System entity. Compatibility is not new to the Refuge System and conceptually dates back to 1918. As policy, it has been used since 1962. The Refuge Recreation Act of 1962 (Recreation Act) directed the Secretary of Interior to allow only those public uses of refuge lands that were "compatible with the primary purposes for which the area was established." This law also required that adequate funds be available for administration and protection of refuges before opening them to any public uses. Legally, refuges are closed to all public uses until officially opened through a compatibility determination.

The National Wildlife Refuge System Administration Act of 1966 set a compatibility standard which refuge managers used until new compatibility regulations, required by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), were adopted. The Improvement Act maintains a compatibility standard but provides more detail regarding the standard and the process, and requires the process be promulgated in regulations. It also requires that a use must be compatible with both the mission of the System and the purposes of the individual refuge, which helps to ensure consistency in application across the System. The Improvement Act also requires that the public have an opportunity to comment on use evaluations.

The Improvement Act stipulates that the needs of wildlife must come first and defines a compatible use as one that "…in the sound professional judgment of the Director, will not materially interfere with or detract form the fulfillment of the mission of the National Wildlife Refuge System or the purposes of the refuge." Sound professional judgment is defined as "…a finding, determination, or decision, that is consistent with principles of sound fish and wildlife management and administration, available science and resources…" Compatibility for priority wildlife-dependent uses may depend on the level or extent of a use.

In 1978, the compatibility standard was tested in court when recreational uses at Ruby Lake NWR (water skiing and motor boating) were found to be in violation of the Refuge Recreation Act. The court determined that compatibility is a biological standard and cannot be used to balance or weigh economic, political, or recreational interests against the primary purpose of the refuge. This ruling stated that the existence of non-compatible uses on a refuge in the past has no bearing on the compatibility of present uses. In their summary of this case, Coggins et al. (1987) conclude "neither poor administration of the Refuge in the past nor prior interferences with its primary purpose, nor past recreational, nor deterioration of its wildlife resources since establishment, nor administrative custom or tradition alters the statutory standard."

The Service recognizes that compatibility determinations are complex. For this reason, refuge managers are required to consider "principles of sound fish and wildlife management" and "available science" in making these determinations. Evaluations of the uses on the Sacramento River NWR are based on the professional judgment of refuge personnel including observations of refuge uses and reviews of appropriate scientific literature.

The compatibility determinations that follow are consistent with the Compatibility Policy and Regulations published in the Federal Register (603 FW 2, 50 CFR 25-26).

Use
Refuge Name:
Establishing and Acquisition Authorities:
Refuge Purposes:
NWRS Mission:
Description of Use
Availability of Resources:
Anticipated Impacts of the Use:
Public Review and Comment:
Determination:
Stipulations Necessary to Ensure Compatibility:
Justification

Prior to new activities being permitted on the Refuge, a compatibility determination and appropriate NEPA documentation is developed and approval and concurrence is obtained from the Regional Chief of Refuges and the California/Nevada Operations Manager.

Environmental Assessments are done to determine the significance of impacts from new activities or actions. When these activities or actions are found to have significant impacts affecting the quality of the human environment or there is disagreement on the impacts, an Environmental Impact Statement is required and includes public input on the decision process.

Some of the following activities were previously covered under compatibility determinations evaluated in 1994 and 2001. During the process of the Comprehensive Conservation Plan these activities have been reevaluated, new activities have been evaluated, and all the activities considered have been determined to be compatible.

Compatibility determinations for the following uses are included within this appendix:
Hunting
Fishing
Wildlife Observation, Wildlife Photography, and Interpretation
Environmental Education
Research
Camping and Recreational Boating
Farming
Grazing
Mosquito and Other Vector Control

COMPATIBILITY DETERMINATION
(March 2005)

Use: Hunting

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Hunting is identified in the Improvement Act as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. As a result the Refuge is proposing to allow dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer hunting. Currently, there are limited opportunities to hunt these species on other public lands along the Sacramento River. The Proposed Action (Alternative B) analyzed in the Comprehensive Conservation Plan (CCP) (USFWS 2005) and the Hunt Plan (USFWS 2005), which are incorporated by reference, contain

maps and unit descriptions where hunting will be allowed. The hunting program will be developed to provide high quality, safe, and cost-effective hunting opportunities, and will be carried out consistent with State regulations, see Refuge Manual 8 RM 6, Hunting. The Hunting Plan was developed to provide safe hunting opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses. The Refuge hunting program will comply with the Code of Federal Regulations Title 50, 32.1 and managed in accordance with Refuge Manual 8 RM 6, Hunting.

Hunting will be permitted in accordance with State and Federal regulations and seasons (Table 1 gives example of annual state hunt seasons for areas within the Refuge) to ensure that it will not interfere with the conservation of fish and wildlife and their habitats. Therefore, the sport hunting of migratory birds, upland game birds and deer on the Refuge is in compliance with State regulations and seasons, the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee), and the Refuge Recreation Act of 1962 (16 U.S.C. 460k).

Approximately 3,356 acres will be open by 2005 and an additional 1,967 acres within 2-10 years to total 5,323 acres (52 percent) open to hunting, see Figure 28, Chapter 5 CCP for details. Hunting of dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer will be allowed in accordance with State hunting regulations during the legal hunting seasons and shooting times.

Most Refuge lands are accessible only by boat (motorized and non-motorized). There are no developed boat ramps or related facilities on the Refuge. There are existing boat ramps with related facilities that provide public access along the portion of the river where Refuge lands are located (Appendix N of CCP (USFWS 2005)). Units that have a parking area will be gated to allow only pedestrian traffic on refuge lands (bicycles and motorized vehicles will not be allowed). Limited camping on gravel bars up to seven days is allowed. Camping on Refuge land, other than gravel bars, is prohibited. For additional information, refer to the Camping and Recreational Boating Compatibility Determination, (USFWS 2005). Camping areas in the vicinity of the Refuge are also identified in Appendix N of the CCP (USFWS 2005).

Method of take: Federally approved non-toxic shot required for all species except deer. Weapons or ammunition for take of deer include shotgun, firing single shotgun slugs, and archery. No shot shell larger than 12 gauge and no shot size larger than “BB” is permitted, except steel “T”. No rifles or pistols may be used or possessed.

There will not be any hunter check stations or direct method to regulate hunter quotas on each unit. It is predicted that there will be minimal hunting (1,500 annual visits) due to the limited vehicle access, dense cover, and seasonal boat access. Hunters must report take of deer according to State regulations. Field checks by refuge law enforcement officers will be planned, conducted, and coordinated with staff and other agencies to maintain

compliance with regulations and assess species and number harvested. We require dogs to be kept on a leash, except for hunting dogs engaged in authorized hunting activities and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).

Table 1. California Hunting Seasons (2003-2004).

Species	Dates
Dove	September 1-15 and from second Saturday in November for 45 days
Waterfowl[1] - Ducks	Third Saturday in October for 33 days and from third Friday in November for 66 days
Waterfowl[1] - Geese	First Saturday in November extending 86 days
American Coot and Common Moorhen	Concurrent with duck season (and during split, if it occurs)
Pheasants	Second Saturday in November extending for 44 days
Quail – General	Third Saturday in October extending through the last Sunday in January
Quail – Archery	Third Saturday in August extending through the last Sunday in September
Snipe	Third Saturday in October extending for 107 days
Turkey – Fall	Second Saturday in November extending for 16 consecutive days
Turkey – Spring	Last Saturday in March, extending for 37 consecutive days
Deer – Archery (Zone C4, all units except Drumheller Unit)	Last Saturday in August extending for 16 consecutive days
Deer – General (Zone C4, all units except Drumheller Unit)	Third Saturday in September extending for 16 consecutive days
Deer – Archery (Zone D3, Drumheller Unit)	Third Saturday in August extending for 23 consecutive days
Deer –General (Zone D3, Drumheller Unit)	Fourth Saturday in September extending for 37 consecutive days
Deer – G1 Late Season (Zone C4 all units except Drumheller Unit)	Fourth Saturday in October extending for 9 consecutive days

Public use signs depicting allowable uses, river mile and unit name will be placed above the approximate ordinary high water mark and at parking areas. The boating guide, California Department of Boating and Waterways boating guide that will depict the unit name and river mile location, a large laminated boating guide, and the Sacramento River NWR brochure will be placed at public boat ramps and units accessible by vehicle.

Landward boundaries are closed to discourage trespass through adjacent private lands. Random, weekly hunter field checks will be conducted by refuge law enforcement officers to assess number of hunters, type and number of harvested species, enforce game laws, refuge regulations, and boundaries. The monitoring information will be summarized and provided to the refuge manager to be used to make management decisions under the adaptive management process. Coordinated law enforcement patrols by refuge officers, special agents, game wardens, park rangers, and deputy sheriffs will take place periodically. Law enforcement support would be provided by California Department of Fish and Game and California Department of Parks and Recreation wardens under a memorandum of understanding with the Refuge (USFWS et al 2001).

Availability of Resources: The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage hunting activities as described above:

	One-Time Costs	Annual Costs
Administration		$15,000
Law Enforcement		$12,000
Outreach, Education, Monitoring		$5,000
Signs, brochures, and maintenance	$20,000	$3,000
TOTAL	**$20,000**	**$35,000**

Additional funds would be required to operate and maintain the hunt program. Law enforcement staffing would be needed. Funding will be sought through the Service budget process. Other sources will be sought through strengthened partnerships, grants, and additional Refuge operations funding to support a safe and quality program as described above. In the future, user fees may be considered.

Funding for the parking areas and trails mentioned in the description of use are included under the Compatibility Determination for Wildlife Observation, Photography and Interpretation (USFWS 2005).

Anticipated Impacts of Use: The Office of Migratory Bird Management sets the general frameworks through their annual regulations permitting the sport hunting of migratory birds. The individual States set seasons within those frameworks. If necessary, the Service develops regulations that may be more restrictive than State hunting regulations in order to protect resources on a refuge-by-refuge basis (i.e., species hunted). Otherwise, the Service observes State regulations on all refuges open to hunting.

Service Regional and Refuge biologists along with scientists from the U.S. Geologic Survey–Biological Resources Division (Office of Migratory Bird Management) and university researchers meet twice annually with State flyway representatives to discuss inventory data and survey reports for migratory game bird populations which are hunted, proposed for hunting and closed to hunting. The Service bases its migratory waterfowl

season length and bag limits for the various species on these surveys. The annual breeding ground survey is one of the most important surveys and has been conducted since 1955. This cooperative effort between the Service and the Canadian Wildlife Service covers Canada, Alaska, and the northern United States prairies where 90 percent of the continental waterfowl populations breed. Results are summarized in various publications, including the annual fall flight forecast. Other important data include harvest and survival rate estimates from band returns. Whether to open a season for a species or not and the establishment of the season length and bag limits are determined by the population objectives for each species. A species must have a harvestable surplus to be considered for hunting. Population objectives for each species are calculated using data from population surveys and banding data.

Current management for mourning doves consists of annual population trend surveys, harvest surveys, and the establishment of annual hunting regulations. Since 1960, management decisions have been made within the boundaries of 3 zones that contain mourning dove populations that are largely independent of each other: the Eastern, Central and Western Management Units. Since 1966, Mourning Dove Call-count Surveys have been conducted annually in the 48 conterminous states by state and federal biologists to monitor mourning dove populations. In 1992, the U.S. Fish and Wildlife Service and state wildlife agencies initiated the national cooperative Harvest Information Program, which enables the Service to conduct nationwide surveys to provide reliable annual estimates of the harvest of mourning doves and other migratory game bird species. The resulting information on status and trends is used by wildlife administrators in setting annual hunting regulations. In 2001, a National Mourning Dove Planning Committee was formed to further develop guidelines that could be used for regional harvest management. The committee produced The Mourning Dove National Strategic Harvest Management Plan. The implementation of the plan began in July 2003 with the initiation of a national pilot reward-band study. Currently population models are being finalized which will aid in the preparation of regional harvest management plans for 2005. Demographic models and data collection programs to support needs of regional harvest management plans will be established in 2005.

Resident game species are protected by both Federal and State laws and regulations to ensure that harvest rates do not negatively impact populations. The potential impacts of hunting on resident upland game birds and deer are discussed and evaluated in the California Environmental Quality Act process and in the CCP and associated EA (USFWS 2005). This process results in periodically updated and publicly reviewed documents. Based on the findings of these documents, the State insures that game animal hunting in California does not adversely impact its wildlife populations to an unacceptable level (CDFG 2004b).

Hunting is a highly regulated activity, and generally takes place at specific times and seasons (dawn, fall and winter) when the game animal is less vulnerable, and other wildlife-dependent activities (e.g., wildlife observation, environmental education and

interpretation) are less common, reducing the magnitude of disturbance to Refuge wildlife. Managed and regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

The use of retrieving dogs would be permitted and encouraged in all areas open to waterfowl hunting. Dogs are also allowed for deer hunting, as described by State regulations. These dogs would be required to be under control at all times. Any hunter who allows his/her dog to disturb wildlife is not well received by other hunters who do not want waterfowl disturbed on the ponds that they are hunting. Law enforcement officers will enforce regulations requiring owners to maintain control over their dogs while on the Refuge. Although the use of dogs is not a form of wildlife-dependent recreation; they do in this case support a wildlife dependent use. Implementing the prescribed restrictions outlined in the Stipulations section should alleviate any substantial impacts.

Two species, the ring-necked pheasant and turkey, were introduced into the area years ago. These non-native species have more potential to compete for habitat with native species, however no such competition has been noted along the river (CFDG 2004b). In addition, selected game species are not known to prey upon other species at unacceptable levels. The potential for competition and predation exists whether the populations are hunted or not; however, removing individuals of non-native species by hunting could conceivably reduce this potential (CDFG 2004b).

Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the hunting seasons. Proper zoning, regulations, and Refuge seasons will be designated to minimize any negative impacts to wildlife populations using the Refuge. Due to the difficulty of accessing and traversing the refuge units (primarily boat access from the river, areas of impenetrable "jungle" habitat, e.g., blackberries, poison oak, etc., which limits hunter access), we anticipate that hunter numbers will be limited. The primary species that will be hunted above the ordinary water mark will be nonnative wild turkey and deer. Harvesting these two species, or any other hunted species, would not result in a substantial decrease in biological diversity on the Refuge.

Direct effects of hunting include mortality, wounding, and disturbance (De Long 2002). Hunting can alter behavior (i.e. foraging time), population structure, and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartelt 1987, Madsen 1985, and Cole and Knight 1990). There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento NWR non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns

and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995, Wolder 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur, and birds can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et. al 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995, Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a 5-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased 4 to 20 fold within the sanctuary (Madsen 1995). Thus sanctuary and non-hunt areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Sacramento River.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for Refuges to manage hunt programs with non-hunt days. At Sacramento NWR, 3-16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). However, intermittent hunting may not always greatly reduce hunting impacts. The intermittent hunting program of three hunt days per week at Sacramento NWR results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). In Germany, several studies reported a range from a few days to approximately three weeks for waterbird numbers to recover to pre-disturbance levels (Fox and Madsen 1997).

The proposed hunt program at Sacramento River NWR will not be intermittent in order to provide consistent management with the existing program on adjacent CDFG lands and waters, preventing confusion among hunters on the river. Boating activity associated with hunting during the fall and winter can alter distribution, reduce use of particular habitats or entire areas by waterfowl and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). Additional impacts from hunting activity may include conflicts with individuals participating in wildlife-dependent priority public uses, such as canoers, kayakers, and other wildlife observers.

The impacts addressed here are discussed in detail in Environmental Assessment (Appendix A, Chapter 4) for the CCP (USFWS 2005) which is incorporated by reference. Biological conflicts will be minimized by following proper zoning and regulations. Refuge

seasons will be designated to minimize negative impacts to wildlife. Difficult access to most units that allow hunting, which is primarily by boat, may limit number of hunters and visits. Sanctuary units, totaling 20 percent of refuge lands, are distributed within separate reaches of the River, which provides areas needed by wildlife for resting, feeding, nesting, and fawning. Dense riparian forests provide additional sanctuary for wildlife species.

Use of federally approved non-toxic shot for all hunting except deer will help minimize possibility of lead poisoning.

A Section 7 consultation with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (and Hunting Plan) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Conflicts between hunting and other public uses and neighboring landowners will be minimized by the following:

- Provide 1,740 acres of the refuge for non-hunting activities (i.e. wildlife observation, photography, interpretation, environmental education and fishing activities) by 2005 and an additional 1,198 acres within 2-10 years for a total of 2,938 acres (28 percent).
- Landward boundaries are closed to discourage trespass from and onto adjacent private lands.
- Hunting will not be allowed on Refuge units that are small in area and close in proximity to urban areas and private dwellings.
- Hunting is not allowed within 50 feet of any landward boundaries adjacent to privately owned property. As per Fish and Game regulations, it is unlawful to hunt or discharge while hunting, any firearm or deadly weapon within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith. The 150-yard area is a "safety zone".
- All Refuge units will be posted with boundary signs and public use information signs prior to opening to the public.
- Provide information about the Refuge hunting program by installing informational signs/kiosks, creating and distributing brochures, and utilizing the Refuge's website (www.sacramentovalleyrefuges.fws.gov).
- Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27 of the CCP).
- On Refuge lands, excluding gravel bars, entry and departure is restricted to one hour before sunrise to one hour after sunset.
- Limited camping on gravel bars up to seven days is allowed. Camping on Refuge

land, other than gravel bars, is prohibited.
- Allow pedestrian and boat traffic only.
- Provide coordinated law enforcement patrols by game wardens, park rangers, and refuge officers to enforce state and federal regulations.

Wildlife populations on the Refuge are able to sustain hunting and support other wildlife-dependent priority uses. To manage the populations to support hunting, the Refuge adopts harvest regulations set by the State within Federal framework guidelines.

Possibly target species and other wildlife will compete for habitat. While each species occupies a unique niche, there is only a finite amount of space available to satisfy various habitat requirements of water, food, cover, breeding, roosting, and fawning areas. So, while individuals of a species compete for habitat within the species niche, most species occupy space to the exclusion of many other species. Target species (dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer) generally do not prey on other species at unacceptable levels. Occasionally, in certain areas, deer browse of seedling valley oak is particularly heavy.

By its very nature, hunting has very few positive effects on the target species while the activity is occurring. However, in our opinion, hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System mission. Furthermore, despite the potential impacts of hunting, a goal of the Sacramento River Refuge is to provide visitors of all ages an opportunity to enjoy wildlife-dependent recreation. Of key concern is to offer a safe and quality program and to ensure adverse impacts remain at an acceptable level.

Recreational hunting will remove individual animals, but does not negatively affect wildlife populations. To assure that populations are sustainable, California Fish and Game Commission in consultation with the California Department of Fish and Game (CDFG) annually review the population censuses to establish season lengths and harvest levels. Each year the Refuge staff conducts habitat management reviews of each unit on the Complex to evaluate wildlife population levels, habitat conditions and public use activities. The areas closed to various hunting activities do provide adequate sanctuaries for wildlife.

The Refuge believes that there will be minimal conflicts between hunters and the other wildlife-dependent recreational uses. The uses differ seasonally (Figure 25, Chapter 5, CCP), are dispersed along the River, and most are not occurring on the same area at the same time. Currently, hunting occurs on the River, outside of the Refuge, without many known conflicts.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received (including those regarding hunting) were addressed in the Response to Comments (Appendix R). No changes were made based on comments received. CDFG (2004b) has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

Determination:

_____Use is Not Compatible

__X__Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Refuge Specific Regulations

  A. Migratory Game Bird Hunting. We allow hunting of goose, duck, coot, moorhen, dove, and snipe on designated areas of the refuge in accordance with State regulations subject to the following conditions:

  1. We only allow shotgun hunting.
  2. You must unload firearms (see 50CFR 27.42(b)) before transporting them between parking areas and hunting areas. Unloaded means that no ammunition is in the chamber or magazine of the firearm.
  3. You may possess only approved nontoxic shotshells while in the field (see 50 CFR 32.2(k)).
  4. You may not hunt within 50 feet of any landward boundary adjacent to private property.
  5. You may not hunt within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith.
  6. Access to the hunt area is by foot traffic or boat only. We do not allow bicycles or other conveyances. Mobility-impaired hunters should consult with the Refuge Manager for allowed conveyances.

7. We prohibit fires on the refuge, except portable gas stoves on gravel bars (see 50 CFR 27.95(a)).
8. We allow camping on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands (see Camping and Recreational Boating Compatibility Determination (USFWS 2005)).
9. The refuge is open for day use access from 1 hour before sunrise until 1 hour after sunset. We allow access during other hours on gravel bars only (see condition A8).
10. We require dogs to be kept on a leash, except for hunting dogs engaged in authorized hunting activities and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).
11. We do not allow permanent blinds. You must remove all personal property, including decoys and boats, at the end of each day (see 50 CFR 27.93).
12. We do not allow cutting or removal of vegetation for blind construction or for making trails.

B. Upland Game Hunting. We allow hunting of pheasant, turkey and quail on designated areas of the refuge in accordance with State regulations subject to the following conditions:

1. We only allow shotgun and archery hunting.
2. Conditions A3, A4, A5, A6, A7, A8, A9, A10, and A12 apply.

C. Big Game Hunting. We allow hunting of black-tailed deer on designated areas of the refuge in accordance with State regulations subject to the following conditions:

1. Conditions B1, A4, A5, A7, A8, A9, and A12 apply.
2. We do not allow construction or use of permanent blinds, platforms, ladders or screw in foot pegs.
3. You must remove all personal property, including stands from the refuge at the end of each day (see 50 CFR 27.93).

- All hunting activities and operations will be reviewed annually to ensure compliance with all applicable laws, regulations, and policies.
- Population censuses will be reviewed annually with the CDFG to ensure that harvest from hunting is not unacceptably impacting the targeted populations. The program will be modified accordingly.
- Each year the Refuge staff will conduct habitat management reviews of each unit to evaluate wildlife population levels, habitat conditions and public use activities.
- Refuge specific hunting information will be available via signs, information panels, brochures and website (www.sacramentovalleyrefuges.fws.gov).
- Refuge officers will patrol, monitor, and collect data on hunting activities in the field to assure that it does not interfere with wildlife resources and other wildlife dependent uses on a weekly basis. The program will be modified accordingly.
- Dog training on the Refuge will not be allowed.
- Hunters using boats (motorized and non-motorized) must abide by the boating stipulations described in the State and Coast Guard regulations on boating.
- Harvest will be estimated using stratified sampling, self-registration, patrol and direct observations.

- Monitor hunting visits by personal contact by law enforcement officers, comment drop box (Capay, Sul Norte and Drumheller Slough units), Refuge web site e-mail, and vehicle counters at units with parking areas.

Justification: Hunting is a wildlife-dependent recreational use listed in the National Wildlife Refuge System Improvement Act. Providing a quality hunting program contributes to achieving one of the Refuge goals (Goal 2, Objective 2.1, Chapter 5 of the CCP). By facilitating this use on the Refuge, we will increase the visitors' knowledge and appreciation of fish and wildlife, which may lead to increased public stewardship of wildlife and their habitats on the Refuge and along the Sacramento River. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System. Approximately half of the Refuge acreage will be closed to hunting to ensure an adequate amount of high-quality feeding and resting habitat in relatively undisturbed areas (28 percent) and completely undisturbed areas (20 percent) (USFWS 2005).

CDFG (2004b) has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources. Wildlife populations along the Sacramento River are currently hunted on both private and public lands, such as Sacramento River Wildlife Area (State), Todd Island and Foster Island (Bureau of Land Management). No impacts to those local populations have been documented (CDFG 2004b).

Based upon impacts described in the Hunting Plan, Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that hunting within the Sacramento River National Wildlife Refuge as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, implementing the hunt plan and associated stipulations will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2020):

___X___ Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

_____ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

<u>NEPA Compliance for Refuge Use Decision</u> (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Don Wadsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Fishing

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The Refuge is proposing to open to fishing: gravel bars, sloughs, oxbow lakes, and the inundated floodplain on all Refuge units by 2005 (USFWS 2005). The Proposed Action (Alternative B) analyzed in the Comprehensive Conservation Plan (CCP) (USFWS 2005) and the Fishing Plan (USFWS 2005), which are incorporated by reference, contain maps and unit descriptions where fishing will be allowed. This will include twenty-three river miles and all seasonally submerged areas below the ordinary

high water mark (Figure 28, Chapter 5, CCP). Currently, only Packer Lake within Packer Unit is open to sport fishing.

Sport fishing is identified in the Improvement Act as one of the legislated wildlife-dependent, priority public uses. Fishing will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats.

Most refuge lands are accessible only by boat. There are no developed boat ramps or related facilities on the Refuge. There are existing boat ramps with related facilities that provide public access along the portion of the river where Refuge lands are located (Appendix N of CCP (USFWS 2005)). Refuge units that have parking areas will be gated so that only pedestrian traffic will be allowed on Refuge lands (bicycles and motorized vehicles will not be allowed). Limited camping on gravel bars up to seven days is allowed. Camping on Refuge land, other than gravel bars, is prohibited. For additional information, refer to the Camping and Recreational Boating Compatibility Determination, (USFWS 2005). Camping areas in the vicinity of the Refuge are also identified in Appendix N of the CCP (USFWS 2005). On Packer Lake, due to primitive access, we only allow boats up to 14 feet (4.2m) and canoes.

Method of enforcement and control will take place through boundary and public use signs, information kiosks at boat ramps and routine patrol by CDFG wardens and refuge officers. Landward boundaries are closed to discourage trespass through adjacent private lands. Entry and departure times on the Refuge will be restricted (i.e. one hour before sunrise to one hour after sunset). Anglers are required to have a State fishing license, but do not need to obtain a refuge fishing permit or a user fee.

Game fish species which will be allowed for legal take include all native and introduced species listed in the California regulations Freshwater Sport Fishing (i.e. Chinook salmon, steelhead, trout, sturgeon, sunfish, shad, stripped bass, carp, catfish, bullhead, crappie, bass and spotted bass). These fish species occur in open water on the Refuge in the main River channel, sloughs, oxbow lakes, and on the inundated floodplain.

Federally listed species that occur on the Refuge include: Chinook salmon, Sacramento River winter-run evolutionary significant unit (ESU) (Federal and State-listed endangered species), Chinook salmon, Central Valley spring-run ESU (Federal and State-listed threatened species), Chinook salmon, Central Valley fall-run ESU and late-fall-run ESU (Federal candidate species and State species of concern), steelhead, Central Valley ESU (Federal-listed threatened species), Valley elderberry longhorn beetle (federally listed threatened species), bald eagle (federally listed threatened species and State-listed endangered species), western yellow-billed cuckoo (Federal candidate species, State-listed threatened species, and FWS Bird of Conservation Concern), and giant garter snake (federally listed endangered species and State-listed threatened species). Critical Habitat for the Sacramento River winter-run Chinook salmon was designated

June 16, 1993 (58 CFR 33212, June 16, 1993). Critical habitat includes the river bottom and riparian zone, which are those terrestrial areas that directly affect a freshwater aquatic ecosystem. Critical Habitat for this ESU includes the Sacramento River from Keswick Dam to Chipps Island, all the waters westward from Chipps Island to the Carquinez Strait Bridge, all the waters of San Pablo Bay, and all the waters of the San Francisco Bay north of the San Francisco Bay–Oakland. The Section 7 consultation with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (and Fishing Plan) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the.

The Refuge adopts harvest regulations set by the State, which uses the best available population information. Sources of population data for Chinook salmon include the California Department of Fish and Game, the U.S. Fish and Wildlife Service (Fisheries Resources Offices and the National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS).

There will not be any method implemented to regulate fishing quotas. It is predicted that there will be minimal fishing (1,000 annual visits) on the Refuge due to the limited vehicle access and seasonal boat access to refuge lands. Fishing will occur year-round with peak fishing use projected to occur spring through the fall. High water and flood events limit fishing opportunities during the winter (Figure 27, Chapter 5, CCP).

The Fishing Plan proposes to open more areas of the refuge to fishing and improve opportunities and access for visitors:

- Provide additional parking areas, trails, and interpretive signs to inform the public about Refuge resources.
- Improve the Packer Lake small boat launching facility in cooperation with other stakeholders.
- Provide information for fishing opportunities in the Sacramento River Refuge brochure.

The Fishing Plan (USFWS 2005) and the Comprehensive Conservation Plan (USFWS 2005) Proposed Action (Alternative B), Chapter 5, which provide detailed discussions of this proposal, are herein incorporated by reference. The Refuge adopts harvest regulations set by the State, which uses the best available population information.

Availability of Resources: Limited funding and staffing would be required to manage the bank and boat fishing on the Sacramento River Refuge. Refuge officers will conduct regular patrols. Law enforcement support would be provided by California Department of Fish and Game and California Department of Parks and Recreation wardens under a memorandum of understanding with the Refuge (USFWS et al 2001). Additional funding would also be needed for the interpretive signs, interpretive materials, and kiosks. Those costs are incorporated into the compatibility determinations for environmental education and interpretation. The Refuge would pursue a variety of funding sources in order to fully

support this use, including agreements with other agencies, grant funding and volunteer assistance for monitoring. In the future, user fees may be considered.

	One-time Costs	Annual Costs
Administration		$2,000
Law Enforcement		$5,000
Outreach, Education, Monitoring		$3,000
Signs and brochures	$3,000	$1,000
Maintenance of facilities		$3,000
TOTAL	**$3,000**	**$14,000**

Additional funding ($110,000) for improving the one-mile access road and small boat launch at Packer Lake has been requested through the Maintenance Management System (MMS) and Refuge Roads Program (Project 00001M).

Funding for the parking areas and trails mentioned in the description of use are included under the Compatibility Determination for Wildlife Observation, Photography and Interpretation (USFWS 2005).

Anticipated Impacts of the Use(s): Fishing as a solitary and stationary activity tends to be less disturbing to wildlife than hunting or motorized boating (Tuite et al 1983). It is well recognized that fishing can give many people a deeper appreciation of fish and wildlife and a better understanding of the importance of conserving habitat, which has ultimately contributed to the Refuge System mission. Furthermore, despite the potential impacts of fishing, a goal of Sacramento River NWR is to provide opportunities for wildlife-dependent recreation. Fishing is one of the six priority public uses on the National Wildlife Refuge System. Of key concern then, is to manage the activity to keep adverse impacts to within acceptable limits.

Fishing activities may influence the composition of bird communities, as well as distribution, abundance, and productivity of waterbirds (Tydeman 1977, Bouffard 1982, Bell and Austin 1985, Bordignon 1985, Edwards and Bell 1985, and Cooke 1987). Shoreline activities, such as human noise, would cause some birds to flush and go elsewhere. Disturbance and destruction of riparian vegetation, bank stability, and water quality may result from high levels of bank fishing activities. Boating associated with fishing can alter bird distribution, reduce use of particular habitats or entire areas by waterfowl and other waterbirds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995).

The impacts addressed here are discussed in detail in Environmental Assessment (Appendix A, Chapter 4) for the CCP (USFWS 2005) which is incorporated by reference. Fishing and other human activities cause disturbance to wildlife (Burger 1981). Cumulative impacts of this increased use have correlating effects on wildlife, habitat and

the fisheries resource (Buckley and Buckley 1976; Glinski 1976; Miller et al. 1998; Reijnen and Foppen 1994; Smith and Hunt 1995).

These impacts will be minimized by the following:

- Open only riverine areas, oxbow lakes and ponds to fishing.
- Use Best Management Practices when maintaining parking areas, roads, and access facilities to prevent erosion or habitat damage.
- Promote use of non-toxic sinkers, split shot, and lures by providing educational information at Refuge kiosks.
- Monitor fishing activities to ensure facilities are adequate and wildlife disturbance is minimal.
- Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.
- Law enforcement patrols will be conducted by game wardens, park rangers, and refuge officers to enforce state and federal regulations.
- Some human disturbance of forest and shrub bird species may occur during nesting and spring/fall migration periods. However, human impacts are expected to be low since many of these areas are covered with dense vegetation, which minimizes human access.
- Some human disturbance of gravel-scrape nesting species such as killdeer, spotted sandpiper, and lesser nighthawk will occur. The most concentrated human use of gravel bars occurs during dove season after nesting season. Other periods of high use may occur during early summer for camping and angling. During this time, volunteers will be utilized to monitor and track the disturbance to utilize for future management decisions. Refuge staff will monitor impacts and respond with best management practices.

Conflicts between fishing and other public uses, and neighboring landowners will be minimized by the following:

- Disseminate California Department of Boating & Waterways boating guide, which depicts Refuge units by river mile, at public boat ramps i.e. Red Bluff Diversion Dam, Woodson Bridge, Irvine Finch, Ord Bend, Butte City, and Sacramento River-Colusa State Park, by 2005.
- Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27 of the CCP).

- Provide information about the Refuge fishing program by installing informational signs/kiosks, creating and distributing brochures, and utilizing the Refuge's website (www.sacramentovalleyrefuges.fws.gov).
- Law enforcement patrols by game wardens, park rangers, and refuge officers to enforce state and federal regulations.
- Landward boundaries are closed to discourage trespass through adjacent private lands.
- Restrict entry and departure times on the refuge i.e. one hour before sunrise to one hour after sunset.
- Camping is allowed on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands (see Camping and Recreational Boating Compatibility Determination (USFWS 2005)).
- Install public use ethics panel, including the importance of removing fishing line, not littering and displaying the "pack it in and pack it out" message at appropriate access points.

The Refuge believes that there will be minimal conflicts between anglers and the other wildlife-dependent recreational uses. The uses differ seasonally (Figure 25, Chapter 5, CCP), are dispersed along the River, and most are not occurring on the same area at the same time. Currently, fishing occurs on the River, outside of the Refuge, without many known conflicts.

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received (including those regarding fishing) were addressed in the Response to Comments (Appendix R). No changes were made based on comments received. CDFG (2004b) has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Refuge Specific Regulations
  Sport Fishing. We allow sport fishing on designated areas of the refuge in accordance with State regulations subject to the following conditions:
  1. We prohibit fires on the refuge, except portable gas stoves on gravel bars (see 50 CFR 27.95(a)).
  2. We allow camping on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands (see Camping and Recreational Boating Compatibility Determination (USFWS 2005)).
  3. The refuge is open for day use access from 1 hour before sunrise until 1 hour after sunset. We allow access during other hours on gravel bars only (see condition 2).
  4. We do not allow cutting or removal of vegetation for blind construction or for making trails.
  5. On Packer Lake, due to primitive access, we only allow boats up to 14 feet (4.2m) and canoes.
- Monitor fishing use to ensure that facilities are adequate and disturbance to wildlife continues to be minimal.
- Only riverine sections, oxbow lakes and ponds, and Packer Lake of the Refuge will be open to fishing (Figure 28, Chapter 5, CCP).
- Parking areas, roads, and related access facilities will be maintained as necessary to ensure public safety and to prevent erosion or habitat damage.
- Promote use of non-toxic sinkers, split shot, and lures by providing information in Refuge kiosks.
- Proper zoning and regulations will be designated.
- Law enforcement patrols by game wardens, park rangers, and refuge officers to enforce state and federal regulations.
- Anglers using boats (motorized and non-motorized) must abide by the boating stipulations described in the State and Coast Guard regulations on boating.

Justification: Fishing is an appropriate wildlife-dependent recreational activity. Based upon impacts described in the Fishing Plan, Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that fishing within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or mission of the National Wildlife Refuge System.

Fishing is a priority public use listed in the Improvement Act. By facilitating this use on the Refuge, the visitors' knowledge and appreciation of fish and wildlife will increase, which may lead to increased public stewardship of wildlife and their habitats on the Refuge and along the Sacramento River. Increased public stewardship will support and complement the Service's actions in achieving the Refuge's purposes and the mission of the National Wildlife Refuge System.

Because of the limited access and number of visitors to the Refuge, this would not pose a problem and could be handled with existing staff. This program as described is determined to be compatible and will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2020):

__X___ Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

_____ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Wildlife Observation, Wildlife Photography, and Interpretation

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Wildlife observation, photography, and interpretation are considered together in this Compatibility Determination because all are considered to be wildlife-dependent, non-consumptive uses and many elements of these programs are similar. All three of these public uses are dependent upon establishing trails and vehicle parking areas in the Refuge as well as remote access points from boats. An estimated 1,000 annual visits will be to participate in these activities. These uses are identified and discussed in detail in Chapter 5 of the CCP (USFWS 2005) and are incorporated by reference.

Some highlights are as follows:

a) Develop and maintain walking trails on Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora and Packer Units to provide wildlife viewing and photographic opportunities and to promote awareness about the value of riparian habitat, management efforts, and plant/wildlife identification tips.
b) Construct a wildlife viewing/photography blind on the Codora Unit as funding becomes available.
c) Place public use signs at the approximate ordinary high water mark on units that will be opened to the public (Figure 27, Chapter 5, CCP) at appropriate (1/2 mile intervals) accessible points. The signs will depict the unit name, river mile, and public uses allowed/ prohibited. The public will be able to access the units by boat.
d) Place interpretive signs and brochure racks at vehicle entrances and boat ramps.

Availability of Resources: The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage the activities as described above:

	One-time Costs	Annual Costs
Administration		$20,000
Law enforcement		$45,000
Construct and maintain 7 interpretive walking trails	$60,000	$5,000
Construct and maintain photography blind	$4,000	$1,000
Interpretive panels and kiosk	$25,000	$2,000
Signs, brochures, and brochure racks at 13 vehicle parking areas/boat launches	$20,000	$3,000
Construct and maintain 8 parking areas	$80,000	$2,000
TOTAL	**$189,000**	**$78,000**

Refuge operational funds are currently available through the Service budget process to administer these uses.

Anticipated Impacts of Use: The construction and maintenance of trails, photography blind and parking lots will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988).

The Refuge provides habitat for resident and migratory wildlife. As a result of these activities, individual animals may be disturbed by human contact to varying degrees. Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Many studies have shown that birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or

nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989). Herons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flushed to distant areas away from people (Burger 1981). A reduced number of shorebirds were found near people who were walking or jogging, and about 50 percent of flushed birds flew elsewhere (Burger 1981). In addition, the foraging time of sanderlings decreased and avoidance (e.g., running, flushing) increased as the number of humans within 100 meters increased at a coastal bay refuge on the Atlantic (Burger and Gochfeld 1991). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1978), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). This could potentially limit the number of breeding pairs of certain passerine species, thus limiting production within refuge riparian habitats (Reijnen and Foppen 1994). In our opinion, due to the habitat requirements and life cycles of Valley elderberry longhorn beetle and Chinook salmon these species will not be impacted by these activities.

Of the wildlife observation techniques, wildlife photographers tend to have the largest disturbance impacts (Klein 1993, Morton 1995, Dobb 1998). While wildlife observers frequently stop to view species, wildlife photographers are more likely to approach wildlife (Klein 1993). Even slow approach by wildlife photographers tends to have behavioral consequences to wildlife species (Klein 1993). Other impacts include the potential for photographers to remain close to wildlife for extended periods of time, in an attempt to habituate the wildlife subject to their presence (Dobb 1998) and the tendency of casual photographers, with low-power lenses, to get much closer to their subjects than other activities would require (Morton 1995), including wandering off trails. This usually results in increased disturbance to wildlife and habitat, including trampling of plants.

The Wildlife Observation, Photography, and Interpretation programs have been designed to avoid or minimize impacts anticipated to Refuge resources and Refuge visitors. Hunting may be impacted by wildlife observation, photography and interpretation. However, the timing of hunt seasons minimizes the overlap with other public uses (Figure 25, Chapter 5, CCP). Accordingly, in our opinion, these uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley

steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Anticipated Impacts of Uses on Future Lands within the Approved Boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination:

_____ Use is Not Compatible

__X__ Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Adequate areas would be designated as wildlife sanctuary with no or limited public use activities to provide high quality habitat for feeding, resting, and nesting. Trails will be designed utilizing existing service roads and open savannah habitat types to provide adequate sanctuary areas. Where site conditions permit, native trees and shrubs will be planted to create screening along trails to reduce disturbance. These measures will also enhance viewing opportunities and provide quality wildlife observation, photography and interpretation experiences.

- Regulations and wildlife friendly behavior (e.g., requirements to stay on designated trails, dogs must be kept on a leash, etc.) will be described in brochures and posted at the Visitor Contact Station(s).

- Refuge biologists and public use specialists will conduct regular surveys of public activities on the refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of the wildlife observation, photography, and interpretation programs.

Justification: These wildlife-dependent uses are priority public uses of the National Wildlife Refuge System. Providing opportunities for wildlife observation, photography, and environmental interpretation would contribute toward fulfilling provisions of the National Wildlife Refuge System Administration Act, as amended in 1997, and one of the goals of the Sacramento River Refuge (Goal 2, Chapter 5, CCP). Wildlife observation, photography, and interpretation would provide an excellent forum for allowing public access and increasing understanding of Refuge resources. The stipulations outlined above should minimize potential impacts relative to wildlife/human interactions. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that wildlife observation, photography and interpretation within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, these wildlife dependent uses will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2020):

__X___ Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

_____ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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USFWS. 2005. Sacramento River National Wildlife Refuge Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Region 1.

Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Environmental Education

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Currently, the environmental education program at Sacramento River Refuge serves approximately 300 students a year. The environmental education program is designed to provide effective resources, tools, and training which facilitates the teaching of accurate scientific and environmental information about the Sacramento River watershed and surrounding areas. The Refuge encourages environmental education as a process of building knowledge in students. The Refuge staff will work with schools (K-12) to integrate environmental concepts and concerns into structured educational

activities. Refuge staff will promote environmental education that is: aligned to the current Federal, State and local standards; curriculum based the meets the goals of the school districts adopted instructional standards; and provides interdisciplinary opportunities, linking the natural world with all subject areas. The environmental education program will be managed in accordance of Refuge Manual 8 RM 3, Outdoor Classroom and Educational Assistance). The proposed environmental education program is discussed in detail as part of the Proposed Action in the CCP and associated EA (CCP Chapter 5 and Appendix A), which are incorporated by reference (USFWS 2005).

Environmental education is identified in the Improvement Act as one of the Big 6 legislated wildlife-dependent, priority public uses.

Environmental education is not considered a Refuge management economic use.

The Refuge proposes to develop an environmental education program by 2005 to service about 1,000 students. Primary visitation will occur during the traditional school year of August through May. Educators will attend a teacher orientation and will design, schedule, and facilitate their own field trips on the Refuge. Refuge staff will provide teacher training, site-specific curricula, materials, and activities, and field trip assistance to enhance learning in an outdoor setting. A local school district guideline for supervision during a field trip recommends one adult for up to ten students and requires at least one credentialed teacher.

Rio Vista, Pine Creek, Phelan Island, Ord Bend, and Packer Units could be promoted as the primary units for school groups to visit (Figure 28, Chapter 5, CCP). The areas meet the basic health and safety needs for students i.e. rest rooms, trails, bus parking, etc. Students will utilize walking trails and picnic tables, to complete their activities and studies. Environmental education study sites on Phelan, Pine Creek, and Ord Bend Units will provide areas for more in-depth studies where students and teachers will participate in restoration and monitoring activities through one-time activities or more long-term monitoring studies.

Students participating in restoration and monitoring activities will work as described in the environmental education program and as permitted in their reservation form. The reservation form allows the teacher to request specific activities or materials. Students will be trained by Refuge staff before they start restoration and monitoring projects to ensure their safety while out in the field, to minimize wildlife and habitat disturbance and to maximize project success.

Future environmental education opportunities on newly acquired lands will include student and teacher participation in habitat restoration and monitoring activities that would be incorporated into the overall program. This compatibility determination will be re-evaluated if new activities in the expansion area are anticipated to significantly change the level of use or impacts.

Availability of Resources: The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage environmental education activities as described above:

	One-time Costs	Annual Costs
Visitor Contact Station	$332,000	$20,000
Administration		$5,000
Establish and Maintain Study Sites	$10,000	$2,000
Staffing (teacher training, student support curriculum development, field trip assistance, teaching students, and administration)	$3,000	$1,000
Equipment, materials, and supplies	$5,000	$2,000
TOTAL	**$350,000**	**$30,000**

Funds are anticipated to be available through the Service budget process for construction of a visitor contact station, establishment of study sites, and potentially some operational costs. Additional funding for staffing and operational costs would be needed. Other sources will be sought through strengthened partnerships, grants, and additional Refuge operations funding to support a safe, quality environmental education program as described above.

Anticipated Impacts of Use: Opening the Refuge to environmental education activities will be compatible with the Refuge's purposes, goals, and objectives and the Refuge System mission.

The construction and maintenance of packed gravel or dirt trails, boardwalks, and platforms will have minor impacts on soils and vegetation around the trails. This could include an increased potential for erosion, soil compaction (Liddle 1975), reduced seed emergence (Cole and Landres 1995), alteration of vegetative structure and composition, and sediment loading (Cole and Marion 1988).

Human activities on trails can result in direct effects on wildlife through harassment, a form of disturbance that can cause physiological effects, behavioral modifications, or death (Smith and Hunt 1995). Birds can be impacted from human activities on trails when they are disturbed and flushed from feeding, resting, or nesting areas. Flushing, especially repetitive flushing, can strongly impact habitat use patterns of many bird species. Flushing from an area can cause birds to expend more energy, be deterred from using desirable habitat, affect resting or feeding patterns, and increase exposure to predation or cause birds to abandon sites with repeated disturbance (Smith and Hunt 1995). Migratory birds are observed to be more sensitive than resident species to disturbance (Klein 1989). Herons and shorebirds were observed to be the most easily disturbed (when compared to gulls, terns and ducks) by human activity and flush to distant areas away from people (Burger 1981). A reduced number of shorebirds were found near people who were walking or jogging, and about 50 percent of flushed birds

flew elsewhere (Burger 1981). In addition, the foraging time of sanderlings decreased and avoidance (e.g., running, flushing) increased as the number of humans within 100 meters increased at a coastal bay refuge on the Atlantic (Burger and Gochfeld 1991). Nest predation for songbirds (Miller et al. 1998), raptors (Glinski 1976), colonial nesting species (Buckley and Buckley 1978), and waterfowl (Boyle and Samson 1985) tends to increase in areas more frequently visited by people. In addition, for many passerine species, primary song occurrence and consistency can be impacted by a single visitor (Gutzwiller et al. 1994). This could potentially limit the number of breeding pairs of certain passerine species, thus limiting production within refuge riparian habitats (Reijnen and Foppen 1994).

The disturbance by environmental education activities is considered to be of minimal impact because: (1) the total number of students permitted through the reservation system is limited to 100 per day; (2) students and teachers will be instructed in trail etiquette and the best ways to view wildlife with minimal disturbance; (3) education groups will be required to have a sufficient number of adults to supervise the group; (4) trail design will provide adequate cover for wildlife; and (5) observation areas and scopes are provided to view wildlife at a distance which reduces disturbance.

Disturbance by students is considered minimal as study sites will be placed in areas already impacted by trail users and Refuge staff, and all off-trail activity will be focused in these small areas. Educators will be instructed on use of the study areas during teacher orientation workshops. Collection of samples for study (i.e., mud, water, plants) will be restricted to study areas, and samples must be used on site. Collection will be of materials needed to enhance hands-on learning and investigation and will be designed as part of structured activities and lessons, guided by teachers, and monitored by Refuge staff. These activities are an integral part of the education program design and philosophy and their impacts are considered minimal.

Education staff will coordinate with Biology staff regarding activities associated with restoration or monitoring projects to ensure that impacts to both wildlife and habitat are minimal. As with any restoration and monitoring activities conducted by Refuge personnel, these activities conducted by students would be at a time and place where the least amount of disturbance would occur.

Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired

lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Future environmental education opportunities in the expansion area associated with habitat restoration and monitoring will have similar impacts as described above.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination:

_____Use is Not Compatible

__X___Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- Participants in the Refuge's environmental education program will be restricted to established trails, study sites, and other facilities including buildings and photo blinds

- All groups using the Refuge for environmental education will be required to make reservations in advance through the Refuge office. This process, which takes the place of a Special Use Permit, allows refuge staff to manage the number and location of visitors for each unit. There is a current refuge policy that educational groups are not charged a fee or required to have a SUP. A daily limit of 100 students participating in the education program will be maintained through this reservation system. Efforts will be made to spread out use by large groups while reservations are made, reducing disturbance to wildlife and over-crowding of Refuge facilities during times of peak demand.

- Trail etiquette including ways to reduce wildlife disturbance will be discussed with teachers during orientation workshops and with students upon arrival during their welcome session. On the refuge, the teacher(s) is responsible for ensuring that students follow required trail etiquette.

- Environmental education study sites will be located where minimal impact to Refuge resources will occur. Refuge biologists and public use specialists will conduct regular surveys of public activities on the refuge. The data will be analyzed and used by the refuge manager to develop future modifications if necessary to ensure compatibility of environmental education programs.

Justification: Environmental education is a priority public use of the National Wildlife Refuge System. It is the intent of the Refuge staff to provide a quality environmental education program. To achieve this goal, the Refuge environmental education program would provide a diversity of environmental education opportunities to students and teachers. These include: (1) facilities, materials, and training; (2) access to a variety of Refuge habitats; and (3) the ability to observe wildlife and conduct hands-on exploration. The program is intended to foster a better understanding of Refuge ecosystems and wildlife resources, and in turn foster a public that is knowledgeable about and involved in natural resource stewardship. Although there is some impact to Refuge lands and wildlife in having an environmental education program, efforts will be made to ensure that they are kept within acceptable levels. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that environmental education within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, environmental education will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2020):

__X_____Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

_____ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Miller, S. G., R. L. Knight, and C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecol. Appl. 8:162-169.

Reijnen, R. and R. Foppen. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warbler (*Pylloscopus trochilus*) breeding close to a highway. J. Appl. Ecol 31: 85-94.

Smith, L. and J. D. Hunt. 1995. Nature tourism: impacts and management. Pp. 203-219 in Knight, R. L.; Gutzwiller, K. J. (Wildlife and recreationists: coexistence through management and research, eds.). Island Press, Washington, D. C.

USFWS. 2005. Sacramento River National Wildlife Refuge Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Region 1.

Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Research

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Two provisions of the National Wildlife Refuge Improvement Act are to "maintain biological integrity, diversity and environmental health" and to conduct "inventory and monitoring." Monitoring and research are an integral part of National Wildlife Refuge management. Plans and actions based on research and monitoring provide an informed approach, which analyzes the management affects on refuge wildlife. The proposed research program is discussed in detail as part of the Proposed Action in the CCP and associated EA, which are incorporated by reference (USFWS 2005).

Sacramento River Refuge receives over 20 requests per year to conduct scientific research at the Refuge. From 1993 to 2003, there have been between two and 20 active Special Use Permits issued for research and monitoring. Special Use Permits would only be issued for monitoring and investigations which contribute to the enhancement, protection, preservation, and management of native Refuge plant and wildlife populations and their habitats. Research applicants are required to submit a proposal that outlines: (1) objectives of the study; (2) justification for the study; (3) detailed methodology and schedule; (4) potential impacts on Refuge wildlife or habitat, including disturbance (short and long term), injury, or mortality (this includes a description of measures the researcher will take to reduce disturbance or impacts); (5) research personnel required; (6) costs to Refuge, if any; and (7) progress reports and end products (i.e., reports, thesis, dissertations, publications). Research proposals are reviewed by Refuge staff and conservation partners, as appropriate. Special Use Permits are issued by the refuge manager, if the proposal is approved.

Evaluation criteria will include, but not be limited to, the following:

- Research that will contribute to specific Refuge management issues will be given higher priority over other research requests.

- Research that will conflict with other ongoing research, monitoring, or management programs will not be granted.

- Research projects that can be accomplished off-Refuge are less likely to be approved.

- Research which causes undue disturbance or is intrusive will likely not be granted. Level and type of disturbance will be carefully evaluated when considering a request.

- Refuge evaluation will determine if any effort has been made to minimize disturbance through study design, including considering adjusting location, timing, scope, number of permittees, study methods, number of study sites, etc.

- If staffing or logistics make it impossible for the Refuge to monitor researcher activity in a sensitive area, the research request may be denied, depending on the specific circumstances.

- The length of the project will be considered and agreed upon before approval. Projects will be reviewed annually.

These criteria will also apply to any properties acquired in the future within the approved boundary of the Refuge.

Availability of Resources: The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage research activities as described above:

	Annual Costs
Administration (Evaluation of applications, management of permits, and monitoring of research projects)	$18,000
TOTAL	**$18,000**

Refuge operational funds are currently available through the Service budget process to administer this program.

Anticipated Impacts of Use: Use of the Refuge to conduct research will benefit Refuge fish, wildlife, plant populations, and their habitat. Monitoring and research investigations are an important component of adaptive management. Research investigations would be used to evaluate habitat restoration projects and ecosystem health (Golet et al. 2003; Stillwater Sciences 2003). Specific restoration and habitat management questions would be addressed in most research investigations to improve habitat and benefit wildlife populations. Standardized monitoring would be used to insure data compatibility for comparisons from across the landscape so that natural resource bottleneck areas could be identified for habitat enhancement and restoration (Elzinga et al. 1998; Ralph et al. 1993). Focal species and indicator species would be identified and investigated and monitored to measure and track riparian habitat restoration success and ecosystem health (Riparian Habitat Joint Venture 2004; Stillwater Sciences 2003).

An expected short-term effect of monitoring and research investigations is that Refuge management activities would be modified to improve habitat and wildlife populations, as a result of new information. Expected long-term and cumulative effects include a growing body of science-based data and knowledge as new continued monitoring and new research compliments and expands upon previous investigations; and, an expanded science-based body of data and information from which to draw upon to implement the best Refuge management possible. Natural resources inventory, monitoring and research are not only provisions of the Refuge Improvement Act, but they are necessary tools to maintain biological integrity and diversity and environmental health, which are also key provisions of the act. Inventory, monitoring and research are intended to improve habitat and wildlife populations. This would improve wildlife-dependent recreation by increasing encounters with wild things.

Some direct and indirect effects would occur through disturbance which is expected with some research activities, especially where researchers are entering sanctuaries. Researcher disturbance would include altering wildlife behavior, going off designated trails, collecting soil and plant samples or trapping and handling wildlife. However, most of these effects would be short-term because only the minimum of samples (e.g., water,

soils, vegetative litter, plants, macroinvertebrates) required for identification and/or experimentation and statistical analysis would be permitted and captured and marked wildlife would be released. Long-term effects would be eliminated/reduced because refuge evaluation of research proposals would insure only proposals with adequate safeguards to avoid/minimize impacts would be accepted. Potential impacts associated with research activities would be mitigated/minimized because sufficient restrictions would be included as part of the study design and researcher activities would be monitored by Refuge staff. Refuge staff would ensure research projects contribute to the enhancement, protection, preservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity. Additionally, Special Use Permit conditions would include conditions to further ensure that impacts to wildlife and habitats are avoided and minimized.

Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

When new lands are acquired by the Refuge, the Refuge would ensure, through the Stipulations presented herein and the terms and conditions in the Special Use Permit, that impacts would be similar to, if not less than, those described.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination: This program as described is determined to be compatible. Potential impacts of research activities on Refuge resources will be minimized because sufficient restrictions and safeguards would be included in the Special Use Permit and research

activities will be monitored by the refuge manager and biologist. The refuge manager and biologist would ensure that proposed monitoring and research investigations would contribute to the enhancement, protection, conservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity, diversity, and environmental health.

_____Use is Not Compatible

__X__Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility: The criteria for evaluating a research proposal, outlined in the Description of Use section above, will be used when determining whether a proposed study will be approved on the Refuge. If proposed research methods are evaluated and determined to have potential adverse impacts on refuge wildlife or habitat, then the refuge would determine the utility and need of such research to conservation and management of refuge wildlife and habitat. If the need was demonstrated by the research permittee and accepted by the refuge, then measures to minimize potential impacts (e.g., reduce the numbers of researchers entering an area, restrict research in specified areas) would be developed and included as part of the study design and on the Special Use Permit (SUP). Special Use Permits will contain specific terms and conditions that the researcher(s) must follow relative to activity, location, duration, seasonality, etc. to ensure continued compatibility. All Refuge rules and regulations must be followed unless otherwise accepted in writing by Refuge management.

All information, reports, data, collections, or documented sightings and observations, that are obtained as a result of this permit are the property of the Service and can be accessed by the Service at any time from the Permittee at no cost, unless specific written arrangements are made to the contrary. The Refuge also requires the submission of annual or final reports and any/all publications associated with the work done on the Refuge. Each SUP may have additional criteria. Each SUP will also be evaluated individually to determine if a fee will be charged and for the length of the permit.

Extremely sensitive wildlife habitat areas would be avoided unless sufficient protection from research activities (i.e., disturbance, collection, capture and handling) is implemented to limit the area and/or wildlife potentially impacted by the proposed research. Where appropriate, some areas may be temporarily/seasonally closed so that research would be permitted when impacts to wildlife and habitat are no longer a concern. Research activities will be modified to avoid harm to sensitive wildlife and habitat when unforeseen impacts arise.

Refuge staff will monitor researcher activities for potential impacts to the refuge and for compliance with conditions on the Special Use Permit. The refuge manager may

determine that previously approved research and special use permits be terminated due to observed impacts. The refuge manager will also have the ability to cancel a Special Use Permit if the researcher is out of compliance with the conditions of the SUP.

Justification: This program as described is determined to be compatible. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that research within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. Refuge monitoring and research will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through the application of knowledge gained from monitoring and research. Biological integrity, diversity and environmental health would benefit from scientific research conducted on natural resources at the refuge. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved restoration and management plans and activities associated with monitoring and research investigations which address specific restoration and management questions.

Mandatory Re-Evaluation Date (March 2015):

_____ Mandatory 15-year Re-Evaluation (for priority public uses)

___X___ Mandatory 10-year Re-Evaluation, Date will be provided in Final EIS/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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USFWS. 2005. Sacramento River National Wildlife Refuge Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Region 1.

Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Camping and Recreational Boating

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: Camping and recreational boating are combined and evaluated together in this compatibility determination because access to camping on the refuge can only occur by boat. The Comprehensive Conservation Plan (CCP) Proposed Action and Environmental Assessment, which are incorporated by reference, would provide camping and associated recreational opportunities below the ordinary high water mark with an emphasis on facilitating priority public uses, including hunting, fishing, wildlife observation, photography, environmental education, and interpretation (USFWS 2005).

Thirteen of the twenty units proposed to be open for public use (above the ordinary high water mark) require refuge visitors to access the unit by boat (Figure 28, Chapter 5, CCP). Those 13 units lack public or county roads and access through private farms is limited to refuge staff for management and administrative purposes only. Restrictions on camping would be aimed at minimizing impacts to wildlife and habitat as well as conflicts with other users, and reducing the potential for wildfires. The Sacramento River is a navigable water within California and boating has been a traditional use. The jurisdiction of the Service regarding navigable waters within the Refuge is discussed in Chapter 1 of the CCP. Boating activities within the river are subject to existing State and Federal laws. No changes are proposed.

Recreational boating use addressed in this compatibility determination includes motorboats and non-motorized boats, including kayaks and canoes, in those waters under the jurisdiction of the Refuge (e.g. floodwater areas, isolated oxbows, and other floodplain wetlands). Motorboats include a variety of crafts powered by 2-cycle or 4-cycle engines. It does not include personal watercraft (jet ski) use.

Camping has not previously been allowed on the Refuge. Historically, camping occurred on most gravel bars along the Sacramento River including those that were eventually acquired by the Refuge. Some demand occurs for camping on the Refuge from visitors wishing to conduct multiple day floats and visitors desiring to secure a hunting location on the Refuge. This demand is seasonal, with a majority of the camping activities occurring during the months of August and September. The anticipated peak use period weekend would be the annual opening of dove season in early September. Camping activity will be allowed to occur on designated Refuge gravel bars below the ordinary high water mark (Figure 27, Chapter 5, CCP) for up to seven days during any 30-day period. An estimated 500 camping visits are anticipated annually on the Refuge. No special facilities would be provided for this type of camping with the exception that a primitive group camping area may be designated at the gravel bar on the Dead Man's Reach Unit. The group site would be available by permit only to formal organizations with groups larger than 20 individuals (e.g., boy scout groups, youth groups, etc.). Approximately 100 annual camping visits, under this Special Use Permit, are anticipated. Access to all of the camping areas is by boat from the navigable waters of the Sacramento River (under State jurisdiction).

Boat ramps and camping areas in the vicinity of the Refuge are identified in EDAW 2002 and can be found in Appendix N of the CCP (USFWS 2005). Camping on the Refuge will not detract from use on other campgrounds.

Availability of Resources: Development of specific a campground on the Dead Man's Reach Unit would require additional funding to build, maintain, and monitor. Currently, resources are stretched to maintain existing Refuge facilities and conduct law enforcement of existing public uses.

The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage boating activities as described above:

	One-time Costs	Annual Costs
Administration	$2,000	$2,000
Law Enforcement		$10,000
Outreach, Education, and Monitoring		$5,000
Boundary surveys and posting	$15,000	$2,000
Camp Site Development and Maintenance	$25,000	$10,000
Signs	$3,000	$1,000
TOTAL	**$45,000**	**$30,000**

Additional funds would be required to construct, operate, and maintain visitor facilities and interpretive materials (see summary table above). Law enforcement staffing would also be needed. Funding would be sought through the Service budget process. Other sources will be sought through strengthened partnerships, grants, coordination with other law enforcement agencies, and additional Refuge operations funding to support a safe, quality public use program as described above.

No boat ramps or other boating related facilities are proposed to be developed within the Refuge.

Anticipated Impacts of Use: Camping and associated recreational boating have occurred for many years along the Sacramento River. Boating activity, both motorized and non-motorized, can alter distribution, reduce use of particular habitats or entire areas by waterbirds and other birds, alter feeding behavior and nutritional status, and cause premature departure from areas (Knight and Cole 1995). More sensitive species may find it difficult to secure adequate food or loafing sites as their preferred habitat becomes fragmented and recreation-related disturbances increase (Skagen et al. 1991; Pfister et al. 1992). Motorized boats generally have more impact on wildlife than non-motorized boats because motorboats produce a combination of movement and noise (Tuite et al. 1983, Knight and Cole 1995). For example, a significant decrease in the proportion of bald eagles feeding at a site was observed when motorized boating activity occurred within 200 meters of that area in the preceding 30 minutes (Skagen 1980). Motorized boats can also cover a larger area in a relatively short time, in comparison to non-motorized boats. Even canoes and kayaks can cause significant disturbance effects based on their ability to penetrate into shallower areas of the marsh (Speight 1973, Knight and Cole 1995). In the Ozark National Scenic Riverway, green-backed heron activity declined on survey routes when canoes and boat use increased on the main river channel (Kaiser and Fritzell 1984). Canoes or slow-moving boats have also been observed to disturb nesting great blue herons (Vos et al. 1985). Huffman (1999) found that non-motorized boats within 30 meters of the shoreline in south San Diego Bay caused all wintering waterfowl to flush between the craft and shore. However, compared to motorboats, canoes and kayaks appear to have

less disturbance effects on most wildlife species (Jahn and Hunt 1964, Huffman 1999, DeLong 2002).

In Denmark, fast-moving boats were observed to have the greatest impact on red-breasted merganser broods (Kahlert 1994). The presence of fast-moving boats also caused the most significant modifications to the amount of time animals spent feeding and resting. In England, an increased rate of disturbance from boats partly caused a decline in roosting numbers of shorebird species (Burton et al. 1996). In addition, boaters have been observed to cause massive flights of diving ducks on the Mississippi River (Thornburg 1973). Motorized boats within 100 meters of shore caused all wintering waterfowl and shorebirds to flush between the craft and shore in south San Diego Bay, regardless of speed. However, disturbance to birds in general was reduced when boats traveled at or below the 5 mph speed limit (Huffman 1999).

Impacts of boating can occur even at low densities, given their noise, speed, and ability to cover extensive areas in a short amount of time. The total number of boats and people can be an inappropriate measure of recreational intensity because the presence of a single boat might be just as disturbing as that of many (Tuite et al. 1983, Knight and Knight 1984).

The habitat along the Sacramento River is a relatively narrow riparian corridor system that receives high use by a variety of Neotropical migratory birds, waterbirds, and raptors. Because boats in confined areas are generally closer to shorelines, waterbirds in sloughs and on the river may be exposed to more human activity than birds in other shoreline habitats (Bratton 1990). Even low levels of boating activity affect the duration and pattern of use by wildlife in this narrow system. In addition, disturbance to nesting birds is caused by boat activity. Active osprey nests occur along the river within and outside the Refuge. Nesting heron and egret colonies occur along the river in the Llano Seco, Flynn, and Mooney Units. Nesting great blue herons are sensitive to a variety of human disturbances. Great blue herons were one of the most sensitive of 23 waterbird species, when measuring flush distances from motorized watercraft (Rodgers and Schwikert 2002).

Motorized boats introduce noise and pollution, in the form of gas and oil in water, and particulates in the air in the riverine habitats of the Refuge. However, please note that the majority of the boat access occurs on State waters outside the jurisdiction of the Refuge.

Camping is a high impact activity which can result in the degradation of Refuge habitat. Camping in itself can disturb and disperse wildlife. Human activity, generators, loud motors, music and dogs associated with some types of camping disturb wildlife and can detract from the outdoor experience of other Refuge users. Fires and firewood collection damage habitat. Use of detergent, soap, and toothpaste in or near rivers harm fish and other aquatic life. Human waste creates unsanitary conditions and litter. Campers sometimes leave garbage, litter, and other undesirable items. Creation of improvements

(e.g., lean-tos, tables, rock walls, etc.) and alteration of the site can be byproducts of camping and may impact localized gravel bar vegetation.
Camping can result in inappropriate uses (e.g., littering, deposition of human waste), devalues vegetation and trampled and devalued wildlife habitats. Camping can degrade land, water, and wildlife by simplifying plant communities, increasing mortality, displacing and disturbing wildlife and distributing refuse (Boyle and Samson 1985). In addition, camping induced soil disturbance may provide conditions that favor weed infestations. Camping in riparian areas may also result in increased runoff into streams due in part to exposed soil and reduction in vegetation (Green 1998). Camping also requires additional law enforcement efforts that may have to be directed at a wide range of violations from those listed above to domestic disturbance/assaults.

Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

In our opinion, the limited camping and associated boating will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination:

_____Use is Not Compatible

__X__Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- No refuge lands other than gravel bars below ordinary high water mark would be open to camping. Refuge informational signs will be located at the approximate ordinary high water mark. Information will also be distributed in brochures and on the web-site.

- Monitoring of boating and camping activities and associated effects on habitat and wildlife will be conducted. Monitoring data will be used by the refuge manager in the periodic re-evaluation of this Compatibility Determination.

- Groups permitted to camp on Refuge lands for the purpose of completing specific projects or utilize a specific refuge unit must adhere to all conditions specified in a special use permit and Refuge regulations.

- Refuge staff will post seasonal camping closures on areas that contain sensitive wildlife species (e.g., active heron colony, osprey nest nearby, etc.).

- No person shall build or maintain fires except on gravel bars in portable gas stoves.

- Limited camping on gravel bars up to seven days during any 30 day period is allowed. Camping on Refuge land, other than gravel bars, is prohibited.

- On Refuge lands, excluding gravel bars, entry and departure is restricted to one hour before sunrise to one hour after sunset.

- We require dogs to be kept on a leash, except for hunting dogs engaged in authorized hunting activities and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).

- Visitors using boats must abide by the boating stipulations described in the State and Coast Guard regulations on boating.

- All property and other items including litter must be removed from campsites upon leaving the Refuge (i.e. pack it in, pack it out).

Justification: Camping and associated boating are not considered wildlife-dependent recreation, but many wildlife-dependent recreational activities (fishing, hunting, environmental education, interpretation, wildlife observation and photography) along the river and within the Refuge are associated with boating. Providing opportunities for wildlife-dependent priority public uses would contribute toward fulfilling provisions under the National Wildlife Refuge System Administration Act as amended in 1997. Although boating has a potential to impact riparian wildlife, implementing the prescribed measures

listed in the Stipulations section should reduce many of these impacts to acceptable levels. It is anticipated that an adequate amount of habitat would be available to the majority of migratory birds and other native wildlife because State boating regulations would be maintained and enforced. Thus, it is anticipated that migratory birds and other native wildlife will find sufficient food resources and resting places such that their abundance and use of the Refuge will not be measurably lessened, the physiological condition and production of migratory birds and other native wildlife will not be impaired, their behavior and normal activity patterns will not be altered dramatically, and their overall status will not be impaired. The Refuge will also implement a monitoring program to help assess disturbance effects on wildlife and habitat and discern adaptive management options. Improved outreach and educational information for Refuge visitors involved in activities associated with boating would also help to reduce the impacts associated with boating and riverside camping activities. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that camping and recreational boating (motorized and non-motorized) within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, camping and associated boating (motorized and non-motorized) will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2015):

_____Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

__X__ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(***March 2005)***

Use: Cooperative Farming Program

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: For the past twelve years the Service has been acquiring parcels of land to establish the Sacramento River Refuge. The Service's goal is to purchase remnant forests, oxbow sloughs, and flood prone lands adjacent to or near the Sacramento River. These properties, along the riparian corridor, often include commercial farmland that includes English walnuts, *Juglans regia,* prunes, *Prunus domestica,* almonds, *Prunus amygdalus,* and various field crops. Currently the Refuge has 1,968 acres of agricultural land that includes; 1,001 acres of walnuts, 243 acres of almonds, 924 acres of row crops,

and 870 acres of fallow fields. Transition farming activities occur on 8 of the 26 refuge units (La Barranca, Jacinto, Capay, Dead Man's Reach, Llano Seco, Hartley Island, Codora, and Drumheller Slough). The proposed cooperative farming program is discussed in detail as part of the Proposed Action in the CCP and associated EA (CCP Chapter 4 and Appendix A), which are incorporated by reference (USFWS 2005). The long-term goal for these agricultural lands is restoration to riparian habitat. In the interim, crops are farmed under an existing Cooperative Land Management Agreement with nonprofit conservation groups that lease the property to local farmers (Refuge files, CLMA). The remaining refuge acreage consists mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, riparian willow scrub, valley oak woodland and savannah, elderberry savannah, gravel bar, grasslands and the 3,307 acres that have been restored to native riparian communities.

General Orchard Management Practices
Orchard production within the Refuge requires progressive management to protect habitat and species while maintaining healthy, productive trees that avoid pest problems. Weeds and pests are controlled throughout the year using an integrated pest management (IPM) strategy (Cerus 2003). Methods include irrigation of the tree rows, domestic bee pollination, and the use of various types of pesticide spraying implements for application of Service approved pesticides. All pesticides are reviewed through the Fish and Wildlife Service National Pesticide Use Proposal Policy prior to authorizing use on the Refuge.

The understory vegetation in the majority of walnut orchards is a managed cover composed of nonnative annual winter weeds; and annual and perennial summer weeds usually Bermuda grass, *Cyanodon dactylon*. The orchards are part of the river floodplain and have a year round cover of resident vegetation which limits the run off of pest control materials. The surface vegetation is mowed during early spring and summer; the walnut orchard units are not disked (Cerus 2003).

General Row Crop Management Practices
Row crops grown on the refuge include corn, wheat, barley, safflower, and sunflower. Typical activities include: discing, planting, mowing to control weed growth, irrigation management, and Service approved herbicide sprays to control weeds. Row crop management activities occur between May and November. The row crop program helps to control weeds during the transition from orchard management to restoration activities.

Research Needs:
There are many research needs regarding the effects of walnut management within the inner river area adjacent to the Refuge units. The role of biological control from the riparian forest as well as the role of bats, birds, and generalist predators is yet not clearly understood. Success with pheromone disruption in walnuts in northern California is being explored, but success has not been demonstrated on a large scale. Further research on

the efficacy of pheromone disruption will be needed before this technology can be recommended for more than one third of the Refuge's walnuts.

Availability of Resources: The following funding/annual costs would be required to administer and manage research activities as described herein: The CLMA cooperator carries the major burden of administering the farming program.

	One-time Costs	Annual Costs
Administration		$10,000
Research	$25,000	$10,000
TOTAL	**$25,000**	**$20,000**

Monitoring is addressed in the CLMA and is conducted and reported to the Refuge by our CLMA partners. Refuge operational funds are currently available through the Service budget process to administer this program.

Anticipated Impacts of Use: The Refuge units, which contain managed walnut orchard production, use the most effective methods of pest control for codling moth, navel orange worm, mites, and walnut husk fly all of which may require a chemical control. All decisions to use a chemical control are based upon monitoring by licensed Pest Control Advisors and are used when cultural and biological methods have failed to control the pests below significantly damaging levels. Failure to treat the pests like codling moth and navel orangeworm, both of which have 3 or 4 generations, will result in population buildups that can impact neighboring walnut and almond orchards. This IPM Plan provides sufficient flexibility to keep the properties managed until further research and field experience with pest control methods can be evaluated and implemented.

It is important to keep the walnut crops managed by the tenant farmers who derive proceeds from the crop versus allowing the large units of walnuts to be unmanaged for years while funding is solicited for restoration. The phasing out of farming on Refuge lands, as opposed to immediate termination, offsets immediate impact to the local farming community and the county tax roles (Jones & Stokes 2002). This is a refuge management economic activity and its utilization, at least in the short-term, helps the Refuge achieve the purposes for which it was created and the mission of the Refuge System.

Effects to non-target organisms can be: interference with normal biological systems and functions, loss of biomass, loss of diversity, interference with normal ecological relationships, bioaccumulation, and other known and unknown effects. The mission of Refuge is to provide for the conservation of migratory birds, native anadromous fish, endangered and threatened species, native plants and other native animals and their habitats. There was a concern that the walnut pest control treatments interfere with the Refuge's purposes by reducing and contaminating existing food and water components of habitat. Rare insects or insects that may function as important pollinators for native plants may also be impacted by walnut arthropod pest treatments. Significant

bioaccumulation has not been associated with any of the approved chemical treatments referred to in this plan (Cerus 2003). Specific impacts to non-target species are addressed in the Orchard Integrated Pest Management Plan (Cerus 2003). Potential impacts from pesticides on anadromous fish, invertebrates, songbirds, and other wildlife are mitigated through restricted pesticide use, implementation of vegetative buffers, and seasonal restrictions on activities that may impact sensitive species.

Section 7 consultations with USFWS (2004a, b) and NOAA-Fisheries (2004a, b) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination:

_____Use is Not Compatible

__X__Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

1. Compliance with annual Pesticide Use Proposal policy.
   - The use of buffers 300 feet or more between the walnut orchard pest control applications and blue elderberry plants should substantially help mitigate effect of applications of walnut pest control treatments on Valley elderberry longhorn beetle (VELB).
   - Wide unsprayed vegetated buffers (200 to 300 feet), reduced application rates

(50 to 100 gallons per acre), low active ingredient concentrations, rapid degradation and soil binding, avoidance of applications during inversions or winds over 7mph, and the addition of drift control agents all reduce the opportunity for pesticides of concern to enter aquatic environments.

- Despite the existence of buffer strips to prevent off site movement or drift of the pest control materials there is still concern that the use of Malathion may have either a transitory or cumulative effects on the reduction of non-target aerial or terrestrial insects, especially those that are rare or serve as pollinators for rare plant species. Inventories of at risk species should be undertaken based on their susceptibility to Malathion treatments. Further field research on the alternative for walnut husk fly control, the spinosad bait, should be accelerated (Cerus 2003).

2. Implementation of the IPM Plan for Walnut Production on the Sacramento River National Wildlife Refuge.
   - Conduct Best Management Practices for orchard farming
   - Experimentation with biological control methods for pest control
   - Monitoring potential impacts to non-target species
3. No public access will occur on farmlands
   - No spray buffers near areas open to the public
   - Notification/signing during periods of pesticide application

4. The Refuge consulted with and received concurrence from both the Sacramento Fish & Wildlife Office and from NOAA-Fisheries for threatened, endangered, and candidate species consultation.
   - Compliance with Intra-Service Section 7 with USFWS (2004a, b) and NOAA-Fisheries (2004a, b).

Research from other areas needs to continue to be evaluated for application to the Refuge. Furthermore, as new methods or products become available to control walnut pests, those that can provide adequate control with less negative impacts than the existing methods will be evaluated for use on the refuge walnut units if appropriate and feasible.

Justification: Part 29.2 of Title 50, Code of Federal Regulations, entitled "Cooperative Land Management" provides: Cooperative agreements with persons for crop cultivation, haying, grazing, or the harvest of vegetative products, including plant life, growing with or without cultivation on wildlife refuge areas may be executed on a share-in-kind basis when such agreements are in aid or benefit to the wildlife management of the area.

Currently, there are not sufficient funds to restore the 1,968 acres of agricultural lands. The refuge cooperators provide resources to the Refuge to assist in other management activities including the Refuge's goal of riparian habitat restoration associated with these lands. The program provides a cost-effective and economical means for the Service to proceed with restoration projects (USFWS 1994 & 2002). Refuge cooperators combined with refuge personnel and resources working together will provide enhanced overall

management of Sacramento River Refuge. Cooperative farmers and private nonprofit conservation organizations have shown a willingness to work with the Service and have the expertise and resources necessary to cooperatively assist in management of Sacramento River Refuge. The completion of defined land management activities by the cooperators will provide direct and substantial overall benefits to Refuge habitat and the associated wildlife.

PRBO has monitored bird populations in different habitat types on the Refuge for over ten years including orchards and fallow fields. Although species diversity and richness is lower in orchards than in riparian habitat, species diversity and richness is measurably higher in the orchards when compared fallow fields (Gilchirst et al. 2002). By eliminating the farming program, in-kind services provide by cooperators for riparian restoration would no longer be available, problems with agricultural pests and noxious weeds would result in poor habitat quality and a perception of irresponsible management of public lands (USFWS 1994).

Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that cooperative farming within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, implementing the Integrated Pest Management Plan, Cooperative Land Management Agreements, and associated stipulations will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2015):

_____ Mandatory 15-year Re-Evaluation, Date will be provided in Final EA/CCP (for priority public uses)

___X___ Mandatory 10-year Re-Evaluation (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

___X___ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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U.S. National Oceanic and Atmospheric Administration National Marine Fisheries Service. 2004b. Informal Intra-agency Section 7 Evaluation for the Integrated Pest Management Plan for Walnut Production on the Sacramento River National Wildlife Refuge, Butte, Glenn and Tehama counties, California (SWR-04-SA-9119:MET).

Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Grazing

Refuge Name: Sacramento River National Wildlife Refuge, located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authority(ies): Sacramento River National Wildlife Refuge (Refuge) was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River Refuge purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The natural and managed vegetation at the refuge provides habitat in the form of water, food, cover, breeding areas, rearing areas, and sanctuary for a variety of wildlife including endangered and threatened species, rare and endemic species, migratory birds, anadromous fish, and game animals, such as waterfowl and deer. Livestock grazing would be conducted annually for a specified period (i.e., seasonally) to manage vegetation for native plant and wildlife habitat. Grazing is administered with a livestock cooperator under a U.S. Fish and Wildlife Service Cooperative Land

Management Agreement (CLMA). The CLMA states provisions for habitat objectives, expected wildlife benefits, shared staffing, facility maintenance, pest control damages, remedies, operating rules and laws and reporting requirements. An annual grazing plan identifies the refuge tract to be grazed and specifies: vegetation and habitat type, grazing objective (primary target weed and/or primary native species or taxa), prescribed expected tract conditions (vegetation height), date by which expected conditions are to be met, livestock turn-in/turn-out dates and Animal Unit Months (AUM). The specific dates are determined by the refuge manager through consultation with the refuge biologist and cooperator to develop a strategy that meets target tract objectives. Each year the needs for vegetation management, including grazing, are evaluated during the annual review of the habitat management plan. The grazing plan has built-in flexibility due to the uncertainties of annual and seasonal precipitation, flooding, and temperatures, and their consequent affect on vegetation growth. This is to insure that expected conditions are met and that refuge vegetation is neither over-grazed nor under-grazed—both conditions result in degraded habitat. Included in the annual grazing plan is a project plan, which also specifies by refuge tract: identified facilities and maintenance projects, materials, shared responsibilities, and special management problems and considerations. This is a refuge management economic activity and its utilization helps the refuge achieve the purposes for which it was created and the mission of the Refuge System. The proposed grazing program is discussed in detail as part of the Proposed Action in the CCP and associated EA (CCP Chapter 4 and Appendix A), which are incorporated by reference (USFWS 2005).

Vegetation and wildlife habitat management occurs in grasslands, Valley oak and elderberry savanna, Valley oak woodlands, mixed-riparian forest, and freshwater marshes. Grazing is conducted periodically (seasonal) each year. The specified time is determined by the refuge and cooperator to meet target tract conditions. Currently Sacramento Refuge Complex has a CLMA for cattle grazing with Llano Seco Ranch, Butte County and Ohm Ranch, Tehama County. The Llano Seco CLMA covers all areas at the Llano Seco Unit, which includes annual grasslands/vernal pools, Valley oak/elderberry savanna, and managed freshwater marsh. The Ohm CLMA covers all areas at the Mooney Unit and Ohm Unit, which includes annual grassland, Valley oak woodland/non-native hybridized California black walnut woodland, mixed-riparian forest, and willow-scrub.

Availability of Resources: The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage research activities as described above:

	Annual Costs
Administration	$1,000
Facilities maintenance	$5,000
TOTAL	**$6,000**

Monitoring is addressed in the annual grazing plan. The Refuge does not charge a user fee and in-kind services are determined annually during the annual grazing plan meeting. Refuge operational funds are currently available through the Service budget process to administer this program.

Anticipated Impacts of Use: Grazing by native wildlife species has long occurred in the California landscape where it has shaped its botanical and zoological resources (Edwards 1992; Edwards 1996). Currently, livestock grazing is an important method of vegetation management (Barry 2003; Griggs 2000). Beneficial effects to refuge habitat, wildlife and native plants would occur as a result of a well managed livestock grazing program. Primary, benefits associated with the grazing program include: the reduction and accumulation of dead plant material; reduction in non-native invasive weeds (Thomsen et al. 1993); increases in native plants, including special status species, from reduced competition for sunlight, water and nutrients with non-native annual grasses (Coppoletta and Moritsch 2001; Davis and Sherman 1992; Menke 1992; Muir and Moseley 1994); increases primary production and resultant increases in plant biomass (McNaughton 1985); increases in flowering, with consequent increases in macro-invertebrate populations, including native pollinators of native plants, and prey items for refuge wildlife such as migratory birds and anadromous salmonids. Grazing would provide optimal shorebird foraging habitat (Colwell and Dodd 1995; Knopf and Rupert 1995) and also would provide short, nutritious grasses for grazing migratory waterfowl (Buchsbaum et al.. 1986), and local deer. Aquatic invertebrates, insects, and special status species would benefit from grazed herbaceous habitats (Bratton 1990; Bratton and Fryer 1990; Panzer 1988; Germano et al. 2001; Knopf). Primary burrowing mammals such as California ground squirrel would increase with grazing and this would result in increases of secondary burrowing animals such as burrowing owls and various snake taxa. Primary, long-term benefits include continued annual native plant production, non-native invasive plant species control, and annual, seasonal use of refuge habitat by migratory birds and resident deer herds. The condition of nesting cover would be maintained through increases in new plant biomass and removal of dense thatch layers. Secondary benefits of the program are the habitat and water system maintenance work done by the cooperator as specified in the CLMA. Periodic grazing can also be used to reduce thatch and mulch accumulation, lessening the threat of wildfire near rural structures and agricultural industrial facilities.

The grazing program would also impact refuge wildlife and habitat. Impacts to some nesting waterfowl, songbirds, would occur (Kirsch 1969; Krueper 1993), as well as Northern Harrier and American Bittern. Mammals, which burrow through thatch such as California meadow vole would likely decrease with grazing. However, these impacts would be short-term because the program would stipulate seasonal grazing. Songbirds, harriers and larger mammals, such as black-tailed jackrabbit, would move to other areas of the Refuge which would provide cover outside the grazed area. Seasonal grazing would improve plant species composition and structure so that short-term impacts to wildlife and habitat would be mitigated by long-term benefits to Refuge vegetation, native plants,

and overall wildlife habitat quality. Therefore, the long-term benefits to habitat to migratory birds, resident deer herds, native plants, and nesting habitat condition would mitigate the short-term, localized impacts to local ground-nesting birds and some small mammals.

Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River Refuge lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

When new lands are acquired by the Refuge, the Refuge would ensure, through the Stipulations presented herein and the terms and conditions in the CLMA or a Special Use Permit, that impacts would be similar to, if not less than, those described.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July 2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination: This program as described is determined to be compatible. Potential impacts of grazing activities on Refuge resources will be minimized because sufficient restrictions would be included as part of the annual grazing plan and grazing activities will be monitored by the refuge manager and biologist. The refuge manager and biologist would ensure the grazing plan and associated projects contribute to the enhancement, protection, conservation, and management of native Refuge wildlife populations and their habitats thereby helping the Refuge fulfill the purposes for which it was established, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity, diversity, and environmental health.

_____Use is Not Compatible

__X__Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

- The criteria for evaluating need for vegetation management, including grazing, are determined during the annual review of the refuge habitat management plan.

- Grazing is conducted in accordance with the CLMA. Any potential problems and impacts to refuge natural and cultural resources are identified during the annual review of the habitat management plan. These problems and impacts are also recorded in the annual grazing plan under associated projects. Measures to eliminate or reduce grazing impacts to refuge resources would be identified in both the CLMA and annual grazing plan and the refuge manger and biologist would monitor their outcome. If grazing impacts could not be eliminated or reduced to sufficiently protect natural and cultural resources, then other techniques for vegetation management would be considered. In addition to stipulations outlined above, in the CLMA, and annual grazing plan, all refuge rules and regulations must be followed by the livestock grazing cooperator unless otherwise accepted in writing by the refuge manager.

- Grazing would not be allowed in sensitive natural or cultural resource sites.

Justification: This program as described is determined to be compatible. Based upon impacts described in the Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that grazing within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. Refuge livestock grazing will directly benefit and support refuge goals, objectives and management plans and activities. Fish, wildlife, plants and their habitat will improve through vegetation management which will result in short-term and long-term reductions of non-native invasive plant species, increases in native plants, increases in biomass, improved foraging conditions for migratory birds and local deer herds, and long-term improved nesting conditions. Consequently, the livestock grazing program would increase or maintain biological integrity, diversity and environmental health. The wildlife-dependent, priority public uses (wildlife viewing and photography, environmental education and interpretation, fishing and hunting) would also benefit as a result of increased biodiversity and wildlife and native plant populations from improved habitat conditions associated with the grazing program. In our opinion, grazing will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Mandatory Re-Evaluation Date (March 2015):

_____ Mandatory 15-year Re-Evaluation (for priority public uses)

___X___ Mandatory 10-year Re-Evaluation, Date will be provided in Final EA/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

COMPATIBILITY DETERMINATION
(March 2005)

Use: Mosquito and Other Vector Control

Refuge Name: Sacramento River National Wildlife Refuge (NWR), located in Tehama, Butte, Glenn and Colusa counties, California.

Establishing and Acquisition Authorities: Sacramento River National Wildlife Refuge was established in 1989. Approximately 11,000 acres of the approved 18,000 acres have been acquired. Legal authorities used for establishment of the Refuge include: the Endangered Species Act of 1973 as amended (16 U.S.C. 1531-1543: 87 Statute 884), the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901) and the Fish and Wildlife Act of 1956 (16 U.S.C. 742).

Refuge Purpose(s): Sacramento River NWR purposes include:

"... to conserve (A) fish or wildlife which are listed as endangered species or threatened species .... or (B) plants ..." 16 U.S.C. Sec. 1534 (Endangered Species Act of 1973)

".. the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..."16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

"... for the development, advancement, management, conservation, and protection of fish and wildlife resources ..." 16 U.S.C. 742f (a) (4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ..." 16 U.S.C. Sec. 742f (b) (1) (Fish and Wildlife Act of 1956)

National Wildlife Refuge System Mission: "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1996, as amended [16 U.S.C. 668dd-ee]).

Description of Use: The proposed use is the implementation of mosquito monitoring and control activities requested and to be conducted by various Mosquito and Vector Control Districts (Districts) within the Sacramento River NWR including Tehama County Mosquito and Vector Control, Butte County Mosquito and Vector Control, Glenn County Mosquito and Vector Control, and Colusa Mosquito Abatement District. This is not a wildlife-dependent public use. There are five mosquito species of concern potentially

produced or harbored on the refuge*: Ochlerotatus melanimon, Ochlerotatus nigromaculis, Aedes vexans, Culex tarsalis*, and *Anopheles freeborni*.
This represents an update of a compatibility determination approved in August 1994 (USFWS 1994). To our knowledge, no mosquito control activities have been conducted or are being conducted on the Sacramento River NWR even though this compatibility determination was approved. Mosquito monitoring and limited control activities have occurred within Sanctuary 1 and Sanctuary 2 of the Llano Seco Unit. This part of the Refuge was acquired for inclusion in the North Central Valley Wildlife Management Area, and is not included within the Sacramento River National Wildlife Refuge Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) (USFWS 2005) which is incorporated by reference. Riparian and agricultural habitats on the Refuge include sand and gravel bars, willow scrub, cottonwood forest, herblands, mixed riparian forest, valley oak woodlands and savannas, grasslands, freshwater wetlands, pastures, cover crops (i.e., winter wheat, safflower, corn, bell beans), almond and walnut orchards. There are no managed wetland units covered under the CCP/EA.

The Districts have verbally informed the refuge manager of their desire to conduct mosquito monitoring and, if necessary, abatement activities in order to protect the public from any mosquito borne diseases. While mosquitoes are considered a nuisance because of their biting, many species are known vectors of serious diseases in California. Although 12 mosquito-borne viruses are known to occur in the state, based on current human health risks, the main disease of concern for mosquito abatement programs in northern California are Western Equine Encephalitis (WEE), St. Louis Encephalitis (SLE), California Encephalitis, West Nile Virus (WNV), and malaria (USFWS 2004a). Only WEE and SLE have caused significant outbreaks of human disease (CA Dept. of Health Services 2003). California is also at risk for WNV which was first detected in the summer of 2003 in adult mosquitoes in Imperial County, and in crows in Orange County. WEE tends to be most serious in very young children, whereas elderly people are most at risk to SLE and WNV (CA Dept. of Heath Services 2003). WEE and WNV can cause serious diseases in horses and emus, and WNV kills a wide variety of endemic and imported birds.

Public concern over human health issues related to mosquito-borne disease has intensified on the west coast with the advance of WNV across the United States. To address mosquito management, a phased response strategy has been developed for implementation on refuges in the Pacific Region (USFWS 2003). This strategy encourages an integrated pest management approach that incorporates habitat and best management practices to reduce the need for and use of insecticides on refuges, while also ensuring that legitimate human, fish, and wildlife health concerns are addressed. To better address issues related to WNV, the current procedures for managing mosquitoes on this Refuge include this phased response program, which identifies thresholds for mosquito treatment and presents specific responses to various conditions encountered in the field (USFWS 2004a). Under this program, if mosquito population monitoring and disease surveillance (implemented by District vector control personnel) indicate that human health thresholds are exceeded, the use of larvicides, pupicides, and/or adulticides

may become necessary. In some cases, emergency actions may be required that are not addressed by this compatibility determination.

The current procedures for implementing mosquito management on the Sacramento NWR Complex are covered under a Special Use Permit (SUP), which involves an annual meeting between District and Refuge staff to coordinate all necessary permitting and implementation planning required to conduct mosquito monitoring and control on the Complex for the upcoming year. When any District formally identifies that mosquito monitoring and control is needed on the Refuge, they will then be included in this process. Issues such as access points and pathways to be used by District personnel, appropriate hours of operation, and requirements for field coordination are discussed, agreed upon, and incorporated into the SUP. As part of this coordination process, District vector control personnel are provided with habitat management data generated by the Refuge biologist on listed species and other trust resources. District personnel share relevant data related to mosquito and disease monitoring in the vicinity of the Refuge. In addition, periodic meetings are conducted in the field with District field staff and the refuge staff to further coordinate activities. These meetings are scheduled throughout the season, when warranted, to ensure protection of endangered and threatened species and other wildlife.

The proposed use would apply the principles in the Draft Integrated Pesticide Management (IPM) Plan for Mosquito Control Activities on the Sacramento National Wildlife Refuge Complex (Complex) incorporated herein by reference (USFWS 2004a). The purposes of the IPM Plan are to: 1) identify mosquito control methods and materials currently approved for use on the Complex; 2) identify their use in an IPM program that is consistent with the goals of the Complex and minimizes public health risk from refuge-harbored mosquitoes; and 3) provide long-term planning to meet the Service's goal of reducing effects of pesticide use on Department of Interior (DOI) trust resources to the greatest extent possible. The IPM Plan outlines a risk-based, hierarchical approach to mosquito management (see attached IPM Figure 3). This approach uses an understanding of mosquito biology and ecology whereby intervention measures depend on continuous monitoring of mosquito populations. When unacceptable mosquito populations are reached, as determined by appropriate monitoring and thresholds, control measures could be implemented. Potential control measures include maintaining or restoring natural drainage channels through Refuge lands, burning, mowing, disking, mosquitofish, BTI, Methoprene, Golden Bear Oil, Adulticides (Pyrethrin, Malathion, Sumitrin, and Naled). For more information about the control measures see IPM Table 3 (attached) and the IPM Plan.

Monitoring mosquitoes on the Refuge is also facilitated by the same SUP, allowing District personnel to sample wetlands and other areas throughout the refuge on a weekly basis throughout the mosquito production season. Three types of monitoring may be conducted pre and post treatment: “dipper” samples for larvae; New Jersey Light Traps for relative abundance of adult *Culex tarsalis* and *Anopheles freeborni* mosquitoes; and landing counts for relative abundance of *Ochlerotatus* mosquitoes. Further details about

these techniques can be found in the IPM Plan. District personnel conducting monitoring will be restricted to public access points on the Refuge. Specific locations and any sites that are within closed areas will be determined within the SUP process, if the need for mosquito control on the Refuge arises.

The Districts would use ground and/or aerial methods to apply larvicides, pupicides, and adulticides depending on the IPM Plan thresholds, Pesticide Use Proposal (PUP) requirements, Endangered Species Act - Section 7 compliance, and SUP conditions imposed by the Refuge. The decision making process would follow the IPM figure #3 (see attached).

Because the U.S. Fish and Wildlife Service uses insecticides, herbicides and fungicides on national wildlife refuges and fish hatcheries, a formal pesticide use review process is employed to ensure that all chemical pesticides approved for use on National Wildlife Refuges have been reviewed for their potential impacts to groundwater, surface water and terrestrial and aquatic non-target vegetation and wildlife, including threatened and endangered species. Pesticides approved for use must be shown to pose the lowest toxicity-related threat to non-target terrestrial and aquatic ecosystems, while addressing the specific pest control objectives. PUPs describe the target pest, crop, method of control, chemicals applied, rates of application, area being treated, sensitive habitats and best management practices are required. PUPs are reviewed and approved at the Refuge Manager, Regional Office, or Washington Office level, depending on the product.

Non-chemical preventative treatments will be used whenever possible. Among chemical treatments, adulticides are considered a last resort, used only after treatment thresholds have been met. Every attempt will be made to treat source areas in the riparian areas with mosquitofish or larvicides rather than adulticides. Other upland habitat blocks receive no treatments. Adulticide applications will not be made within 100 feet of wetlands, lakes, rivers or streams containing listed fish species, unless winds or inversions favor pesticide drift away from the water. Aerial application of adulticides is not anticipated to occur due to the threatened and endangered species that occur within the river and in the riparian areas on the Refuge.

Mosquito monitoring and control is discussed in Chapter 6 of the CCP. It is also detailed in the Draft IPM Plan (which is included as Appendix P of the CCP).

Availability of Resources: The following funding/annual costs would be required to administer and manage activities as described above:

	ANNUAL COSTS
Administration (Evaluation of applications, permit compliance, and monitoring)	$5,000
TOTAL	**$5,000**

Refuge operational funds are currently available through the Service budget process to administer this program.

Anticipated Impacts of Use: One of the major objectives of the Refuge is to provide high quality feeding areas for migratory birds and other wildlife; there is concern that mosquito control treatments may be interfering with that objective by reducing the existing food base. Effects on non-target organisms (i.e., those other than mosquitoes) can be loss of biomass, loss of diversity, interference with normal ecological relationships, bioaccumulation, or other unknown effects. Another concern is that rare insects and/or insects that may function as important pollinators for rare plants may be impacted by mosquito control treatments. Use of non-native biological controls such as mosquitofish may alter ecological relationships of native species. Significant bioaccumulation has not been associated with any of the chemical treatments proposed in the IPM Plan. Moreover, in a study conducted on Colusa NWR and Sutter NWR, researchers found no reductions in total abundance or biomass of aquatic macro-invertebrates in the treated (i.e., application of pyrethrin, permethrin, or malathion) or control fields (Lawler et al. 1997). While this study provides encouraging information about adulticides use there are still some questions about their effects on refuge resources. This study focused on the effects of a single adulticide treatment. During most years, Colusa, Butte Sink, and Sutter NWRs receive multiple adulticide treatments, often weekly during the fall flood-up season. Effects of multiple applications may have cumulative effects not detected in the 1997 study. In addition, effects on smaller common invertebrates (i.e. cladocera, copepods) were not studied, but should be included in future research efforts, given their lower acute toxicity tolerances (Johnson and Finley 1980).

The following text in italics is the conclusion/summary section from the Environmental Effects of Mosquito Control "white paper" (USFWS 2004b) and serves to substantiate the importance of using the IPM approach.

Mosquitoes are a natural component of many aquatic and terrestrial ecosystems. Like other aquatic insects with terrestrial adult stages, mosquitoes provide a link between aquatic and terrestrial habitats. Predation is probably the largest source of mortality for both larval and adult mosquitoes and, although there are relatively few predators that specialize on mosquitoes, these insects are fed upon by a wide variety of invertebrate and vertebrate predators. The impact of greatly reducing mosquito populations in aquatic and terrestrial ecosystems has not been studied.

Virtually every pesticide currently used to manage mosquito populations has the potential to adversely impact nontarget species. Widely used larvicides such as Bti and methoprene have been demonstrated to kill susceptible chironomid midge larvae, with experimental evidence suggesting that such population-level impacts may result in community-level food web effects. All adulticides are broad-spectrum insecticides that can potentially impact a wide variety of invertebrates and some vertebrates. The degree to which non-target organisms or communities may be impacted by mosquito control

pesticides is often difficult to predict because of differences in susceptibility among species, differences in toxicity of various formulated products, and basic knowledge gaps in toxicity data to certain species. An additional factor is the paucity of studies examining non-target impacts of mosquito control at large spatial and temporal scales. Organized mosquito control most often occurs at a landscape level such as a county or parish. When pesticides are applied to manage mosquito populations, it is often at multiple locations over relatively large spatial scales. Furthermore, pesticides may be applied to any given area multiple times in a season, year after year. The majority of non-target mosquito control pesticide studies have examined impacts at much smaller temporal and spatial scales, such as one application in a single wetland. While these studies provide useful data, it is difficult to extrapolate the results of these small-scale experiments into predictions of impacts from much larger scale treatments.

Mosquito monitoring will include regular visits by District personnel to sample mosquito larvae (dip counts) and adults (landing counts) in wetlands and adjacent areas. Currently, there is no monitoring occurring on the Refuge and it is not expected to occur more than once a week in the future. The Refuge will provide the Districts current habitat management maps which will include sensitive areas to avoid.

Larval treatment for mosquitoes does not involve a route, and may be applied on the ground. B.t.i. and methoprene may be applied aerially. Adulticide treatments will occur along a specific route, designated to minimize drift into sensitive areas. The Refuge will provide these maps to the Districts during the SUP process. Adulticide treatments will occur in evenings or early mornings when adult mosquitoes are active and Refuge personnel and visitors are not present. Their frequency will be determined by a combination of mosquito population levels exceeding treatment thresholds and the maximum allowable applications per site for a given season (approximately June 1 to October 31). Treatment thresholds are found in the IPM Plan.

For the purposes of using certain pesticides to control mosquitoes, a mosquito-borne public health emergency is defined as:

Actual or threatened, imminent outbreak of western equine encephalitis (WEE), St. Louis encephalitis (SLE), West Nile encephalitis (WNE), malaria, or other mosquito-borne public health disease. The presence of WEE, SLE, WNE, or malaria viral titers or mosquito pool titers in the mosquito population or in sentinel chickens (in accordance with test protocols developed by the California Department of Health Services, Environmental Management Branch, and the U.S. Department of Health and Human Services, Center for Disease Control) will confirm that a public health emergency exists or is imminent. This threshold will have been met when the mosquito abatement districts notifies the refuge manager of a laboratory test that is positive for any of the above viruses. The West Nile encephalitis is now also being monitored due to the discovery of its presence on the east coast in the vicinity of New York City and other locations in September 1999.

Mosquito monitoring will cause direct and indirect disturbance effects. Disturbance would include altering wildlife behavior, going off designated trails, and collecting water samples. However, most of these effects would be short-term because of the short duration of mosquito monitoring. The sampling interval is also spread out over time and would typically be once a week. Sampling locations will be restricted to areas already open to the public (unless specifically designated in the SUP process), and therefore will not be in sensitive wildlife areas. Long-term effects would be eliminated/reduced because sufficient restrictions would be included as part of the SUP, and District activities would be monitored by Refuge staff. Refuge staff would ensure that mosquito monitoring does not detract from the Refuge purposes, the mission of the National Wildlife Refuge System, and the need to maintain ecological integrity. Additionally, SUP conditions would include conditions to further ensure that impacts to wildlife and habitats are avoided and minimized.

Mosquito control will have minimal impact to public use activities on the Refuge. Using the approach identified in this determination and the IPM Plan, mosquito control will utilize the least toxic and the least amount of insecticide is used at each level of the hierarchy. Adulticide treatments will occur in evenings or early mornings when adult mosquitoes are active and Refuge personnel and visitors are not present.

Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

Following the IPM approach, including the implementation of adequate monitoring, will lessen potential short-term, long-term, and cumulative impacts of mosquito control activities to acceptable levels. As part of the IPM approach, the annual PUP and SUP processes would continue to be used by the Sacramento NWR Complex staff.

Anticipated Impacts of Uses on future lands within the approved boundary: The following conditions must be met before allowing existing uses to occur on newly acquired lands: (1) There is no indirect, direct, or cumulative threat anticipated to human health or safety; (2) There is no indirect, direct, or cumulative threat anticipated to natural or cultural resources; (3) The use is consistent with management of existing Sacramento River NWR lands and would contribute to achieving Refuge goals. In particular, existing Refuge regulations would not be compromised; (4) The newly acquired lands represent a meaningful unit within which to manage the activity; and (5) There are no anticipated conflicts with priority public uses.

Public Review and Comment: Public review and comments were solicited in conjunction with distribution of the Draft CCP/EA for the Sacramento River Refuge, released in July

2004. Few comments were received specific to the Compatibility Determinations. Comments received were addressed in the Response to Comments (Appendix R). No changes were made based on comments received.

Determination:

_____Use is Not Compatible

__X__Use is Compatible with the Following Stipulations

Stipulations necessary to ensure compatibility:

1. All mosquito abatement activities will be evaluated and authorized via steps identified in the risk-based, hierarchical approach outlined in the IPM Plan (Figure 3).
2. The implementation of mosquito control measures will be conducted in accordance with approved PUPs. PUPs will require the use of Best Management Practices (BMPs) to ensure the least toxic and the least amount of insecticide is used at each level of the hierarchy. A list of BMPs can be found in the attached Appendix 2 from the IPM Plan.
3. The implementation of mosquito control measures will be conducted in accordance with Section 7 of the Endangered Species Act. The Refuge will provide a map of sensitive areas to avoid while monitoring or treating mosquitoes.
4. Mosquito control will be authorized on an annual basis by a SUP. The SUP will detail the justification for pesticide applications, identify the specific areas to be treated, and list any additional, necessary restrictions or conditions that must be followed before, during, or after treatment. District and Refuge staff will work together to agree upon issues related to access, methods of operation, and timing of access, as well as to exchange information related to listed species occurrences, permitting, and relevant agency policy.
5. The Refuge will monitor mosquito monitoring and control activities to ensure compliance with the Stipulations presented here and any additional restrictions or conditions specified in the SUP, as well as to ensure the impacts remain at an acceptable level.
6. Districts are required to notify the refuge manager prior to treatments or expected series of treatments. Treatments can occur after mosquito populations exceed treatment thresholds as documented by monitoring data. The refuge manager will be notified of any detection or virus activity in a sentinel flock or mosquito pools as soon as possible. This will establish the risk of a public health emergency.
7. While on the Refuge, District personnel must display a copy of the SUP on vehicle dashboards at all times. Speed limit on the Refuge is 25 miles per hour and gates are to be left as found.
8. An annual report summarizing the mosquito control activities will be provided to the refuge manager by December 31 each year. The report will include: 1) a brief narrative describing the season in general including whether or not a virus was

detected, by which method it was detected, and what date; 2) identify any useful observations such as unusually high or low production areas that might help in future habitat management considerations to minimize mosquito populations; 3) summaries of dip count and light trap data by mosquito species; 4) summary of landing count data, including pre and post treatment evaluations; 5) a list of treatment dates, locations marked on Refuge map, material and amount used, and whether on an individual unit or a route.

9. Adulticide applications will also not be made within 100 feet of wetlands, lakes, rivers or streams containing listed fish species, unless winds or inversions favor pesticide drift away from the water.
10. Adulticide treatments will occur in evenings or early mornings when adult mosquitoes are active and Refuge personnel and visitors are not present.

Justification: Mosquito management activities controlled by a process that involves incorporating the National and Regional Mosquito Guidance, the local IPM Plan, annual PUPs and SUPs would contribute towards a compatible program consistent with refuge purposes and Refuge System mission. Appropriate safeguards are incorporated into the planning efforts to ensure that the level of mosquito control is commensurate with the associated public health risk. In particular, the above stipulations and those within the PUPs and SUPs will help to alleviate or lessen any impacts to fish, wildlife, plants and their habitats along with the Refuge's ability to maintain the biological integrity, diversity, and environmental health of the Refuge. Any additional terms and conditions included in the SUP will be based, at least in part, on the results of monitoring efforts. If monitoring demonstrates an unacceptable impact to Refuge resources, this use will be reevaluated. Based upon impacts described in the Integrated Pest Management Plan for Mosquito Control, Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), it is determined that mosquito management activities within the Sacramento River National Wildlife Refuge, as described herein, will not materially interfere with or detract from the purposes for which the Refuge was established or the mission of the Refuge System. In our opinion, mosquito management activities will not conflict with the national policy to maintain the biological diversity, integrity, and environmental health of the refuge.

Although mosquito control has a potential to impact non-target wetland wildlife, implementing the prescribed measures listed in the Stipulations section should reduce many of these potential impacts. Mosquito-borne disease issues are a real threat in the northern Central Valley. Refuge staff has worked with local Districts on mosquito control at the other refuges within the Complex. The Refuges and the Districts have worked cooperatively to implement IPM and we anticipate doing the same for the Sacramento River NWR.

The Refuge in association with the Districts will implement a monitoring program to help assess disturbance effects on wildlife and habitat and to ensure those effects remain

within acceptable levels. Monitoring will help to reduce impacts associated with mosquito management activities.

This compatibility determination may need to be reevaluated in the event that a national policy for management of mosquitoes on National Wildlife Refuges is finalized.

Mandatory Re-Evaluation Date (March 2015):

_____ Mandatory 15-year Re-Evaluation (for priority public uses)

___X___ Mandatory 10-year Re-Evaluation, Date will be provided in Final EA/CCP (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision (check one below):

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

References

California Department of Health Services. 2003. California mosquito-borne virus surveillance and response plan.

Johnson, W. W., and M. T. Finley. 1980. Handbook of acute toxicity of chemicals to fish and aquatic invertebrates. U. S. Dept. of Int., Fish and Wildl. Serv. Res. Pub. 137, 98pp.

Lawler, S.P., T. Jensen, and D.A. Dritz. 1997. Mosquito Management on National Wildlife Refuges Ecosystems Effects Study: Phase II – California. Effects of ultra low volume applications of pyrethrin, malathion, and permethrin on macro-invertebrates in the Sacramento National Wildlife Refuge Complex. Technical Report prepared for the U.S. Fish and Wildlife Service – Cooperative Agreement No. 14-48-0001-94582.

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USFWS 2004a. Draft Integrated Pest Management Plan for Mosquito Control at the Sacramento National Wildlife Refuge Complex. Revised May 2004. Willows, California

USFWS 2004b. Environmental Effects of Mosquito Control "white paper." U.S. Fish and Wildlife Service, Region 1.

USFWS. 2005. Sacramento River National Wildlife Refuge Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Region 1.

Refuge Determination:

Prepared by: _____ (Signature) 1/20/05 (Date)

Refuge Manager/
Project Leader
Approval: _____ (Signature) 1/20/05 (Date)

Concurrence:

Refuge Supervisor: Dan Walsworth (Signature) 3/16/05 (Date)

Regional Chief,
National Wildlife
Refuge System: Margaret J. Kolar (Signature) 3/18/05 (Date)

California/Nevada
Operations Manager: Steve Thompson (Signature) 3/21/2005 (Date)

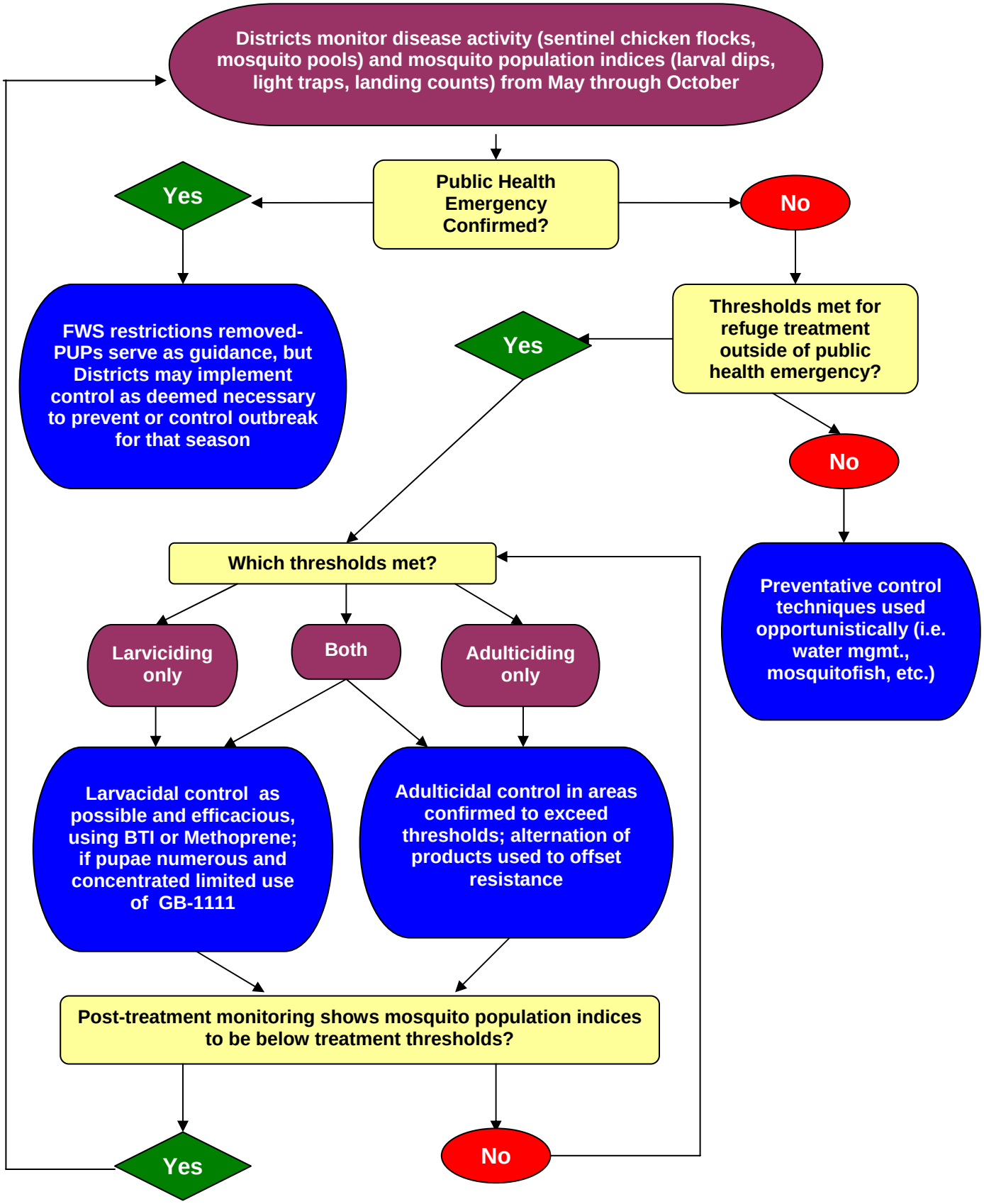

Figure 3. Decision-making process regarding mosquito control on an individual refuge at the Sacramento National Wildlife Refuge Complex.

Table 3. Comparison of mosquito control techniques and materials.				
Control Technique	**Mosquito Control Objectives**	**Usage**	**Advantages**	**Disadvantages**
Delayed Flooding	To delay initiation of major refuge mosquito production at the onset of fall floodup.	Preventative; can be optimized by refuge depending on historic/documented timing of wildlife use (i.e. migration patterns) and water availability.	Potentially reduces need for treatment during the late summer/early fall season.	None apparent at this time.
Rapid Floodup/ Irrigation	To minimize the number of cohorts of *Aedes* mosquitoes hatching from individual units or blocks of units.	Preventative; used on 10-20% of wetlands, including spring/summer WPU irrigations and initial fall floodup of SFM units; large water control structures have been installed in these units for this purpose.	Potentially reduces number of additional treatments by helping to synchronize larval development and adult emergence.	Sacrifices slower flooding, which reduces amount of sustained "feather edge" habitat in SFM wetlands preferred by many migratory birds.
Mid-irrigation Drainage	To flush larvae into sub-optimal habitats, interrupting life cycle and minimizing subsequent adult emergence.	Opportunistic active management to control mosquitoes; available for use infrequently and only on a very small percentage of habitat base; during irrigations on small units, when majority of larvae can be drained quickly (i.e. in one day).	Potentially eliminates or reduces need for additional control efforts.	Removes abundant food source for migratory birds; results in less efficient irrigation in terms of labor/water costs.
Irrigation Prior to Full Pond Drying	To avoid dry phase necessary for *Aedes* eggs to "ripen" prior re-flooding, resulting in reduced hatch and emergence.	Opportunistic/preventative; available for use only when weather conditions favor rapid plant growth and plants have achieved appropriate height prior to pond drying.	Potentially eliminates or reduces need for additional control efforts.	Requires more intensive monitoring of habitat conditions to achieve proper timing of irrigation.
Burning	Literature indicates potential to reduce mosquito populations by killing eggs and substrate beneficial to their life cycle.	Ancillary to mosquito control; used mainly for wetland habitat enhancement by reducing rank vegetation or undesirable species; typically does not occur on more than 5-10% of wetland habitats for a given refuge.	May be able to reduce need for additional control efforts; benefits habitat condition.	If used over large acreages, annual sacrifice of vegetative structure could be detrimental to many species of wildlife, including non-target invertebrates.
Mowing/ Disking	May have potential to reduce mosquito populations by killing eggs and substrate beneficial to their life cycle.	Ancillary to mosquito control; used mainly for wetland habitat enhancement by reducing undesirable species and providing openings for bird use, avian disease monitoring and wildlife viewing; typically annual use is $\leq$ 5% of wetland habitats per refuge.	May be able to reduce need for additional control efforts; periodic use benefits condition of some habitat types;	If used over large acreages, annual sacrifice of vegetative structure could be detrimental to many species of wildlife, including non-target invertebrates.

Table 3 (cont.). Comparison of mosquito control techniques and materials.				
Control Technique	**Mosquito Control Objectives**	**Usage**	**Advantages**	**Disadvantages**
Mosquitofish	To maintain a constant predation pressure on low to moderate mosquito larvae/pupae densities and minimize adult emergence.	Mostly preventative; typically stocked at 0.1 to 1.0 lbs./acre (roughly 1000 fish/pound) in SW and PP wetlands during summer and selected SFM wetlands during the fall.	Persistent in wetlands, often present without stocking.	Cannot effectively control *Aedes* densities that occur on most SFM;
BTI	To minimize adult emergence by reducing larvae populations.	For larvae control in discrete areas such as standing pools or small open units. Applied at 16-32 oz./acre depending on formulation.	Low toxicity, low persistence in environment; target-specific to dipterans; can effectively control mosquitoes in localized areas.	Questionable efficacy on heavy floodwater mosquito (*Oclhlerotatus*) densities; non-target mortality to some midge larvae.
Methoprene	To minimize adult emergence by preventing larvae from hatching.	For larvae control; growth regulator that prevents larvae from hatching; rates vary depending on formulation.	Low toxicity, low persistence in environment; target-specific to dipterans; can effectively control mosquitoes in localized areas; may leave larvae available as forage items.	Non-target impacts to dipterans other than mosquitoes.
Golden Bear Oil	To minimize adult emergence by reducing pupae populations.	For pupae control in discrete areas such as standing pools or windrowed concentrations. Applied at 3-5 gallons/acre.	Provides a method to control pupae.	Not target specific; can cause mortality to other air breathing invertebrates.
Adulticides – Pyrethrin, Malathion, Sumithrin, Naled	Reduction of adult mosquitoes to reduce public health risk or significant nuisance.	For active control of adult mosquitoes; applied with ULV fogger at dusk to treat extensive areas. Rates vary with product.	Method to control adult mosquitoes if necessary; not applied directly to water.	Not target specific; likely effects flying insects active at dusk; Efficacious use relies upon light wind and inversion conditions to treat standard 300-foot swath; insecticide resistance can develop without material rotation.

Appendix 2. Suggested "best management practices" for mosquito control efforts in managed wetlands (Source: Selected Tables from Central Valley Joint Venture. 2004. Best Management Practices for Mosquitoes in Managed Wetland Environments. in Draft, 33pp.

Water Management Practices to reduce mosquito production in managed wetlands.

Best Management Practice	**Strategies**	**Mosquito Control Objective**	**Advantages**	**Disadvantages**
Delayed fall flooding	Delay flooding of some wetland units until later in the fall. Target units with greatest historical mosquito production and/or closest to urban areas.	To delay initiation of floodwater mosquito production in seasonal wetlands by reducing the amount of mosquito habitat available during optimal breeding conditions (warm summer/early fall weather).	Depending on flood date, can reduce the need or amount of additional treatment. Delayed flooding can provide "new" food resources for wildlife later in the season.	Reduces the amount of habitat for early fall migrants and other wetland-dependent species, and may increase potential for waterfowl depredation on agricultural crops (especially rice). Flooding is often dictated by water availability or contractual dates for delivery. Delayed flooding may still produce mosquitoes in warm years. Private hunting clubs can't lease blinds that aren't flooded.
Rapid fall flooding	Flood wetland basin as fast as possible. Coordinate flooding with neighbors or water district to maximize flood-up rate.	To minimize number of mosquito cohorts hatching on a given area.	Reduces the need for multiple treatments needed by synchronizing larval development and adult emergence.-	Requires coordination & ability to flood quickly. Reduces slow, feather-edge flooding that is heavily utilized by waterbirds.
Flood & drain wetland	Flood wetland and hatch larvae in pond. Drain wetland to borrow or other ditch where larvae can be easily treated, drowned in moving water, or ~~be~~ consumed by predators. Immediately reflood wetland.	Hatches mosquito larvae and moves them to a smaller area for treatment before they can emerge into adults.	Can eliminate or reduce the need for additional mosquito control efforts.	Additional cost to purchase water to re-flood wetland. More labor intensive.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Early fall flood-up planning	Apply BMPs to wetlands identified for early flooding. To the extent possible, areas targeted for early fall flooding should not be near urban centers and should not have a history of heavy mosquito production.	To reduce the early season production of mosquitoes or to reduce their encroachment on urban areas.	Allows for the provision of early flooded habitat while minimizing mosquito production and conflicts with urban areas.	Some additional effort required to monitor and identify suitable areas and possible planning among multiple landowners.
Maintain stable water level	Ensure constant flow of water into pond to reduce water fluctuation due to evaporation, transpiration, outflow, and seepage.	To reduce conditions for additional floodwater mosquito production in summer and fall.	Provides a stable wetland environment for breeding wildlife during spring and summer. Discourages undesired excessive vegetative growth which could also become additional mosquito breeding substrate.	Requires regular monitoring and adjustments to water control structures. May be difficult if water availability is intermittent or unreliable. Reduces mudflat habitat that is attractive to shorebirds and waterfowl.
Water circulation	Provide a constant flow of water equal to discharge at drain structure.	To keep water fresh and moving to deter stagnant conditions for mosquito production; reduces water level fluctuation and potential production of floodwater mosquitoes.	Discourages warm water conditions associated with avian botulism outbreaks.	Requires landowner to purchase additional "maintenance" water. May be difficult if water availability is intermittent or unreliable
Rapid irrigation	7-10 day irrigation (from time water enters the pond to complete drawdown).	Shorten irrigation period to reduce time available for mosquitoes (especially *Culex tarsalis* and *Anopheles freeborni*) to complete lifecycle.	Provides some level of wetland irrigation while reducing the time available for mosquitoes to complete lifecycle.	Does not allow manager to use long duration irrigation for weed control. Requires ability to rapidly flood & drain wetland.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Reduced number of irrigations	Evaluate necessity of irrigation, especially multiple irrigations, based on spring habitat conditions and plant growth. Eliminate irrigations when feasible.	To eliminate unneeded additional irrigations which could provide potential habitat for mosquitoes.	Reduces potential need for additional mosquito control. Saves water and manpower costs. Discourages excessive growth of undesirable vegetation (i.e. joint and Bermuda grass)	May reduce seed production or plant biomass with less irrigation.
Early spring drawdown and irrigation	Drawdown wetland in late March or early April. Irrigate in late April or early May when weather is cooler and mosquitoes are less of a problem.	To reduce need for irrigation in June, July, and August, when potential for mosquito production would be higher.	Wetland irrigation can be accomplished without creating potential mosquito problems. May allow moist-soil plants to take advantage of natural rainfall during the spring.	Reduces shallow wetland habitat for migratory shorebirds and waterfowl in April and May, during a major migration period. Newly germinated wetland plants may be impacted by cold weather conditions.
Don't let field completely dry and crack between spring drawdown and irrigation	Irrigate wetland before soil completely dries.	To eliminate necessary drying period for floodwater mosquito egg hatchability.	May reduce mosquitoes produced from irrigation	Requires close monitoring of soil conditions to prevent soil from drying before irrigation.
Subsurface irrigation	Maintain high ground water levels by keeping boat channels or deep swales permanently flooded.	To reduce amount of irrigation water during mosquito breeding season.	Reduce need for surface irrigation while maintaining soil moisture to promote moist-soil plant production.	Requires deep swales or boat channels to be effective. Requires additional pipes in channels for equipment access. May not produce intended irrigation result if water table is naturally low. Requires that water be maintained longer than normal in swales. May promote unwanted vegetation growth in swales or promote irrigation of non-target plants in wetland.
Utilize water sources with mosquito predators for flooding wetlands	Flood wetlands with water sources containing mosquito fish or other invertebrate predators such as permanent ponds to passively introduce mosquito predators	To inoculate newly flooded wetlands with mosquito predators.	May establish mosquito predators faster than natural colonization.	Requires source of water with already established sources of mosquito predators. Not applicable to wetlands flooded with well water.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Drain irrigation water into ditches or other water bodies with abundant mosquito predators	Drain irrigation water into locations with mosquito predators as opposed to adjacent seasonal wetland or dry fields.	To provide predators opportunities to consume mosquito larvae. To reduce chance of second hatch from draining water into adjacent seasonal wetland or dry field.	Already a common wetland management practice.	Must have ditch or water body with established predator population available to accept drain water. Does not allow for irrigation water to be reused in adjacent wetlands.

Vegetation management practices to reduce mosquito production in managed wetlands.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Mowing	Mow undesirable or overgrown vegetation that serves as mosquito breeding substrate prior to flooding.	To reduce standing vegetation that mosquitoes can use for egg laying and larval development. To create open water habitat that allows mosquito predators (fish, invertebrates, birds) better access to larvae and potentially more wave action to drown mosquito larvae.	Dual benefits of improving wildlife habitat and reducing mosquito breeding substrate.	Effects are largely temporary, so must be conducted annually. Overuse could be detrimental to some species of wildlife and non-target invertebrates. Mowed vegetation may float providing mosquito habitat and decomposition may affect water quality.
Burning	Controlled burn of undesirable or overgrown vegetation that may provide mosquito breeding substrate.	See mowing. Can also kill mosquito eggs.	See mowing.	Requires burn permit. Liability concerns. Most landowners are not adequately prepared to conduct a controlled burn. Special consideration should be taken around plastic pipes or water control structures. Overuse could be detrimental to some species of wildlife and non-target invertebrates.
Discing	Disc undesirable or overgrown vegetation that may provide mosquito breeding substrate.	See mowing.	See mowing. Can provide longer-term control of undesirable vegetation by itself or in conjunction with other management practices.	Creates walking problems for hunters. Overuse could be detrimental to some species of wildlife and non-target invertebrates.
Haying	Mow and bale undesirable or overgrown vegetation that may provide mosquito breeding substrate.	See mowing. Also removes vegetation after cutting.	Dual benefits of improving habitat and reducing mosquito breeding substrate. Removal of mowed vegetation further decreases mosquito breeding substrate and may improve water quality.	Overuse could be detrimental to some species of wildlife and non-target invertebrates. Removes seed that wintering waterfowl forage on. Expensive. Often difficult to find someone to bale and haul plant material.
Selective Grazing	Summer-Fall grazing. Short duration, high intensity grazing.	To reduce standing vegetation that provides habitat for mosquitoes.	Relatively inexpensive.	Irrigation for grass and/or livestock watering may exacerbate mosquito production. Livestock tend to forage on plants that produce seed for waterfowl. Livestock may damage levees or ditches.

Wetland infrastructure maintenance activities used to reduce mosquito production in managed wetlands.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Levee Inspection & Repair	Walk or drive levees, flag problem spots, repair as needed. Consider design elements to improve integrity of levee (see levee design).	To reduce mosquito habitat/production caused by seepage into adjacent fields or dry ponds.	Allows for early identification of problem spots. Helps conserve water and reduces growth of unwanted vegetation.	Requires annual monitoring and funding for repairs.
Water Control Structure Inspection, Repair, & Cleaning	Inspect structures and repair or replace as needed. Remove silt and vegetation build-up in front of structures. Adequately close, board or mud-up controls.	To reduce mosquito habitat/production caused by seepage into adjacent ponds or drainage ditches. Remove silt blockages that may trap water and impede drainage.	Enhances water management capabilities and limits unwanted vegetation or standing water.	Requires annual monitoring and funding for cleaning or repair.
Ditch Cleaning	Periodically remove silt or vegetation from ditches to maintain efficient water delivery and drainage.	To allow for rapid flooding/drainage & reduce vegetation substrate for breeding mosquitoes.	Enhances water management capabilities and limits unwanted vegetation or standing water.	Requires funding for ditch cleaning. Excessive vegetation removal on ditch banks can result in negative impacts to nesting birds and other wildlife.
Pump Tests & Repair	Test pump efficiency and make any necessary repairs to maximize output.	Could identify output problems and if corrected, allow managers to flood more rapidly.	May promote faster irrigation and flood-up if output can be improved.	Requires pump test. May be costly to repair or replace pump/well.

Wetland restoration and enhancement features to reduce production of mosquitoes in managed wetlands.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Independent water management	To the extent possible, design wetland projects to include independent inlets and outlets for each wetland unit.	To reduce the need to move water through multiple wetland units when flooding or irrigating target areas. This can reduce the number of mosquitoes produced per flood event.	Creates wetland units that are hydrologically distinct from one another allowing for diverse wetland management.	May require additional water control structures and ditches to be constructed and maintained. Increases restoration costs and complexity of management.
Adequately sized water control structures	Increase size and number of water control structures. When installing, set to proper grade to allow for complete drawdown.	To improve ability to implement rapid flooding/irrigation BMPs (Table 1).	See rapid flooding/irrigation BMPs (Table 1).	Increased size and number of water control structures will increase restoration costs and management complexity.
Swale construction (sloped from intake to drain)	Construct or enhance swales so they are sloped from inlet to outlet and allow the majority of the wetland to be drawndown.	To improve ability to implement rapid flooding/irrigation BMPs (Table 1). Creates a means to move water through wetlands without flooding entire wetland basin. Reduces mosquito habitat by allowing isolated sections of habitat to drain. Provides mosquito predators with access to all portions of wetland.	See rapid flooding and irrigation BMPs (Table 1). Provides habitat diversity and enhances capabilities to implement moist-soil management. Provides a more cost-effective and wildlife friendly alternative to laser-leveling to create drainage.	See rapid flooding and irrigation BMPs (Table 1). Reduces standing water in spring that is often used by foraging waterbirds. May result in additional expense to create swales. Shallow swales must be periodically re-cut if silt deposition or dense emergent vegetation is a problem. Could be a deep water hazard in hunting areas.
Wetland size considerations	Install cross-levees to facilitate more rapid irrigation and flood-up (Table 1). Build "underwater" levees that isolate irrigation water during the spring, but can be overtopped during fall and winter flooding.	To improve ability to implement rapid flooding/irrigation BMPs (Table 1).	Assists with faster flooding and drainage. Cross levees (checks) can provide loafing habitat for waterfowl and shorebirds.	Additional levees may result in decreased wildlife use and diversity. Expensive. Requires additional levee maintenance and water control structures.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Ditch design (2:1 slopes & minimum 4 foot bottom) **consider 3:1 slope or greater to discourage burrowing animal damage and potential seepage problems*	Construct or improve ditches to quality standard that prevents unwanted vegetation growth or unnecessary seepage.	Reduces likelihood of vegetation growing along ditch banks. Excessive vegetation slows water flow, traps silt, and can be used as substrate for mosquito eggs.	Improves water flow and decreases maintenance of vegetation that grows along canal banks.	May require re-designing some delivery ditches to meet specific design criteria. Could affect habitat for wildlife species such as giant garter snakes. Steeper slopes may erode more quickly and created a hazard for hunters.
*Levee design & compaction (≥3:1 slopes & >80% compaction)**	Construct or improve levees to quality standard that ensures stability and prevents unwanted seepage.	To reduce mosquito habitat caused by seepage into adjacent fields or dry ponds.	Properly constructed levees prevent seepage from erosion or rodent damage, and reduce need for annual maintenance.	Additional expense to repair or build levees on existing properties.
Deep channels or basins constructed in seasonal wetlands	Excavate deep channels or basins to maintain permanent water areas (> 2.5 feet deep) within a portion of seasonal wetlands. Provides year-round habitat for mosquito predators which can inoculate seasonal wetlands when they are irrigated or flooded.	To reduce mosquito larvae through predation.	Provides on-site source of mosquitofish and other mosquito predators to seasonal wetlands. Increases overall habitat diversity.	Expensive to excavate and maintain permanent water. Potential problems with emergent vegetation. May be a deep water hazard in hunting areas.
Permanent water reservoir that floods into seasonal wetlands	Maintain separate permanent water reservoir that conveys water to seasonal wetlands. Provides year-round habitat for mosquito predators which can inoculate seasonal wetlands when they are irrigated or flooded.	To reduce mosquito larvae through predation.	Provides on-site source of mosquitofish and other mosquito predators to seasonal wetlands. Increases overall habitat diversity.	Additional expense to construct reservoir that feeds water to seasonal wetlands and expensive to maintain permanent water.

Biological Controls

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Mosquitofish	Stock managed wetlands with mosquitofish or encourage habitats for naturalized populations. Utilize water sources with mosquitofish to passively transport predators to newly flooded habitats.	To supplement mosquito predator population.	Provides a non-chemical control of mosquito larvae. Mosquito fish are often available free of charge to landowners from their local district.	May reduce non-target populations of invertebrates or other mosquito predators. Not appropriate for vernal pool habitats.
Encourage invertebrate predators	Maintain permanent or semi-permanent water where mosquito predators can develop and be maintained. Discourage use of broad spectrum pesticides.	To reduce mosquito populations through predation.	Provides biological control of mosquito larvae and adults.	None.
Swallow colonies	Do not discourage nesting swallows.	To reduce mosquito populations through predation.	Provides biological control of adult mosquitoes.	Guano.
Bats	Build bat boxes	To reduce mosquito populations through predation.	Provides biological control of adult mosquitoes.	Potential (or perceived potential) for transmission of rabies.

Suggested coordination activities between wetland managers and Mosquito and Vector Control Districts (MVCD).

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Habitat management and flooding schedule coordination	Consult with MVCDs on Agency-sponsored habitat management plans on private lands (i.e. Presley Program). Consult with Districts on the timing of wetland flooding on public lands – urge private landowners to do the same.	Allows MVCDs the opportunity to provide input on habitat management and recommend BMPs to reduce mosquitoes.	Reduces potential conflicts between MVCDs, landowners, and Agencies/NGOs when managing or flooding wetlands. Provides information exchange.	Requires a commitment of time from MVCDs, landowners, and Agencies/NGOs to meet and coordinate activities.
Identify problem areas for mosquito production and target for implementation of BMPs	Local MVCDs identify problem locations for mosquito production and work with landowners and Agencies/NGO's to implement mosquito BMPs. Identify potential cost-share opportunities to implement BMPs.	Work to reduce mosquito production through BMPs on properties that are most problematic.	Allows limited resources from MVCDs and Agencies/NGO's to be targeted towards problem areas. Provides opportunities for monitoring the effectiveness of BMPs.	None
Wetland Habitat Restoration and enhancement project design & coordination	Consult with local MVCDs on the design of restoration and enhancement projects.	To determine where features to discourage mosquito production can be incorporated into wetland habitat restoration and enhancement projects where feasible.	Reduces potential conflicts between Districts, landowners, and Agencies/NGOs when restoring or enhancing wetlands. Provides a priori consultation for MVCDs on wetland projects.	Requires some flexibility from MVCDs, landowners, and Agencies/NGOs when designing projects. BMPs will likely increase the project cost.
Coordinate Monitoring Activities	Facilitate monitoring mosquito populations of larval and adult stages before and after implementation of BMPs.	Determine the effectiveness of BMPs to refine and prioritize their future use.	Provides a means to evaluate and document effectiveness of BMPs.	Requires time and resources to accomplish.

Appendix C. Sacramento River National Wildlife Refuge Hunting Plan

I. Introduction

Sacramento River National Wildlife Refuge (Refuge) is part of the Sacramento National Wildlife Refuge Complex (Complex) and is located in the Sacramento Valley of north-central California. The Valley is bordered by the Sierra Nevada Range and Cascade Range to the east and the North Coast Range to the west. The Refuge is composed of 26 properties (units) along a 77-mile stretch of the Sacramento River between the cities of Red Bluff and Princeton, 90 miles north of the metropolitan area of Sacramento. As of June 2005, the Refuge consists of approximately 10,304 acres of riparian habitat, wetlands, uplands, intensively managed walnut and almond orchards, and row crops in Tehama, Butte, and Glenn counties. Colusa County is within the approved refuge boundary, but the Refuge does not currently administer any properties along the river within the county.

The Valley is an extensive agricultural area, which historically included vast herds of pronghorn and tule elk and tens of millions of wintering ducks and geese. Lands that surround the Refuge are mostly orchards and irrigated rice lands with some dairying, safflower, barley, wheat, and alfalfa crops. Topography is flat with a gentle slope to the south. The predominant soil type is Columbia loam.

Riparian habitat along the Sacramento River has been identified as critically important for endangered and threatened species, anadromous salmonids, native resident fishes, migratory birds, native plants, and to the natural processes of the River. There has been a 98 percent reduction of riparian habitat along the Sacramento River. Habitat loss resulted from forest clearing, primarily for agriculture, dams for flood control and water storage on the main stem and tributaries, which attenuate and alter hydrology and geomorphology, and bank stabilization, such as levees and rip-rap, for flood control. The relatively small amount of remaining riparian woodland provides a strikingly disproportionate amount of habitat value for wildlife. The Refuge is managed to maintain, enhance and restore habitats for threatened and endangered species, migratory birds, anadromous fish, and native plants and vegetation. As much as possible, habitat is managed for natural diversity of indigenous flora and fauna. Riparian forests are being restored by converting flood-prone croplands along the Sacramento River in cooperation with The Nature Conservancy (TNC), River Partners (RP), and local farmers.

There are a variety of outdoor activities that occur on the Sacramento River and adjacent lands. Hunting, fishing, wildlife observation, environmental education, interpretation, tubing, and canoeing are some of the commonly known activities that occur during different times of the year on some private and public lands (Figure 25, Chapter 5, CCP, USFWS 2005). Hunting of birds and mammals is a traditional outdoor activity that is consistent with Federal and State law as appropriate.

The purpose of this hunting plan is to outline how the program will be operated within the Refuge. In addition, the hunting plan documents how the Refuge will provide safe hunting

opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses.

The Service has determined hunting of dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer to be a compatible wildlife-dependent recreation (Hunting Compatibility Determination, Appendix B, CCP (USFWS 2005)). California Fish and Game Department (2004b) also has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources. Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

The Office of Migratory Bird Management sets the general frameworks through their annual regulations permitting the sport hunting of migratory birds. The individual States set seasons within those frameworks. If necessary, the Service develops regulations that may be more restrictive than State hunting regulations in order to protect resources on a refuge-by-refuge basis (i.e., species hunted). Otherwise, the Service observes State regulations on all refuges open to hunting.

U.S. Fish and Wildlife Service Regional and Refuge biologists along with scientists from the U.S. Geologic Survey–Biological Resources Division (Office of Migratory Bird Management) and university researchers meet twice annually with State flyway representatives to discuss inventory data and survey reports for migratory game bird populations which are hunted, proposed for hunting and closed to hunting. The Service bases its migratory waterfowl season length and bag limits for the various species on these surveys. The annual breeding ground survey is one of the most important surveys and has been conducted since 1955. This cooperative effort between the Service and the Canadian Wildlife Service covers Canada, Alaska, and the northern United States prairies where 90 percent of the continental waterfowl populations breed. Results are summarized in various publications, including the annual fall flight forecast. Other important data include harvest and survival rate estimates from band returns. Whether to open a season for a species or not and the establishment of the season length and bag limits are determined by the population objectives for each species. A species must have a harvestable surplus to be considered for hunting. Population objectives for each species are calculated using data from population surveys and banding data.

Current management for mourning doves consists of annual population trend surveys, harvest surveys, and the establishment of annual hunting regulations. Since 1960, management decisions have been made within the boundaries of 3 zones that contain mourning dove populations that are largely independent of each other: the Eastern,

Central and Western Management Units. Since 1966, Mourning Dove Call-count Surveys have been conducted annually in the 48 conterminous states by state and federal biologists to monitor mourning dove populations. In 1992, the U.S. Fish and Wildlife Service and state wildlife agencies initiated the national cooperative Harvest Information Program, which enables the Service to conduct nationwide surveys to provide reliable annual estimates of the harvest of mourning doves and other migratory game bird species. The resulting information on status and trends is used by wildlife administrators in setting annual hunting regulations. In 2001, a National Mourning Dove Planning Committee was formed to further develop guidelines that could be used for regional harvest management. The committee produced The Mourning Dove National Strategic Harvest Management Plan. The implementation of the plan began in July 2003 with the initiation of a national pilot reward-band study. Currently population models are being finalized which will aid in the preparation of regional harvest management plans for 2005. Demographic models and data collection programs to support needs of regional harvest management plans will be established in 2005.

Resident game species are protected by both Federal and State laws and regulations to ensure that harvest rates do not negatively impact populations. The potential impacts of hunting on resident upland game birds and deer are discussed and evaluated in the California Environmental Quality Act process. This process results in periodically updated and publicly reviewed documents. Based on the findings of these documents, the State insures that game animal hunting in California does not adversely impact its wildlife populations to an unacceptable level (CDFG 2004b).

Wildlife populations along the Sacramento River are currently hunted on both private and public lands, such as Sacramento River Wildlife Area (State), Todd Island and Foster Island (Bureau of Land Management). No impacts to those local populations have been documented (CDFG 2004b). Hunting is a highly regulated activity, and generally takes place at specific times and seasons (dawn, fall and winter) when the game animal is less vulnerable, and other wildlife-dependent activities (e.g., wildlife observation, environmental education and interpretation) are less common. The combination of these factors reduces the magnitude of disturbance to Refuge wildlife. Regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

Two species, the ring-necked pheasant and turkey, were introduced into the area years ago. These non-native species have more potential to compete for habitat with native species, however no such competition has been noted along the river (CFDG 2004b). In addition, selected game species are not known to prey upon other species at unacceptable levels. The potential for competition and predation exists whether the populations are hunted or not; however, removing individuals of non-native species by hunting could conceivably reduce this potential (CDFG 2004b).

II. Conformance with Statutory Authorities

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System, purposes for which individual Refuges were established, policies, laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), the Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual. The Refuge Recreation Act of 1962, as amended, authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use when such uses did not interfere with the area's primary purpose.

The Improvement Act identified a new mission statement for the Refuge System; established six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation); emphasized conservation and enhancement of the quality and diversity of fish and wildlife habitat; stressed the importance of partnerships with Federal and State agencies, Tribes, organizations, industry, and the general public; mandated public involvement in decisions on the acquisition and management of refuges; and required, prior to acquisition of new refuge lands, identification of existing compatible wildlife-dependent uses that would be permitted to continue on an interim basis pending completion of comprehensive conservation planning.

The Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a CCP for each refuge by the year 2012; provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Improvement Act also establishes a formal process for determining compatibility of uses. Before any uses, including wildlife-dependent recreational uses, are allowed on refuges, Federal law requires that they be formally determined compatible. A compatible use is defined as a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the purposes of the refuge or mission of the Refuge System. Sound professional judgment is defined as a finding, determination, or decision that is consistent with the principles of sound fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), and applicable laws. The Service strives to provide wildlife-dependent recreational uses when compatible. If financial resources are not available to design, operate, and maintain a priority use, the refuge manager will take reasonable steps to obtain outside assistance from the State and other conservation interests.

The Sacramento River Refuge was established in 1989 by the authority provided under the Endangered Species Act of 1973 and the Emergency Wetlands Resources Act of 1986, using monies made available through the Land and Water Conservation Fund Act of 1965.

The Service proposed and Congress authorized the acquisition of 18,000 acres of land for establishment of the Sacramento River Refuge. The area considered for acquisition is located along the Sacramento River between Colusa and Red Bluff in Colusa, Glenn, Butte, and Tehama counties. A combination of fee title and conservation easement acquisitions was used to protect this habitat. The purpose of the Sacramento River Refuge is to preserve, restore, and enhance riparian habitat for threatened and endangered species, migratory birds, anadromous fish, native plants and vegetation. Compatibility determinations are included in Appendix B of the CCP (USFWS 2005). Based upon biological impacts described in the Hunting Compatibility Determination (CD), Comprehensive Conservation Plan and Environmental Assessment (USFWS 2005), which are incorporated by reference, hunting within the Sacramento River National Wildlife Refuge is a compatible use and will not materially interfere with or detract from the purposes for which the Refuge was established. Stipulations within the Hunting CD to ensure compatibility include: refuge-specific regulations; monitoring of hunting activities, habitat conditions, public use activities, and wildlife population levels; and routine law enforcement patrols.

III. Statement of Objectives

Hunting is identified in the Refuge Improvement Act as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. The Refuge encourages dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer hunting which are currently hunted species on other public lands along the Sacramento River. The hunting program will be conducted in a safe and cost-effective manner, and will be carried out consistent with State regulations, see the Refuge Manual 8 RM 5, Hunting. The Hunting Plan was developed to provide safe hunting opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses. The Refuge hunting program will comply with the Code of Federal Regulations Title 50, 32.1 and managed in accordance with Refuge Manual Chapter 8 RM 5, Hunting.

Hunting will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats. Therefore, the sport hunting of migratory birds, upland game birds and deer on the Refuge is in compliance with State regulations and seasons, the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee), and the Refuge Recreation Act of 1962 (16 U.S.C. 460k).

IV. Assessment

A. *Are wildlife populations present in numbers sufficient to sustain optimum population levels for priority refuge objectives other than hunting?*

Yes, wildlife populations are present in sufficient numbers for priority refuge objectives for wildlife management and for wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education,

and interpretation). The Refuge adopts harvest regulations set by the State, which uses concepts of density dependant compensatory mortality and adaptive harvest management to ensure sustained game species populations. The Refuge units are evaluated to determine the best public use strategy for providing high quality wildlife-dependent public use opportunities. Almost half of refuge lands are closed to hunting, with 28 percent providing opportunities for other wildlife dependent uses and 20 percent remaining closed to all public use in order to provide areas of sanctuary that will function as a strong population base.

B. *Is there competition for habitat between target species and other wildlife?*
Possibly; while each species occupies a unique niche, there is only a finite amount of space available to satisfy various habitat requirements of water, food, cover, breeding, roosting, and fawning areas.

C. *Are there unacceptable levels of predation by target species on other wildlife forms?*
No, target species (dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer) generally do not prey on other species at unacceptable levels. Occasionally, in certain areas, deer browse of seedling valley oak is particularly heavy.

V. Description of Hunting Program

A. *Areas of the refuge that support populations of the target species*
Target game species commonly occurring on the Refuge include waterfowl, coots, common moorhen, snipe, dove, quail, pheasant, turkey and deer. Descriptions of freshwater wetland and riparian habitats and their associated plant/wildlife species are described below and in further detail in Chapter 3 of the CCP. A list of animal and plant species occurring on the Refuge can be found in Appendix G of the CCP. An overview of hunted target wildlife species is also described below.

Habitats

<u>Riparian Habitats and Vegetation</u>
Refuge "riparian" habitats are referred to as: open water, gravel and sand bars, herbland cover, blackberry scrub, Great Valley riparian scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Valley oak, and Valley freshwater marsh (Geographic Information Center at California State University, Chico 2002). Distributions of these habitats on Refuge units can be seen in Figures 11-24 (Chapter 3, CCP).

Open water constitutes water, either standing or moving, and does not necessarily include vegetation. These areas support many fish species, including salmon, steelhead, and sturgeon, as well as avian species such as American white pelican, double-crested cormorant, osprey, kingfisher, and common merganser.

Gravel and sand bars appear as open, unvegetated areas in air photos, but ground inspection reveals several annual and short-lived perennial species of sun-loving herbs, grasses, and aromatic subshrubs. The vegetation cover is less than 50 percent. Species such as killdeer, spotted sandpiper, and lesser nighthawk commonly use these areas.

Herbland cover is composed of annual and perennial grasses and forbs, and is enclosed by other riparian vegetation or the stream channel. Species such as lazuli bunting, blue grosbeak, and common yellowthroat frequently nest in these areas.

Blackberry scrub is vegetation where 80 percent or more of the coverage is blackberry shrubs. Blackberry shrubs are important escape cover for California quail, and are used for perches by a variety of songbirds.

Great Valley riparian scrub forms from primary succession processes where vegetation becomes established in areas where erosion and sedimentation of deposits have occurred (Holland 1986; Holland and Roye 1989). Vegetation includes streamside thickets dominated by sandbar or gravelbar willows, or by other fast growing shrubs and vines. It is also commonly populated by cottonwood, California rose, Mexican tea, and wild grape. Typical inhabitants include the black-chinned hummingbird, willow flycatcher, western flycatcher, mourning dove, and black phoebe.

Great Valley cottonwood riparian forest consists of cottonwoods that are at least one year old and account for 80 percent or greater of the canopy coverage. Cottonwood forests are an early successional stage riparian vegetation type and consist of primarily mature Fremont cottonwood trees and sparse understory (Holland 1986; Holland and Roye 1989). They can also include one or more species of willows and have a dense understory of Oregon ash, box elder, wild grape, and various herbs and grasses. Species such as the bald eagle, yellow-billed cuckoo, and western flycatcher nest and forage in this habitat type.

Great Valley mixed riparian forest (MRF) is a forest vegetation type consisting of later successional species, such as valley oak (Holland 1986; Holland and Roye 1989). Valley oak accounts for less than 60 percent of the canopy coverage with black walnut, Oregon ash, and western sycamore also present. Willows and cottonwood may also be present in relatively low abundance. The dense understory often consists of Oregon ash, box elder, poison oak, and wild grape. Due to the dense canopy and understory, a large variety of Neotropical migrant bird species use this habitat, such as the yellow-billed cuckoo, yellow-rumped warbler, black-headed grosbeak, and spotted towhee. Since MRF frequently edges oxbows and sloughs, it attracts a large array of species that are “wetland-related”, including the northwestern pond turtle, great blue heron, great egret, double-crested

cormorant, wood duck, yellow-breasted chat, common yellowthroat, and song sparrow.

The valley oak riparian forest (VORF) consists of vegetation with at least 60 percent valley oak canopy. Restricted to the highest parts of the floodplain, VORF occurs in areas that are more distant from or higher than the active river channel. This habitat type is a medium-to-tall deciduous, closed-canopy forest dominated by valley oak and may include Oregon ash, black walnut, and western sycamore. The understory includes California pipevine, virgin's bower, California blackberry, California wildrose, poison oak, and blue wild-rye (Holland 1986). Common species found here include the red-shouldered hawk, great-horned owl, western screech-owl, acorn woodpecker, Bewick's wren, bushtit, and scrub-jay. Historically an extensive habitat, it has been greatly reduced by agriculture and firewood harvesting and is now only limited and scattered in occurrence.

Valley oak woodland (VOW) is found on deep, well-drained alluvial soils, far back from or high above the active river channel (Holland 1986). VOW is an open, winter-deciduous savanna dominated by widely spaced oaks, blue elderberry, and coyote-brush, with an understory of grasses and forbs. VOW often intergrades with VORF. Due to its more open nature, VOW attracts different avian species than VORF, such as the Swainson's hawk, American kestrel, western kingbird, loggerhead shrike, yellow-billed magpie, and western meadowlark. VOW once occupied thousands of acres in the Great Central Valley. It occurred on the best agricultural soils (Columbia and Vina type) that covered thousands of acres in the Great Valley (Bureau of Soils 913; Holland 1986; Holmes et al. 1915; Watson et al. 1929). Consequently, valley oak woodlands are among the most reduced natural habitat type in California.

Valley freshwater marsh is dominated by perennial emergent monocots, a type of marsh vegetation. Cattails or tules usually are the dominants, often forming stands that are sparingly populated with additional species, such as rushes and sedges. Coverage may be very high, approaching 100 percent. Typical riparian areas that support freshwater marsh include the main channel, tributaries, sloughs, abandoned channel, oxbow lakes, and ponds. These areas attract an array of wetland-dependent species such as mallard, wood duck, black-crowned night-heron, great egret, great blue heron, American bittern, northwestern-pond turtle and giant garter snake.

Wetland Habitats

The Sacramento River, its tributaries, sloughs, abandoned channels, oxbow lakes, and ponds support freshwater wetlands. The river channel is dynamic: it varies with meander belt position from shallows near gravel bars to deep holes below steep cut banks. Depth and flow velocity also varies with seasonal differences in runoff and with flow releases from Keswick Dam. Generally, water in the channel

is relatively fast moving and cold. Oxbow lakes occur on the middle Sacramento River floodplain. They form on meandering rivers when the channel breaches a narrow gap of land in the loop and a sand plug seals the upriver arm of the loop. They vary in depth depending on siltation. Water is calm and relatively warm compared to the main channel. Sloughs and swales convey and distribute water on the floodplain. They are usually wet only during high water and flood events. Gravel pits were excavated on the Sacramento River floodplain for private and public roads and an experimental artificial salmon-spawning project conducted by the Bureau of Reclamation. Gravel pits form wetlands when the bottom contacts the water table. Large portions of the Sacramento River floodplain become temporary wetlands when inundated with seasonal runoff from the tributaries and releases from Keswick Dam. A diversity of fish and wildlife use these various types of wetlands during portions of their life history, including nesting, migration, and wintering periods.

Target Species

CDFG (2004b) also has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing.

Migratory Game Birds

The primary waterfowl use of the Refuge is by migrating and wintering birds during the months of August through March. Peak populations occur during December, when several thousand ducks are present. A small percentage remains through spring and summer months to nest. Common wintering duck species include mallard, American widgeon, green-winged teal, northern shoveler, wood duck, ring-necked duck, common golden-eye, and common merganser. Wintering goose species consist mostly of western Canada geese, but occasionally white-fronted geese. The primary summer nesting species include mallard, wood duck, and common merganser, and lesser numbers of cinnamon teal and western Canada goose.

Waterfowl areas consist primarily of wetlands including the main river channel, tributaries, sloughs, swales, oxbow lakes, and freshwater marshes. When flooded by winter rains and releases from Keswick Dam, the sloughs, swales, and oxbow lakes become important winter habitat for waterfowl, especially ducks. A few species such as mallard, wood duck, common merganser, and Canada goose nest in herbaceous vegetation near the river and raise their broods at the wetlands and riparian area.

The mourning dove commonly uses gravel bars and nest in riparian forests and orchards. Current riparian restoration efforts provide excellent foraging, loafing,

and nesting habitat for mourning doves, which tend to prefer the early succession stages of willow scrub and cottonwood forest.

Upland Game Birds

Game birds occupy various riparian habitats along the Sacramento River. The more mature riparian habitats, especially Valley oak riparian forest and Valley oak savannah, provide excellent habitat for California quail, wild turkey and black-tailed deer. California quail nest in the herbaceous layer of various riparian habitats and use blackberry and other thickets for escape cover. Wild turkey use large trees for roosts and nest in dense herbaceous vegetation. Ringed-neck pheasant nest in dense herbaceous vegetation and feed and roost in various riparian habitats.

Big Game

Black-tailed deer occupy various riparian habitats along the Sacramento River. Fawning areas are usually in dense riparian forest where deer find sanctuary from predators. Deer graze and browse on selected riparian plants and agricultural crops during their annual life history.

B. *Areas to be opened to the public*

The Refuge currently consists 10,304 acres of agricultural, wetland, grassland, and riparian habitats (Table 1, Chapter 1, CCP). Approximately 3,356 acres will be open by 2005 and an additional 1,967 acres within 2-10 years to total 5,323acres (52 percent) open to hunting (Figure 28, Chapter 5, CCP). The 5,323 acres open to hunting is also open to other wildlife-dependent recreational uses including fishing, wildlife observation and photography, environmental education, and interpretation.

Access to the Refuge units is primarily by boat access only. As funding is secured, eight units (Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora, Packer, and Drumheller Slough) will have parking areas developed for pedestrian access.

C. *Species to be taken, hunting periods*

Hunting of waterfowl, coots, common moorhen, snipe, dove, quail, pheasant, turkey and deer will be allowed in accordance with State hunting regulations during the legal hunting seasons and shooting times (Table 10, Chapter 5, CCP).

In order to promote interest in hunting, the Sacramento River Refuge will continue to coordinate a Llano Seco Junior Pheasant Hunt with the Llano Seco Ranch, CDFG and California Waterfowl Association. This once-a-year hunt has occurred on private property adjacent to the Sacramento River Refuge.

D. *Justification for a permit if one is required*

A California hunting license and tags are required for taking any bird or mammal.

Assess the need for turkey and deer hunting by permit only on Refuge lands during the 2005-7 hunting season. If the refuge determines that overcrowding or overharvest becomes an issue, a Refuge permit would be required to hunt these species on the Refuge.

Hunters do not need to obtain a Refuge hunting permit or pay a special user fee to hunt on the Refuge. In the future, Refuge user fees may be considered. There is a fee for State hunting licenses and tags.

E. *Procedures for consultation and coordination procedures with State*

Participate in the Sacramento Refuge Complex pre and post hunting meetings with the State managers and wardens. In addition, CDFG, California State Parks and Recreation, and the Refuge have a Memorandum of Understanding (MOU) (USFWS et. al 2001) that authorizes cooperative management efforts. Yearly coordination meetings are held in accordance with the MOU. CDFG (2004b) also has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

F. *Methods of control and enforcement (identify check stations)*

- Boundary and public use signs depicting allowable uses will be placed and maintained above the approximate ordinary high water mark and at vehicle access points.
- California Department of Boating and Waterways boating guide that depicts the unit name and river mile location, a large laminated boating guide, and the Sacramento River Refuge brochure will be placed at public boat ramps and units accessible by vehicle.
- Service roads will be gated to allow only pedestrian access from parking areas.
- Landward boundaries are closed to discourage trespass through adjacent private lands.
- Hunting is not allowed within 50 feet of any landward boundaries adjacent to privately owned property. As per Fish and Game regulations, it is unlawful to hunt or discharge while hunting, any firearm or deadly weapon within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith. The 150-yard area is a “safety zone”.
- Monitor hunting visits by personal contact by law enforcement officers, comment drop boxes (Capay, Drumheller Slough, and Sul Norte units), Refuge web site e-mail, and vehicle counters at units with parking.
- Field checks by refuge law enforcement officers will be planned and coordinated with staff and other agencies to maintain compliance with regulations and assess

species and number harvested.

- Regular law enforcement patrols by refuge officers, special agents, game wardens, park rangers, and deputy sheriffs.
- There will not be any check stations on the Refuge.

G. Funding and staffing requirements for the hunt.

The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage hunting activities as described above:

	One-Time Costs	Annual Costs
Administration		$15,000
Law Enforcement		$12,000
Outreach, Education, Monitoring		$5,000
Signs, brochures, and maintenance	$20,000	$3,000
TOTAL	**$20,000**	**$35,000**

Approximately 95 staff days would be required to monitor and conduct the hunt program for the Sacramento River Refuge. This would include administration, law enforcement patrol, education and outreach, and monitoring of the program. It would also include sign posting. During the first year, the Refuge would install information signs both at available parking areas as well as at access points above the ordinary high water mark, and developing a general Refuge and a hunt brochure. The total cost of the program is expected to be $35,000.00 per year. The initial setup in the first year for the hunt program is expected to cost an additional $20,000.00. No user fees are being proposed at this time. Base funding is will need to be increased to cover costs. Currently, the Refuge has two law enforcement officers (funding for a third officer in fiscal year 2005) that patrol along the Sacramento River Refuge.

H. *Consideration of providing opportunities for hunters with disabilities*

- Construct a one-mile accessible trail on Sul Norte Unit.
- Make all parking areas and portable toilets fully accessible.
- Develop parking lots at vehicle accessible hunting units (Capay, Sul Norte and Drumheller Slough).
- Work with partners to further develop hunting opportunities on refuge and other public lands. Nearby facilities have opportunities for disabled access (see Appendix N of the CCP).

VI. Measures Taken to Avoid Conflicts With Other Management Objectives

The impacts addressed here are discussed in detail in Environmental Assessment (Appendix A, Chapter 4) for the CCP (USFWS 2005) which is incorporated by reference.

A. *Biological Conflicts*

Biological conflicts will be minimized by the following:

- Proper zoning, regulations, and Refuge seasons will be designated to minimize negative impacts to wildlife.
- Due to difficult access to most units where hunting is allowed, (primarily only by boat) the number of hunters and visits will self-limit the amount of hunting that occurs on the Refuge.
- Sanctuary units are located within separate reaches of the River, which distributes areas needed by wildlife for resting, feeding, nesting, and fawning.
- Density of the riparian forests provides additional sanctuary for wildlife species.
- Use of federally approved non-toxic shot for all hunting except deer will help minimize possibility of lead poisoning.
- No hunting during the breeding season (except spring turkey). Hunting will be allowed only during designated seasons for waterfowl, upland game birds, and deer.
- Law enforcement presence to minimize excessive harvest and other infractions (illegal use of lead shot, take of non-game species, littering, etc.).
- No firearms permitted on the Refuge outside the designated firearm hunting seasons and areas.
- Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.
- Provide information in Refuge kiosks about preventing the spread of invasive species including the spread of aquatic species by boats.

B. *Public Use Conflicts*

Conflicts between hunting and other public uses and neighboring landowners will be minimized by the following:

- Provide 1,740 acres of the refuge for non-hunting activities only (i.e. wildlife observation, photography, interpretation, environmental education and fishing activities) by 2005 and an additional 1,198 acres within 2-10 year for a total of 2,938 acres (28 percent) which will separate the user groups spatially. Non hunting activities are also allowed on the 52 percent (5,323 acres) of the Refuge open to hunting.
- Landward boundaries are closed to discourage trespass from and onto adjacent private lands.
- Hunting will not be allowed on Refuge units that are small in area and close in proximity to urban areas and private dwellings.
- Post all Refuge units with boundary signs and provide public use information signs prior to opening to the public.

- Construct gates and fences at access points to reduce the potential of trespass. Each gate is signed with access restrictions and a contact number for more information.
- Provide information about the Refuge hunting program by installing informational signs/kiosks, creating and distributing brochures, and utilizing the Refuge's website (www.sacramentovalleyrefuges.fws.gov).
- Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27 of the CCP).
- Restrict entry and departure times on the refuge i.e. one hour before sunrise to one hour after sunset.
- Camping is allowed on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands (see Camping and Recreational Boating Compatibility Determination (USFWS 2005)).
- Allow pedestrian and boat traffic only.
- Hunters using boats (motorized and non-motorized) must abide by the boating stipulations described in the State and Coast Guard regulations on boating.
- Provide coordinated law enforcement patrols by game wardens, park rangers, and refuge officers to enforce state and federal regulations.
- Outreach plan will serve as a means for managing social conflicts.

C. *Administrative Conflicts*

There are no administrative conflicts with this proposal at this time. As the program expands (i.e. permit system), there may be conflicts associated with the cost of the program.

VII. Conduct of the Hunt

The following special regulations are proposed to replace the existing special regulations for Hunting of Migratory Game Birds, Upland Game and Big Game on the Sacramento River Refuge. The regulations will be noticed in the Federal Register and incorporated into 50 CFR 32.24, California Refuge-specific regulations.

A. *Refuge-specific hunting regulations*

A. Migratory Game Bird Hunting. We allow hunting of goose, duck, coot, moorhen, dove, and snipe on designated areas of the refuge in accordance with State regulations subject to the following conditions:

1. We only allow shotgun hunting.

2. You must unload firearms (see 50 CFR 27.42(b)) before transporting them between parking areas and hunting areas. Unloaded means that no ammunition is in the chamber or magazine of the firearm.

3. You may possess only approved nontoxic shotshells while in the field (see 50 CFR 50 32.2(k)).
4. You may not hunt within 50 feet of any landward boundary adjacent to private property.
5. You may not hunt within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith.
6. Access to the hunt area is by foot traffic or boat only. We do not allow bicycles or other conveyances. Mobility-impaired hunters should consult with the Refuge Manager for allowed conveyances.
7. We prohibit fires on the refuge, except portable gas stoves on gravel bars (see 50 CFR 27.95(a)).
8. We allow camping on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands (see Camping and Recreational Boating Compatibility Determination (USFWS 2005)).
9. The refuge is open for day use access from 1 hour before sunrise until 1 hour after sunset. We allow access during other hours on gravel bars only (see condition A8).
10. We require dogs to be kept on a leash, except for hunting dogs engaged in authorized hunting activities and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).
11. We do not allow permanent blinds. You must remove all personal property, including decoys and boats, at the end of each day (see 50 CFR 27.93).
12. We do not allow cutting or removal of vegetation for blind construction or for making trails.

B. Upland Game Hunting. We allow hunting of pheasant, turkey and quail on designated areas of the refuge in accordance with State regulations subject to the following conditions:
1. We only allow shotgun and archery hunting.
2. Conditions A3, A4, A5, A6, A7, A8, A9, A10, and A12 apply.

C. Big Game Hunting. We allow hunting of black-tailed deer on designated areas of the refuge in accordance with State regulations subject to the following conditions:
1. Conditions B1, A4, A5, A7, A8, A9, and A12 apply.
2. We do not allow construction or use of permanent blinds, platforms, ladders or screw in foot pegs.
3. You must remove all personal property, including stands from the refuge at the end of each day (see 50 CFR 27.93).

B. *Anticipated public reaction to the hunt*

Most hunters would support the opening of the Sacramento River Refuge to hunting. Hunting and fishing have a strong traditional use on the Sacramento River. During the comment periods and public meetings for the CCP in 2001 and 2004, a variety of opinions were heard. The majority of the comments received

supported increasing access to the Refuge and opening as much of the Refuge to hunting as possible (see Chapter 2 and Appendix R of the CCP). Some hunters, and other Refuge visitors, may object to boat only access to many of the Refuge units and for not installing additional boat ramps on the Refuge. Anti-hunting individuals and organizations also voiced their objection to any hunting on the Sacramento River Refuge (see Appendix R of the CCP).

The refuge will provide opportunities for approximately 1,500 annual hunting visits. A total of 5,500 annual visits are estimated for all wildlife-dependent recreational uses.

C. *Hunter application and registration procedures*

A California hunting license and tags is required for taking any bird or mammal. See Section G Hunter Requirements below.

D. *Description of hunter selection process, if needed*

At this time, there are no restrictions or limits on the number of hunters permitted on the Refuge. See Section G Hunter Requirements below.

E. *Media selection for announcing and publicizing the hunt.*

The refuge has a standard list of local media contacts for news releases. A news release announcing the hunt will be sent out approximately one month prior to the first day of the hunt. Yearly announcements, if needed, will be issued thereafter. A draft news release regarding the hunting program is attached. An Outreach plan is also included below.

Outreach plan

1. Issue

The Service intends to propose the opening of Sacramento River Refuge to hunting.

2. Basic facts about the issue

- Approximately 3,356 acres will be open by 2005 and an additional 1,967 acres within 2-10 years to total 5,323 acres (52 percent) open to hunting (Figure 28, Chapter 5, CCP).
- Hunting of waterfowl, coots, common moorhen, snipe, dove, quail, pheasant, turkey and deer will be allowed in accordance with State and refuge-specific hunting regulations during the legal hunting seasons and shooting times
- Hunting will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats.
- Method of enforcement and control will take place through boundary and public use signs, information kiosks at boat ramps, and routine patrol by CDFG wardens and refuge officers.

- Biological conflicts will be minimized by use of federally approved non-toxic shot and providing sanctuary areas that are strategically dispersed and well distributed along the River.
- The density of the riparian forests and presence of poison oak, ticks, mosquitoes and periodic flooding will reduce or limit the amount of visitation on some areas.
- Hunting will not be allowed on Refuge units that are small in area and close in proximity to urban areas and private dwellings.
- Landward boundaries are closed to discourage trespass from and onto adjacent private lands.
- Entry and departure times on the refuge will be restricted except for camping on the gravel bars.
- The majority of the hunt area will be accessible by boat access only. This access will serve to limit the number of hunters using the refuge.

3. Communication goals

- Continue to solicit input from partners and keep lines of communication open
- Continue to attend pre and post hunt meetings with CDFG
- Continue to solicit input from Refuge Hunting Program and Disabled Access working groups.
- Continue to coordinate with the Sacramento River Conservation Area Forum.
- Ensure accurate public information and provide news releases.
- Utilize the Refuge's website to provide information (www.sacramentovalleyrefuges.fws.gov).

4. Message

A quality, compatible and safe hunting program can be implemented and maintained on the Sacramento River Refuge.

5. Interested parties

State fish and wildlife agencies; Tribes; nongovernmental organizations; conservation groups; hunting, fishing, and wildlife observation groups; educators; farmers and ranchers; other federal agencies; Members of Congress; state and county representatives; news media; and many members of the public.

6. Date

March 2005

F. *Description of hunter orientation, including pre hunt scouting opportunities*

Maps and hunting information will be provided on the Sacramento Refuge Complex website, in the California State hunting regulations, at public boat ramps, and entrance roads to refuge units. The refuge will be open year-round, therefore pre hunt scouting will be allowed in hunt areas.

G. *Hunter requirements*

(1) State determined age requirement
- Applicants for deer hunting must be at least 12 years old as stated in State regulations.
- Youth hunters, 15 year or younger, must be accompanied by adults 18 years or older.

(2) Allowable equipment
- Method of take: Federally approved non-toxic shot required for all species except, deer. No shot shell larger than 12 gauge and no shot size larger than "T" is permitted. Weapons or ammunition for take of deer include shotgun, firing single shotgun slugs, and archery. No rifles or pistols may be used or possessed on the Refuge.
- Dogs are required to be kept on a leash, except for hunting dogs engaged in authorized hunting activities and under the immediate control of a licensed hunter (see 50 CFR 26.21(b)).
- We do not allow permanent blinds. You must remove all personal property, including decoys and boats, at the end of each day (see 50 CFR 27.93).

(3) Use of open fires
- We prohibit fires on the refuge, except portable gas stoves on gravel bars (see 50 CFR 27.95(a)).

(4) Licensing and permits
- State hunting license is required for taking any bird or mammal. Hunters must carry licenses and be prepared to show them upon request.
- State and Federal duck stamps are required to take migratory waterfowl, an upland game bird stamp is required to take dove, pheasants, quail, and turkey; State license tags are required for taking deer.
- Assess the need for turkey and deer hunting by permit only on Refuge lands during the 2005-7 hunting seasons. This would be an additional Refuge permit required to hunt these species on the Refuge.

(5) Reporting harvest
- Hunters must complete harvest report/comment report card at unit drop box on the Capay, Sul Norte, and Drumheller Slough units.
- Hunters must report take of deer to CDFG according to State regulations.

(6) Hunter training and safety
Hunters are required to successfully complete a hunter education course in order to purchase a State hunting license.

(7) Other information (use of dogs, falconry, etc.)

- Bird hunting: trained retrieving dogs are allowed.
- Deer hunting: use of dogs is allowed according to State regulations.
- Falconry is not allowed.
- Dog trials are not allowed.

VIII. Compatibility Determination

See Appendix B in CCP (USFWS 2005)

IX. Appropriate NEPA Documents

See EA (Appendix A in CCP (USFWS 2005))

X. Evaluation

A. *Monitoring and reporting use levels and trends*

There are numerous acceptable methods and techniques that have been developed for estimating number of visits on refuges. These methods may apply to different situations including areas not accessible by roads, areas that have more than one activity occurring at a time, or areas that have multiple access points. The following methods of estimating the number of visitors will be used on Sacramento River Refuge: direct observations, traffic counters, patrols, self-registration, extrapolations from limited data using stratified samples, and best professional judgment. Harvest limits will be estimated using stratified sampling, self-registration, patrol, and direct observations.

A team of specialists are completing the FWS Visitation Estimation Handbook that will be used on all National Wildlife Refuges. It will take into account staffing levels, Refuge acreage, volunteer support, access points, monitoring sites, etc. Given multiple variables, estimation methods will be presented for use on various areas. Currently, there are interim guidelines for visitation monitoring on National Wildlife Refuges for the Refuge Management Information System - Public Education and Recreation section.

Use levels, trends, and needs will be evaluated through hunters' harvest report/comment report cards, report take of deer, auto counters, hunter contact in the field, comments during working group, agencies, and public meeting, e-mails and letters. The visitor use will be recorded annually in the Refuge Management and Information System.

B. *Surveying needs of the hunting visitor*

Through the ongoing research program on the Refuge, universities will be contacted to develop a survey assessing visitor needs.

C. *Are we meeting program objectives?*

There is currently no hunting on the Sacramento River Refuge. The hunting program objective to, "*provide high quality hunting opportunities on 3,356 acres by 2005 and*

an additional 1,967 acres within 2-10 years", will be met through the CCP strategies. Monitoring will determine if we are meeting program objectives.

D. *Do we need to resolve any conflicts?*

Not at this time. The hunting program and outreach plans are written to minimize future conflicts.

NEWS RELEASE

U.S. FISH & WILDLIFE SERVICE - REGION 1
Sacramento NWR Complex
752 County Road 99 W
Willows, CA 95988

FOR IMMEDIATE RELEASE
Contact: Denise Dachner
530/934-2801

Sacramento River National Wildlife Refuge Lands Open to Hunting

The Sacramento River National Wildlife Refuge (Refuge) is opening 3,356 acres between Red Bluff Diversion Dam and Princeton to hunting on _____. Take of deer, turkeys, quail, waterfowl, coots, snipe, dove and pheasants will be allowed in accordance with the State of California and Refuge-specific hunting regulations during the legal hunting seasons. Brochures and posted public use signs, including the River-mile for reference, will assist hunters in determining Refuge unit locations. For further information and Refuge-specific hunting regulations see SacramentoValleyRefuges.fws.gov or call 530-934-2801.

The U.S. Fish and Wildlife Service is the principal federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Service manages the 95-million-acre National Wildlife Refuge System, which encompasses 544 national wildlife refuges, thousands of small wetlands and other special management areas. It also operates 69 national fish hatcheries, 64 fishery resource offices and 81 ecological services field stations. The agency enforces federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies. 02/05

- FWS -

For more information about the U.S. Fish and Wildlife Service, visit our home page at http://www.fws.gov

Appendix D. Sacramento River National Wildlife Refuge Fishing Plan

I. Introduction

Sacramento River National Wildlife Refuge (Refuge) is part of the Sacramento National Wildlife Refuge Complex (Complex) and is located in the Sacramento Valley of north-central California. The Valley is bordered by the Sierra Nevada Range and Cascade Range to the east and the North Coast Range to the west. The Refuge is composed of 26 properties (units) along a 77-mile stretch of the Sacramento River between the cities of Red Bluff and Princeton, 90 miles north of the metropolitan area of Sacramento. As of June 2005, the Refuge consists of approximately 10,304 acres of riparian habitat, wetlands, uplands, intensively managed walnut and almond orchards, and row crops in Tehama, Butte, and Glenn counties. Colusa County is within the approved refuge boundary, but the Refuge does not currently administer any properties along the river within the county.

The Valley is an extensive agricultural area, which historically vast herds of pronghorn and tule elk and millions of wintering ducks and geese. Lands that surround the Refuge are mostly orchards and irrigated rice lands with some dairying, safflower, barley, wheat, and alfalfa crops. Topography is flat with a gentle slope to the south. Predominant soil type is Columbia loam.

Riparian habitat along the Sacramento River provides important habitat for endangered and threatened species, anadromous salmonids, native resident fishes, migratory birds, native plants, and to the natural processes of the River. There has been a 98 percent reduction of riparian habitat along the Sacramento River. Habitat loss resulted from forest clearing, primarily for agriculture, dams for flood control and water storage on the main stem and tributaries, which attenuate and alter hydrology and geomorphology, and bank stabilization, such as levees and rip-rap, for flood control. The relatively small amount of remaining riparian woodland provides a strikingly disproportionate amount of habitat value for wildlife. The Refuge is managed to maintain, enhance and restore habitats for threatened and endangered species, migratory birds, anadromous fish, and native plants and vegetation. As much as possible, habitat is managed for natural diversity of indigenous flora and fauna. Riparian forests are being restored by converting flood-prone croplands along the Sacramento River in cooperation with The Nature Conservancy (TNC), River Partners (RP), and local farmers.

There are a variety of outdoor activities that occur on the Sacramento River and adjacent lands. Hunting, fishing, wildlife observation, environmental education, interpretation, tubing, and canoeing are some of the commonly known activities that occur during different times of the year on some private and public lands (Figure 25, Chapter 5, CCP, USFWS 2005). Fishing is a traditional outdoor activity that is consistent with Federal and State law as appropriate.

The purpose of this fishing plan is to outline how the program will be operated within the Refuge. In addition, the fishing plan documents how the Refuge will provide safe fishing

opportunities, while minimizing conflicts with other priority wildlife-dependent recreational uses.

II. Conformance with Statutory Authorities

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System, purposes for which individual Refuges were established, policies, laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual. The Refuge Recreation Act of 1962, as amended, authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use when such uses did not interfere with the area's primary purpose.

The Improvement Act identified a new mission statement for the Refuge System; established six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation); emphasized conservation and enhancement of the quality and diversity of fish and wildlife habitat; stressed the importance of partnerships with Federal and State agencies, Tribes, organizations, industry, and the general public; mandated public involvement in decisions on the acquisition and management of refuges; and required, prior to acquisition of new refuge lands, identification of existing compatible wildlife-dependent uses that would be permitted to continue on an interim basis pending completion of comprehensive conservation planning.

The Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a CCP for each refuge by the year 2012; provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Improvement Act also establishes a formal process for determining compatibility of uses. Before any uses, including wildlife-dependent recreational uses, are allowed on refuges, Federal law requires that they be formally determined compatible. A compatible use is defined as a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the purposes of the refuge or mission of the Refuge System. Sound professional judgment is defined as a finding, determination, or decision that is consistent with the principles of sound fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), and applicable laws. The Service strives to provide wildlife-dependent recreational uses when compatible. If financial resources are not available to design, operate, and maintain a priority use, the refuge manager will take reasonable steps to obtain outside assistance from the State and other conservation interests.

The Refuge was established in 1989 by the authority provided under the Endangered Species Act of 1973 and the Emergency Wetlands Resources Act of 1986, using monies made available through the Land and Water Conservation Fund Act of 1965. The Service proposed and Congress authorized the acquisition of 18,000 acres of land for establishment of the Sacramento River Refuge. The area considered for acquisition is located along the Sacramento River between Colusa and Red Bluff in Colusa, Glenn, Butte, and Tehama counties. A combination of fee title and conservation easement acquisitions was used to protect this habitat. The purpose of the Sacramento River Refuge is to preserve, restore, and enhance riparian habitat for threatened and endangered species, migratory birds, anadromous fish, native plants and vegetation. Compatibility determinations are included in Appendix B of the CCP (USFWS 2005).

Based upon biological impacts described in the Fishing Compatibility Determination (CD), Comprehensive Conservation Plan, and Environmental Assessment (USFWS 2005), which are incorporated by reference, fishing within the Sacramento River National Wildlife Refuge is a compatible use and will not materially interfere with or detract from the purposes for which the Refuge was established. Stipulations within the Fishing CD to ensure compatibility include: refuge-specific regulations, monitoring of fishing use, promoting the use of non-toxic sinkers, maintaining access facilities, and routine law enforcement patrols.

III. Statement of Objectives

Fishing is identified in the Refuge Improvement Act as a priority use for refuges when it is compatible with the refuge purposes and mission of the Refuge System. As a result the Refuge encourages fishing for legal take of freshwater game fish species. The fishing program will be of the highest quality, conducted in a safe and cost-effective manner, and to the extent practicable, carried out in accordance with State regulations, see 8 RM 6, Sport Fishing. The Fishing Plan was developed to provide safe fishing opportunities, while minimizing impacts to wildlife, plants and conflicts with other wildlife-dependent recreational uses. The Refuge fishing program will comply with the Fish and Game Code or from Title 14 of the California Code of Regulations as adopted by the Fish and Game Commission under authority of the Fish and Game Code and managed in accordance with Refuge Manual 8 RM 6, Sport Fishing.

Fishing will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats. Therefore, sport fishing on the Refuge is in compliance with State regulations and seasons, the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-ee), and the Refuge Recreation Act of 1962 (16 U.S.C. 460k).

The purpose of this fishing plan is to outline how the program will be operated within the Refuge. The objective of the fishing plan is to provide safe, quality fishing opportunities, for the visiting public. The Service has determined fishing to be a compatible wildlife-

dependent recreation (USFWS 2005). The fishing program will not detract from the purposes of the Refuge or the mission of the Refuge System nor will it interfere with other wildlife-life dependent recreational uses or with wildlife management objectives. California Fish and Game Department (2004b) also has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

IV. Assessment.

Evaluate the fishing resources on the refuge populations and habitat. Points to be discussed include, but are not limited to, the following:

A. *Is the fishery resource capable of sustaining fishing pressure?*

Yes, the fishery resource is capable of sustaining fishing pressure. The Sacramento River is currently open to fishing on other public lands surrounding the Refuge. Species that may occur on the Refuge include pacific, river and, western brook lamprey, white and green sturgeon, threadfin and American shad, Chinook salmon (Central Valley fall, late fall, and spring run as well as winter run), coho salmon, sockeye salmon, Central Valley steelhead, rainbow and brown trout, tui and thicktail chub, lahotan redside, hitch, California roach, Sacramento blackfish, Sacramento splittail, hardhead, Sacramento squawfish, speckled dace, golden shiner, fathead minnow, goldfish, carp, Sacramento sucker, black, brown, and yellow bullhead, white and channel catfish, mosquitofish, Mississippi silverside, threespine stickleback, Sacramento perch, bluegill, redear and green sunfish, pumpkinseed, warmouth, white and black crappie, striped, largemouth, smallmouth, and spotted bass, bigscale logperch, tule perch, and prickly, riffle and staghorn sculpin.

Federally listed species that occur on the Refuge include: Chinook salmon, Sacramento River winter-run evolutionary significant unit (ESU) (Federal and State-listed endangered species), Chinook salmon, Central Valley spring-run ESU (Federal and State-listed threatened species), Chinook salmon, Central Valley fall-run ESU and late-fall-run ESU (Federal candidate species and State species of concern), steelhead, Central Valley ESU (Federal-listed threatened species), Valley elderberry longhorn beetle (federally listed threatened species), bald eagle (federally listed threatened species and State-listed endangered species), western yellow-billed cuckoo (Federal candidate species, State-listed threatened species, and FWS Bird of Conservation Concern), and giant garter snake (federally listed endangered species and State-listed threatened species). Critical Habitat for the Sacramento River winter-run Chinook salmon was designated June 16, 1993 (58 CFR 33212, June 16, 1993). Critical habitat includes the river bottom and riparian zone, which are those terrestrial areas that directly affect a freshwater aquatic ecosystem. Critical Habitat for this ESU includes the Sacramento River from Keswick Dam to Chipps Island, all the waters westward from Chipps Island to the

Carquinez Strait Bridge, all the waters of San Pablo Bay, and all the waters of the San Francisco Bay north of the San Francisco Bay–Oakland. The Section 7 consultation with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (and Fishing Plan) is not likely to adversely affect any of the special status species/designated critical habitat occurring on the Refuge.

Non-native bass, bluegill, crappie, and sunfish compete for habitat with native species. Competition is especially severe in oxbows and sloughs, which provide relatively scarce still-water habitats, which are dominated by non-native fishes. Non-native bass also prey on juvenile salmonids and other native.

The Refuge adopts harvest regulations set by the State, which uses the best available population information. Sources of population data for Chinook salmon include the California Department of Fish and Game, the U.S. Fish and Wildlife Service (Fisheries Resources Offices and the National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS).

B. *Does the refuge control all access to the resource? If not, can the refuge regulate sport fishing on these waters?*

No, the Refuge does not control all access to the resource. With this fishing plan, the Refuge will provide consistent regulations with the State and NOAA NMFS and will provide additional enforcement of these regulations.

C. *Is a fishery management plan needed?*

No, a fishery management plan is not needed. Management of the fishery resources already occurs through the Fisheries Resource Offices and other agencies, including CDFG and NOAA NMFS.

V. Description of Fishing Program

A. *Areas of the refuge that support the fishery resource.*

Game fish species occur in open water on the Refuge in the main River channel, sloughs, oxbow lakes, and on the inundated floodplain. Open water constitutes water, either standing or moving, and does not necessarily imply vegetation. Gravel and sand bars appear as open, unvegetated areas in air photos, but ground truthing reveals several annual and short-lived perennial species of sun-loving herbs, grasses and aromatic subshrubs. The vegetation cover is less than 50 percent. The above descriptions of open water, gravel and sand bar were developed by the Geographic Information Center at California State University, Chico (2002) for mapping the riparian vegetation of the Sacramento River.

A diversity of game fish species use various types of wetlands during portions of their life history, including spawning, migration, and wintering periods. The

Sacramento River, its tributaries, sloughs, abandoned channels, oxbow lakes, and ponds support freshwater wetlands. These wetland areas are described as follows.

The river channel is dynamic: it varies with meander belt position from shallows near gravel bars to deep holes below steep cut banks. Depth and flow velocity also varies with seasonal differences in runoff and with flow releases from Keswick Dam. Generally, water in the channel is relatively fast moving and cold. Oxbow lakes occur on the middle Sacramento River floodplain. They form on meandering rivers when the channel breaches a narrow gap of land in the loop and a sand plug seals the upriver arm of the loop. They vary in depth depending on siltation. Water is calm and relatively warm compared to the main channel. Sloughs and swales convey and distribute water on the floodplain. They are usually wet only during high water and flood events. Gravel pits were excavated on the Sacramento River floodplain for private and public roads and an experimental artificial salmon-spawning project conducted by the Bureau of Reclamation. Gravel pits form wetlands when the bottom contacts the water table. Large portions of the Sacramento River floodplain become temporary wetlands when inundated with seasonal runoff from the tributaries and releases from Keswick Dam.

B. *Areas to be opened to the public.*

The Refuge currently consists 10,304 acres of agricultural, wetland, grassland, and riparian habitats (Table 1, Chapter 1, CCP). Approximately 5,096 acres will be open by 2005 and an additional 3,165 acres within 2-10 years to total 8,261 acres (80 percent) open to fishing (Figure 28, Chapter 5, CCP). Gravel bars, sloughs, oxbow lakes, and the inundated floodplain on all Refuge units will be open to the public for fishing.

Access for fishing on the Refuge is primarily by boat access. Bank fishing can be accessed by boat or by walking onto any of the Refuge units that are not designated as sanctuary. Please refer to Figure 28 in the CCP for more information (USFWS 2005). As funding is secured, eight units (Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora, Packer, and Drumheller Slough) will have parking areas developed for pedestrian access.

C. *Fishery-related species to be taken*

Game fish species which will be allowed for legal take include all native and introduced species listed in the California regulations Freshwater Sport Fishing i.e. Chinook salmon, steelhead, trout, sturgeon, sunfish, shad, stripped bass, carp, catfish, bullhead, crappie, bass and spotted bass. Fishing will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats.

D. *Seasons*

Fishing will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats. For some species, fishing will occur year-round. For others like the winter-run Chinook salmon, the State seasons are designed to protect listed species. The winter-run Chinook salmon season ends in December because this species begins their run in January.

E. *Justification for permit, if one is required.*

Anyone 16 years and older must have a State fishing license to take any kind of fish. See section G Angler Requirements below.

Anglers do not need to obtain a Refuge fishing permit or pay a special user fee to fish on the Refuge. In the future, Refuge user fees may be considered. There is a fee for State fishing licenses.

F. *Procedures for consultation and coordination with State.*

- Continue to solicit input from partners and keep lines of communication open.
- Continue to attend the Sacramento River Area Forum meetings.
- Ensure accurate public information and provide news releases.
- CDFG (2004b) also has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

G. *Methods of enforcement.*

- Public use signs depicting allowable uses will be placed above the ordinary high water mark and at vehicle access points.
- California Department of Boating and Waterways boating guide that depicts the unit name and river mile location, a large laminated boating guide and the Sacramento River Refuge brochure will be placed at public boat ramps and units accessible by vehicle.
- Gate parking areas to allow pedestrian access only.
- Landward boundaries are closed to discourage trespass through adjacent private lands.
- Law enforcement patrols by game wardens, park rangers, refuge officers to enforce state and federal regulations.
- Camping is allowed on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands.

H. *Funding and staffing requirements for the sport fishing program.*

The following funding/annual costs (based on FY 2003 costs) would be required to administer and manage fishing activities as described above:

	One-time Costs	Annual Costs
Administration		$2,000
Law Enforcement		$5,000
Outreach, Education, Monitoring		$3,000
Signs and brochures	$3,000	$1,000
Maintenance of facilities		$3,000
TOTAL	**$3,000**	**$14,000**

Approximately 25 staff days would be required to monitor and conduct the fishing program for the Sacramento River Refuge. This would include administration, law enforcement patrol, education and outreach, and monitoring of the program. It would also include sign posting. During the first year, the Refuge would install information signs both at available parking areas as well as at access points above the ordinary high water mark, and developing a general Refuge brochure. The total cost of the program is expected to be $14,000.00 per year. The initial setup in the first year for the hunt program is expected to cost an additional $3,000.00. No user fees are being proposed at this time. Base funding is will need to be increased to cover costs. Currently, the Refuge has two law enforcement officers (funding for a third officer in fiscal year 2005) that patrol along the Sacramento River Refuge.

I. *Consideration of providing opportunities for anglers with disabilities and youth anglers*.

- All parking areas and portable restrooms are fully accessible.
- Develop parking lots at vehicle accessible fishing units (Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora, Packer and Drumheller Slough).
- Work with partners to develop fishing opportunities on refuge units and other public lands. Nearby facilities have opportunities for disabled access (see Appendix N of the CCP).

VI. Measures Taken to Avoid Conflicts With Other Management Objectives.
The impacts addressed here are discussed in detail in Environmental Assessment (Appendix A, Chapter 4) for the CCP (USFWS 2005) which is incorporated by reference.

A. *Biological Conflicts*.

- Open only riverine areas, oxbow lakes and ponds to fishing.
- Maintain parking areas, roads, and access facilities to prevent erosion or habitat damage (see Figure 28 of the CCP (USFWS 2005)).
- Promote use of non-toxic sinkers, split shot, and lures by providing information in refuge kiosks.
- Monitor fishing activities to ensure facilities are adequate and wildlife disturbance is minimal.
- Section 7 consultations with USFWS (2004) and NOAA-Fisheries (2004) concluded that the CCP (USFWS 2005) is not likely to adversely affect any of the special

status species/designated critical habitat occurring on the Refuge including: bald eagle, giant garter snake, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, Valley elderberry longhorn beetle, western yellow billed cuckoo, fall-run Chinook salmon, and late fall-run Chinook salmon.

B. *Public Use Conflicts*.

Reducing conflicts between fishing and hunting, non-consumptive uses, and neighboring landowners will be minimized by the following:

- Disseminate California Department of Boating & Waterways boating guide, which depicts Refuge units by river mile, at public boat ramps i.e. Red Bluff Diversion Dam, Woodson Bridge, Irvine Finch, Ord Bend, Butte City, and Sacramento River-Colusa State Park, by 2005.
- Place public use signs at vehicle access points and at the approximate ordinary high water mark on all Refuge units open to the public. The signs will depict the unit name, river mile, and public uses allowed/prohibited (Figures 26 & 27 of the CCP).
- Provide information about the Refuge fishing program by installing informational signs/kiosks, creating and distributing brochures, and utilizing the Refuge's website (www.sacramentovalleyrefuges.fws.gov).
- Law enforcement patrols by game wardens, park rangers, and refuge officers to enforce state and federal regulations.
- Landward boundaries are closed to discourage trespass through adjacent private lands.
- Restrict entry and departure times on the refuge.
- Anglers using boats (motorized and non-motorized) must abide by the boating stipulations described in the State and Coast Guard regulations on boating.

C. *Administrative Conflicts*.

There are no administrative conflicts with this proposal at this time.

VII. Conduct of the Sport Fishing Programs.

The following special regulations are proposed to replace the existing special regulations for Sport Fishing on the Sacramento River Refuge. The regulations will be noticed in the Federal Register and incorporated into 50 CFR 32.24, California Refuge-specific regulations.

A. *Refuge-specific fishing regulations*.

Sport Fishing. We allow sport fishing on designated areas of the refuge in accordance with State regulations subject to the following conditions:

1. We prohibit fires on the refuge, except portable gas stoves on gravel bars (see 50 CFR 27.95(a)).

2. We allow camping on gravel bars up to seven days during any 30-day period. We prohibit camping on all other refuge lands (see Camping and Recreational Boating Compatibility Determination (USFWS 2005)).

3. The refuge is open for day use access from 1 hour before sunrise until 1 hour after sunset. We allow access during other hours on gravel bars only (see condition 2).
4. We do not allow cutting or removal of vegetation for blind construction or for making trails.
5. On Packer Lake, due to primitive access, we only allow boats up to 14 feet (4.2m) and canoes.

B. *Anticipated public reaction to the sport fishing program.*

Most anglers would support the opening of the Sacramento River Refuge to fishing. Hunting and fishing have a strong traditional use on the Sacramento River. During the comment periods and public meetings for the CCP in 2001 and 2004, a variety of opinions were heard. The majority of the comments received supported increasing access to the Refuge and opening as much of the Refuge to hunting and fishing as possible (see Chapter 2 and Appendix R of the CCP). Some anglers, and other Refuge visitors, may object to boat only access to many of the Refuge units and for not installing additional boat ramps on the Refuge.

The refuge will provide opportunities for approximately 1,000 annual fishing visits. A total of 5,500 annual visits are estimated for all wildlife-dependent recreational uses.

C. *Media selection for announcing and publicizing the sport fishing program.*

The refuge has a standard list of local media contacts for news releases. A news release announcing the Refuge opening of 23 river miles to fishing will be sent to these contacts. A draft news release regarding the fishing program is attached. An Outreach plan is also included below.

Outreach plan

1. Issue

The Service intends to propose the opening of Sacramento River Refuge to fishing.

2. Basic facts about the issue

- Gravel bars, sloughs, oxbow lakes, and the inundated floodplain are proposed to be opened on all Refuge units.
- Twenty-three river front miles and all seasonally submerged areas below the ordinary high water mark will be opened for fishing by 2005.
- Fishing will be allowed in accordance with State and Refuge-specific fishing regulations during the legal fishing seasons and species.
- Fishing will be permitted in accordance with State and Federal regulations and seasons to ensure that it will not interfere with the conservation of fish and wildlife and their habitats.

- Method of enforcement and control will take place through boundary and public use signs, information kiosks at boat ramps and routine patrol by CDFG wardens and refuge officers.
- Landward boundaries are closed to discourage trespass through adjacent private lands.
- Entry and departure times on the refuge will be restricted.

3. Communication goals
- Continue to solicit input from partners and keep lines of communication open.
- Continue to attend the Sacramento River Area Forum meetings.
- Ensure accurate public information and news stories.
- Continue to solicit input from local/county Fish and Game Commissions.
- Utilize the Refuge's website to provide information (www.sacramentovalleyrefuges.fws.gov).

4. Message
A quality, compatible and safe fishing program can be implemented and maintained on the Sacramento River Refuge.

5. Interested parties
State fish and wildlife agencies; Tribes; conservation groups; hunting, fishing, and wildlife observation groups; educators; farmers and ranchers; other federal agencies; Members of Congress; state and county representatives; news media; and many members of the public.

6. Date
March 2005

D. *Angler application and registration procedures (if needed)*

Anglers are required to have a valid State fishing license to fish on the Refuge. See section F Angler Requirements below.

E. *Description of angler selection process (if needed)*

At this time, there are no restrictions or limits on the number of anglers permitted on the Refuge.

F. *Angler requirements*

(1) Allowable equipment

All fish may be taken only by angling with one closely attended rod and line or one hand line with not more than three hooks nor more than three artificial lures attached thereto.

(2) Use of open fires

We prohibit fires on the refuge, except portable gas stoves on gravel bars (see 50 CFR 27.95(a)).

(3) Licensing and permits

Anyone 16 years and older must have a State fishing license to take any kind of fish. Every person, while engaged in taking any fish, shall display their valid sport fishing license by attaching it to their outer clothing at or above the waistline.

(4) Creel census.

There will be no reporting requirements of anglers unless required by CDFG.

(5) Reporting requirements

There will be no reporting requirements of anglers unless required by CDFG.

(6) Angler training and safety

Anglers are not required to successfully complete a course in order to purchase a State sport fishing license.

(7) Other information (use of boats, motors, etc.)

On Packer Lake, due to primitive access, we only allow boats up to 14 feet (4.2m) and canoes.

VIII. Compatibility Determination.

See Appendix B in CCP (USFWS 2005)

IX. Appropriate NEPA Documents

See EA (Appendix A, CCP (USFWS 2005))

X. Evaluation

A. *Monitoring and reporting use levels and trends.*

Auto counters, angler contact in the field, comments during agency and public meetings, e-mails and letters are some of the methods used to evaluate visitor use levels, trends, and needs. The visitor use will be recorded annually in the Refuge Management and Information System.

B. *Surveying needs of the fishing visitor.*

Through the on going research program on the Refuge, universities will be contacted to develop a survey assessing visitor needs.

C. *Are we meeting program objectives?*

Currently, on the Refuge only Packer Lake is open to fishing. The fishing objective to: provide high quality fishing opportunities on 23 river-front miles and all

seasonally submerged areas below the high water mark will be posted open to the public by 2005 will be met through CCP strategies. Monitoring will determine if we are meeting program objectives.

D. *Do we need to resolve any conflicts?*

Not at this time. The fishing program and outreach plans are written to minimize future conflicts.

NEWS RELEASE

U.S. FISH & WILDLIFE SERVICE - REGION 1
Sacramento NWR Complex
752 County Road 99 W
Willows, CA 95988

FOR IMMEDIATE RELEASE
Contact: Denise Dachner
530/934-2801

Sacramento River Refuge Lands Open to Fishing

The Sacramento River National Wildlife Refuge (Refuge) has opened fishing for species that occur in the Refuge's sloughs, oxbow lakes, and inundated floodplain and fishing from its exposed sand and gravel bars between Red Bluff Diversion Dam and Princeton. Take of all native and introduced fish species will be allowed in accordance with the State of California and Refuge-specific freshwater sport fishing regulations during the legal fishing seasons. Brochures available at most public boat ramps and posted public use signs, including the River-mile for reference, will assist anglers in determining Refuge unit locations. For further information and refuge specific fishing regulations see SacramentoValleyRefuges.fws.gov or call 530-934-2801.

The U.S. Fish and Wildlife Service is the principal federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Service manages the 95-million-acre National Wildlife Refuge System, which encompasses 544 national wildlife refuges, thousands of small wetlands and other special management areas. It also operates 69 national fish hatcheries, 64 fishery resource offices and 81 ecological services field stations. The agency enforces federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies. 02/05

- FWS -

For more information about the U.S. Fish and Wildlife Service, visit our home page at http://www.fws.gov

Appendix E. Sacramento River National Wildlife Refuge Fire Management Plan

The Department of the Interior (DOI) fire management policy requires that all refuges with vegetation that can sustain fire must have a Fire Management Plan that details fire management guidelines for operational procedures and values to be protected/enhanced. The Fire Management Plan (FMP) for the Sacramento River National Wildlife Refuge (NWR) provides guidance on preparedness, prescribed fire, wildland fire, and prevention. Values to be considered in the FMP include protection of Refuge resources and neighboring private properties, effects of burning on refuge habitats/biota, and firefighter safety. Refuge resources include properties, structures, cultural resources, trust species including Endangered, Threatened, and species of special concern, and their associated habitats. The FMP will be reviewed periodically to ensure that the fire program is conducted in accordance and evolves with the U.S. Fish and Wildlife Service (USFWS) mission and the Refuge's goals and objectives.

The FMP is written to provide guidelines for appropriate suppression and prescribed fire programs at Sacramento River NWR. Prescribed fires may be used to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research.

This plan will help achieve resource management objectives by enabling the Refuge to utilize prescribed fire, as one of several tools, to control non-native vegetation and reduce fire hazards in grassland and riparian habitats. It will be used in conjunction with other management tools that are currently applied on Refuge properties (i.e., grazing, mowing and herbicide applications) to meet resource objectives.

It is the intent of the USFWS to conduct wildland fire suppression and prescribed fire operations within the Sacramento River NWR.

Copies of the plan are available for review at the Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, California 95988. (530) 934-2801.

Copies are also available via the internet at the following address
http://sacramentovalleyrefuges.fws.gov

Appendix F. Compliance with Section 7 of the Endangered Species Act

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
1-1-04-I-2214

JUL 21 2004

To: Refuge Manager, Sacramento National Wildlife Refuge Complex
Willows, California

From: Field Supervisor, Sacramento Fish and Wildlife Office
Sacramento, California

Subject: Informal Intra-agency Section 7 Evaluation for the *Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge*, Butte, Glenn, and Tehama counties, California

This letter is in response to your July 6, 2004, letter requesting concurrence that the *Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge* (CCP), dated June 2004, will not will not adversely affect federally-listed species. The Sacramento Office of the U.S. Fish and Wildlife Service (Service) received your request and the accompanying CCP on July 7, 2004. At issue are potential effects to the federally-listed vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), giant garter snake (*Thamnophis gigas*), and bald eagle (*Haliaeetus leucocephalus*). Our primary concern and mandate is the protection of federally-listed species pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

As part of the informal intra-agency Section 7 consultation process, the Service has reviewed the following documents: (1) your July 6, 2004, letter requesting informal Section 7 consultation; (2) the *Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge*, dated June 2004; (3) the *Intra-agency Formal Consultation on Management, Operations, and Maintenance of the Sacramento National Wildlife Refuge Complex, Willows, California* (Service File Number 1-1-98-F-0013), dated April 28, 1999; (4) the subsequent amendment (Service File Number 1-1-02-F-0206), dated June 10, 2002; and, (5) the Service's *Informal Endangered Species Section 7 Consultation for Integrated Pest Management Plan for Walnut Production at the Sacramento River National Wildlife Refuge, Butte, Glenn, and Tehama Counties, California* (Service File Number 1-1-04-I-1462), dated June 10, 2004.

TAKE PRIDE IN AMERICA

The Sacramento River National Wildlife Refuge (Refuge) is located in Butte, Glenn, and Tehama counties, and consists of approximately 10,141 acres of riparian and agricultural habitats owned by the Service, and approximately 1,281 acres of riparian habitats owned by Llano Seco Ranch. The CCP is designed to guide management of the Refuge for the next 15 years, and is accompanied by a hunting plan, fishing plan, fire management plan, and integrated pest management plan. The purposes of the CCP are to: (1) provide a clear statement of direction for future management of the Refuge; (2) provide long-term continuity in Refuge management; (3) communicate the Service's management priorities for the Refuge to their partners, neighbors, visitors, and the general public; (4) provide an opportunity for the public to help shape the future management of the Refuge; (5) ensure that management programs on the Refuge are consistent with the mandates of the National Wildlife Refuge System; (6) ensure that the management of the Refuge is consistent with Federal, State, and local plans; and, (7) provide a basis for budget requests to support the Refuge's needs for staffing, operations, maintenance, and capital improvements.

The Service concurs with your determination that the activities outlined in the CCP and in the accompanying hunting plan, fishing plan, fire management plan, and integrated pest management plan will lead to long-term benefits to federally-listed species. Furthermore, the activities proposed in the CCP are consistent with the *Intra-agency Formal Consultation on Management, Operations, and Maintenance of the Sacramento National Wildlife Refuge Complex, Willows, California* (Service File Number 1-1-98-F-0013), dated April 28, 1999, and the subsequent amendment (Service File Number 1-1-02-F-0206), dated June 10, 2002.

If you have questions regarding the informal intra-agency Section 7 consultation for the *Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge*, please contact Rick Kuyper or Adam Zerrenner, Sacramento Valley Branch Chief, of my office at (916) 414-6645.

cc:
California Department of Fish and Game, Rancho Cordova, California (Attn: Terry Roscoe)

INTRA-SERVICE SECTION 7 EVALUATION

Originating Unit: Sacramento NWR Complex (530) 934-2801 **Date:** July 6, 2004

I. Region: 1

II. Service activity: Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge

III. Pertinent Species and Habitat

A. Listed species and/or their critical habitat within the action area:

1. Within the action area that will or may be affected:

- Bald eagle (*Haliaeetus leucocephalus*)
- Giant garter snake (*Thamnophis gigas*)
- Chinook salmon, Sacramento River winter-run ESU (*Oncorhynchus tshawytscha*)
- Chinook salmon, Central Valley spring-run ESU (*Oncorhynchus tshawytscha*)
- Steelhead, Central Valley ESU (*Oncorhynchus mykiss*)
- Valley elderberry longhorn beetle (*Desmocerus californicus diamorphus*)

2. Within the action area that will not be affected: NONE

B. Proposed species and/or proposed critical habitat: NONE

1. Within the action area that will or may be affected: NONE

2. Within the action area that will not be affected: NONE

C. Candidate species within the action area:

- Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)
- Chinook salmon, Central Valley fall-run and late-fall-run ESU (*Oncorhynchus tshawytscha*)

D. Include species/habitat occurrence on a map.

IV. Geographic area or station name and action: The proposed action is to implement a Comprehensive Conservation Plan for the Sacramento River National Wildlife Refuge. This management plan and the associated wildlife management activities and public use will be implemented at all Units of the Refuge. The current riparian habitat restoration program was

addressed in the restoration environmental assessment for the following Units of the Refuge: Ryan (now part of La Barranca Unit), Ohm, Haleakala (now part of Ohm Unit), Pine Creek, Kaiser (now referred Capay Unit), Phelan Island, Koehnen (now referred to as Deadman's Reach Unit), Hartley Island, and Stone (now referred to as Drumheller Unit). Public fishing at Packer Lake was covered under a previous Intra-service Section 7 consultation.

V. Location (maps attached):

A. Central Valley/San Francisco Bay Ecoregion

B. County and State:

Tehama County, California– Blackberry Island Unit, La Barranca Unit, Todd Island Unit, Moony Island Unit, Ohm Unit, Flynn Unit, Heron Island, Rio Vista Unit, and Foster Island Unit.

Butte County, California– Pine Creek Unit, Deadman's Reach Unit, and Llano Seco Unit.

Glenn County, California– McIntosh Landing North, McIntosh Landing South, Capay Unit, Phelan Island Unit, Jacinto Unit, North Ord Unit, Ord Unit, South Ord Unit, Hartley Island Unit, Sul Norte Unit, Codora Unit, Packer Unit, and Drumheller Slough Unit.

C. Blackberry Island Unit– 4.7 miles south of Red Bluff, California
La Barranca Unit– 5.3 miles south of Red Bluff, California
Todd Island Unit– 6.7 miles south of Red Bluff, California
Mooney Island Unit– 7.1 miles south of Red Bluff, California
Ohm Unit– 8.0 miles south of Red Bluff, California
Flynn Unit– 9.3 miles south of Red Bluff, California
Heron Island Unit– 1.2 miles south of Tehama, California
Rio Vista Unit– 8.4 miles south of Tehama, California
Foster Island Unit– 12.5 miles south of Tehama, California
Pine Creek Unit– 7.9 miles west of Chico, California
Deadman's Reach Unit– 10.2 miles southwest of Chico, California
Llano Seco Unit– 15.2 miles southwest of Chico, California
McIntosh North Unit– 2.7 miles north of Hamilton City, California
McIntosh South Unit– 1.3 miles north of Hamilton City, California
Capay Unit– 3.5 miles south of Hamilton City, California
Phelan Island Unit– 4.7 miles south of Hamilton City, California
Jacinto Unit– 6.9 miles south of Hamilton City, California
North Ord Unit– 7.4 miles south of Hamilton City, California
Ord Unit– 8.2 miles south of Hamilton City, California
South Ord Unit– 9.1 miles south of Hamilton City, California
Hartley Island Unit– 3.3 miles north of Butte City, California
Sul Norte Unit– 0.3 miles west of Butte City, California

Codora Unit– 0.6 miles southwest of Butte City, California
Packer Unit– 1.2 miles southwest of Butte City, California
Drumheller Unit– 3.1 miles south of Butte City, California

VI. Description of the proposed action:

See attached Comprehensive Conservation Plan titled *Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge* and Draft Environmental Assessment.

VII. Determination of effects

A. Explanation of effects of the action:

The management goals and strategies specified in the *Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge* (CCP) will not adversely affect endangered, threatened and neither candidate species, nor will they adversely modify Critical Habitat or Essential Fish Habitat for listed species. In the long-term, riparian habitat restoration and management along the Sacramento River, and associated vegetation, habitat and wildlife surveys (inventory and monitoring) and research will benefit listed species. Wildlife dependant public use (wildlife observation, environmental education, nature interpretation, photography, fishing, hunting) will likely increase awareness of refuge natural resources, including listed species. Furthermore, the CCP is consistent with the Environmental Assessment titled *Proposed Restoration Activities on the Sacramento River National Wildlife Refuge: Ryan, Ohm, Haleakala, Pine Creek, Kaiser, Phelan Island, Koehnen, Hartley Island, and Stone Unit*, the Intra-agency Formal Section 7 for public fishing at Packer Lake, and the Intra-agency Formal Section 7 titled *Consultation on Management, Operations, and Maintenance of the Sacramento National Wildlife Refuge Complex, Willows, California* and dated April 1999, and the consultation letter with the National Oceanographic and Atmospheric Administration, Fisheries (SWR-01-SA-5781:MET) dated August 17, 2001.

Wildlife population surveys have been conducted on Sacramento River NWR for ten years. The Point Reyes Bird Observatory is conducting avian monitoring using fixed-radius point counts, constant effort mist netting, spot mapping, area searches, and vegetation analysis. California State University, Chico is conducting baseline and long-term riparian vegetation monitoring. Numerous and diverse research investigations have been done at various scales by universities, federal and State agencies, conservation agencies, and the refuge (Appendix R). These monitoring projects and research investigation will assist refuge management for fish, wildlife, plants and vegetation associated with the middle Sacramento River ecosystem and the Refuge.

A diversity of wildlife exists in the area. Species listed by federal or state government as endangered or threatened potentially near Sacramento River NWR and vicinity include:

Bald Eagle (*Haliaeetus leucocephalus*) – federal listed as threatened and State-listed as endangered – nests in Lake, Mendocino, Trinity, Siskiyou, Modoc, Shasta, Tehama, Lassen, Plumus and Butte counties, and in the Lake Tahoe Basin. The bald eagle occurs throughout the

year at and in the vicinity of Sacramento River NWR, but is not know to breed here. Individuals forage and roost throughout the northern Sacramento Valley in locations supporting a various permanent and temporary wetlands. Eagles occur in areas that have relatively large, open roost trees. Suitable perch trees occur along the Sacramento River throughout the project sites and vicinity.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) – federal candidate species and State-listed as endangered – breeding range in California includes lower Colorado River, Kern River and Sacramento River. Surveys for the western yellow-billed cuckoo identified a breeding range on the middle Sacramento River between Red Bluff and Meridian, just southeast of Colusa. The cuckoo was located on the Sacramento River NWR during recent surveys. The cuckoo nests in larger trees, such as Fremont's cottonwood, located in close proximity to mixed riparian forest and willow and herbaceous scrublands.

Giant garter snake (GGS) (*Thamnophis couchi gigas*) – federal and state-listed as threatened – historically ranged from the Sacramento/San Joaquin Delta to the south end of the Tulare Lake Basin. The present distribution is from Chico to central Fresno County. The giant garter snake requires freshwater wetlands, such as marshes and low gradient streams. Permanent wetlands are of particular importance, as they provide habitat over the summer and early fall when seasonal wetlands are dry. Giant garter snakes have adapted to drainage and irrigation systems, especially those associated with rice cultivation.

Chinook salmon, Sacramento River winter-run ESU (*Oncorhynchus tshawytscha*) – federal listed as endangered and State-listed as endangered – only occurs in California and most spawning is limited to the main stem of the Sacramento River. This ESU includes populations of winter-run chinook salmon in the Sacramento River and its tributaries. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta, upstream into the Sacramento River from December through July. Downstream migration of juvenile winter-run chinook salmon occurs from November through May. They migrate in the Sacramento River past the refuge as fry and smolts. Winter-run chinook salmon can rear in the following areas on the Sacramento River: above Red Bluff Diversion Dam (moving downstream as smolts, and probably in the lower river between river mile 70 and 164 (moving downstream on as fry). Water temperatures determine juvenile rearing locations and river conditions strongly influence movement. Critical Habitat for the Sacramento River winter-run chinook salmon was designated June 16, 1993 (58 CFR 33212, June 16, 1993). Critical Habitat for this ESU includes the Sacramento River from Keswick Dam to Chipps Island, all the waters westward from Chipps Island to the Carquinez Strait Bridge, all the waters of San Pablo Bay, and all the waters of the San Francisco Bay north of the San Francisco Bay–Oakland. Critical habitat includes the river bottom and riparian zone, which are those terrestrial areas that directly affect a freshwater aquatic ecosystem.

Chinook salmon, Central Valley spring-run ESU (*Oncorhynchus tshawytscha*) – federal listed as threatened and State-listed as threatened – only occurs in California in the main stem of the Sacramento River, and the Mill Creek, Deer Creek, Big Chico Creek, and Butte Creek tributaries. This ESU includes all naturally spawned populations of spring-run chinook salmon in the Sacramento River and its tributaries. Adult salmon leave the ocean and migrate through

the Sacramento-San Joaquin Delta, upstream into the Sacramento River from March through September. Downstream migration of juvenile spring-run chinook salmon occurs from March through June, while yearlings emigrate downstream from November through April. Most spawning occurs in headwater tributary streams. Critical habitat for this ESU is under development.

Chinook salmon, Central Valley fall-run and late-fall-run ESU (*Oncorhynchus tshawytscha*) – federal candidate species – This ESU only occurs in California and includes all naturally spawned populations of fall-run chinook salmon in the Sacramento and San Joaquin River Basins and their tributaries, east of Carquinez Strait. The ESU is designated as a candidate for listing due to concerns over specific risk factors. **Fall-run Chinook salmon** occur on the main stem of the Sacramento River. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta, upstream into the Sacramento River from July through December and spawn from October through December. Spawning occurs on the mainstem of the Sacramento River, including below the Red Bluff Diversion Dam. **Late-fall-run Chinook salmon** occur on the main stem of the Sacramento River. Adult salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta, upstream into the Sacramento River from October through April and spawn from January through April. Spawning occurs above the Red Bluff Diversion Dam and lower tributaries of the middle and upper Sacramento River.

Steelhead (*Oncorhynchus mykiss*) Central Valley Evolutionary Significant Unit – federal listed as threatened – an anadromous form of rainbow trout, which only occurs in California and has traditionally supported a major sport fishery in the Sacramento River system. This ESU includes all naturally spawned populations of steelhead and their progeny in the Sacramento and San Joaquin Rivers and their tributaries. Excluded are steelhead from San Francisco and San Pablo Bays and their tributaries. The historical range of steelhead in the Central Valley has been reduced by dams and water diversions that now restrict the species to the lower portions of major rivers where habitat is less favorable for steelhead spawning and rearing. They use the Sacramento River as a migration corridor to and from spawning grounds in the mainstem of the river above the Red Bluff Diversion Dam, the tributary streams, and the Coleman National Fish Hatchery. They are present in the Sacramento River year-round, either as smolts migrating downstream or adults migrating upstream or downstream. Upstream migration begins in July, peaks in the fall, and continues through February or March. Most spawning occurs from January through March. Juvenile migration generally occurs during the spring and early summer after at least 1 year of rearing in upstream areas. Populations have greatly declined over much of the species' range, including the Sacramento River basin, due to blockage of upstream migration by dams and flood control projects, agricultural and municipal diversions, deleterious temperatures in the Sacramento River, reduced availability of spawning gravels, and toxic discharges. Critical habitat for this ESU is under development.

Valley elderberry longhorn beetle (*Desmocerus californicus*) – federal listed as threatened – are known only from their host plant, the elderberry (*Sambucus mexicana*). Adults feed on foliage and are present from March through early June and breed during this period. Eggs are laid on leaves, branches, bark crevices, and trunks and hatch within a few days. Larvae bore through the stem pith, creating a pupation gallery. Adults chew through bark creating exit holes. Upon emergence, the adults occupy foliage, flowers, and stems of the host plant. This life cycle

is believed to take two years. These beetles are endemic to riparian habitat of the Sacramento and San Joaquin Valleys. Elderberry shrubs occur in mixed riparian forests and Valley oak and elderberry savannas. All elderberry shrubs larger than one-inch diameter are considered habitat for this species. Elderberry plants occur throughout the refuge in natural riparian forests and are being planted at restoration sites in mixed-riparian forest and elderberry savanna. Elderberry bushes are not planted within 300 feet of the refuge boundary next to private agricultural operations.

VIII. Effect determination and response requested.

A. Listed species/designated critical habitat:

Determination	Response requested
may effect/not likely to adversely affect (species: Bald eagle)	_X__ Concurrence
may effect/not likely to adversely affect (species: Giant garter snake)	_X__ Concurrence
may effect/not likely to adversely affect (species: Winter-run chinook salmon) (Refuge to contact NOAA-Fisheries)	_X__ Concurrence
may effect/not likely to adversely affect (species: Spring-run chinook salmon) (Refuge to contact NOAA-Fisheries)	_X__ Concurrence
may effect/not likely to adversely affect (species: Central Valley steelhead) (Refuge to contact NOAA-Fisheries)	_X__ Concurrence
may effect/not likely to adversely affect (species: Valley elderberry longhorn beetle)	_X__ Concurrence

B. Proposed species/proposed critical habitat: NONE

Determination	Response requested

C. Candidate Species:

Determination	Response requested
no effect (species: Western yellow-billed cuckoo)	_X__ Concurrence
no effect (species: Fall-run chinook salmon) (Refuge to contact NOAA-Fisheries)	_X__ Concurrence
no effect (species: Late fall-run chinook salmon) (Refuge to contact NOAA-Fisheries)	_X__ Concurrence

Signature
Refuge Manager/Sacramento NWR Complex

7/6/2004
Date

IX. Reviewing ESO Evaluation:

A. Concurrence X Nonconcurrence _____

B. Formal consultation required

C. Conference required

D. Informal conference required

E. Remarks (attach additional pages as needed): The actions proposed have been analyzed in a formal consultation with SNWR-1-1-98-F-0013 and 1-1-02-F-0206

Signature
Field Supervisor
Sacramento Fish and Wildlife Office

7/20/04
Date

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

August 31, 2004 9/2/04

RIT		INT	RIT		INT
X	MGR				
X	D-MGR				
	ARM-N			BUDG TECH	
X	ARM-S			PURC AGT	
	ARM-R			WK LDR	
	BIO-1			SAC SHOP	
	BIO-2			COL SHOP	
	BIO-3			SUT SHOP	
	BIO-4			RIV SHOP	
	ESMT-1			FMO	
	ESMT-2			SUP RNG TECH	
	ORP			LD RNG TECH	
	INT SPEC			RNG TECH-1	
	LEO			RNG TECH-2	

In Reply Refer To:
1422 ADM-OFCA 5781:MET

Kevin S. Forester, Refuge Manager
Sacramento National Wildlife Refuge
U.S. Fish and Wildlife Service
752 County Road 99W
Willows, California 95988

Dear Mr. Forester:

This is in response to your letter of July 6, 2004 requesting National Marine Fisheries Service's (NOAA Fisheries) concurrence that the proposed Comprehensive Conservation Plan (CCP) to be implemented within the Sacramento River National Wildlife Refuge in Butte, Glen, and Tehama Counties, California, is not likely to adversely affect Federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss),* candidate Central Valley fall/late fall-run Chinook salmon (*O. tshawytscha*), and their respective designated critical/essential habitats.

The Sacramento River Refuge is composed of 26 properties along a 77-mile stretch of the Sacramento River between the cities of Red Bluff and Princeton. The CCP calls for the refuge to be managed in such a way as to preserve, restore, and enhance riparian habitat for threatened and endangered species, breeding and wintering migratory birds, anadromous fish, resident species and native plants. To the extent possible, the habitat is to be managed for natural diversity of indigenous flora and fauna. Riparian forests are being restored by converting flood prone agricultural lands along the Sacramento River into natural riparian habitat. The U.S. Fish and Wildlife Service (FWS) also intends to manage the refuge lands to provide high quality wildlife dependant recreation, education, and research opportunities for the public.

Several active management practices are planned to be carried out on the refuge properties. These activities include control of invasive exotic species, river bank/erosion management, mosquito control, vegetation management, active habitat restoration, fire prevention/ hazard reduction, facilities maintenance, and visitors services including environmental education, hunting and fishing. Also included in the CCP are many conservation and mitigation measures designed to ensure that none of these active management practices will adversely effect the above listed salmonids.

Provided that all of the conservation and mitigation measures listed in the CCP are strictly adhered to, NOAA Fisheries concurs that the proposed Comprehensive Conservation Plan for the Sacramento River National Wildlife Refuge is not likely to adversely affect listed salmonids or their critical habitat.

Finally, the proposed project area has been identified as Essential Fish Habitat (EFH) for Chinook salmon (*Oncorhynchus tshawytscha*) in Amendment 14 of the Pacific Salmon Fishery Management Plan pursuant to the MSA. Federal action agencies are mandated by the MSA (section 305[b][2]) to consult with NOAA Fisheries on all actions that may adversely affect EFH, and NOAA Fisheries must provide EFH Conservation Recommendations (section 305[b][4][A]). Because the proposed action is not likely to adversely affect species listed under the ESA (including Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon), and the habitat requirements of Central Valley fall/late fall-run Chinook salmon in the project area are similar to those of the listed species, EFH Conservation Recommendations are not required at this time, however, if there is a substantial revision to the action FWS will need to initiate EFH consultation.

If you have any questions regarding this correspondence or if NOAA Fisheries can provide further assistance on this project, please contact Mr. Michael Tucker in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Tucker may be reached by telephone at (916) 930-3604, or by Fax at (916) 930-3629.

Sincerely,

for Rodney R. McInnis
Regional Administrator

cc: NMFS-PRD, Long Beach, CA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
1-1-04-I-1462

DATE: 5-5-04

RT		INT	RT		INT
X	MGR			SECTY	
X	D-MGR			ADM OFCR	
	ARM-N			BUDG TECH	
	ARM-S			PURC AGT	
	ARM-R			WK LDRN	
	BIO-1			SAC SHOP	
	BIO-2			COL SHOP	
	BIO-3			SUT SHOP	
	BIO-4			RIV SHOP	
	ESMT-1			FMO	
	ESMT-2			SUP RNG TECH	
	ORP			LD RNG TECH	
	INT SPEC			RNG TECH-1	
	LEO			RNG TECH-2	

MAY 3 2004

Mr. Kevin Foerster
Refuge Manager
U.S. Fish and Wildlife Service
Sacramento National Wildlife Refuge Complex
725 County Road 99 W
Willows, California 95988

Subject: Informal Endangered Species Section 7 Consultation for Integrated Pest Management Plan for Walnut Production at the Sacramento River National Wildlife Refuge, Butte, Glenn, and Tehama Counties, California

Dear Mr. Foerster:

This is in response to your March 22, 2004, letter and accompanying documents that requested informal consultation on the proposed Integrated Pest Management Plan (IPM Plan) for Walnut Production at the Sacramento River National Wildlife Refuge (Sacramento River NWR) located at Butte, Glenn, and Tehama counties, California. Your request was received by the U.S. Fish and Wildlife Service (Service) on March 23, 2004. At issue are potential effects to the federally-listed valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB), giant garter snake (*Thamnophis gigas*), and bald eagle (*Haliaeetus leucocephalus*). Our primary concern and mandate is the protection of federally-listed species pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

The proposed project involves the development of an IPM Plan to manage 1,529 acres of walnut orchards that are managed for wildlife habitat and commercial nut production. The walnut orchards are leased to farmers who commercially grow the walnut crop until the orchards are removed and native vegetation is planted. It is the goal of the Sacramento River NWR to replace these walnut orchards with native vegetation to provide habitat for native species. Currently, these orchards are being managed for walnut production rather than being abandoned because these orchards, if left unmanaged, would provide a habitat for pests, including insects, weeds, diseases, and rodents. The purpose of the plan is to: (1) identify those walnut pest control methods/materials currently approved for use in the Sacramento River NWR; (2) incorporate their use into an IPM program consistent with the goals of the Sacramento River NWR;

TAKE PRIDE IN AMERICA

(3) provide long-term planning to meet the Service's goal of reducing effects of pesticide use on Federal trust resources to the greatest extent possible.

The Service has reviewed the proposed project, including: (1) the *Draft Integrated Pest Management Plan for Walnut Production on the Sacramento River National Wildlife Refuge*, dated September 2003; (2) the *Environmental Assessment, Cooperative Farming on the Sacramento NWR, Tehama, Butte, and Glenn counties, California*, dated June 1994; (3) the *United States District Court, Western District of Washington at Seattle, Washington Toxics Coalition, Northwest Coalition for Alternatives to Pesticides, Pacific Coast Federation of Fishermen's Associations, and Institute for Fisheries Resources (Plaintiffs), v. Environmental Protection Agency, and Mike Leavitt, Administrator, (Defendants), v. American Crop Protection Agency, et al. (Intervener-Defendants) (Case Number C01-132C)*, dated July 2, 2002; and, (4) *Intra-agency Formal Consultation on Management, Operations, and Maintenance of the Sacramento National Wildlife Refuge Complex, Willows, California (Service File Number 1-1-98-F-0013*), dated June 10, 2002.

The Service concurs with your determination that the proposed project will not adversely affect federally-listed species. The VELB is not likely to be adversely affected because buffers of 300 feet or more will be used between the walnut orchards and elderberry plants (*Sambucus* sp.), the host plant for the VELB. Giant garter snakes are not likely to be adversely affected because this species does not occur near orchards at the Sacramento River NWR, and there is no suitable habitat present. Bald eagles could potentially nest in walnut orchards, but at this time there are no known occurrences of bald eagles nesting or foraging in or near walnut orchards.

Therefore, unless new information reveals effects of the proposed action that may affect listed species in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Act is necessary.

If you have questions regarding the proposed Integrated Pest Management Plan for Walnut Production on the Sacramento River NWR Project, please contact Rick Kuyper or Adam Zerrenner, Sacramento Valley Branch Chief, of my office at (916) 414-6645.

Sincerely,

Chris Nagano
Chief, Endangered Species Division

cc:
California Department of Fish and Game, Rancho Cordova, California (Attn: Terry Roscoe)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

April 29, 2004

In Reply Refer To:
SWR-04-SA-9119:MET

Kevin S. Forester, Refuge Manager
Sacramento National Wildlife Refuge
U.S. Fish and Wildlife Service
752 County Road 99W
Willows, California 95988

Dear Mr. Forester:

This is in response to your letter of March 22, 2004, requesting National Marine Fisheries Service's (NOAA Fisheries) concurrence that the proposed integrated pest management plan for walnut production at the Sacramento River National Wildlife Refuge (SRNWR) in Glenn, Butte, and Tehama Counties, California is not likely to adversely affect Federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss)*, candidate Central Valley fall/late fall-run Chinook salmon (*O. tshawytscha*) and their respective designated critical and essential habitats.

The SRNWR currently has within its boundaries 1,529 acres of walnut orchards that are managed for wildlife habitat and commercial nut production. The U.S. Fish and Wildlife Service (Service) uses the proceeds from the walnuts to help fund riparian restoration on several units of the SRNWR. The long term plan is to begin to remove these orchards over the next two to five years and replace then with native riparian and upland vegetation to provide habitat for fish and wildlife species. It is important that these orchards be properly managed until they are removed so as to avoid infestations of pests such as insects, weeds, diseases, and vertebrates, which could in turn cause off site impacts to neighboring walnut farmers along the river.

The Service has developed an integrated pest management plan (IPMP) with a primary focus on controlling codling moths, naval orange worms, web spinning mites, walnut husk flies, San Jose scale, aphids, walnut blight, vertebrate pests and weeds. The primary method of control of these pests will be closely controlled application of chemical and organic pesticides. Several protective measures will be implemented in the application of these pesticides to ensure they do not enter or adversely affect the aquatic environment of the Sacramento River. These measures include, but are not limited to, maintenance of wide unsprayed vegetated buffers from 200 to 300 feet in width, minimal application rates, low active ingredient concentrations, use of rapid degradation and soil binding chemicals, avoidance of application during inversions or winds over seven miles per hour, and the addition of drift control agents.

Based on the restorative goals of this project, the likelihood of long term beneficial effects on salmonid habitat, and provided that the above listed protective measures are strictly adhered to, NOAA Fisheries concurs with your determination that implementation of the proposed integrated pest management plan for walnut production at the Sacramento River National Wildlife Refuge is not likely to adversely affect listed salmonids or their critical habitat. This concludes section 7 consultation for the proposed project; however, should new information indicate that the project may effect listed species in an unforseen manner, further consultation may be necessary.

Finally, the proposed project area has been identified as Essential Fish Habitat (EFH) for Chinook salmon (*Oncorhynchus tshawytscha*) in Amendment 14 of the Pacific Salmon Fishery Management Plan pursuant to the MSA. Federal action agencies are mandated by the MSA (section 305[b][2]) to consult with NOAA Fisheries on all actions that may adversely affect EFH, and NOAA Fisheries must provide EFH Conservation Recommendations (section 305[b][4][A]). Because the proposed action is not likely to adversely affect species listed under the ESA (including Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon), and the habitat requirements of Central Valley fall/late fall-run Chinook salmon in the project area are similar to those of the listed species, EFH Conservation Recommendations are not required at this time; however, if there is a substantial revision to the action the Service will need to initiate EFH consultation.

If you have any questions regarding this correspondence or if NOAA Fisheries can provide further assistance on this project, please contact Mr. Michael Tucker in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Tucker may be reached by telephone at (916) 930-3604, or by Fax at (916) 930-3629.

Sincerely,

Rodney R. McInnis
Acting Regional Administrator

cc: NMFS-PRD, Long Beach, CA

Appendix G. Wildlife and Plant Species at the Sacramento River National Wildlife Refuge and Vicinity (Red Bluff To Colusa)

APPENDIX G - Wildlife and Plant Species at the Sacramento River National Wildlife Refuge and Vicinity (Red Bluff to Colusa)

(* nonnative species)

ANIMALS

MAMMALS

COMMON NAME	SCIENTIFIC NAME
Marsupalia (opossums)	
Virginia opossum*	*Didelphis virginiana**
Insectivora (shrews and moles)	
Broad-footed mole	*Scapanus latimanus*
Chiroptera (bats)	
Pallid bat	*Antrozous pallidus*
Big brown bat	*Eptesicus fuscus*
Silver-haired bat	*Lasionycteris noctivagans*
Western red bat	*Lasiurus blossevilli*
Hoary bat	*Lasiurus cinereus*
California myotis	*Myotis californicus*
Western small footed bat	*Myotis ciliolabrum*
Western long-earred bat	*Myotis evotis*
Little brown bat	*Myotis lucifugus*
Fringed bat	*Myotis thysanodes*
Yuma myotis	*Myotis yumanensis*
Western pipistrelle	*Pipistrellus hesperus*
Townsend's big-eared bat	*Pletocus townsendii*
Western mastiff bat	*Eumops perotis*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Lagomorpha (rabbits and hares)	
Brush rabbit	*Sylvilagus bachmani*
Desert cottontail	*Sylvilagus audubonii*
Black-tailed hare	*Lepus californicus*
Rodentia (rodents)	
California ground squirrel	*Spermophilus beecheyi*

Western gray squirrel	*Sciurus griseus*
Botta's pocket gopher	*Thomomys bottae*
California kangaroo rat	*Dipodomys californicus*
Beaver	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromyscus maniculatus*
Brush mouse	*Peromyscus boylii*
Dusky-footed woodrat	*Neotoma fuscipes*
California vole	*Microtus californicus*
Muskrat	*Ondatra zibethicus*
Black rat*	*Rattus rattus**
Norway rat*	*Rattus norvegicus**
House mouse*	*Mus musculus**
Porcupine	*Erethizon dorsatum*
Carnivora (carnivores)	
Coyote	*Canis latrans*
Red fox*	*Vulpes vulpes**
Gray fox	*Urocyon cinereoargenteus*
Black Bear	*Ursus americanus*
Ringtail	*Bassariscus astutus*
Raccoon	*Procyon lotor*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*
Badger	*Taxidea taxus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*
River Otter	*Lontra canadensis*
Mountain lion	*Puma concolor*
Bobcat	*Linx rufis*
Feral house cat*	*Felis silvestris**
Artiodactyla (hoofed mammals)	
Wild Pig*	*Sus scrofa**

Black-tailed deer	*Odocoileus hemionus hemionus*

AMPHIBIANS

Bufonidae (true toads)	
Western toad	*Bufo boreas*
Hylidae (treefrogs)	
Pacific treefrog	*Pseudacris regilla*
Ranidae (true frogs)	
Bullfrog*	*Rana catesbeiana**

REPTILES

Emydidae (turtles)	
Slider*	*Trachemys scirpta**
Northwestern pond turtle	*Clemmys marmorata marmorata*
Phrynosomatidae (iguanid lizards)	
Western fence lizard	*Sceloporus occidentalis*
Scincidae (skinks)	
Western skink	*Eumeces skiltonianus*
Teiidae (whiptail lizards)	
Western whiptail	*Cnemidophorus tigris*
Anguidae (alligator lizards)	
Southern alligator lizard	*Elgaria multicarinata*
Colubridae (Colubrid snakes)	
Sharp-tailed snake	*Contia tenius*
Western yellow-bellied racer	*Coluber constrictor*
Coachwhip	*Masticophis flagellum*
Gopher snake	*Pituophis catenifer*
Common kingsnake	*Lampropeltis getulus*
Common garter snake	*Thamnophis sirtalis*
Western terrestrial garter snake	*Thamnophis elegans*
Western aquatic garter snake	*Thamnophis couchi*

Giant garter snake	*Thamnophis gigas*
Viperidae (vipers)	
Western rattlesnake	*Crotalis viridis*

BIRDS

Podicipediformes (grebes)	
Pied-billed grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Eared grebe	*Podiceps nigricollis*
Western grebe	*Aechmophorus occidentalis*
Clark's grebe	*Aechmophorus clarkii*
Pelicaniformes (pelicans and cormorants)	
American white pelican	*Pelecanus erythrorhynchos*
Double-crested cormorant	*Phalacrocorax auritus*
Ciconiiformes (herons and egrets)	
American bittern	*Botaurus lentiginosus*
Least bittern	*Ixobrychus exilis*
Great blue heron	*Ardea herodias*
Great egret	*Casmerodius albus*
Snowy egret	*Egretta thula*
Cattle egret	*Bubulcus ibis*
Green heron	*Butorides striatus*
Black-crowned night heron	*Nycticorax nycticorax*
Anseriformes (ducks, geese, and swans)	
Greater white-fronted goose	*Anser albifrons*
Lesser snow goose	*Chen caerulescens*
Ross's goose	*Chen rossii*
Cackling Goose	*Branta hutchinsii*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Green-winged teal	*Anas crecca*
Mallard	*Anas platyrhyncos*

Northern pintail	*Anas acuta*
Blue-winged teal	*Anas discors*
Cinnamon teal	*Anas cyanoptera*
Northern shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
Eurasian wigeon	*Anas penelope*
American wigeon	*Anas americana*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Lesser scaup	*Aythya affinis*
Common goldeneye	*Bucephala clangula*
Barrow's goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Hooded merganser	*Lophodytes cucullatus*
Common merganser	*Mergus merganser*
Ruddy duck	*Oxyura jamaicensis*

Falconiformes (vultures, hawks, eagles, and falcons)

Turkey vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
White-tailed kite	*Elanus leucurus*
Bald eagle	*Haliaeetus leucocephalus*
Golden eagle	*Aquila chrysaetos*
Northern harrier	*Circus cyaneus*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Red-shouldered hawk	*Buteo lineatus*
Swainson's hawk	*Buteo swainsoni*
Red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine falcon	*Falco peregrinus*

Galliformes (turkey, grouse, quail, and pheasants)	
Ring-necked pheasant*	*Phasianus colchicus**
Wild turkey	*Meleagris gallopavo*
California quail	*Callipepla californica*
Gruiformes (cranes and rails)	
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Common moorhen	*Gallinula chloropus*
American coot	*Fulica americana*
Charadriiformes (shorebirds and gulls)	
Black-bellied plover	*Pluvialis squatarola*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Greater yellowlegs	*Tringa melanoleuca*
Lesser yellowlegs	*Tringa flavipes*
Spotted sandpiper	*Actitis macularia*
Western sandpiper	*Calidris mauri*
Least sandpiper	*Calidris minutilla*
Dunlin	*Calidris alpina*
Long-billed dowitcher	*Limnodromus scolopaceus*
Wilson's snipe	*Gallinago delicata*
Wilson's phalarope	*Phalaropus tricolor*
Red-necked phalarope	*Phalaropus lobatus*
Ring-billed gull	*Larus delawarensis*
California gull	*Larus californicus*
Herring gull	*Larus argentatus*
Caspian Tern	*Sterna caspia*
Forster's tern	*Sterna forsteri*
Columbiformes (pigeons and doves)	
Rock pigeon*	*Columba livia*
Band-tailed pigeon	*Patagioenas fasciata*

Mourning dove	*Zenaida macroura*
Cuculiformes (cuckoos and roadrunners)	
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
Strigiformes (owls)	
Barn owl	*Tyto alba*
Short-eared owl	*Asio flammeus*
Western screech owl	*Otus kennicottii*
Great horned owl	*Bubo virginianus*
Northern pygmy owl	*Glaucidium gnoma*
Long-eared owl	*Asio otus*
Caprimulgiformes (goatsuckers and nighthawks)	
Lesser nighthawk	*Chordeiles acutipennis*
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Apodiformes (swifts and hummingbirds)	
Vaux's swift	*Chaetura vauxi*
Black-chinned hummingbird	*Archilochus alexandri*
Anna's hummingbird	*Calypte anna*
Calliope hummingbird	*Stellula calliope*
Rufous hummingbird	*Selasphorus rufus*
Allen’s hummingbird	*Selasphorus sasin*
Coraciiformes (kingfishers)	
Belted kingfisher	*Ceryle alcyon*
Piciformes (woodpeckers)	
Lewis' woodpecker	*Melanerpes lewis*
Acorn woodpecker	*Melanerpes formicivorous*
Red-breasted sapsucker	*Sphyrapicus ruber*
Nuttall's woodpecker	*Picoides nuttallii*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Northern flicker	*Colaptes auratus*

Passeriformes

Flycatchers

Olive-sided flycatcher	*Contopus cooperi*
Western wood pewee	*Contopus sordidulus*
Willow flycatcher	*Empidonax traillii*
Hammond's flycatcher	*Empidonax hammondii*
Dusky flycatcher	*Empidonax oberholseri*
Pacific-slope flycatcher	*Empidonax difficilis*
Black phoebe	*Sayornis nigricans*
Say's phoebe	*Sayornis saya*
Ash-throated flycatcher	*Myiarchus cinerascens*
Western kingbird	*Tyrannus verticalis*

Shrikes

Loggerhead shrike	*Lanius ludovicianus*

Vireos

Cassin's vireo	*Vireo cassinii*
Hutton's vireo	*Vireo huttoni*
Warbling vireo	*Vireo gilvus*

Corvids

Western scrub jay	*Aphelocoma californica*
Yellow-billed magpie	*Pica nuttalli*
American crow	*Corvus brachyrhynchos*
Common raven	*Corvus corax*

Larks and Swallows

Horned lark	*Eremophila alpestris*
Purple martin	*Progne subis*
Tree swallow	*Tachycineta bicolor*
Violet-green swallow	*Tachycineta thalassina*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Bank swallow	*Riparia riparia*
Cliff swallow	*Hirundo pyrrhonota*
Barn swallow	*Hirundo rustica*

Wrentit, Titmice and Bushtit	
Wrentit	*Chamaea fasciata*
Oak titmouse	*Baeolophus inornatus*
Bushtit	*Psaltriparus minimus*
Nuthatches and Creeper	
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Brown creeper	*Certhia americana*
Wrens	
Bewick's wren	*Thryomanes bewickii*
House wren	*Troglodytes aedon*
Winter wren	*Troglodytes troglodytes*
Marsh wren	*Cistothorus palustris*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Blue-gray gnatcatcher	*Polioptila caerulea*
Western bluebird	*Sialia mexicana*
Mountain bluebird	*Sialia currucoides*
Swainson's thrush	*Catharus ustulatus*
Hermit thrush	*Catharus guttatus*
American robin	*Turdus migratorius*
Varied thrush	*Ixoreus naevius*
Northern mockingbird	*Mimus polyglottos*
American pipit	*Anthus rubescens*
Cedar waxwing	*Bombycilla cedrorum*
European starling*	*Sturnus vulgaris**
Orange-crowned warbler	*Vermicora celata*
Nashville warbler	*Vermivora ruficapilla*
Yellow warbler	*Dendroica petechia*
Yellow-rumped warbler	*Dendroica coronata*
Black-throated gray warbler	*Dendroica nigrescens*
Townsend’s Warbler	*Dendroica townsendi*

Hermit warbler	*Dendroica occidentalis*
MacGillivray's warbler	*Oporornis tolmiei*
Common yellowthroat	*Geothlypis trichas*
Wilson's warbler	*Wilsonia pusilla*
Yellow-breasted chat	*Icteria virens*
Western tanager	*Piranga ludoviciana*
Black-headed grosbeak	*Pheucticus melanocephalus*
Blue grosbeak	*Guiraca caerulea*
Lazuli bunting	*Passerina amoena*
Spotted towhee	*Pipilo maculatus*
California towhee	*Pipilo crissalis*
Chipping sparrow	*Spizella passerina*
Lark sparrow	*Chondestes grammacus*
Savannah sparrow	*Passerculus sandwichensis*
Fox sparrow	*Passerella iliaca*
Song sparrow	*Melospiza melodia*
Lincoln's sparrow	*Melospiza lincolnii*
Golden-crowned sparrow	*Zonotrichia atricapilla*
White-throated sparrow	*Zonotrichia albicollis*
White-crowned sparrow	*Zonotrichia leucophrys*
Dark-eyed junco	*Junco hyemalis*
Red-winged blackbird	*Agelaius phoeniceus*
Tricolored blackbird	*Agelaius tricolor*
Western meadowlark	*Sturnella neglecta*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Brewer's blackbird	*Euphagus cyanocephalus*
Brown-headed cowbird	*Molothrus ater*
Hooded oriole	*Icterus cucullatus*
Bullock’s oriole	*Icterus bullockii*
Purple finch	*Carpodacus purpureus*
House finch	*Carpodacus mexicanus*

Pine siskin	*Carduelis pinus*
Lesser goldfinch	*Carduelis psaltria*
Lawrence's goldfinch	*Carduelis lawrencei*
American goldfinch	*Carduelis tristis*
Evening grosbeak	*Coccothraustes vespertinus*
House sparrow*	*Passer domesticus**

FISH

Petromyzontidae (lamprey)

Pacific lamprey	*Lampetra tridentata*
River lamprey	*Lampetra ayresi*
Western brook lamprey	*Lampetra richardsoni*

Acipenseridae (sturgeon)

White sturgeon	*Acipenser transmontanus*
Green sturgeon	*Acipenser medirostris*

Clupeidae (herring)

Threadfin shad*	*Dorosoma petenense**
American shad*	*Alosa sapidissima**

Salmonidae (salmon and trout)

Chinook salmon, Central Valley fall- and late-fall-run ESU	*Oncorhynchus tshawytscha*
Chinnook salmon, Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*
Chinook salmon, Central Valley spring-run ESU	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Sockeye salmon	*Oncorhynchus nerka*
Central Valley Steelhead ESU	*Oncorhynchus mykiss*
Rainbow Trout*	*Salmo gairdneri**
Brown trout*	*Salmo trutta**

Cyprinidae (minnow)

Tui chub	*Gila bicolor*
Thicktail chub	*Gila crassicauda*

Lahontan redside	*Richardsonius egregius*
Hitch	*Lavinia exilicauda*
California roach	*Hesperoleucus symmetricus*
Sacramento Blackfish	*Orthodon microlepidotus*
Sacramento splittail	*Pogonichthys macrolepidotus*
Hardhead	*Mylopharodon conocephalus*
Sacramento squawfish	*Ptychocheilus grandis*
Speckled dace	*Rhinichthys osculus*
Golden shiner*	*Notemigonus crysoleucas**
Fathead minnow*	*Pimephales promelas**
Goldfish*	*Carassius auratus**
Carp*	*Cyprinus carpio**
Catostomidae (sucker)	
Sacramento sucker	*Catostomus occidentalis*
Ictaluridae (catfish)	
Black bullhead*	*Ictalurus melas**
Brown bullhead*	*Ictalurus nebulosus**
Yellow bullhead*	*Ictalurus natalis**
White catfish*	*Ictalurus catus**
Channel catfish*	*Ictalurus punctatus**
Poeciliidae (livebearer)	
Mosquitofish*	*Gambusia affinis**
Atherinidae (silverside)	
Mississippi silverside*	*Menidia audens**
Gasterosteidae (stickleback)	
Threespine stickleback*	*Gasterosteus aculeatus**
Percichthyidae (temperate basses)	
Striped bass*	*Morone saxatilis**
Centrarchidae (sunfish)	
Sacramento perch	*Archoplites interruptus*
Bluegill*	*Lepomis macrochirus**
Redear sunfish*	*Lepomis microlophus**

Pumpkinseed*	*Lepomis gibbosus**
Green sunfish*	*Lepomis cyanellus**
Warmouth*	*Lepomis gulosus**
White crappie*	*Pomoxis annularis**
Black crappie*	*Pomoxis nigromaculatus**
Largemouth bass*	*Micropterus salmoides**
Smallmouth bass*	*Micropterus dolomieui**
Spotted bass*	*Micropterus punctulatus**
Percidae (perch)	
Bigscale logperch*	*Percina macrolepida**
Embiotocidae (surfperch)	
Tule perch	*Hysterocarpus traski*
Cottidae (sculpin)	
Prickly sculpin	*Cottus asper*
Riffle sculpin	*Cottus gulosus*
Staghorn sculpin	*Leptocottus armatus*

VASCULAR PLANTS

FERN ALLIES

Equisetaceae (Horsetail Family)	
Common horsetail	*Equisetum arvense*
Smooth scouring-rush	*Equisetum laevigatum*

CONIFERS

Pinaceae (Pine Family)	
Gray pine	*Pinus sabiniana*

DICOT FLOWERING PLANTS

Aceraceae (Maple Family)	
Box elder	*Acer negundo californicum*
Silver maple*	*Acer saccharinum**
Amaranthaceae (Amaranth Family)	
Tumbleweed*	*Amaranthus albus**

Mat amaranth	*Amaranthus blitoides*
Red-rooted amaranth*	*Amaranthus retroflexus**
Anacardiaceae (Sumac Family)	
Oriental pistachio*	*Pistacia chinensis**
Western poison-oak	*Toxicodendron diversilobum*
Apiaceae (Carrot Family)	
Toothpick-weed*	*Ammi visnaga**
Bur-chervil	*Anthriscus caucalis*
Poison-hemlock*	*Conium maculatum**
Fennel*	*Foeniculum vulgare**
Kellog's yampah	*Perideridia kelloggii*
Shepherd's needle*	*Scandix pecten-veneris**
Common hedge-parsley	*Torilis arvensis*
Purple hedge-parsley*	*Torilis arvensis purpurea**
Knotted hedge-parsley*	*Torilis nodosa**
Aristolochiaceae (Pipevine Family)	
California pipevine	*Aristolochia californica*
Asclepiadaceae (Milkweed Family)	
Narrow-leaved milkweed	*Asclepias fascicularis*
Showy milkweed	*Asclepias speciosa*
Asteraceae (Sunflower Family)	
Blow-wives	*Achyrachaena mollis*
Annual agoseris	*Agoseris heterophylla*
Western ragweed	*Ambrosia psilostachya*
Mayweed*	*Anthemis cotula**
Mugwort	*Artemisia douglasiana*
California aster	*Aster chilensis*
Annual saltmarsh aster	*Aster subulatus*
Marsh Baccharis	*Baccharis douglasii*
Coyote-brush	*Baccharis pilularis*
Mule's fat	*Baccharis salicifolia*
Sticktight	*Bidens frondosa*

California brickellbush	*Brickellia californica*
Yellow star-thistle*	*Centaura solstitialis**
Valley pineapple-weed	*Chamomilla occidentalis*
Common pineapple-weed	*Chamomilla suaveolens*
Chicory*	*Cichorium intybus**
Bull thistle*	*Cirsium vulgare**
South American horseweed*	*Conyza bonariensis**
Canadian horseweed	*Conyza canadensis*
Many-flowered horseweed*	*Conyza floribunda**
Australian cotula*	*Cotula australis**
Western goldenrod	*Euthamia occidentalis*
Narrow-leaved filago*	*Filago gallica**
Weedy cudweed*	*Gnaphallium luteo-album**
Western marsh cudweed	*Gnaphallium palustre*
Rosilla	*Helenium puberulum*
Telegraph-weed	*Heterotheca grandiflora*
Oregon golden-aster	*Heterotheca oregona*
Smooth cat's ear*	*Hypochoeris glabra**
Willow-leaved lettuce*	*Lactuca saligna**
Prickly lettuce*	*Lactuca serriola**
Long-beaked hawkbit*	*Leontodon taraxacoides longirostris**
Douglas' microseris	*Microseris douglasii*
Dwarf wooly-marbles	*Psilocarphus brevissimus brevissimus*
Oregon woolly marbles	*Psilocarphus oregonus*
Old-man-in-the-spring*	*Senecio vulgaris**
Milk-thistle*	*Silybum marianum**
Spiny-leaved sow-thistle*	*Sonchus asper asper**
Common sow-thistle*	*Sonchus oleraceus**
Slender sow-thistle*	*Sonchus tenerrimus**
Spiny cocklebur	*Xanthium spinosum*
Cocklebur	*Xanthium strumarium*

Betulaceae (Birch Family)	
White alder	*Alnus rhombifolia*
Boraginaceae (Borage Family)	
Bugloss fiddleneck	*Amsinckia lycopsoides*
Common fiddleneck	*Amsinckia menziesii*
Silky cryptantha	*Cryptantha crinita*
Wild heliotrope	*Heliotropium curassavicum*
Valley popcorn-flower	*Plagiobothrys canescens*
Brassicaceae (Mustrad Family)	
Black mustard*	*Brassica nigra**
Shepherd's purse*	*Capsella bursa-pastoris**
Lesser swinecress*	*Coronopus didymus**
Mediterranean hoary-mustard*	*Hirschfeldia incana**
Broad-leved mustard*	*Lepidium latifolium**
Shining pepper-grass	*Lepidium nitidum nitidum*
Upright pepper-grass	*Lepidium strictum*
Jointed charlock*	*Raphanus raphanistrum**
Radish*	*Raphanus sativus**
Western yellowcress	*Rorippa curvisiliqua occidentalis*
Virginia winged-rockcress	*Sibara virginica*
Callitrichaceae (Water-starwort Family)	
Variable-leaved water-starwort	*Callitriche heterophylla*
Caprifoliaceae (Honeysuckle Family)	
Blue elderberry	*Sambucus mexicana*
Capparaceae (Caper Family)	
Clammyweed	*Polanisia dodencandra trachysperma*
Caryophyllaceae (Pink Family)	
Sticky mouse-eared chickweed*	*Cerastium glomeratum**
Herniaria*	*Herniaria hirsuta hirsuta**
Boccone's sandspurry*	*Spergularia bocconei**
Common chickweed*	*Stellaria media**

Chenopodiaceae (Goosefoot Family)	
Lamb's-quarters*	*Chenopodium alnum**
Mexican tea*	*Chenopodium ambrosioides**
Jerusalem-oak*	*Chenopodium botrys**
Tasmanian goosefoot*	*Chenopodium pumilio**
Glaucous-leaved goosefoot*	*Chenopodium strictum glaucophyllum**
Winged-pigweed*	*Cycloloma atriplicifolium**
Russian thistle*	*Salsola tragus**
Convolvulaceae (Morning-glory Family)	
Bindweed*	*Convolvulus arvensis**
Cornaceae (Dogwood Family)	
Brown dogwood	*Cornus glabrata*
Crassulaceae (Stonecrop Family)	
Water pygmyweed	*Crassula aquatica*
Pygmyweed	*Crassula connata*
Cucurbitaceae (Gourd Family)	
California manroot	*Marah fabaceus agrestis*
Cuscutaceae (Dodder Family)	
Field dodder	*Cuscuta pentagona*
Elatinaceae (Waterwort Family)	
Variable-stamened waterwort	*Elatine heterandra*
Red waterwort	*Elatine rubella*
Euphorbiaceae (Spurge Family)	
Spotted spurge*	*Chamaesyce maculata**
Turkey-mullein	*Eremocarpus setigerus*
Fabaceae (Legume Family)	
American licorice	*Glycyrrhiza lepidota*
Angular-seeded pea*	*Lathyrus angulatus**
California pea	*Lathyrus jepsonii californicus*
Bird's-foot-trefoil	*Lotus corniculatus*
Spanish lotus	*Lotus purshianus purshianus*

Bicolored lupine	*Lupinus bicolor tridentatus*
Sky lupine	*Lupinus nanus*
Small-flowered lupine	*Lupinus polycarpus*
Spotted medick*	*Medicago arabica**
Common bur-clover*	*Medicago polymorpha**
Alfalfa*	*Medicago sativa**
White sweet-clover*	*Melilotus alba**
Indian sweet-clover*	*Melilotus indica**
Black locust*	*Robinia pseudoacacia**
Strawberry clover	*Trifolium fragiferum*
Rose clover*	*Trifolium hirtum**
Tomcat clover	*Trifolium willdenovii*
Red-flowered vetch*	*Vicia benghalensis**
Garden vetch*	*Vicia sativa sativa**
Winter vetch*	*Vicia villosa varia**
Fagaceae (Beech Family)	
Valley oak	*Quercus lobata*
Gentianaceae (Gentian Family)	
June centaury	*Centaurium muehlenbergii*
Geraniaceae (Geranium Family)	
Long-beaked stork's-bill*	*Erodium botrys**
Short-fruited stork's-bill*	*Erodium brachycarpum**
Red-stemmed filaree*	*Erodium cicutarium**
White-stemmed filaree*	*Erodium moschatum**
Cut-leaved geranium*	*Geranium dissectum**
Hippocastanaceae (Buckeye Family)	
California buckeye	*Aesculus californica*
Juglandaceae (Walnut Family)	
Northern California black walnut	*Juglans californica hindsii*
English walnut*	*Juglans regia**
Lamiaceae (Mint Family)	
Cut-leaved bugleweed	*Lycopus americanus*

Horehound*	*Marrubium vulgare**
Pennyroyal*	*Mentha pulegium**
Sonoma hedge-nettle	*Stachys stricta*
Loasaceae (Loasa Family)	
Giant blazingstar	*Mentzelia laevicaulis*
Lythraceae (Loosestrife Family)	
Valley redstem	*Ammannia coccinea*
Robust redstem	*Ammannia robusta*
Hyssop loosestrife*	*Lythrum hyssopifolium**
Lowland toothcup	*Rotala ramosior*
Malvaceae (Mallow Family)	
Velvetleaf*	*Abutilon theophrasti**
Rose mallow (California hibiscus)	*Hibiscus lasiocarpus*
Bull mallow*	*Malva nicaeensis**
Little mallow*	*Malva parviflora**
Martyniaceae (Unicorn-plant Family)	
Common unicorn-plant*	*Proboscidea louisianica louisinica**
Molluginaceae (Carpet-weed Family)	
Indian chickweed*	*Mollugo verticillata**
Moraceae (Mulberry Family)	
Edible fig*	*Ficus carica**
Oleaceae (Olive Family)	
Oregon ash	*Fraxinus latifolia*
Onagraceae (Evening-primrose Family)	
Tall annual willowherb	*Epilobium brachycarpum*
Fringed willowherb	*Epilobium ciliatum ciliatum*
Yellow waterweed	*Ludwigia peploides peploides*
Montevideo waterweed	*Ludwigia peploides montevidensis*
Hairy evening-primrose	*Oenothera elata hirsutissima*
Papaveraceae (Poppy Family)	
California poppy	*Esdhoscholzia californica*

Plantaginaceae (Plantain Family)	
Cut-leaved plantain*	*Plantago coronopus**
English plantain*	*Plantago lanceolata**
Common plantain*	*Plantago major**
Platanaceae (Sycamore Family)	
Western sycamore	*Platanus racemosa*
Polygonaceae (Buckwheat Family)	
Naked buckwheat	*Eriogonum nudum*
Wright's buckwheat	*Eriogonum wrightii trachygonum*
Swamp smartweed	*Polygonum amphibium emersum*
Common knotweed*	*Polygonum arenastrum**
Water-pepper*	*Polygonum hydropiper**
Mild water-pepper	*Polygonum hydropiperoides*
Willow-weed	*Polygonum lapathifolium*
Lady's thumb*	*Polygonum persicaria**
Dotted smartweed	*Polygonum punctatum*
Green dock*	*Rumex conglomeratus**
Curly dock*	*Rumex crispus**
Bitter dock*	*Rumex obtusifolius**
Fiddle dock*	*Rumex pulcher**
Portulacaceae (Purslane Family)	
Redmaids	*Calandrinia ciliata*
Common purslane*	*Portulaca oleracea**
Primulaceae (Primrose Family)	
Scarlet pimpernel	*Anagallis arvensis*
Ranunculaceae (Buttercup Family)	
Virgin's bower	*Clematis ligusticifolia*
Prickle-seeded buttercup*	*Ranunculus muricatus**
Rosaceae (Rose Family)	
Cherry plum*	*Prunus cerasifera**
California rose	*Rosa californica*

Himalayan blackberry*	*Rubus discolor**
California blackberry	*Rubus ursinus*
Rubiaceae (Madder Family)	
California button-willow	*Cephalanthus occidentalis californicus*
Cleavers	*Galium aparine*
Salicaceae (Willow Family)	
Fremont's cottonwood	*Populus fremontii*
Sandbar willow	*Salix exigua*
Goodding's black willow	*Salix gooddingii*
Arroyo willow	*Salix lasiolepis*
Scrophulariaceae (Figwort Family)	
Round-leved water-hyssop*	*Bacopa rotundifolia**
Valley-tassels	*Castilleja attenuata*
Sharp-leaved fluellin*	*Kickxia elatine**
False pimpernel	*Lindernia dubia*
Seep monkey-flower	*Mimulus guttatus*
Downy mimetanthe	*Mimulus pilosus*
Moth mullein*	*Verbascum blattaria**
Woolly mullein*	*Verbascum thapsus**
Water speedwell*	*Veronica anagallis-aquatica**
Purslane speedwell	*Veronica peregrina xalapensis*
Simaroubaceae (Quassia Family)	
Tree-of-heaven*	*Ailanthus altissima**
Solanaceae (Nightshade Family)	
Thorn-apple	*Datura wrightii*
Many-flowered tobacco*	*Nicotiana acuminata multiflora**
Tree tobacco*	*Nicotiana glauca**
Indian tobacco	*Nicotiana quadrivalvis*
Lance-leaved ground-cherry*	*Physalis lanceifolia**
American black nightshade	*Solanum americanum*

Tamaricaceae (Tamarisk Family)	
Small-flowered tamarisk*	*Tamarix parviflora**
Urticaceae (Nettle Family)	
Hoary creek nettle	*Urtica dioica holosericea*
Burning nettle*	*Urtica urens**
Verbenaceae (Vervain Family)	
Creeping lippia	*Phyla nodiflora nodiflora*
Rosy lippia*	*Phyla nodiflora rosea**
South American vervain*	*Verbena bonariensis**
Halberd-leaved vervain*	*Verbena hastata**
Western vervain	*Verbena lasiostachys scabrida*
Shore vervain	*Verbena litoralis*
Viscaceae (Mistletoe Family)	
Big-leaved mistletoe	*Phoradendron macrophyllum*
Vitaceae (Grape Family)	
California wild grape	*Vitis californica*
Zygophyllaceae (Caltrop Family)	
Puncture-vine*	*Tribulus terrestris**
MONOCOT FLOWERING PLANTS	
Alismataceae (Water-plantain Family)	
Water-plantain	*Alisma plantago-aquatica*
Fringed water-plantain	*Damasonium californicum*
Burhead	*Echinodorus berteroi*
Tule-potato	*Sagittaria latifolia*
Long-lobed arrowhead	*Sagittaria longiloba*
Montevideo arrowhead	*Sagittaria montevidensis calycina*
Sanford's arrowhead	*Sagittaria sanfordii*
Cyperaceae (Sedge Family)	
Santa Barbara sedge	*Carex barbarae*
Dense sedge	*Carex densa*
Clustered field sedge	*Carex praegracilis*

Torrent sedge	*Carex nudata*
Fox sedge	*Carex vulpinoidea*
Taper-tipped cyperus	*Cyperus acuminatus*
Small-flowered cyperus*	*Cyperus difformis**
Tall cyperus	*Cyperus eragrostis*
Yellow nutsedge	*Cyperus esculentus*
Red-rooted cyperus	*Cyperus erythrorhizos*
Black cyperus	*Cyperus nigra*
Purple nutsedge*	*Cyperus rotundus**
False nutsedge	*Cyperus strigosus*
Pale spike-rush	*Eleocharis macrostachya*
Engelmann's spike-rush	*Eleocharis obtusa engelmannii*
Four-angled spike-rush	*Eleocharis quadrangulata*
Hard-stemmed tule	*Scirpus acutus occidentalis*
River bulrush	*Scirpus fluvialtilis*
Saltmarsh bulrush	*Scirpus maritimus*
Rough-seeded bulrush*	*Scripus mucronatus**
Tuberous bulrush*	*Scirpus tuberosus**
Hydrocharitaceae (Waterweed Family)	
Ricefield water-nymph*	*Najas graminea**
Common water-nymph	*Najas quadalupensis*
Juncaceae (Rush Family)	
Sharp-fruited rush	*Juncus acuminatus*
Jointed rush	*Juncus articulatus*
Baltic Rush	*Juncus balticus balticus*
Common toad rush	*Juncus bufonius bufonius*
Congested toad rush	*Juncus bufonius congestus*
Pacific rush	*Juncus effusus pacificus*
Pointed rush	*Juncus oxymeris*
Iris-leaved rush	*Juncus xiphiodes*

Lemnaceae (Duckweed Family)	
Columbian watermeal	*Wolffia brasiliensis*
Liliaceae (Lily Family)	
Bluedicks	*Dichelostemma capitatum capitatum*
Ithuriel's spear	*Triteleia laxa*
Poaceae (Grass Family)	
Avnes bentgrass*	*Agrostis avenacea**
Short-awned foxtail	*Alopecurus aequalis*
Meadow foxtail	*Alopecurus pratensis*
Giant-reed*	*Arundo donax**
Wild oat*	*Avena fatua**
Ripgut brome*	*Bromus diandrus**
Soft chess*	*Bromus hordeaceus**
Red brome*	*Bromus madritensis rubens**
Smooth-flowered soft chess*	*Bromus racemosus**
Swamp pricklegrass*	*Crypsis schoenoides**
Bermuda grass*	*Cynodon dactylon**
Jungle-rice*	*Echinochloa colona**
Water-grass*	*Echinochloa crus-galli**
Blue wild-rye	*Elymus glaucus glaucus*
Creeping lovegrass	*Eragrostis hypnoides*
Purple lovegrass	*Eragrostis pectinacea pectinacea*
Tall fescue	*Festuca arundinacea*
Common velvetgrass*	*Holcus lanatus**
Meadow barley	*Hordeum brachyantherum brachyantherum*
Low barley	*Hordeum depressum*
Hare wall*	*Hordeum murinum leporinum**
Rice cutgrass	*Leersia oryzoides*
Bearded sprangletop*	*Leptochloa fascicularis**
Annual ryegrass*	*Lolium multiflorum**

Alkali ryegrass	*Leymus triticoides*
Deergrass	*Muhlenbergia rigens*
Smooth witchgrass*	*Panicum dichotomiflorum**
Dallisgrass*	*Paspalum dilatatum**
Knotgrass	*Paspalum distichum*
Harding-grass*	*Phalaris aquatica**
Lemmon's canarygrass	*Phalaris lemmonii*
Paradox canarygrass*	*Phalaris paradoxa**
Annual bluegrass*	*Poa annua**
Mediterranean beardgrass*	*Polypogon maritimus**
Annual beardgrass*	*Polypogon monspeliensi**
Yellow bristlegrass*	*Setaria pumil**
African bristlegrass*	*Setaria sphacelat**
Johnsongrass*	*Sorghum halepense**
Six-weeks fescue*	*Vulpia bromoide**
Foxtail fescue*	*Vulpia myuros hisuta**
Pontederiaceae (Pickerel-weed Family)	
Marsh mud-plantain*	*Heteranthera limosa**
Potamogetonaceae (Pondweed Family)	
Leafy pondweed	*Potamogeton foliosus*
Long-leaved pond weed	*Potamogeton nodosus*
Typhaceae (Cattail Family)	
Southern cattail	*Typha domingensis*
Broad-leaved cattail	*Typha latifolia*

Appendix H. Glossary

Abiotic Factors: The non-living parts of an ecosystem, such as light, temperature, water, oxygen, and other nutrients or gases.

Accumulation: The build-up of a chemical in an organism due to repeated exposure.

Adaptive Management: The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels (Service Manual 602 FW 1.6).

Alluvial Fan: Accumulation of sediment where a stream moves from a steep gradient to a flatter gradient and suddenly loses transporting power.

Alluvial: Pertaining to clay, silt, sand, gravel or other sedimentary matter deposited by flowing water, usually within a river valley.

Alternatives: Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. (1) A reasonable way to fix the identified problem or satisfy the stated need. (40 CFR 150.2) (2) Alternatives are different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues (Service Manual 602 FW 1.6).

Animal Unit Month (AUM): The amount of forage necessary to maintain one 1,000-pound animal for one month.

Appropriated Water: Surface water in an irrigation district that has been assigned or allocated to owners of water rights.

Appurtenant Land: The land base to which water rights legally pertain or belong.

Aquatic: Pertaining to water, in contrast to land. Living in or upon water.

Aquatic Habitat: The physical, chemical, and vegetative features that occur within the water of lakes, ponds, reservoirs, rivers, irrigation canals, and other bodies of water.

Artifact: An object made by humans; usually in reference to primitive tools, vessels, weapons, etc.

ATV: All Terrain Vehicle (either 3 or 4-wheeled vehicles).

Bank: The rising ground bordering a body of water or forming the edge of a cut or hollow.

Biodiversity (biological diversity): Refers to the full range of variability within and among biological communities, including genetic diversity, and the variety of living organisms, assemblages of living organisms, and biological processes. Diversity can be measured in terms of the number of different items (species, communities) and their relative abundance, and it can include horizontal and vertical variability. The variety of life, including the variety of living organisms, the genetic differences among them, and the communities in which they occur.

Biological Control: The use of organisms or viruses to control weeds or other pests.

Biological Integrity: Biotic composition, structure, and functioning at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities (Service Manual 602 FW 1.6).

Biota: The plant and animal life of a region.

Biotic Factors: All the living organisms -- fungi, protists, vertebrate, invertebrate, plants, etc. and their impacts on other living things within an ecosystem.

Bottom Land: Eligible land with a water duty of 3.5 AF/acre/year.

Categorical Exclusion (CE, CX, CATEX, CATX): A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

CFR: Code of Federal Regulations.

Community: The combined populations of all organisms in a given area, and their interactions. For example, the frogs, fish, algae, cattails, and lily pads in a backyard pond make up a community.

Compatible Use: A proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the national wildlife refuge (Service Manual 603 FW 2.6).

Compatibility Determination: A written determination signed and dated by the refuge manager and Regional Chief signifying that a proposed or existing use of a national wildlife refuge is a compatible use or is not a compatible use. The Director makes this delegation through the Regional Director (Service Manual 603 FW 2.6).

Comprehensive Conservation Plan (CCP): A document that describes the desired future conditions of the refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge, helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (Service Manual 602 FW 1.6).

Concern: See Issue.

Coordination Area: A wildlife management area made available to a State, by "(A) cooperative agreement between the United States Fish and Wildlife Service and the State fish and game agency pursuant to Section 4 of the Fish and Wildlife Coordination Act (16 U.S.C. 664); or (B) by long-term leases or agreements pursuant to the Bankhead-Jones Farm Tenant Act (50 Stat. 525; 7 U.S.C. 1010 et seq.)." States manage Coordination Areas, but they are part of the Refuge System. We do not require CCPs for Coordination Areas (Service Manual 602 FW 1.6).

Cultural Resource: The physical remains of human activity (artifacts, ruins, petroglyphs, etc.) and conceptual content or context of an area such as a traditional sacred site. It includes historically, archaeologically and architecturally significant resources.

Cultural Resource Inventory: A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Cultural Resource Overview: A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field offices background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).

Deposits: Material that is laid down through the actions of wind, water, ice, or other natural process.

Detritus: An accumulation of decomposing plant and animal remains.

Dissolved-Solids: Particles that are dissolved and suspended in water. See also total dissolved solids.

Diversion: A structure in a river or canal that diverts water from the river or canal to another water course.

Drain: A canal that collects and transports excess water from irrigated farmland.

Easement: A privilege or right that is held by one person or other entity in land owned by another.

Ecological Integrity: The integration of biological integrity, natural biological diversity, and environmental health; the replication of natural conditions (Service Manual 602 FW 1.6).

Ecology: The branch of biology that studies the interactions of organisms within an environment, either with other organisms (biotic factors) or with the non-living components (abiotic factors) of that ecosystem.

Ecosystem: The sum of all interacting parts of the environment and associated ecological communities within a particular area; an ecological system. Many levels of ecosystems have been recognized. Very few, if any ecosystems are self-contained; most influence, or are influenced by, components or forces outside the system. For administrative purposes, we have designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries, and their sizes and ecological complexity vary.

Ecosystem Approach: Protecting or restoring the natural function (processes), structure (physical and biological patterns), and species composition of an ecosystem, recognizing that all components are interrelated.

Effect: A change in a resource, caused by a variety of events including project attributes acting on a resource attribute (direct), not directly acting on a resource attribute (indirect), another project attributes acting on a resource attribute (cumulative), and those caused by natural events (e.g., seasonal change).

Efficiency: With reference to an irrigation water delivery system, the proportion of the amount of water delivered for irrigation use compared to the total amount of water released to meet that delivery (i.e., amount of delivery divided by amount of release).

Effluent: Waste material discharged into the environment from a wastewater treatment facility.

Emergent Vegetation: Rooted, aquatic plants that have most of their vegetative (nonroot) parts above water.

Endemic Species: Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

Endangered Species: Any species that is in danger of extinction throughout all or a significant portion of its range and listed as such by the Secretary of the Interior in accordance with the Endangered Species Act of 1973. Endangered species are afforded protection under the Act as amended and under various State laws for State-listed species.

Entitlement: The annual maximum amount of water which can be delivered to a parcel of land, a product of eligible acres and water duty (expressed in acre-feet).

Environment: The sum total of all biological, chemical, and physical factors to which organisms are exposed; the surroundings of a plant or animal.

Environmental Assessment (EA): A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Education: A process designed to develop a citizenry that has the awareness, concern, knowledge, attitudes, skills, motivation, and commitment to work toward solutions of current environmental problems and the prevention of new ones. Environmental education within the National Wildlife Refuge System incorporates materials, activities, programs, and products that address the citizen's course of study goals, the objectives of the refuge/field station, and the mission of the Refuge System.

Environmental Health: Abiotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural abiotic processes that shape the environment (Service Manual 602 FW 1.6).

Environmental Impact Statement (EIS): A detailed written statement required by section 102(2) (C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Ephemeral: Pertains to streams, lakes and wetlands that exist temporarily each year.

Evapotranspiration: The collective processes by which water is transferred from the surface of the earth, including from the soil and the surface of water-bodies (through evaporation) and from plants (through transpiration).

Evolutionary Significant Unit (ESU): A sub-population of a species that is defined by substantial reproductive isolation from other conspecific units and represents an important component of the evolutionary legacy of the species.

Exotic and Invading Species. (Noxious Weeds): Plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insects or disease; or nonnative, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or has adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Unite States and to the public health.

Fallow: Allowing land that normally is used for crop production to lie idle.

Federal Trust Resources: A trust is something managed by one entity for another who holds the ownership. The Service holds in trust many natural resources for the people of the United States of America as a result of Federal Acts and treaties. Examples are species listed under the Endangered Species Act, migratory birds protected by the Migratory Bird Treaty Act and other international treaties, and native plant or wildlife species found on the Refuge System.

Finding of No Significant Impact (FONSI): A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Floodplain: The relatively flat area along the sides of a river which is naturally subjected to flooding.

Fluvial: Pertaining to a river.

Flyway: A route taken by migratory birds between their breeding grounds and their wintering grounds. Four primary migration routes have been identified for birds breeding in North America: the Pacific, Central, Mississippi, and Atlantic Flyways.

Foraging: The act of feeding; another word for feeding.

Forbs: Herbaceous dicotyledonous plants.

Fragmentation: The process of reducing the size and connectivity of habitat patches.

Friable Soil: Easily crumbled or pulverized soil.

GIS: Geographic Information System. Refers to such computer mapping programs as ArcView, ArcInfo, ERDAS, etc.

Goal: Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Service Manual 620 FW 1.6).

Habitat: Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Habitat Restoration: Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy forestlands, rangelands, and aquatic systems.

Hydrograph: The local pattern and magnitude of water flow influenced by season and dam releases.

Hydrologic Regime: The local pattern and magnitude of water flow influenced by season.

Hydrology: The science dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere. The distribution and cycling of water in an area.

Impoundment: A body of water created by collection and confinement within a series of levees or dikes thus creating separate management units although not always independent of one another.

Impact: See effect.

Indigenous: Native to the area.

Inner River Zone: The estimated portion of river alluvium that has experienced river channel migration in the recent past and is likely to experience channel movement in the near future; the area includes the 100-year meanderbelt and areas of projected river bank erosion over the next 50 years.

Integrated Pest Management (IPM): Methods of managing undesirable species, such as weeds, including education; prevention, physical or mechanical methods or control; biological control; responsible chemical use; and cultural methods.

Interpretation: Interpretation can be an educational and recreational activity that is aimed at revealing relationships, examining systems, and exploring how the natural world and human activities are interconnected.

Invertebrate: Animals that do not have backbones. Included are insects, spiders, mollusks (clams, snails, etc.), and crustaceans (shrimp, crayfish, etc.).

Irrigation Drainwater: Ideally, subsurface water which flows from irrigated land and generally transports higher concentrations of dissolved salts than the water applied to the land.

Issue: Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition (Service Manual 602 FW 1.6).

Landowner: A person or entity indicated as the owner of property on the various ownership maps maintained by the Office of the County Assessor.

Landscape Ecology: A sub-discipline of ecology, which focuses on spatial relationships and interactions between patterns and processes. This emerging science integrates hydrology, geology, geomorphology, soil science, vegetation science, wildlife science, economics, sociology, law, engineering and land use planning to conserve, enhance, restore and protect the sustainability of ecosystems on the land.

Lease: A legal contract by which water rights are acquired for a specified period of time for a specified rent or compensation.

Levee: An embankment along the river to prevent water from overbank flooding.

Management Alternative: See Alternative.

Management Concern: See Issue.

Management Opportunity: See Issue.

Marsh: A periodically wet or continually flooded area where the water is shallow enough to allow the growth of emergent vegetation such as sedges, rushes, and cattails.

Marsh Habitat: Habitat that is characterized by shallow water and emergent vegetation. Unless otherwise specified, this term does not apply to similar habitat found in rivers, drains, or canals.

Meander: The bend of curve in a river or stream channel. Migration of the river or stream channel.

Meander Scar: The area of land marked by the earlier presence of a meandering river channel; the mark is usually identified by different soil texture and color.

Migration: The seasonal movement from one area to another and back.

Migratory Bird: A bird that seasonally moves between geographic areas. In reference to birds in the Great Basin, a bird that breeds in Great Basin and subsequently moves south of the Great Basin for the winter months. Birds that migrate south of Mexico for the winter are considered Neotropical migrants.

Mission Statement: Succinct statement of the unit's purpose and reason for being.

Mitigation: To avoid or minimize impacts of an action by limiting the degree or magnitude of the action; to rectify the impact by repairing, rehabilitating, or restoring the affected environment; to reduce or eliminate the impact by preservation and maintenance operations during the life of the action.

Model: A mathematical formula that expresses the actions and interactions of the elements of a system in such a manner that the system may be evaluated under any given set of conditions.

Moist-Soil: A process where water is drawn down intentionally or naturally to produce mudflats (i.e., moist soil) that is required for germination of many desirable plants.

Monitoring: Data collected and analyzed periodically for comparing trends in that which is being monitored. Monitoring is necessary to identify, track and analyze results of management actions at the refuge so that future management actions may be adapted to obtain the best benefits to wildlife and habitat (see adaptive management).

Mud Flat: Expanses of mud contiguous to a water body often covered and exposed by tides.

National Environmental Policy Act (NEPA): An act which encourages productive and enjoyable harmony between humans and their environment, to promote efforts that will prevent or eliminate damage to the environment and atmosphere, to stimulate the health and welfare of humans. The act also established the Council on Environmental Quality (CEQ). Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (from 40 CFR 1500).

National Wildlife Refuge (Refuge or NWR): A designated area of land or water or an interest in land or water within the system, including national wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas (except coordination areas) under the Service jurisdiction for the protection and conservation of fish and wildlife. A complete listing of all units of the Refuge System may be found in the

current “Report of Lands Under Control of the U.S. Fish and Wildlife Service” (Service Manual 602 FW 1.6).

National Wildlife Refuge System, Refuge System, or System: Various categories of areas that are administered by the Secretary for the conservation of fish and wildlife, including species that are threatened with extinction; all lands, waters, and interest therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management or waterfowl production areas.

National Wildlife Refuge System Mission (mission): "The mission of the System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (Service Manual 602 FW 1.6).

Natural Recruitment: Plant establishment through natural processes. In riparian systems these processes include: flooding, sediment deposition, erosion, and seed dispersal from local or upstream plant sources.

Native Species: Species that normally live and thrive in a particular ecosystem.

Neotropical Migratory Birds: Migratory birds that breed in North American and winter in Central and South America.

NEPA: National Environmental Policy Act of 1969.

Niche: An organism's "place," or role, in an ecosystem. This involves many components of the organism's life: where it lives (habitat), what it eats, by whom it is eaten, when it migrates or breeds, etc. All of these factors combine to determine the role of the organism in its ecosystem.

No Action Alternative: An alternative under which existing management would be continued.

Non-Priority Public Uses: Any use other than a compatible wildlife-dependent recreational use.

Notice of Intent (NOI): A notice that an environmental impact statement will be prepared and considered (40 CFR 1508.22). Published in the *Federal Register*.

NWR: National Wildlife Refuge.

Objective: A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable (Service Manual 602 FW 1.6).

One-hundred-year Floodplain: The relatively flat portion of the river channel that has a one percent chance of being inundated by flood water in any given year.

One-hundred-year Meanderbelt: The area of land over which a river channel has historically migrated over a 100-year period.

Operation and Maintenance (O&M) Costs: Charges paid by water users for delivery of water in the Newlands Project that are paid to the Newlands Project operator for reasonable and customary operation and maintenance of the delivery system.

Opportunities: Potential solutions to issues.

Ordinary High Water Mark: That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Outreach: Outreach is two-way communication between the USFWS and the public to establish mutual understanding, promote involvement, and influence attitudes and actions, with goal of improving joint stewardship of our natural resources.

Overbank Flooding: River flows that exceed the boundaries of the existing river channel and flood the adjacent riparian areas and bottomlands.

Oxbow Lake: A horseshoe-shaped lake formed in an abandoned meander bend of a river.

Passerine Bird: A songbird or other perching bird that is in the order Passeriformes. Blackbirds, crows, warblers, sparrows, and wrens for example.

Perennial: In reference to a body of water, one that contains water year-to-year and that rarely goes dry.

Peak Flow: The maximum discharge of a stream during a specified period of time.

Permeability: The property or capacity of porous rock, sediment, or soil to transmit water.

Phenology: Life cycle of particular species.

Phreatophytes: Plants whose roots penetrate to the water table.

Physiographic: Physical geography of a particular region of the U.S.

PILT: Payment-in-Lieu-of-Taxes.

Planning Area: The area upon which the planning effort will focus. A planning area may include lands outside existing planning unit boundaries currently studied for inclusion in the Refuge System and/or partnership planning efforts. It also may include watersheds or ecosystems outside of our jurisdiction that affect the planning unit. At a minimum, the planning area includes all lands within the authorized boundary of the refuge (Service Manual 602 FW 1.6).

Planning Team: A team or group of persons working together to prepare a document. Planning teams are interdisciplinary in membership and function. Teams generally consist of a planning team leader, refuge manager and staff biologists, a state natural resource agency representative, and other appropriate program specialists (e.g., social scientist, ecologist, recreation specialist). We also will ask other Federal and Tribal natural resource agencies to provide team members, as appropriate. The planning team prepares the CCP and appropriate NEPA documentation (Service Manual 602 FW 1.6).

Planning Team Leader: The planning team leader typically is a professional planner or natural resource specialist knowledgeable of the requirements of NEPA and who has planning experience. The planning team leader manages the refuge planning process and ensures compliance with applicable regulatory and policy requirements (Service Manual 602 FW 1.6).

Planning Unit: A single refuge, an ecologically or administratively related refuge complex, or distinct unit of a refuge. The planning unit also may include lands currently outside refuge boundaries (Service Manual 602 FW 1.6).

Plant Community: An assemblage of plant species of a particular composition. The term can also be used in reference to a group of one or more populations of plants in a particular area at a particular point in time; the plant community of an area can change over time due to disturbance (e.g., fire) and succession.

Pollutant: Any introduced gas, liquid, or solid that makes a resource unfit for a specific purpose.

Population: All the members of a single species coexisting in one ecosystem at a given time.

Preferred Alternative: This is the alternative determined (by the decision maker) to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management. The Service's selected alternative at the Draft CCP stage.

Prescribed Fire: The skillful application of fire to natural fuels under conditions of weather, fuel moisture, soil moisture, etc., that allows confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

Prime Farmland: Farmland in an area or region that is considered to be the most ideal farmland based on several criteria; usually soil types and land productivity of the land are two of the most important criteria.

Priority Public Uses: Compatible wildlife-dependent recreation uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).

Proposed Action: The Service's proposed action for Comprehensive Conservation Plans is to prepare and implement the CCP.

Public: Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.

Public Involvement: A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public Involvement Plan: Broad long-term guidance for involving the public in the comprehensive planning process.

Public Scoping: See public involvement.

Purposes of the Refuge: "The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge (Service Manual 602 FW 1.6).

Purveyor: A private land owner or association that controls water rights for the ability to use the water.

Raptor: A bird of prey, such as a hawk, eagle, or owl.

Record of Decision (ROD): A concise public record of decision prepared by the Federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).

Recreation Day: A standard unit of use consisting of a visit by one individual to a recreation area for recreation purposes during any reasonable portion or all of a 24-hour period.

Recruitment: The annual increase in a population as determined by the proportion of surviving offspring produced during a specific period (usually expressed per year).

Refuge: Short of National Wildlife Refuge.

Refuge Goal: See goal.

Refuge Operating Needs System (RONS): The Refuge Operating Needs System is a national database that contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates (Service Manual 602 FW 1.6).

Refuge Purposes: See purposes of the Refuge.

Refuge Revenue Sharing Program or RRSP: Proves payments to counties in lieu of taxes using revenues derived from the sale of products from refuges.

Refuge Use: Any activity on a refuge, except administrative or law enforcement activity carried out by or under the direction of an authorized Service employee.

Restoration: The return of an ecosystem to an approximation of its former unimpaired condition.

Restoration, Cultural Restoration (also Active Restoration): Restoration that uses horticultural and agricultural techniques for plant establishment. Common practices of cultural restoration includes: propagating seeds, acorns and cuttings in a greenhouse; planting these propagules in rows so that irrigations systems may be installed and maintained and weeds can be sprayed and mowed. Specific human actions taken to reestablish the natural processes, vegetation and resultant habitat of an ecosystem.

Restoration, Passive Restoration: Restoration that relies on natural processes for plant establishment. These processes include: flooding, sediment deposition, erosion, and seed dispersal from local or upstream plant sources. Allowing an ecosystem to restore its natural processes, vegetation and resultant habitat without human actions.

Riparian Area: Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes and estuarine-marine shorelines.

Riparian Habitat: Gravel bars, sand dunes, non-vegetated riverbanks, herbaceous, scrub and forested vegetation, which provides habitat for plants, macro-invertebrates, fish and wildlife.

Riverine: Pertaining to rivers and floodplains.

RMIS: Refuge Management Information System database

Secretary: Short of the Secretary of the Interior.

Sediment: Any material, carried in suspension by water, which ultimately settles to the bottom of water courses. Sediments may also settle on stream banks or flood plains during high water flow.

Service or USFWS: Short for U.S. Fish and Wildlife Service.

Shorebirds: Long-legged birds, also known as waders, belonging to the Order Charadriiformes that use shallow wetlands and mud flats for foraging and nesting.

Slough: A naturally occurring side or overflow channel that holds water.

Soil Erosion: The wearing away of the land's surface by water, wind, ice, or other physical process.

Sound Professional Judgment: A finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the Refuge Administration Act of 1966 (16 U.S.C. 668dd-668ee), and other applicable laws. Included in the finding, determination, or decision is a refuge manager's field experience and knowledge of the particular refuge's resources (Service Manual 603 FW 2.6).

Spatial Distribution: The pattern of frequency of a specific habitat type over a larger area.

Species: A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.

Species Composition: A group of species that inhabit a specific habitat type in its healthy state. To enhance species composition is to ensure that all or as many species as possible inhabit the appropriate habitat by improving the quality of that habitat.

Step-Down Management Plan: A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives (Service Manual 602 FW 1.6).

Strategy: A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Service Manual 602 FW 1.6).

Submergent Vegetation: Plants that grows completely submerged except when flowering.

Succession: The replacement of one plant community by another over time.

Surface Water: A body of water that has its upper surface exposed to the atmosphere.

System or Refuge System: National Wildlife Refuge System.

Terminus: In reference to a stream or river, its end point; where it flows into a lake or other basin.

Threatened Species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and one that has been designated as a threatened species in the *Federal Register* by the Secretary of the Interior. Threatened species are afforded protection under the Endangered Species Act of 1973.

Tiering: The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues (40 CFR 1508.28).

Total Dissolved-Solids (TDS): The total concentration of solids (or salts) dissolved in water; specific conductance is a surrogate measure of dissolved solids. More specifically, total dissolved-solids is an aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, etc. of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts.

Trace Elements: Metallic elements (with atomic number >21) generally occurring in trace amounts in water, including iron, manganese, copper, chromium, arsenic, mercury, and vanadium.

Transient Species: Animals that migrate through a locality without breeding or overwintering.

Trust Species: Species for which the U.S. Fish and Wildlife Service has primary responsibility, including, most federally listed threatened and endangered species, anadromous fishes once they enter inland U.S. waterways, migratory birds, and certain marine mammals.

Turbidity: Cloudiness of a water body caused by suspended silt, mud, pollutants, or algae.

Understory: Shrubs and herbaceous plants that typically grow beneath larger trees in a woodland.

Upland: An area where water normally does not collect and where water does not flow on an extended basis. Uplands are non-wetland areas.

USFWS or Service: Short for U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service Mission: Our mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people (Service Manual 602 FW 1.6).

Vegetation: The composition plant species, their frequency of occurrence, density, and age classes at a specified scale.

Vegetation Community: See plant community.

Vegetation Type or Habitat Type: A land classification system based upon the concept of distinct plant associations.

Vernal Pool: Seasonally flooded depressions on soils with an impermeable layer such as a hardpan, claypan, volcanic basalt, or saturated alkali clays. The impermeable layer allows the pools to retain water much longer then the surrounding uplands; nonetheless, the pools are shallow enough to dry up each season. Vernal pools often fill and empty several times during the rainy season. Only plants and animals that are adapted to this cycle of wetting and drying can survive in vernal pools over time.

Vertebrate: An animal having a segmented backbone or vertebral column; includes mammals, birds, fish, amphibians, and reptiles.

Vision Statement: A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates (Service Manual 602 FW 1.6).

Water Year: That period of time between October 1 of one calendar year and September 30 of the next calendar year. Traditionally, hydrologic data (i.e., stream flows, precipitation, etc.) was summarized or totaled for this period of time.

Waterfowl: A group of birds that include ducks, geese, and swans (belonging to the order Anseriformes).

Water-righted Acreage: The land base for which there are water rights.

Water Rights: A grant, permit, decree, appropriation, or claim to the use of water for beneficial purposes, and subject to other rights of earlier date of use, called priority, or prior appropriation.

Watershed: The entire land area that collects and drains water into a river or river system.

Wetland: Land that is transitional between upland (terrestrial) and aquatic systems (greater than about 6-feet deep) where the water table is usually at or near the surface or the land is covered by shallow water... wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (plants that require wet conditions); (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin and others, 1979).

Wetland Habitat: Habitat provided by shallow or deep water (but less than 6-feet deep), with or without emergent and aquatic vegetation in wetlands. Wetland habitat only exists when and where a wetland or portion of a wetland is covered with water (visible surface water). Consequently, the size and shape of "wetland habitat" will fluctuate from season-to-season and year-to-year while the size and shape of the "wetland" within which wetland habitat occurs will remain constant from season to season and from year to year. Wetlands only provide habitat for waterfowl, shorebirds, muskrats, aquatic insects, and other wetland-dependent wildlife when they contain surface water (i.e., when they provide wetland habitat).

Wildfire: A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildland fire: A free burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands. Often referred to a wildfire.

Wildlife: All nondomesticated animal life; included are vertebrates and invertebrates.

Wildlife Corridor: A landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions. Such corridors may facilitate several kinds of traffic, including frequent foraging movement, seasonal migration, or the once in a lifetime dispersal of juvenile animals. These are transition habitats and need not contain all the habitat elements required for long-term survival of reproduction of its migrants.

Wildlife-Dependent Recreational Use: "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence (Service Manual 602 FW 1.6).

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Appendix J. Consultation and Coordination with Others

1.0 Public Outreach

This Appendix describes consultation and coordination efforts with the public, interested groups, and other agencies. Section 2 of this Appendix contains the distribution list for the CCP. The organizations and individuals listed in this section were either sent notification about the release of the Draft CCP or a copy of the Draft CCP. The majority of this list was also sent planning updates or attended the public scoping meetings in 2001.

1.1 Outreach During Scoping

FWS News Release (sent to over 30 media organizations):

- May 8, 2001

Federal Register Notice of Intent:

- Published on June 11, 2001
- Published on September 24, 2001 (extended comment period)

Public Scoping Meetings:

- May 30, 2001 in Willows
- June 4, 2001 in Chico
- June 5, 2001 in Red Bluff
- June 6, 2001 in Colusa.

Newspaper articles:

Chico Enterprise Record

- May 29, 2001
- June 5, 2001
- June 9, 2001

CN&R

- July 5, 2001

Presentations:

- Board of Directors of the Sacramento River Conservation Area Forum, November, 2000

Other:

- Sacramento River Preservation Trust, July 2001 newsletter
- California Waterfowl Association Action Alert (www.calwaterfowl.org)

1.2. Outreach Between Scoping and Release of Draft CCP

Planning Updates (sent to 200-300 people/organizations):
- May 2001
- August 2001
- July 2002
- December 2003

Numerous meetings were attended by Refuge staff from 2001-2004. At these meetings staff provided updates on the status of the CCP and any comments received were incorporated into the planning process. Also, in each of the planning updates, a request for comments was given. When comments were received, they were incorporated into the planning process.

1.3 Outreach During Release of Draft CCP

Federal Register Notice of Availability:
- Published on June 29, 2004

FWS News Release (sent to over 30 media organizations):
- July 6, 2004

Letter and News Release (sent to over 400 people/organizations):
- July 6, 2004

Public Meetings:
- July 20, 2004 in Willows
- July 21, 2004 in Chico
- July 27, 2004 in Red Bluff
- July 29, 2004 in Colusa

Presentations Given about the CCP:
- Glenn County Board of Supervisors, July 7, 2004
- Butte County Board of Supervisors, July 13, 2004
- Tehama County Board of Supervisors, July 13, 2004
- Technical Advisory Committee of the Sacramento River Conservation Area Forum, July 6, 2004
- Board of Directors Sacramento River Conservation Area Forum, July 15, 2004

Legal Notices:

Red Bluff Daily News
- July 8, 2004
- July 14, 2004

Willows Journal
- July 9, 2004
- July 14, 2004

Colusa County Sun Herald
- July 9, 2004
- July 14, 2004

Corning Observer
- July 9, 2004
- July 14, 2004

Chico Enterprise Record
- July 14, 2004
- July 22, 2004

The Sacramento Valley Mirror
- July 10, 2004
- July 14, 2004

Newspaper articles:

Red Bluff Daily News
- July 9, 2004
- July 23, 2004
- July 26, 2004
- August 2, 2004

Appeal-Democrat
- July 13, 2004

Chico Enterprise Record
- July 8, 2004
- July 16, 2004
- July 23, 2004
- August 15, 2004

Willows Journal
- July 14, 2004

Copies of the Draft Plan provided at these Locations:

Libraries:
- Bayliss Library (Glenn)
- Butte County Library (Chico)
- Butte County Library (Oroville)
- Colusa County Library (Colusa)
- Colusa County Library (Princeton)
- Corning Library (Corning)
- Orland City Library (Orland)
- Tehama County Library (Los Molinos)
- Tehama County Library (Red Bluff)
- Willows Public Library (Willows)

Local Businesses:
- Chico Sportsman's Den (Chico)
- Fisherman's Cove (Chico)
- Four Corners Store (Butte City)
- Kittle's Outdoor & Sport Co (Colusa)
- Scotty's Bar & Grill (Chico)
- The Tackle Box (Chico)
- TJ's Ord Store (Ord Bend)
- Westside Outdoorsman (Willows)
- Woodson Bridge Mini-Mart (Corning)
- Sacramento River Discovery Center (Red Bluff)

Websites where the Draft CCP, Planning Updates, and CCP information is provided:
- Sacramento National Wildlife Refuge Complex webpage (www.sacramentovalleyrefuges.fws.gov)
- USFWS Pacific Region Planning webpage (www.pacific.fws.gov/planning)

Newsletters and Other Websites that provided information about the CCP:
- Redding Outdoors (July 11, 2004)
- County of Glenn, Rambling (July 11, 2004)

- Sacramento River Preservation Trust, July 2004 newsletter
- California Waterfowl Association Action Alert (www.calwaterfowl.org)
- Refuge Forum California Flyway website (www.refugeforums.com/refuge)
- Sacramento River Metadata Library website (www.watershedportal.org/)
- Sacramento River, A guide to Recreation and Public Access (www.sacramentoriver.org)
- Sacramento River Watershed Program (www.sacriver.org)
- Battle Creek Watershed Conservancy (www.battle-creek.net/sacriver)
- The Ivory Bill (www.50birds.com)
- Animal Protection Institute Action Alert (www.api.4animals.org)
- MSN Group, Animals Wildlife and Environment (http://groups.msn.com)
- American Motorcycle Association Legislative Alerts and Updates (www.capwiz.com/amacycle/issues/alert)

2.0 Distribution List

Federal, State and County Elected Officials
Office of U.S. Senator Barbara Boxer
Office of U.S. Senator Dianne Feinstein
Office of U.S. Representative Wally Herger
Office of State Senator Sam Aanestad
Office of State Assemblyman Doug La Malfa
Office of State Assemblyman Rick Keene
Governor Arnold Schwarzenegger
Chairperson R.J. Beeler, Butte County Board of Supervisors
Supervisor District 2, Jane Dolan, Butte County Board of Supervisors
Supervisor District 3, Mary Ann Houx, Butte County Board of Supervisors
Supervisor District 4, Curt Josiassen, Butte County Board of Supervisors
Supervisor District 5, Kim Yamaguchi, Butte County Board of Supervisors
Chairperson David Womble, Colusa County Board of Supervisors
Supervisor District 1, Christy Scofield, Colusa County Board of Supervisors
Supervisor District 2, E. Doug White, Colusa County Board of Supervisors
Supervisor District 3, Mark Marshall, Colusa County Board of Supervisors
Supervisor District 4, William Waite, Colusa County Board of Supervisors
Chairperson Gary Freeman, Glenn County Board of Supervisors
Supervisor District 1, Tom McGowan, Glenn County Board of Supervisors
Supervisor District 3, Forrest Sprague, Glenn County Board of Supervisors
Supervisor District 4, Denny Bungarz, Glenn County Board of Supervisors
Supervisor District 5, Keith Hansen, Glenn County Board of Supervisors
Chairperson Ross Turner, Tehama County Board of Supervisors
Supervisor District 1, Barbara McIver, Tehama County Board of Supervisors
Supervisor District 2, George Russell, Tehama County Board of Supervisors
Supervisor District 3, Charles Williard, Tehama County Board of Supervisors
Supervisor District 5, William Borror, Tehama County Board of Supervisors

Federal Agencies

U.S. Department of Agriculture
- U.S. Forest Service
  - James Fenwood, Forest Supervisor
  - Randy Jero
- Natural Resource Conservation Service – Colusa, Willows, Chico
  - Chuck Bell, State Conservationist
  - Dean Burkett
  - Wendell Gilgert
  - Jessica Groves
  - Dennis Nay, District Conservationist

U.S. Department of Commerce
- National Marine Fisheries Service
  - Michael Aceitano
  - Leah Mahan
  - Rosalie del Rosario
  - Michael Tucker

U.S. Department of Defense
- U.S. Army Corps of Engineers
  - Michael Conrad Jr., Colonel
  - Art Champ, Chief, Regulatory Branch

U.S. Department of the Interior
- Bureau of Reclamation – Sacramento, Red Bluff
  - Kirk Rodgers, Regional Director, Mid Pacific Regional Office
  - Basia Trout
- Fish and Wildlife Service
  - Sacramento
    - Steve Thompson, California Nevada Operations Manager
    - Steve Dyer, Chief Sacramento Realty Office
    - Dave Paullin, Refuge Supervisor, California Nevada Office
    - Mark Pelz, Refuge Planning Office
    - Bart Prose, Div. of Habitat Conservation
    - Caroline Prose, Sacramento FWO
    - Robert Shaffer, CVHJV
    - Richard Smith, Refuge Planning Office
    - Darrin Thome, Sacramento FWO
    - Dan Walsworth, Refuge Supervisor, California Nevada Office
    - Wayne White, Field Supervisor, Sacramento FWO
    - Adam Zerrenner, Sacramento FWO

Stockton
- Dan Castleberry, Central Valley Project Improvement Act
- John Icanberry, Central Valley Project Improvement Act

Red Bluff
- James G. Smith, Project Leader, Red Bluff FWO
- Tom Kisanuki, Deputy Project Leader, Red Bluff FWO
- Patricia Parker, Fisheries Biologist, Red Bluff FWO
- Jack Willamson, Fisheries Biologist, Red Bluff FWO
- Kimberly True, Assistant Project Leader, CA-NV Fish Health Center

Portland, OR
- Carolyn Bohan, Regional Chief
- Nathan Caldwell, T-21 Coordinator
- David Drescher, Branch Chief GIS/Mapping
- Nell Fuller, Refuge Policy and Compliance
- Michael Green, MBHP
- Ben Harrison, Chief of Land Protection Planning
- Jean Harrison, Chief of Visitor Services & Comm.
- Chuck Houghten, Chief of Refuge Planning
- Sam Johnson, Branch of Refuge Biology
- Kay KierHaggenjos, Div. of Refuge Planning
- Mike Marxen, Team Leader, Division of Refuge Planning
- Steve Moore, Chief Refuge Operations Support
- Fred Paveglio, Branch of Refuge Biology
- Anan Raymond, Chief of Cultural Resources
- Paul Rauch, Div. of Engineering
- James Roberts, Refuge Operations Support
- Susan Saul, External Affairs
- Catherine Sheppard, Div. of Realty
- Nick Valentine, Cultural Resources
- Tara Zimmerman, MBHP

Arlington, VA
- Liz Bellantoni

National Conservation Training Center
- Liz Fritsch
- Ann Post Roy, Conservation Library

Bureau of Land Management, Redding
- Glen R. Miller, Environmental Coordinator
- Chuck Schultz, Area Manager

State Agencies

Department of Fish and Game – Sacramento, Redding, Rancho Cordova, Chico, Willows, Butte City

Randy Benthin
Don Blake, Habitat Supervisor
Tom Blankenship
John Carlson, Wildlife and Inland Fisheries Division
Scott Clemons, Riparian Habitat Manager, Wildlife Conservation Board
Banky Curtis, Regional Manager, Region 2
Larry Eng
Paul Hofmann, Wildlife Biologist
Diana Jacobs, Deputy Director, Science Advisor
Don Koch, Regional Manager, Region 1
Henry Lamelli
Teresa Leblanc
Dan Odenweller, Central Valley Bay Delta Branch
Paul Ward, Associate Biologist, Marine Fisheries

Resources Agency

Felix Arteaga
Rebecca Fawver
Tim Ramirez

Department of Parks and Recreation

Daniel Abeyta, Office of Historic Preservation
Woody Elliott, Senior Resource Ecologist
Robert Foster, Supervisor
Trisha Tillotson, Hydraulics, District 3

Department of Water Resources – Sacramento, Red Bluff

Deputy Director, State Water Project
Annalene Bronson
Koll Buer
Barbara Castro
Stacy Cepello
Adam Henderson
James L. Martin, Wetlands Coordinator

Fish and Game Commission

Jim Kellogg, President

State Board of Reclamation

Betsy Marchand, President of the Reclamation Board
Peter Rabbon, General Manager

California Division of Forestry
Paul Hendricks

California Bay-Delta Authority
Vickie Newlin

Local

Butte County Cooperative Extension
Bill Olsen, Director

Butte County
Jim Camy, Butte County Mosquito & Vector Control District
J. Michael Madden, Butte County Emergency Services
Lynne Tillis, Department of Water Resources and Conservation
Bob Townsend, Public Works

Colusa County
Colusa County Fish and Game
Steven Hackney, Planning Department
David B. Whitesell, Colusa Mosquito Abatement District

Glenn County
John Benoit, Planning Department
Peter J. Boice, Fish, Game and Recreation Commission
Jack F. Cavier, Jr., Glenn County Mosquito & Vector Control
Jon Hays, Fish, Game and Recreation Commission
Christy Leighton, Planning Department
Dan Obermeyer, Planning Department

Tehama County
Ernie Ohlin, Public Works
George Robson, Planning Department
Tehama County Mosquito and Vector Control District, Red Bluff

Sacramento-Yolo County Mosquito and Vector Control District, Elk Grove
David Brown

City of Tehama
Ron Warner, Mayor

Public Libraries

Bayliss Library
Butte County Library – Chico Branch
Butte County Library – Oroville Branch

Colusa County Library – Colusa Branch
Colusa County Library – Princeton Branch
Corning Library
Orland City Library
Tehama County Library – Los Molinos Branch
Tehama County Library – Red Bluff Branch
Willows Public Library
Brent Miller, Head Librarian, Sacramento

Private Groups and Individuals
Assembly Committee on Water, Parks & Wildlife
Tim Adkins
Mark Adams, President, Chico Area Flyfishers
Dr. Doug Alexander, California State University, Chico
Don and Barbara Anderson
Animal Protection Institute
Jerry Arnoldy
Rel Atwood
Thad Baker
Ronald & Jeanette Barnes
Joe Becker, California Bowmen Hunters
Paul Biehn
Big Chico Creek Watershed Alliance
Serge Birk
Jay Bogiatto, Department of Biological Sciences, California State University, Chico
Robert A. Booher, Robert A. Booher Consulting
Dennis Bowker, Sacramento River Watershed Program
Dave Bowman
Lance Boyd, Princeton-Codora-Glenn Irrigation District
Jim Bremner, Bremner Farms
John Brooks, Valley Mirror
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Rudy Buriani
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California State Clearinghouse
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Chico Sportsman's Den
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Ann Chrisney, Riparian Habitat Joint Venture
Gene Clark
Robert D. Clark, North Delta Water Agency
Jim Clarkson, Raptor Rod Works
Walter Cook
George & Linda Colbin
Matt Colwell, Western Canal Water District
Mark A. Corrie, Fisherman's Cove
John Cosby
Chuck Crain, Crain Walnut Shelling
Marci D'Arpino, Plan-Tech
Dan Davey
Kim Davis
Robert Davison, Wildlife Management Institute
Dave Dodds, United Outdoorsman
Edward F. Edgerton
Dan Efseaff, River Partners
Greg Elliott, PRBO
Ruth Erwin
Tom Evans, Family Water Alliance
Al Faldiaza
Andrew Farrar
Troy Felder
Robert Fields, National Wildlife Refuge Association
Barney Flynn
Bernard Flynn
Brendon Flynn, Pacific Farms
Cecilia Flynn, Shasta View Farms
Dr. Thomas A. Flynn, O.D., Shasta View Farms, LLC
Four Corners Store
Dennis Fusam
Francisco Garcia
Bill Gaines, California Waterfowl Association
Lew Garbutt
Bryan Gardenhire
Dan Gardner
Mike Gardner
Gene German

Goeff Geupel, Point Reyes Bird Observatory
Eric Ginney, Bidwell Environmental Institute, CSU/Chico
Steven Greco, University of California, Davis
Lupe Green, Sacramento River Discovery Center
Dr. Tom Griggs
Greg Golet, The Nature Conservancy
Jesse Gonzalez, Sacramento Safari Club – President
Calvin Guin
Rob H.
Heather Hacking, Enterprise Record
Scott Hartman, National Trappers Association
Edward Hay
Hilary R. Hedman
Bryan Henderson
Mark Hennelly, California Waterfowl Association
Les Heringer, M&T Ranch, Inc.
Karen Holl, University of California, Santa Cruz
Dr. Bob Holland
Dr. Donald Holtgrieve, Dept. of Geo. & Planning, California State Univ., Chico
John Hunt
Charles Irwin
Lola Jeffers, Reclamation District No. 1004
Bill Jenkins
Pete Jessen
Phillip N. Judge, Judge Bros. Farms
Bill Karr, Western Outdoor News
Marlin Keller
Ron Keyawa, Keyawa Orchard/3-B Ranch
Paul Kirk, Dep't of Biological Sciences, California State University, Chico
Kittle's Outdoor & Sport Co.
Michael Koehnen, C.F. Koehnen & Sons
Dr. Matt Kondolf, University of California, Berkeley
Gary W. Kramer
Nick Kraemer
Thomas Kraemer
Jason Larabee, for Representative John Doolittle
Scott Larrabee, Larrabee Farms
Eric Larsen, University of California, Davis
Richard Laurson
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Dave Lee
Merle Leighty, Mallard Ponds
Jeff Leitner, Fund for Animals
Barbara LeVake, Sacramento Valley Land Owners Association

Shirley Lewis
Gordon Long, Multiple Use Managers, Inc.
Dean Lundie
Ryan Luster, The Nature Conservancy
Raymond P. Lyon
Bill & Rachel Mackay
Carlene C. Mann
Dr. Michael Marchetti, Dep't of Biological Sciences, California State Univ., Chico
Curt Martin
Dr. Paul Maslin, Dep't of Biological Sciences, California State University, Chico
Rick Massa
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Bill Mayo
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Jason McCaig
Carol McClendon
Bruce McCrea
Bruce McGowan
Todd McKinnon
Orvil McKinnis, Westlands Water District
Celnia Meinberg
J. Dwight Melancon, Supervisor, Western Geophysical
John Merz, Sacramento River Preservation Trust
Tanya Meyer
Ed Migale
Gregg Miley
Paul Min
Tim Monolis, Central Valley Bird Club
Cathy Morris, The Nature Conservancy
Dr. Jeff Mount, Dep't of Geology, University of California, Davis
John Muegge
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Robert Murillo
Dr. Marlyce Myers, The Nature Conservancy
Ron & Pam Myers
Julie Myrah, CalTrans
Chuck Nelson, Geographic Information Center, California State University, Chico
Bill Nichols, Nichols Ranch
Alex Oehler, Field Representative, U.S. Congressman Herger
Charles Ohm
John C. Ohm
Dale Olson
Patrick J. Pendergast, The Fly Shop – Travel Director
Harley Perez

Daryl Peterson, The Nature Conservancy
Craig Poundstone
Jose Puente
Dr. Jim Pushnik, California State University, Chico
Marshall Pylman, Sacramento Safari Club – Secretary
Mike Rakestraw
Danny James Redding
Jim Rhode
Mike Riley
Mike Roberts, The Nature Conservancy
Jeff Robinson
Frank Roepke
Rudolph Rosen, Ducks Unlimited, Western Regional Office
Cecil Ross
Jennifer Rotnem, Sponsored Programs, California State University, Chico
George Russell
Sacramento River Reclamation District
Irvin Schiffman, River Partners
Dr. Robert Schlising, Dep't of Biological Sciences, California State Univ., Chico
John Scott, United Sportsman for Habitat & Wildlife Conservation
Scotty's Bar & Grill
Eric See
John & April Senior
Pia Sevelius
Jackson Shedd, Altacal Audubon Society
Dr. Kristina Shierenbeck, Dep't of Biological Sciences, California State Univ., Chico
David Sieperda, Llano Seco Ranch
Dr. Michael Singer, California State University, Berkeley
Stacy Small, PRBO
Jim Snowden
Matt Southam
Kevin Spangler
Elizabeth Stallman, The Humane Society
Walt Stile III
Ron Stromstad, Ducks Unlimited
Dave Suford, PRBO
Dr. Donald Sullivan, Department of Geography, University of Denver
Susan Sutton, Family Water Alliance
Helen Swagerty, River Partners
TJ's Ord Store
Dan Taylor, National Audubon Society, California State Office
Van Tenny, General Manager, Glenn-Colusa Irrigation District
The Tackle Box
Fred Thomas, Cerus Consulting

Fred Thomas
Richard T. Thieriot, Parrott Investment Corporation
Ron Touchon, Calpine-Land Manager
Greg Townley
Greg Treber
Jamie D. Tucker
Mike Vaiana
John Vert
Barbara Vlamis, Director, Butte Environmental Council
Dave Vogel
Bill Waggershauer
John Wagner
Mike & Sharon Wallace
Ron Warner
David Wasney, Jr.
Gregg Werner, The Nature Conservancy
Westside Outdoorsman
George & Gini Whitney
Dr. Dawn S. Wilson, Dep't of Biological Sciences, California State University, Chico
Dr. Gordon Wolfe, Dep't of Biological Sciences, California State Univ., Chico
Wood Treatment Facility
Woodson Bridge Mini-Mart & Deli
Woodson Bridge RV Park
Dr. David S. Wood, Dep't of Biological Sciences, California State University, Chico
David Yee, Central Valley Bird Club
Dawit Zeleke, Project Director, The Nature Conservancy

Appendix K. List of Planning Team Members and Persons Responsible for Preparing this Document

U.S. Fish and Wildlife Service

Core Planning Team

Kevin Foerster	Project Leader, Sacramento NWRC
Kelly Moroney	Refuge Manager, Sacramento River NWR
Denise Dachner	Outdoor Recreation Planner, Sacramento NWRC
Joe Silveira	Wildlife Biologist, Sacramento NWRC
Jennifer Isola	Wildlife Biologist, Sacramento NWRC
Mark Pelz	Refuge Planner – GIS Analyst, CA/NV Planning Office
Jacqueline Ferrier	Refuge Planner, Sacramento NWRC
Miki Fujitsubo	Former CCP Planner, CA/NV Planning Office
Ramon Vega	Former Refuge Manager, Sacramento River NWR

Expanded Team Members

Paul Hofmann	Wildlife Biologist, California Dept. of Fish and Game
Woody Elliot	Resource Ecologist, California Dept. of Parks and Recreation
Jason Douglas	Sr. Fish and Wildlife Biologist, FWS – Sacramento FWO
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Appendix L. Rationale for Public Use Determinations for the Units of Sacramento River National Wildlife Refuge

Percentages described in the CCP objectives and strategies represent current refuge acres and do not necessarily reflect the long-term percentages of lands open for visitor use on the Refuge. For example, we have proposed 80 percent of the Refuge open for wildlife-dependent activities. However, as the Refuge acquires new properties, additional acreages maybe opened for public use or they maybe set aside as sanctuary. This plan does not define public use or sanctuary objectives as a percentage figure, but rather seeks the most appropriate land use for individual sites within the context of the entire Refuge.

The process for determining visitor use on each of the Refuge units includes analyzing many different elements. Some of these include:

- Are there sensitive resources that require protection (i.e. cultural resources or nesting colonies)?
- Is public access to the unit via land or boat?
- Is the unit landlocked by private land ownership?
- Is there a large enough land base to open the unit to hunting?
- Are there safety considerations that may impact public access?
- Are there private residences or other land uses nearby that may conflict with certain types of public use?
- Characteristics of the unit that lend itself to certain uses (i.e. proximity to urban area and access or facilities for school groups)?
- Is there a historic type of public use on the site?

Big 6 – open to hunting, fishing, wildlife observation, photography, environmental education, and interpretation

Big 5 - open to fishing, wildlife observation, photography, environmental education, and interpretation

Sanctuary – closed to public use

Public Use Determinations

Unit Name: Level of Public Use:

La Barranca – Big 6

- Makes large continuous area for hunting with Mooney and Todd Island units.
- Boat access only.

Blackberry Island – Big 5

- Small acreage.
- Private residence close proximity.
- Good fishing from gravel bar.
- Boat access only.

Todd Island – Big 6

- Big 6 uses are consistent with current Bureau of Land Management (BLM) public use/contingency for transfer.
- Adjacent to La Barranca and Mooney units that will have Big 6 uses.
- Boat access only.

Mooney – Big 6

- Existing deeded hunting rights.
- Makes large continuous area for hunting with La Barranca and Todd Island units.
- Boat access only.
- Due to a pre-exisiting hunting easement, this unit is closed to waterfowl hunting, but is open for all other hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Contact refuge manager for details.

Ohm – Sanctuary

- Closed to public due to sensitive resource areas, except northern 62 acres which is closed to waterfowl hunting, but is open for all other hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Contact refuge manager for details.
- Portion east of River is an area of disputed ownership and if determined to be owned by the Service will be designated as sanctuary due to close proximity to residences (except below ordinary high water mark).
- Large tract of quality habitat on northern section of Refuge for wildlife sanctuary.
- Boat access only.

Flynn – Big 5, with gravel bar as Big 6

- Coyote Creek good natural separation between sanctuary to the north (Ohm Unit) and the Flynn Unit (see CCP chapter 3 unit descriptions for details).
- Good gravel bar for canoe/boat access.
- Good wildlife viewing opportunities.
- Boat access only.
- 57 acres of gravel bar are below ordinary high water mark and open to Big 6.

Heron Island – Big 6

- No sensitive resource issues.
- Surrounded by agricultural lands.
- Boat access only.

Rio Vista – Northern portion Big 5, southern portion Big 6, eastern edge Sanctuary

- Northern portion closed to hunting due to proximity to Woodson Bridge State Park, Tehama county park, RV park, and private residences.
- Northern portion has good vehicle access via South Avenue for Big 5 users.
- Southern portion open to hunting via boat access only.

- Southern portion adjacent to California Department of Fish and Game (DFG, Merrill Landing Unit), that is also open to hunting via boat access.
- Sanctuary along eastern edge designated as a buffer to adjacent private landowners and to provide undisturbed sanctuary for wildlife populations.

Foster Island – Big 6

- Big 6 uses consistent with current BLM public use/contingency for transfer.
- Boat access only.

McIntosh Landing North – Sanctuary except gravel bar as Big 6

- Close proximity to private residences.
- Small acreage.
- Quality Neotropical migrant bird breeding habitat.
- Provides sanctuary on the middle section of the Refuge.
- Lacks public vehicle access.
- 6 acres of gravel bar are below ordinary high water mark and open to Big 6.

McIntosh Landing South – Sanctuary

- Small acreage.
- Steep eroding river bank makes boat access difficult.
- Unsafe entrance/exit on Highway 45 for vehicles.

Pine Creek – Big 5

- Good environmental education site due to close proximity to Chico.
- Good wildlife viewing opportunities and habitat restoration sites.
- Trails already exist.
- Private residences on west side of unit preclude hunting.
- Existing levee separates DFG (Pine Creek Unit) to the south that is currently open for hunting via boat access.
- Proposed that State Parks/The Nature Conservancy (TNC) property near bridge may provide a parking and visitor facility area.
- Good vehicle access on northwest corner via Highway 32.
- Vehicle access delayed due to CalTrans requirements for vehicle safety turn lanes.

Capay – Big 6

- Historic hunting use
- Adjacent to DFG (Pine Creek Unit) to the north that is open to hunting.
- Pedestrian access to River bank along existing road.
- Good vehicle access via County Road 23.

Phelan Island – Big 6

- Existing environmental education activities facilitated by Refuge partners.
- Existing internal roads available for guided tours.
- Good wildlife viewing and habitat restoration sites.

- Historic hunting use.
- Boat access only.

Jacinto – Big 6
- Adjacent to DFG (Shannon Slough Unit) that is open to hunting.
- Boat access only.

Dead Man's Reach – Northwest portion Big 6, remainder Big 5
- Big 6 below ordinary high water mark, Big 5 above ordinary high water mark.
- Deer grazing concerns by adjacent landowners.
- Large gravel bar for easy boat access.
- Boat access only.

North Ord – Sanctuary
- Small acreage.
- Provides sanctuary in the middle section of the Refuge.
- Close proximity to private residences.
- Lacks public vehicle access.
- Steep river bank makes boat access difficult.

Ord Bend – Big 5
- Adjacent to Ord Bend County Park.
- Close proximity to Chico.
- Private residences close proximity.
- Small acreage.
- Good vehicle access via Ord Bend county road.

South Ord – Big 6
- Adjacent to DFG (Ord Bend Unit) that is open to hunting.
- Boat access only.

Llano Seco Island 1 – Big 6
- Adjacent to DFG (Jacinto Unit) that is open to hunting.
- Boat access only.

Llano Seco Island 2 – Big 6
- Historic hunting use.
- Boat access only.

Llano Seco Riparian Sanctuary – Sanctuary
- Original goal of Llano Seco property to be sanctuary.
- Large tract of habitat for sanctuary for middle portion of Refuge.
- Public access would potentially negatively impact private land easement sanctuaries.

- Sensitive resource protection.
- No vehicle access.

Hartley Island – Big 6 western portion, Sanctuary eastern portion

- Adjacent to DFG (Oxbow Unit) that is open to hunting.
- Large portion is below ordinary high water mark.
- Boat access only.
- Eastern portion sanctuary due to no access (surrounded by private property).

Sul Norte – Big 6, except for very southern portion Big 5

- Adjacent to DFG (Beehive Bend Unit) that is open to hunting.
- South end closed to hunting as buffer to Highway 162 and the units to the south that are Big 5.
- Good vehicle access and parking.

Codora – Big 5

- Adjacent to Packer Unit which is currently open to fishing.
- Good wildlife viewing opportunities.

Packer – Big 5, with gravel bar as Big 6

- Currently open to fishing.
- Close proximity to private residences.
- Good vehicle access via Highway 45.
- 11 acres of gravel bar are below ordinary high water mark and open to Big 6.

Head Lama – Sanctuary and Big 6

- High quality habitat for sanctuary.
- Provides sanctuary on southern portion of the Refuge.
- Big 6 below ordinary high water mark.
- Boat access only.

Drumheller Slough – Big 6

- Historic hunting on surrounding properties.
- Vehicle access by county road.

Appendix M. Applicable Laws and Executive Orders and Relationships to Federal, State, and Local Policies and Plans

This appendix contains an overview of laws, executive orders, polices, and plans created by federal, state and local agencies with jurisdiction in the vicinity of Sacramento River Refuge. Table 1 contains a list of applicable laws and executive orders that may affect the Refuge's CCP or the Service's implementation of the CCP. A brief description of the law, executive order, policy, or plan is included as well as how it relates to the CCP.

1.0 Federal Government

Table 1. Applicable Laws and Executive Orders		
Law, Regulation, or Guideline	**Description**	**Relation to the CCP**
Agency Coordination		
Executive Order No. 12372, Intergovernmental Review of Federal Programs.	Requires that Federal agencies afford other agencies review of documents associated with Federal programs.	Copies of this environmental assessment were sent to the California State Clearinghouse, Federal and State agencies, and local governments.
Human Rights Regulations		
Executive Order 12898, Environmental Justice. February 11, 1994 Americans with Disabilities Act of 1990 (ADA)	Requires Federal agencies to consider the effects of projects and policies on minority and lower income population. Provides for access to Federal facilities for the disabled.	The proposed action will not have a disproportionately high and adverse human health or environmental effect on minority populations and low-income populations. The proposed action promotes reasonable and appropriate uses of the land that preserve the natural character and protect the natural resources of the area.
Cultural Resources Regulations		
Antiquities Act of 1906	This act authorizes the scientific investigation of antiquities on Federal land. It prohibits and provides penalties for unauthorized search for or collection of artifacts or other objects of scientific interest. The Act also authorizes the president to establish national monuments and cultural areas on Federal lands.	The Service will continue to comply with this Act under the CCP.
Executive Order No. 11593, Protection and Enhancement of the Cultural Environment	States that if the Service proposes any development activities that may affect archaeological or historical sites, the Service will consult with Federal and State Historic Preservation Officers to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Order under the CCP.

Table 1. Applicable Laws and Executive Orders		
Law, Regulation, or Guideline	**Description**	**Relation to the CCP**
Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 25 USC 3001 et seq.)(NAGPRA)	Regulations for the treatment of Native American graves, human remains, funeral objects, sacred objects, and other objects of cultural patrimony. Requires consultation with Native American Tribes during Federal project planning.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Act under the CCP.
Archaeological Resources Protection Act of 1979 (PL 96-95; 93 STAT 722; 16 USC 470aa-47011), as amended (ARPA)	Protects materials of archeological interest from unauthorized removal or destruction and requires Federal managers to develop plans to locate archeological resources.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Act under the CCP.
Executive Order 13007, Indian Sacred Sites. 24 May, 1996	Provides for access to, and ceremonial use of, Indian sacred sites on Federal lands used by Indian religious practitioners and direction to avoid adversely affecting the physical integrity of such sites.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Order under the CCP.
American Indian Religious Freedom Act 1978 (PL 95-341; 92 STAT 469; 42 USC 1996)	Provides for freedom of Native Americans to believe, express, and exercise their traditional religion, including access to important sites.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Act under the CCP.
Archaeological and Historic Preservation Act of 1974 (PL 93-291; 88 STAT 174; 16 USC 469)	Provides for the preservation of historical buildings, sites, and objects of national significance.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Act under the CCP.
National Historic Preservation Act of 1966 (PL 89-665; 50 STAT 915; 16 USC 470 et seq.; 36 CFR 800), as amended (NHPA)	Requires Federal agencies to consider the effects of any actions or programs on historical properties.	Cultural resources identified in the project area have been identified and will be protected. The Service will continue to comply with this Act under the CCP.
Biological Resources Regulations		
Endangered Species Act of 1973 (16 USC 1531 et seq.), as amended (ESA)	Provides for protection of plants, fish, and wildlife that have a designation as threatened or endangered.	An Intra-Service Section 7 has been completed with the Service and with NOAA-Fisheries for endangered and threatened species on the Refuge.
National Environmental Policy Act of 1969 (42 USC 4321 et seq) (NEPA)	Requires analysis, public comment, and reporting for environmental impacts of Federal actions.	The public has been notified of the availability of the draft Environmental Assessment and had a 45-day period to provide comments.

Table 1. Applicable Laws and Executive Orders		
Law, Regulation, or Guideline	**Description**	**Relation to the CCP**
Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. Jan. 10, 2001.	Instructs Federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation Plans, the North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.	The Service has incorporated the strategies and recommendations of the listed management plans into the CCP to conserve migratory birds. The Service will continue to comply with this Order under the CCP.
Fish and Wildlife Conservation Act of 1980 (16 USC 661-667e), as amended	Requires the Service to monitor non-game bird species, identify species of management concern, and implement conservation measures to preclude the need for listing under ESA.	The Service will continue to comply with this Act under the CCP.
The Bald and Golden Eagle Protection Act of 1940 (16 USC 668 et seq.)	Provides protection for bald and golden eagles.	The Service will continue to comply with this Act under the CCP.
Migratory Bird Treaty Act of 1918, as amended (MBTA)	Provides protection for bird species that migrate across state and international boundaries.	The Service will continue to comply with this Act under the CCP.
The Clean Water Act of 1972, Section 404 (33 USC 1344 et seq.), as amended	Provides for protection of water quality.	The Service will continue to comply with this Act under the CCP.
Fish and Wildlife Act of 1956 (16 USC 742a-743j)	Provides Secretary of Interior with authority to protect and manage fish and wildlife resources.	The Service will continue to comply with this Act under the CCP.
Fish and Wildlife Coordination Act of 1958	Requires equal consideration and coordination of wildlife conservation with other water resource development programs.	The Service will continue to comply with this Act under the CCP.
Emergency Wetlands Resources Act of 1986	Promotes the conservation of migratory waterfowl and offsets or prevent the serious loss of wetlands by the acquisition of wetlands and other essential habitats.	The Service will continue to comply with this Act under the CCP.
Federal Noxious Weed Act of 1990	Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other Federal and State agencies.	The Service will continue to comply with this Act under the CCP.
Rivers and Harbor Act of 1899	Requires authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, and under a navigable water of the U.S.	The Service will continue to comply with this Act under the CCP.

Table 1. Applicable Laws and Executive Orders		
Law, Regulation, or Guideline	**Description**	**Relation to the CCP**
Hazardous Materials Regulations		
Oil Pollution Act of 1990 (PL 101-380; 33 USC 2701, et seq.)	Provides oil pollution policies and protections.	The Service will continue to comply with this Act under the CCP.
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (PL 96-510; 42 USC 9601, et seq.) (CERCLA)	Provides mechanism for hazardous waste clean up.	No evidence of contaminants or hazardous waste was identified in the project area.
Land and Water Use Regulations		
The National Wildlife Refuge System Administration Act of 1966 (16 USC 668dd-668ee), National Wildlife Refuge System Improvement Act of 1997 (PL 105-57)	Administration, management, and planning for National Wildlife Refuges, Amends the National Wildlife Refuge System Administration Act of 1966. Requires development of CCPs for all refuges outside of Alaska.	The Service determined that hunting, fishing, wildlife observation, photography, environmental education, interpretation, research, camping and recreational boating, farming, grazing, and mosquito and other vector control are compatible with the purposes for which the refuge was established. This document will satisfy this Act.
Executive Order No. 11988, Floodplain Management	Provides for the support, preservation, and enhancement of the natural and beneficial values of floodplains.	No structure that could either be damaged by or significantly influence the movement of floodwater in the project area is planned for construction by the Service, thus the proposed action is consistent with this Order.
Executive Order No. 11990, Protection of Wetlands	Provides for the conservation of the natural and beneficial values of wetlands and their associated habitats.	The Service plans no detrimental impacts to wetlands but plans to preserve wetlands in the project area, thus the proposed action is consistent with this Order.
The Refuge Recreation Act of 1962, as amended	Provides for recreation use that is compatible with the primary purpose of a refuge.	The Service determined that recreation including hunting, fishing, wildlife observation, photography, environmental education, interpretation, and camping and recreational boating are compatible with the purposes for which the refuge was established.

Table 1. Applicable Laws and Executive Orders		
Law, Regulation, or Guideline	**Description**	**Relation to the CCP**
Fish and Wildlife Improvement Act of 1978	Improves administration of fish and wildlife programs and amends earlier laws including Refuge Recreation Act, NWRS Administration Act, and Fish and Wildlife Act of 1956. Authorizes the Secretary to accept gifts or real and personal property on behalf of the U.S. Also authorizes use of volunteers on Service projects and appropriations to carry out a volunteer program.	The Service will continue to comply with this Act under the CCP.

2.0 Fish and Wildlife Service Plans, Policies and Programs

Sacramento River Refuge is managed as part of the National Wildlife Refuge System within a framework provided by legal and policy guidelines reviewed in Chapter 1 of this CCP. The role of the Service is introduced in Chapter 1, as well as the mission of the National Wildlife Refuge System. The Service's policies on Compatibility, Planning, and Biological Integrity, Diversity, and Environmental Health mandated by the National Wildlife Refuge System Improvement Act of 1977 are also discusses in Chapter 1, which also provides a general overview of regulatory context. The Comprehensive Conservation Planning process is discussed in Chapter 2.

The Service is actively involved in the development and implementation of a number of conservation plans for migratory bird species, including the Partners in Flight North American Landbird Conservation Plan, North American Waterfowl Management Plan, United States Shorebird Conservation Plan, and the North American Waterbird Conservation Management Plan. Regional step-down plans specific to the Sacramento River area are discussed below.

2.1 North American Waterfowl Management Plan

The North American Waterfowl Management Plan documents the strategy between the United States, Canada and Mexico to restore waterfowl populations through habitat protection, restoration and enhancement. Implementation of the plan is at the regional level. The Sacramento River NWR is covered by the Central Valley Joint Venture. The Central Valley, from Red Bluff in the north to Bakersfield in the south, is the single most important waterfowl wintering area in the Pacific Flyway, supporting 60 percent of all the total migrating population. Hundreds of thousands of wintering and breeding shorebirds and a host of other migratory and resident birds also depend on the wetland and agricultural resources of this region for survival. The Central Valley Joint Venture is currently in the process of updating its implementation plan, and will include goals for the conservation of breeding and wintering waterfowl, breeding and wintering shorebirds, grassland and riparian birds, and other waterbirds. The Joint Venture is currently in the process of updating its implementation plan, and will include goals for the conservation of

breeding and wintering waterfowl, breeding and wintering shorebirds, grassland and riparian birds, and other waterbirds.

North American Waterfowl Management Plan Goals (1998 Update)

- Enhance the capability of landscapes to support waterfowl and other wetland-associated species by ensuring that Plan implementation is guided by biologically based planning, which in turn is refined through ongoing evaluation.
- Define the landscape conditions needed to sustain waterfowl and benefit other wetland-associated species, and participate in the development of conservation, economic, management, and social policies and programs that most affect the ecological health of these landscapes.
- Collaborate with other conservation efforts, particularly migratory bird initiatives, and reach out to other sectors and communities to forge broader alliances in a collective search for sustainable uses of landscapes.
- Maintain the current diversity of duck species throughout North America and achieve a continental breeding population of 62 million ducks during years with average environmental conditions, which would support a fall flight of 100 million.
- Increase or reduce goose populations to sustainable levels listed in Appendix 1.
- Reduce Western tundra swan population to 60,000, and increase Pacific Coast trumpeter swan population to 43,200.
- In the Central Valley Habitat Joint Venture Area, protect 80,000 acres, restore 120,000 acres, and enhance 735,000 acres.

Central Valley Habitat Joint Venture Implementation Plan Goals (1990)

- Protect, maintain, improve, and restore habitat to increase waterfowl populations to desired levels in the Central Valley of California consistent with other objectives of the NAWMP.
- Protect 80,000 additional acres of existing wetlands through acquisition of fee-title or perpetual conservation easements.
- Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by the NWR's, State WA's, and the GRCD.
- Secure CVP power for NWR's, State WA's, GRCD, and other public land private lands dedicated to wetland management.
- Increase wetland areas by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easements.
- Enhance waterfowl wetland habitats on 291,555 acres of public and private lands.
- Enhance waterfowl habitat on 443,000 acres of agricultural lands.
- Increase waterfowl populations to desired levels: total ducks (breeding: 400,000; mallard (breeding): 300,000; total ducks (winter): 4,700,000; mallard (winter): 531,000; pintail (winter): 2,800,000; total geese and swans: 875,000; cackling Canada: 200,000; Aleutian Canada: 5,000; Lesser snow: 320,000; Ross': 100,000; tule white-fronted: 5,000; Pacific white-fronted: 200,000; tundra swan: 40,000.

2.2 Partners in Flight Bird Conservation Plan

North American Landbird Conservation Plan (Rich et. al 2004) summarizes geographic and habitat priorities for 449 species of landbirds across the continent. This plan includes, for the first time anywhere, estimates of continental population sizes and future population objectives for all landbirds. This plan will not replace Bird Conservation Plans, but rather will initiate a new round of dialogue on population and habitat objectives at continental, national, regional, state and local levels. The highest priority birds (102 species) constitute the new PIF Watch List. Also included in the plan is a list of characteristic species which include species that may not be rare or declining but which are integral to the biotic integrity of large habitats or regions. These species, along with the Watch List species, are addressed as species suites in the plan. PIF's objective is to help land managers use the PIF plans, along with those from other bird initiatives, to undertake effective habitat conservation actions in the proper geographic context in North America.

The California Partners in Flight (CalPIF) began in 1992 to promote the conservation of resident and migratory landbirds and their habitats in California through research, monitoring, education, and collaboration among public and private landowners and managers, government agencies, non-government organizations, and individuals and other bird conservation efforts. The California Partners in Flight program has completed six habitat and bioregion based Bird Conservation Plans (BCP's) for Riparian, Oak Woodlands, Coastal Scrub and Chaparral, Grasslands, Coniferous Forests, and the Sierra Nevada Bioregion. A Shrub steppe Plan is currently in review and a Desert Plan is in development.

CalPIF initiated the Riparian Habitat Joint Venture (RHJV) project in 1994. The goal of the RHJV is to conserve, increase, and improve riparian habitat in order to protect and enhance California's native resident birds and Neotropical migratory birds. The Riparian Bird Conservation Plan (RHJV 2004) emphasizes a suite of 17 bird species chosen because of their conservation interest and as focal species representative of riparian habitats in the state. This Conservation Plan focuses on data concerning bird species associated with riparian habitat, but conservation recommendations, if implemented, should benefit many riparian associated species.

The six objectives of the RHJV are: (1) Compile existing information on riparian habitat throughout the state to identify key riparian areas, as well as information gaps. Promote and coordinate efforts to obtain the information. (2) Develop guidelines for the protection of existing riparian habitat on public lands and recommend alternatives for protection of habitat on private lands. (3) Restore riparian habitat on public and private lands using commonly accepted, scientifically valid restoration techniques. (4) Enhance the productivity and biodiversity of riparian communities using appropriate management techniques. (5) Establish a network of high-quality riparian habitats throughout California to enhance and protect native birds. (6) Educate the general public and resource managers about the status and value of California's riparian habitat.

Riparian Bird Conservation Plan (2004) (California Partners in Flight and the Riparian Habitat Joint Venture)

- Increase the breeding range of native birds and safeguard healthy bird communities with high productivity.
- Maximize riparian ecosystem health, promote a self-sustaining functioning system, and maximize the cost-effectiveness of riparian conservation activities.
- Increase the overall breeding range and/or abundance of native riparian birds by designing and implementing horticultural restoration projects that mimic natural riparian plant diversity and "patchiness". Such plantings will most quickly support a diverse community of bird species that can successfully nest in the restored habitat.
- Increase the value of existing/ongoing habitat and restoration projects for bird species.
- Ensure that large landscape-scale management and flood control projects maximize benefits to wildlife in conjunction with benefits to agriculture and urban populations. Achieving numerous goals simultaneously would maximize the overall value of such projects to the people of California.
- Implement and time land-management activities with the goal of maximizing bird species productivity or "source" populations.
- Protect, recreate, or minimize interruptions of natural processes, particularly hydrology and associated high-water events to allow/promote/facilitate the natural cycle of channel movement, sediment deposition, and scouring that results in a diverse mosaic of riparian vegetation classes.

2.3 United States Shorebird Conservation Plan

The United States Shorebird Conservation Plan was developed through a partnership effort by State and Federal agencies, non-government organizations (NGOs), academic institutions, and individuals committed to restoring and maintaining stable shorebird populations in the U.S. and throughout the Western Hemisphere (Brown et al. 2000). The Southern Pacific Coast Regional Shorebird Management Plan (Hickey et. al 2003) establishes regional goals and objectives for western California Coast and Central Valley. Important shorebird habitats identified under this plan in the Central Valley include managed wetlands, agricultural fields and vernal pool rangelands.

Southern Pacific Coast Regional Shorebird Plan (2003)

- Increase the wintering population of the Mountain Plover in the Central Valley. Create suitable open foraging habitat by managing for giant kangaroo rats (*Dipodomys ingens*) and using fire and grazing, as appropriate.
- Increase populations of breeding and wintering Snowy Plovers and wintering Long-billed Curlews in the Central Valley.
- Increase breeding and wintering populations of other shorebirds in the Central Valley.
- Restore, enhance, and manage wetlands with integrated wetland management goals, which accommodate the needs of a greater diversity of birds, including shorebirds.
- Ensure the availability of high quality water for wetlands.
- Resist fragmentation or loss of existing wetland complexes by urban encroachment.
- Promote management practices in agricultural lands and vernal pool rangelands that will provide for a greater diversity of birds, including shorebirds. Also promote easements and other options for maintaining wildlife-friendly agricultural lands and vernal pool rangelands.
- Reduce use of contaminated agricultural evaporation ponds by shorebirds and other waterbirds while creating alternative uncontaminated habitats that will mimic historic saline playa wetlands thereby maintaining the current mix of waterbird communities.
- Increase shorebird use of sewage ponds or wetlands using treated sewage effluent if issues of disease transmission and contaminants can be addressed.

2.4 North American Waterbird Conservation Plan (2002)

North American Waterbird Conservation Plan (NAWCP) provides an overarching continental framework and guide for conserving waterbirds. It sets forth goals and priorities for waterbirds in all habitats from the Canadian Arctic to Panama, from Bermuda through the U.S. Pacific Islands, at nesting sites, during annual migrations, and during non-breeding periods. It advocates continent-wide monitoring; provides an impetus for regional conservation planning; proposes national, state, provincial and other local conservation planning and action; and gives a larger context for local habitat protection.

The vision of the NAWCP is the distribution, diversity, and abundance of breeding, migratory, and non-breeding waterbirds are sustained or restored throughout the lands of North America, Central American, and the Caribbean. Four goals were established in the plan (Kushlan et. al 2002) to accomplish this vision (1) species and population goal, (2) habitat goal, (3) education and information goal, and (4) coordination and integration goal. A regional step-down plan for Pacific Coast will focus on key species and habitats and develop specific goals and objectives for management, monitoring, research and outreach.

Species and Population Strategies

- Determine population status for all species of waterbirds throughout North America, Central America, and the Caribbean.
- Institute a large scale, dispersed, partnership-based population monitoring system.
- Initiate monitoring of demography, habitats, wintering range, and important threats, such as seabird bycatch, as appropriate for species and areas.
- Develop analytical tools and analytical schemes to determine and assess population trends against trend thresholds for each species.
- Define sustainable population goals for all species, at regional scales as possible and as needed, and eventually at the continental scale.
- Determine the extent and root causes of public perception of waterbirds, particularly locally abundant species, and develop programs that help bring public perception in line with scientific and economic findings.
- Energize JVs and agencies to take responsibility for setting and achieving population goals through appropriate management.
- Develop a global perspective on populations to aid in interpretation of population trends.
- Synthesize information to identify key factors affecting populations in order to take appropriate conservation action.

Habitat Strategies

- Identify key marine, freshwater, and terrestrial habitats for waterbirds, including breeding, wintering, migratory, roosting, and foraging habitats.
- Implement conservation and management actions that secure important habitats.
- Increase understanding of waterbird habitat requirements, threats to habitat quality, and habitat interaction at different scales.
- Develop and implement habitat management plans for waterbirds for each planning unit.
- Identify, inventory and document key sites that potentially qualify as global, continental, national, or state IBAs and other key sites for waterbirds.
- Refine and continually update the list and description of IBAs for waterbirds.

Education and Information Strategies

- Ensure that information on waterbird conservation is available in a form that is useful for planning, implementation, and management purposes.
- Increase effectiveness of communication by partnering with outreach activities for other birds and for other environmental programs.
- Develop relationships with educators of all levels and participate in programs that increase awareness and improve education.
- Develop and widely distribute educational information on habitat conservation strategies.
- Work with users of waterbird habitats to promote practices and policies that reduce impacts on the birds.

Coordination and Integration Strategies

- Establish cooperative actions with organizations concerned with the conservation, research, and management of waterbirds and their habitats.
- Establish cooperative actions with other bird conservation initiatives, particularly through common goal setting, and multi-species approaches such as advocated by NABCI.
- Establish cooperative linkages with other bird conservation initiatives concerned with aquatic habitats.
- When initiatives for other aquatic bird groups are not underway, catalyze simultaneous planning and conservation of all water-dependent bird species.
- Seek to achieve integrated bird conservation action that incorporates the needs of waterbirds.
- Exchange information and expertise with international, national, regional state/provincial and local partners, and establish networks between conservationists, scientists, and habitat managers.
- Develop waterbird plans, where appropriate, at national, regional, JV, and state/provincial levels.
- Influence environmental policies and programs to positively affect waterbird conservation.
- Participate in international programs in ways that enhance the conservation of waterbirds.
- Increase human and financial resources available for waterbird conservation.

2.5 USFWS/CDFG Tricolored Blackbird Status Update and Management Guidelines (from Beedy, E.C. and W.J. Hamilton 1997. Tricolored Blackbird Status Update and Management Guidelines. Jones and Stokes, Inc. 97-009. Sacramento, CA. Prepared for USFWS and CDFG.)

- Maintain viable, self-sustaining populations distributed throughout the current range of the species.
- Avoid losses of tricolor colonies and their reproductive effort throughout their range.
- Increase the breeding opportunities on suitable public lands and on private lands managed for this species.
- Enhance public awareness and support for protection of this unique species.
- Minimize losses of important foraging habitat for both nesting and wintering populations.

2.6 Pacific Flyway Management Plan: Western Management Unit Mourning Dove Goals and Objectives (1992)

- Maintain the Western Management Unit (WMU) population of mourning doves and its habitat at levels consistent with optimum distribution, density, and recreational uses of the resources.
- Determine the causes of mourning dove population declines in the (WMU) and establish procedures to reverse the trends.

- Increase the population levels of WMU mourning doves to a point where call-count indices average no less than 16 in the Coastal subunit.
- Increase and maintain adequate habitat to sustain the current seasonal distribution of WMU mourning doves throughout their range. The important habitat components are appropriate structures for nesting and roosting (trees), and food and water sources.
- Maximize the potential for sustained consumptive and non-consumptive uses of the mourning dove resource in the WMU.

2.7 Anadromous Fish Restoration Program

The Central Valley Project Improvement Act (CVPIA) was signed into law in 1992. The CVPIA directed the Secretary of the Interior to amend previous authorizations of California's Central Valley Project to: "include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic use and fish and wildlife enhancement as a project purpose equal to power generation." Section 3406(b)(1) of the CVPIA directs the Secretary of the Interior to develop and implement a program that makes all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley streams on a long-term, sustainable basis.

The major resulting program is known as the Anadromous Fish Restoration Program. The goal of the AFRP, is concurrent to section 3406(b)(1) of the CVPIA, to: "develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991." Since 1995, the AFRP has helped implement over 195 projects to restore natural production of anadromous fish.

Six general objectives need to be met to achieve this program goal:

- Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat;
- Improve survival rates by reducing or eliminating entrainment of juveniles at diversions;
- Improve the opportunity for adult fish to reach their spawning habitats in a timely manner;
- Collect fish population, health, and habitat data to facilitate evaluation of restoration actions;
- Integrate habitat restoration efforts with harvest and hatchery management;
- Involve partners in the implementation and evaluation of restoration actions.

2.8 California Bay-Delta Program

Established in May 1995, the California Bay-Delta Program (CALFED) is a cooperative effort of federal and state agencies working with local communities to improve the quality and reliability of California's water supplies and revive the San Francisco Bay-Delta

ecosystem. CALFED's mission is to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. The California Bay-Delta Plan (2000) is a balanced, comprehensive approach to reduce conflicts over limited water supplies and to address the Program's four objectives (water supply reliability, ecosystem restoration/watershed management, water quality, levee system integrity) through 11 major program elements (water management, storage, conveyance, water use efficiency, water transfers, environmental water account, drinking water quality, watershed management, levee system integrity, ecosystem restoration and science).

The California Bay-Delta Authority (CBDA) is a state agency created by the California Legislature to oversee implementation of the CALFED Program (California Bay-Delta Act of 2003). The CBDA oversees the 23 state and federal agencies working cooperatively through the CALFED Bay-Delta Program to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem.

CALFED Ecosystem Restoration Program

- Improve aquatic and terrestrial habitats and natural processes to support stable, self-sustaining populations of diverse and valuable plant and animal species, and includes recovery of species listed under the State and Federal Endangered Species Acts.
- Protect or restore functional habitat types throughout the watershed for public values such as recreation, scientific research, and aesthetics.
- Prevent establishment of additional non-native species and reduce the negative biological and economic impacts of established non-native species.
- Improve and maintain water and sediment quality to eliminate, to the extent possible, toxic impacts on organisms in the system, including humans.

3.0 State of California

3.1 Comprehensive Management Plan for the Sacramento River Wildlife Area (2004)
The existing Sacramento River Wildlife Area is located within Colusa, Glenn, and Butte Counties. It is part of the Department's Sacramento Valley - Central Sierra Region (SVCSR). The Sacramento River Wildlife Area is composed of thirteen physically separate Units that extend from River Mile 145 (RM 145) just north of the City of Colusa, upstream to RM 215 which is three miles south of Woodson Bridge.

The expressed purposes of this Plan are as follows:

- To guide the management of habitats, species, appropriate public use and programs to achieve the Department's mission: "To manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public."

- To direct an Ecosystem Approach to the management of the Wildlife Area in coordination with the principles of the Sacramento River Conservation Area Forum and the objectives of the California Bay- Delta Program.
- To identify appropriate public use opportunities within the Wildlife Area.
- To direct the coordination of efforts and resources with the managers of other public and private conservation lands adjacent to the Wildlife Area in order to maximize the benefits of the ecosystem for fish, wildlife and native plants and to facilitate public education and interaction with the natural environment.
- To direct the management of the Wildlife Area in a manner that promotes cooperative relationships with adjoining private property owners.
- To establish a descriptive inventory of the sites and the wildlife and plant resources that occur in the Wildlife Area.
- To provide an overview of the Wildlife Area's operation, maintenance and personnel requirements to implement management goals. It serves as a budget planning aid for annual regional budget preparation.
- To provide an overview of the potential and actual environmental impacts and subsequent mitigations that may occur during management, and environmental documentation to comply with State and federal statutes and regulations.

3.2 Sacramento River Conservation Area Forum

Sacramento River from its confluence with the Feather River, near Verona (RM 80), to Keswick Dam, just north of Redding (RM 302). The SRCA includes land in Shasta, Tehama, Butte, Glenn, Colusa, Sutter and Yolo Counties. The SRCA is an outgrowth of an effort initiated through State Senate Bill 1086 in 1986. That legislation created an Advisory Council that completed the *Upper Sacramento River Fisheries and Riparian Habitat Management Plan* in 1989. The State Legislature received that *Plan* and directed its implementation through Senate Concurrent Resolution No.62 in 1989. Subsequent to the resolution and related actions, DWR developed the initial SRGIS. The Riparian Habitat Committee of the Advisory Council also conducted an extensive public process that resulted in the completion of the *Sacramento River Conservation Area Handbook* in 1999. The *Handbook* is an important document that established Basic Principles and management Guidelines for the SRCA. The *Handbook* specifies the overall Goal for the SCRA: Preserve remaining riparian habitat and reestablish a continuous riparian ecosystem along the Sacramento River between Redding and Chico and reestablish riparian vegetation along the river from Chico to Verona.

4.0 County

The Sacramento River Refuge includes parts of Colusa, Glenn, Butte and Tehama Counties. Each county is a multi-purpose government structure directed by an elected Board of Supervisors. There are also numerous special districts within each county, which are limited-purpose governmental agencies, such as fire districts, mosquito and vector control districts, irrigation districts and reclamation districts. Local land use policies are established in the general plans of each county, which are adopted by the respective

Boards of Supervisors. The four counties' general plans designate the areas adjacent to the Sacramento River for agriculture and floodway related land uses as follows:

- **Tehama County** - The Refuge is entirely within the "Habitat Reserve" land use designation and the "Primary Floodway" Zoning District. The land use policies of the County General Plan are supportive of the preservation of agriculture and there are also policies regarding conservation of habitat and Special Status Species.
- **Butte County** - The Refuge is entirely within the "Agricultural" land use designation and agricultural zoning districts. The land use policies of the County General Plan are strongly directed to the preservation of agriculture and there is also policy regarding the protection of Special Status Species.
- **Glenn County** - The Refuge is entirely within the "Intensive Agriculture" Land use designation and the "AE – 40" Zoning District. The General Plan is primarily directed to the support of agricultural use in the rural area and there is also a policy specifying early consultation for projects involving Wildlife Management Agencies.
- **Colusa County** - The Refuge is entirely within the "Floodway" land use designation and the "Floodway" zoning district. The land use policies of the County General Plan are primarily directed to the support of agricultural use in the rural area and there are also policies regarding the value of natural resources.

The local land use polices of Butte, Glenn, Tehama and Colusa counties that relate to management of the Sacramento River Refuge are summarized in the Table 2 below.

Table 2. Summary of Local Land Use Policies that relate to Refuge Management.

County	Category	Land Use Policy
Butte County General Plan (Butte County Planning Department 1991)	Agricultural and Crop Land	Policy b. Retain in an agricultural designation on the Land Use Map areas where location, natural conditions and water availability make lands well suited to orchard and field crop use, while considering for non-agricultural use areas where urban encroachment has made inroads into agricultural areas and where past official actions have planned areas for development.
Butte County General Plan (Butte County Planning Department 1991)	Biological Habitat	Policy b. Prevent development and site clearance other than river bank protection of marshes and significant riparian habitats. Policy d. Regulate development to facilitate survival of identified rare and endangered plants and animals.
Butte County General Plan (Butte County Planning Department 1991)	Natural Areas	Policy a. Encourage the creation and expansion of natural and wilderness areas.

Table 2. Summary of Local Land Use Policies that relate to Refuge Management.		
County	**Category**	**Land Use Policy**
Glenn County General Plan (QUAD Consultants 1993)	5.1.1 Agriculture/ Soils	As the most extensive land use in the county, agriculture constitutes a significant component of the local economy. Agricultural land also provides valuable open space and important wildlife habitat. It is important that the County take steps to preserve its agricultural land from both economic and environmental perspectives. ...Converting prime agricultural land to non-agricultural uses is considered an irreversible loss of resources. ...With the primary goal being that of preserving the county's valuable agricultural resources, a variety of preservation tools can be used.... Policy NRP-1. Maintain agriculture as a primary, extensive land use, not only in recognition of the economic importance of agriculture, but also in terms of agriculture's contribution to the preservation of open space and wildlife habitat.
Glenn County General Plan (QUAD Consultants 1993)	5.3.1 Land Use/Growth	Agriculture is the single most important component of the county's economic base, protection of agricultural land is of great importance. Land use patterns, goals and policies have been established which promote agricultural land preservation and protect these lands from urban encroachment. ...It is the intent of the County to promote orderly growth by directing new growth into areas where it can be accommodated and served adequately, and to avoid potential land use conflicts through the appropriate distribution and regulation of land uses. Only compatible uses will be encouraged in agricultural areas; compatible uses are defined as those uses capable of existing together without conflict or ill effect.
Glenn County General Plan (QUAD Consultants 1993)	6.7 Coordination with Wildlife and Land Management Agencies	For all projects, with the exception of those associated with sites low in wildlife value, early consultation with wildlife agencies should occur.
Tehama County General Plan (Tehama County 1983)		Preservation of Tehama County's agricultural resources was identified as a key objective in the General Plan....The basic concept of the General Plan is the resolution of the inherent conflict between agricultural and non-agricultural uses....The Plan also contains other policies designed to prevent the piecemeal conversion of agricultural lands to other uses and to create a climate of public understanding in Tehama County which is supportive of agriculture.
Tehama County General Plan (Tehama County 1983)	Agricultural Preserve Lands	Objective AG-3. Protection of agricultural lands, whenever possible, from non-agricultural development through separation by natural buffers and land use transition areas that mitigate or prevent land use conflicts. Objective AG-4. Protection of agricultural lands from development pressures or uses which will adversely impact or hinder existing or foreseeable agricultural operations.

Table 2. Summary of Local Land Use Policies that relate to Refuge Management.		
County	**Category**	**Land Use Policy**
Tehama County General Plan (Tehama County 1983)	Wildlife Resources	Objective WR-1. Preserve environmentally sensitive and significant lands and water valuable for their plant and wildlife habitat, natural appearance and character. Objective WR-2. Afford. To the extent feasible, adequate protection to areas identified by the California Department of Fish and Game and the California Natural Diversity Data Base as critical riparian zones. Objective WR-3. Support and coordinate County plans with interjurisdictional programs for the proper management of riparian resources in the County.
Tehama County General Plan (Tehama County 1983)	Natural Resource Lands and Recreation	Objective NRR-1. Protection of resource lands for the continued benefit of agriculture, timber, grazing, recreation, wildlife habitat, and quality of life.
Integrated Resources Management Program for Flood Control in the Colusa Basin, (Colusa Basin Drainage District and U.S. Bureau of Reclamation 2000)		The unincorporated communities within Colusa County include Arbuckle, College City, Grimes, Maxwell, Princeton, and Stonyford. Incorporated cities in Colusa County include Colusa and Williams. The county also contains small settlement areas with permanent populations of less than 100 people. Land uses in Colusa County are typical of the rural counties of California. The eastern half of the county is dominated by large farms with much of the privately owned land following square-mile section lines. This portion of the county is relatively flat and use for the cultivation of rice, orchards, and row crops. The western half of the county contains the Coastal Range foothills, which are often used as rangeland.
Colusa County General Plan (Colusa County 1989)		The majority of rangeland and general agriculture," "orchards," national wildlife refuge," and undeveloped bottomlands. The westernmost portion of the county contains areas of the Mendocino National Forest. In general, the eastern half of the county is designated "general agriculture" and the majority of the western half is designated either "national forest land" or "rangeland."
Colusa County Interim Farmland 1996" (California Department of Conservation 1998)		"Current land use within the eastern one-half of Colusa County is primarily "irrigated farmland" with small pockets of "non-irrigated farmland," "urban and built-up land", and "other land" (primarily wildlife preservation areas). The central area of the county consists primarily of "non-irrigated farmland" and the westernmost section of the county is primarily "other land" (i.e., Mendocino National Forest). Water bodies in the county include Funks Reservoir and East Park Reservoir, which are located in the northern and western centers respectively.

Appendix N. Referenced Tables from the Sacramento River Public Recreation Access Study (EDAW 2003).

Table 4.1-1. Study Area Counties

Local Area	Regional Area		
Local Counties	**Adjacent Counties**	**SACOG Area Counties**	**SF Bay/Delta Area Counties**
Butte	Lake	El Dorado	Alameda
Colusa	Mendocino	Placer	Contra Costa
Glenn	Plumas	Sacramento	Marin
Tehama	Shasta		Napa
	Sutter [1]		San Francisco
	Trinity		San Mateo
	Yolo [1]		Santa Clara
	Yuba [1]		Solano
			Sonoma

[1] Represents adjacent counties that are also part of the SACOG region.
Source: EDAW 2003

Table 4.1-2. Demographic Profile of the Study Area Residents

County	Population (2001) [1]	Population (2002) [1] (% growth)	Median Age (2000)[2]	M/F (2000) [2]	% White (2000) [3,4]	% Hispanic/ Latino (2000) [3,5]	Median HH Income (1999) [3]
Butte	205,400	207,000 (0.8%)	35.8	49.0 / 51.0	84.5	10.5	31,924
Colusa	19,150	19,450 (1.6%)	31.5	50.8 / 49.2	64.3	46.5	35,062
Glenn	26,800	26,800 (0.0%)	33.7	50.5 / 49.5	71.8	29.6	32,107
Tehama	56,100	56,900 (1.4%)	37.8	49.4 / 50.6	84.8	15.8	31,206
Local Sub-Total	307,450	310,150 (0.9%)	--	--	--	--	--
Alameda	1,462,900	1,486,600 (1.6%)	34.5	49.1 / 50.9	48.8	19.0	55,946
Contra Costa	965,100	981,600 (1.7%)	36.4	48.8 / 51.2	65.5	17.7	63,675
El Dorado	161,600	163,600 (1.2%)	39.4	49.9 / 50.1	89.7	9.3	51,484
Lake	59,500	60,300 (1.3%)	42.7	49.4 / 50.6	86.2	11.4	29,627
Marin	248,100	249,900 (0.7%)	41.3	49.5 / 50.5	84.0	11.1	71,306
Mendocino	87,100	87,700 (0.7%)	38.9	49.7 / 50.3	80.8	16.5	35,996
Napa	126,600	128,000 (1.1%)	38.3	49.9 / 50.1	80.0	23.7	51,738
Placer	254,900	264,900 (3.9%)	38.0	49.1 / 50.9	88.6	9.7	57,535
Plumas	20,850	21,000 (0.7%)	44.2	49.9 / 50.1	91.8	5.7	36,351
Sacramento	1,247,800	1,279,900 (2.6%)	33.8	49.0 / 51.0	64.0	16.0	43,816
San Francisco	785,700	793,600 (1.0%)	36.5	50.8 / 49.2	49.7	14.1	55,221
San Mateo	712,400	717,000 (0.6%)	36.8	49.4 / 50.6	59.5	21.9	70,819
Santa Clara	1,697,800	1,719,600 (1.3%)	34.0	50.7 / 49.3	53.8	24.0	74,335
Shasta	166,700	169,200 (1.5%)	38.9	48.7 / 51.3	89.3	5.5	34,335
Solano	398,600	405,800 (1.8%)	33.9	50.4 / 49.6	56.4	17.6	54,099
Sonoma	464,300	471,000 (1.4%)	37.5	49.2 / 50.8	81.6	17.3	53,076
Sutter	80,100	81,900 (2.2%)	34.1	49.5 / 50.5	67.5	22.2	38,375
Trinity	13,000	13,100 (0.8%)	44.6	51.0 / 49.0	88.9	4.0	27,711
Yolo	171,800	176,300 (2.6%)	29.5	48.9 / 51.1	67.7	25.9	40,769
Yuba	60,900	61,000 (0.2%)	31.4	50.4 / 49.6	70.6	17.4	30,460
Regional Sub-Total	9,185,750	9,332,000 (1.6%)	--	--	--	--	--
TOTAL	9,493,200	9,642,150 (1.6%)	--	--	--	--	--

[1] DOF – Table E-1 (rounded); as of January 1, 2001/2002
[2] DOF – Table E-5a (not rounded); as of January 2002
[3] 2000 Census Data, U.S. Census Bureau 2002
[4] Caucasian of any nationality. Therefore, a Caucasian born in a Latin American country may also be considered Latino and double counted by the Census Bureau in two categories.
[5] Represents individuals of Hispanic or Latino origin of any race; therefore, can include Caucasians, Asians, etc.
Source: EDAW 2003

Table 4.1-7. Population Projections for the Study Area Counties

	Year				
County	**2002 [1]**	**2005 [2]**	**2010 [2]**	**2015 [2]**	**2020 [2]**
Butte	207,000 (0.8%)	235,000 (4.3%)	259,800 (2.0%)	281,200 (1.6%)	308,900 (1.9%)
Colusa	19,450 (1.6%)	24,200 (7.5%)[3]	29,200 (3.8%)[3]	33,900 (3.0%)[3]	39,200 (2.9%)[3]
Glenn	26,800 (0.0%)	31,800 (5.8%)	36,700 (2.9%)	41,300 (2.4%)	46,500 (2.4%)
Tehama	56,900 (1.4%)	56,700 (-0.1%)	71,500 (4.7%)	78,200 (1.8%)	85,100 (1.7%)
Sub-Total	310,150	347,700 (3.9%)	397,200 (2.7%)	434,600 (1.8%)	479,700 (2.0%)
Alameda	1,486,600	1,580,200 (2.1%)	1,671,200 (1.1%)	1,735,800 (0.8%)	1,811,800 (0.9%)
Contra Costa	981,600	1,021,400 (1.3%)	1,071,400 (1.0%)	1,108,100 (0.7%)	1,152,900 (0.8%)
El Dorado	163,600	187,000 (4.6%)	212,000 (2.5%)	232,900 (1.9%)	252,900 (1.7%)
Lake	60,300	69,200 (4.7%)	77,600 (2.3%)	84,400 (1.7%)	93,000 (2.0%)
Marin	249,900	257,600 (1.0%)	263,500 (0.5%)	267,300 (0.3%)	273,800 (0.5%)
Mendocino	87,700	95,500 (2.9%)	103,200 (1.6%)	109,700 (1.2%)	116,700 (1.2%)
Napa	128,000	135,700 (2.0%)	143,900 (1.2%)	150,500 (0.9%)	158,400 (1.0%)
Placer	264,900	298,500 (4.1%)	339,300 (2.6%)	373,400 (1.9%)	406,900 (1.7%)
Plumas	21,000	21,900 (1.4%)	22,700 (0.7%)	23,100 (0.3%)	23,500 (0.3%)
Sacramento	1,279,900	1,368,500 (2.3%)	1,486,500 (1.7%)	1,591,100 (1.4%)	1,707,600 (1.4%)
San Francisco	793,600	793,500 (0.0%)	787,500 (-0.2%)	765,900 (-0.6%)	755,800 (-0.3%)
San Mateo	717,000	765,800 (2.2%)	794,600 (0.7%)	809,100 (0.4%)	834,500 (0.6%)
Santa Clara	1,719,600	1,867,400 (2.8%)	1,987,800 (1.3%)	2,063,000 (0.7%)	2,163,000 (1.0%)
Shasta	169,200	185,700 (3.2%)	203,500 (1.8%)	217,500 (1.3%)	231,000 (1.2%)
Solano	405,800	444,100 (3.1%)	485,500 (1.8%)	521,200 (1.4%)	559,500 (1.4%)
Sonoma	471,000	514,200 (3.0%)	557,300 (1.6%)	591,900 (1.2%)	628,400 (1.2%)
Sutter	81,900	90,400 (3.3%)	99,600 (2.0%)	107,200 (1.5%)	115,600 (1.5%)
Trinity	13,100	13,800 (1.8%)	14,400 (0.9%)	15,000 (0.8%)	15,400 (0.5%)
Yolo	176,300	188,600 (2.3%)	205,000 (1.7%)	219,500 (1.4%)	236,400 (1.5%)
Yuba	61,000	66,000 (2.7%)	71,400 (1.6%)	76,300 (1.3%)	81,900 (1.4%)
Sub-Total	9,332,000	9,965,000 (2.2%)	10,597,900 (1.2%)	11,062,900 (0.9%)	11,619,000 (1.0%)
TOTAL	9,642,150	10,312,700 (2.3%)	10,995,100 (1.3%)	11,497,500 (0.9%)	12,098,700 (1.0%)

[1] DOF - Table E-1 (rounded); as of January 1, 2001/2002
[2] DOF; Interim County Population Projections
[3] Figures in parenthesis show average annual compound growth rate from the previous period
Source: EDAW 2003

Table 4.1-3. Age Characteristics of Outdoor Recreators in the Study Area

Study Area	Age Group (percent)					
	Less than 26 years	26-30 years	31-40 years	41-50 years	51-64 years	65 + years
Local Area	9.3	5.6	31.5	29.6	18.5	5.6
Regional Area	12.2	11.3	30.1	22.3	16.1	8.0
TOTAL	12.0	10.8	30.3	22.9	16.3	7.8

Source: DPR 1998

Table 4.1-4. Education Level Characteristics of Outdoor Recreators in the Study Area

Study Area	Education Level (percent)				
	Less than high school	High school graduate	Some college/trade school	College/trade school grad	Graduate degree or some graduate level education
Local Area	12.7	15.9	42.9	15.9	12.7
Regional Area	4.8	16.6	30.8	31.8	16.0
TOTAL	5.5	16.5	31.8	30.5	15.8

Source: DPR 1997

Table 4.1-5. Race/Ethnic Background of Outdoor Recreators in the Study Area

Study Area	Ethnicity (percent)							
	Caucasian / White	Mexican-American	Other Hispanic	African-American	Asian	American Indian	Other	Mixed
Local Area	79.4	14.3	1.6	--	--	1.6	--	3.2
Regional Area	68.6	7.0	2.1	4.5	4.3	1.0	3.5	8.9
TOTAL	69.5	7.7	2.0	4.2	3.9	1.1	3.2	8.5

Source: CIC 1997

Table 4.1-6. Household Income Characteristics of Outdoor Recreators in the Study Area

Study Area	Income Level (percent)					
	Under $20,000	$20,000 to $29,999	$30,000 to $39,999	$40,000 to $49,999	$50,000 to $74,999	$75,000 or more
Local Area	30.2	20.8	18.9	13.2	13.2	3.8
Regional Area	16.5	11.5	13.3	13.1	21.7	24.0
TOTAL	17.6	12.3	13.7	13.1	20.9	22.3

Source: DPR 1997

Table 4.2-1. 1980 Study Participants Activity Participation Reports

Activities Reported in Survey	River Section in 1980 DWR Study			Total %
	Diversion Dam to Hamilton City Bridge %	Hamilton City Bridge to Chico Landing %	Chico Landing to Meridian Bridge %	
Relaxing	53	42	52	49
Fishing	46	45	50	47
Power boating	19	19	63	34
Camping	42	0	48	30
Canoeing	54	3	13	23
Tubing	27	15	24	22
Swimming/beach use	38	0	29	22
Picnicking	14	13	18	15
Special events	13	11	0	8
Sightseeing	0	0	12	4

Source: DWR 1982

Table 4.2-2. 1980 DWR Study Participants' Trip Characteristics

Trip Characteristics	River Section in 1980 DWR Study		
	Diversion Dam to Hamilton City Bridge %	Hamilton City Bridge to Chico Landing %	Chico Landing to Meridian Bridge %
Sacramento River is destination	77	90	81
On trip in route elsewhere	13	4	15
Staying nearby	20	6	4

Source: DWR 1982

Table 4.2-3. 1980 DWR Study – Overnight vs. Day Use

Overnight Stay vs. Day Use	River Section in 1980 DWR Study		
	Diversion Dam to Hamilton City Bridge %	Hamilton City Bridge to Chico Landing %	Chico Landing to Meridian Bridge %
Overnight	48	9	48
Day use	52	91	52

Source: DWR 1982

Table 4.2-4. 1980 DWR Study Participants' Reports of Length of Stay in Sacramento River Area

Length of Stay	River Section in 1980 DWR Study		
	Diversion Dam to Hamilton City Bridge	Hamilton City Bridge to Chico Landing	Chico Landing to Meridian Bridge
Average overnight stay (days)	3	4	3.7
Average length of day use (hours)	3.9	3.4	4.2

Source: DWR 1982

Table 4.2-5. Priority Public Uses in DPR 1997 Study

Activity	Percent Partic.	Rank	Activity	Percent Partic.	Rank
Walking (recreational)	90.1	1	**Power boating**	**24.7**	**22T**
Visiting museums, historic sites	81.5	2	Mountain biking (off paved surfaces)	22.4	24
Beach activities	75.5	3	Downhill skiing	21.9	25
Trail hiking	73.1	4	Golf	18.5	26
Driving for pleasure	72.1	5	Saltwater fishing	18.5	27
Picnicking at developed sites	**71.5**	**6**	Basketball	18.2	28
Use of open grass or turf areas	71.3	7	Water skiing	17.0	29
Visiting zoos and arboretums	70.7	8	Tennis	16.9	30
Attending outdoor cultural events	62.7	9	Skateboarding and rollerblading	14.8	31
Camping in developed sites (tent or RV)	**61.5**	**10**	4-Wheel drive use off paved roads	13.9	32
Swimming in lakes/rivers/ocean	**61.0**	**11**	Horseback riding	13.8	33
General nature study, wildlife viewing	**59.4**	**12**	Target shooting	13.8	34
Attending outdoor sports events	54.2	13	Mountain climbing	12.0	35
Swimming in outdoor pools	53.5	14	Soccer	11.4	36
Bicycling (on paved surfaces)	49.2	15	Cross-country skiing	9.9	37
Freshwater fishing	**39.8**	**16**	Football	8.6	38
Use of play equipment, tot-lots	37.2	17	**Hunting**	**8.0**	**39**
Camping–primitive areas & backpacking	**30.7**	**18**	Use of motorcycles, ATV's, off-road	7.7	40
Jogging and running	29.9	19	Sailboating and windsurfing	7.1	41
Softball and baseball	29.0	20	Surfing	4.0	42
Other non-mechanized winter sports	28.5	21	Snowmobiling	3.7	43
Kayaking, rowboating, canoeing	24.7	22T			

Bold type indicates a priority public use or closely associated activity.
T = Tie in ranking

Source: DPR 1998

Table 4.2-6. Level of Participation in Recreation Activities during the Previous 12 Months

Activity	Ave. # of days	Rank	Activity	Ave. # of days	Rank
Walking (recreational)	83.56	1	Attending outdoor cultural events	4.22	23
Driving for pleasure	29.65	2	Visiting zoos and arboretums	3.87	24
Bicycling (on paved surfaces)	23.38	3	Basketball	3.86	25
Use of open grass or turf areas	22.19	4	Horseback riding	3.05	26
Jogging and running	21.15	5	**Camping - primitive areas & backpacking**	**2.90**	**27**
General nature study, wildlife viewing	**19.35**	**6**	Soccer	2.78	28
Swimming outdoor pools	15.80	7	4-Wheel drive use off paved roads	2.67	29
Use of play equipment, tot-lots	15.31	8	Water skiing	2.26	30
Trail hiking	14.46	9	Target shooting	2.17	31
Beach activities	13.38	10	Saltwater fishing	2.04	32
Swimming in lakes/rivers/ocean	**9.11**	**11**	Downhill skiing	1.85	33
Visiting museums, historic sites	7.76	12	Other non-mechanized winter sports	1.80	34
Picnicking at developed sites	**7.57**	**13**	Kayaking, rowboating, canoeing	1.73	35
Camping developed sites	**7.28**	**14**	Use of motorcycles, ATVs, off-road	1.68	36
Attending outdoor sports events	7.19	15	Mountain climbing	1.46	37
Softball and baseball	6.59	16	**Hunting**	**1.35**	**38**
Freshwater fishing	**6.43**	**17**	Sailboating and windsurfing	0.74	39
Skateboarding and rollerblading	5.12	18	Cross-country skiing	0.63	40
Golf	4.99	19	Surfing	0.55	41
Mountain biking (off paved surfaces)	4.87	20	Football	0.51	42
Power boating	**4.51**	**21**	Snowmobiling	0.32	43
Tennis	4.25	22			

Bold type indicates a priority public use or closely associated activity.
Source: DPR 1998

Table 4.2-7. Comparison of Outdoor Recreators' Participation in Recreation Activities Across Geographic Sub-Areas

Recreation Activity	Percent of Participants				
	Local Area	Adjacent Counties	SACOG Region	SF Bay/ Delta	Total Study Area
Hunting	17.2	18.7	5.9	3.3	8.0
Freshwater Fishing	48.3	44.4	47.1	34.8	39.8
General Nature Study	62.1	59.7	52.9	60.8	59.4
Power Boating	44.8	30.2	17.6	21.5	24.7
Swimming (lakes/rivers/ocean)	72.4	66.1	58.8	58.0	61.0
Picnicking at Developed Sites	75.9	64.5	58.6	74.0	71.5
Camping at Developed Sites	65.5	61.3	56.9	62.2	61.5
Camping at Primitive Sites	31.0	31.7	33.3	29.4	30.7

Source: DPR 1998

Table 4.2-8. Study Area Survey Respondents Use of Outdoor Recreation Setting Types

Area Type	Level of Use by % of Respondents					
	Not At All	Once or Twice/ Year	Several Times/ Year	Once or Twice/ Month	Once Per Week	At Least 2-3 Times/ Week
Natural and undeveloped areas (large areas in a natural or nearly natural condition, with few developments)	7.4	27.9	37.4	13.8	7.4	6.1
Developed nature-oriented parks and recreation areas (with picnic areas, trails, information centers)	4.3	18.4	45.4	18.7	8.3	4.9
Highly developed parks and recreation areas in or near urban areas	7.6	20.8	27.5	21.7	14.4	8.0
Historical or cultural buildings, sites, or areas	8.6	37.1	39.6	11.3	1.2	2.1
Private outdoor recreation areas and facilities	20.9	29.8	24.5	9.8	8.0	7.1

Source: DPR 1998

Table 4.2-9. Factors Influencing Enjoyment of Most Important Activity

Factor	Percent of Responses		
	Not Important	Somewhat Important	Very Important
Being in the outdoors	2.5	10.1	87.4
Relaxing	2.8	19.9	77.3
Beauty of the area	2.5	20.8	76.7
Quality of the natural setting	3.2	21.5	75.4
Releasing or reducing tension	2.2	26.1	71.7
Being with family and friends	11.7	18.6	69.7
Having a change from the daily routine	6.6	25.6	67.7
Getting away from crowded situations	5.1	28.5	66.5
Keeping fit and healthy	9.5	25.7	64.8
Feeling in harmony with nature	10.2	26.0	63.8
Availability of facilities	8.2	29.7	62.0
Doing something your youth enjoyed	27.5	17.6	54.9
Achieving spiritual fulfillment	25.8	32.5	41.7
Experiencing challenge and excitement	25.1	33.6	41.4
Meeting new people	52.7	31.3	16.0

Source: DPR 1998

Table 4.2-10. Changes in Time Spent on Outdoor Activities by Study Area Residents (5 years ago)

Study Area	Amount of Time			
	More	Same	Less	Don't Know
Local Area	39.1	25.0	35.9	0.0
Regional Area	36.7	31.5	31.8	0.0
TOTAL	36.9	30.9	32.1	0.0

Source: DPR 1998

Table 4.2-11. Estimates of Participation and Projected Indexes of Change for Wildlife Related Activities, 1995-2040

Activity	Baseline	Projected Index of Change by Year				
	1995	2000	2010	2020	2030	2040
Fishing						
Days	119.10 [1]	1.05	1.16	1.25	1.33	1.40
Participation	7.50 [2]	1.05	1.12	1.20	1.23	1.30
Hunting						
Days	36.00 [1]	0.94	0.95	0.96	0.95	0.88
Participation	1.70 [2]	0.94	0.85	0.79	0.73	0.67
Nature Observation						
Days	838.50 [1]	1.10	1.33	1.58	1.82	2.01
Participation	16.70 [2]	1.08	1.23	1.37	1.52	1.65

[1] Millions of participant days.
[2] Millions of participating persons.
Source: Cordell, et al., 1999.

Table 4.3-1. Management Interview Categories

Category	Number of interviews
Federal land management agency	3
State land management agency	6
Non-profit land trust	2
Total	11

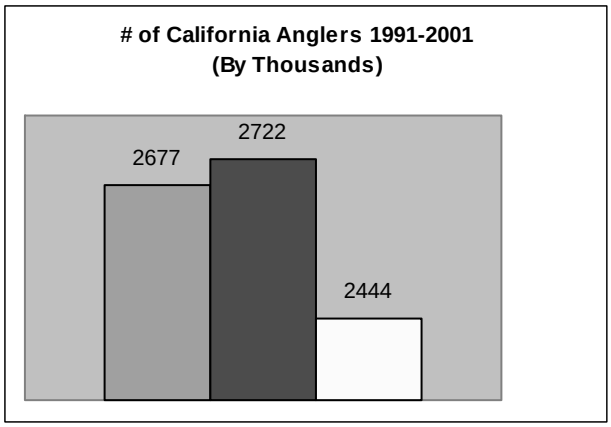
Source: EDAW 2003

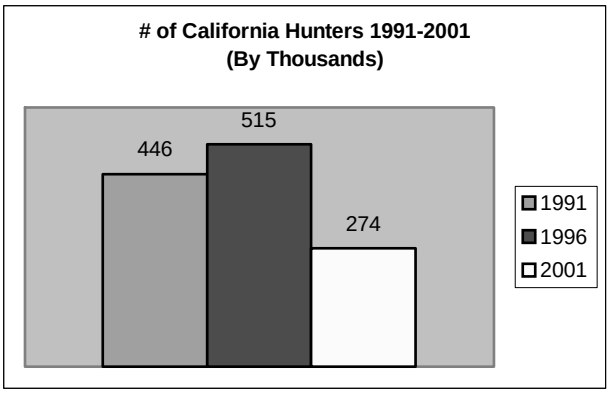
1991-2001 Survey Comparisons

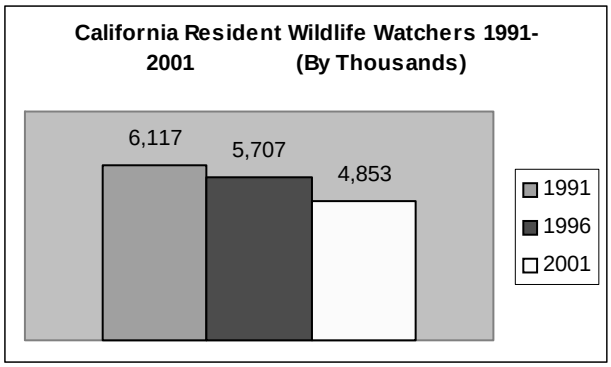
California 1991 and 2001 Comparison

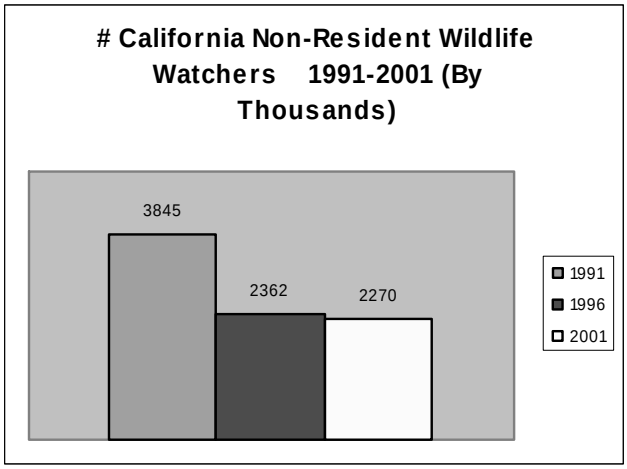
	1991	2001	Percent change
Fishing			
(Numbers in thousands)			
Anglers in-state	2,67	2,444 *	
Days in-state	23,994	27,663 *	
In-state trip-related expenditures	$1,078,873	$1,116,707 *	
State resident anglers	2,707	2,389	–12
Total expenditures by state residents	$2,334,734	$2,149,634 *	
Hunting			
(Numbers in thousands)			
Hunters in-	446	274	–39
Days in-state	5,211	3,426	–34
In-state trip-related expenditures	$140,249	$154,412 *	
State resident hunters	537	278	–48
Total expenditures by state residents	$836,095	$364,008	–56
Nonresidential Wildlife Watching			
(Numbers in thousands)			
Participants in-state	3,845	2,270	–41
Days in-state	42,353	23,807	–44
State resident participants	3,408	2,191	–36
Residential Wildlife Watching			
(Numbers in thousands)			
Total participants	6,117	4,853	–21
Observers	4,531	3,072	–32
Feeders	4,899	3,763	–23
Wildlife-Watching Expenditures			
(Numbers in thousands)			
Trip-related expenditures by state residents	$1,429,681	$832,531 *	
Total expenditures by state residents	$3,311,245	$2,234,350 *	

*No significant difference at the 0.10 level of significance.


# of California Anglers 1991-2001
(By Thousands)
2677
2722
2444


# of California Hunters 1991-2001
(By Thousands)
446
515
274
1991
1996
2001


California Resident Wildlife Watchers 1991-2001 (By Thousands)
6,117
5,707
4,853
1991
1996
2001


California Non-Resident Wildlife Watchers 1991-2001 (By Thousands)
3845
2362
2270
1991
1996
2001

California 1996 and 2001 Comparison

U.S. Fish & Wildlife Service—California

	1996	2001	Percent change
Fishing			
(Numbers in thousands)			
Anglers in-	2,722	2,444 *	
Days in-state	36,914	27,663	–25
In-state trip-related expenditures	$1,632,823	$1,116,707	–32
State resident anglers	2,721	2,389 *	
Total expenditures by state residents	$4,189,242	$2,149,634	–49
Hunting			
(Numbers in thousands)			
Hunters in-	515	274	–47
Days in-state	7,452	3,426	–54
In-state trip-related expenditures	$301,217	$154,412	–49
State resident hunters	578	278	–52
Total expenditures by state residents	$1,144,663	$364,008	–68
Nonresidential Wildlife Watching			
(Numbers in thousands)			
Participants in-state	2,362	2,270 *	
Days in-state	24,587	23,807 *	
State resident participants	2,391	2,191 *	
Residential Wildlife Watching			
(Numbers in thousands)			
Total participants	5,707	4,853	–15
Observers	4,306	3,072	–29
Feeders	4,336	3,763 *	
Wildlife-Watching Expenditures			
(Numbers in thousands)			
Trip-related expenditures by state residents	$1,529,728	$832,531	–46
Total expenditures by state residents	$2,880,151	$2,234,350 *	

*No significant difference at the .10 level of significance.

TABLE 2-1
FACILITIES AMENITIES MATRIX BY RIVER MILE

Subreach	River Mile #	SITE NAME	OWNER	AC.	ACCESS				SITE AMENITIES & USES																																	
						Mode of Access			Facility Signage				Boating Facilities				On-Site Parking				Pedestrian Access			Overnighting (R=Reservable/ NR=Non-reservable)					Water		Picnic sites				Toilet Facilities			Other Amenities			Recreation Uses			
					Public Use Allowed	Public Road	River (RL)	River (RR)	Entrance	Directional	Facility Rules	Services	Marina	Ramp(s)	Carry-in	Boat Dock/Landing	Asphalt Lot	Gravel Lot	Boat trailor Parking	Dirt Lot	ADA Accessible	Paved Walks	Unpaved Walks/Trails	Tent sites	Tent/Trailer Sites	RV Sites	Group Camps	Cabins	Potable Water	Drinking Fountains	Picnic Tables	Picnic Shelters	BBQ Grills/Pits	Informal/Tree shaded	Flush toilets & sinks	Porta-potties	None	Showers	Public Phones	Store/Bar/Restaurant	Fishing	Hiking	Hunting	Wildlife Observation
Red Bluff/Los Molinos	243	Lake Red Bluff Recreation Area	USFS	~488	✓	✓		✓	✓	✓	✓			2				✓	✓		✓	✓	✓	30/NR			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
	242	Altube Island	BOR					✓																													✓							
	239.5	Blackberry Island	USFWS	36																																								
	238	Todd Island	BLM	~125				✓																													✓							
	238	La Barranaca Unit	USFWS	1067																																								
	236	Mooney Unit	USFWS	344																																								
	235	Hunter's Resort	Private	~12	✓	✓	✓		✓				✓	✓		✓			✓						10				✓		✓				✓									✓
	234	Ohm Unit	USFWS	750																																								
	232	Flynn Unit	USFWS	552																																								
	231.5	North Mill Creek Fishing Access	Tehama Co.	3	✓	✓	✓													✓			✓														✓				✓			✓
	239.5	Blackberry Island	USFWS	40																																								
	229.7	Hidden Harbor Marina & RV Park	Private	8.86	✓	✓	✓		✓				✓	✓		✓			✓						31				✓		✓				✓					✓	✓			✓
	229.5	Mill Creek Park Launching Facility	Tehama Co.	51	✓	✓	✓		✓					✓			✓		✓										✓		✓	✓	✓		✓	✓								
	229.5	Driftwood RV Fishing Resort	Private	~6	✓	✓	✓		✓							✓		✓							30		✓		✓		✓				✓			✓			✓			✓
	229.5	River's Rest Resort	Private	~2	✓	✓	✓		✓							✓		✓							32			✓	✓		✓				✓						✓			✓
Woodson Bridge	228	Heron Island Unit	USFWS	116																																								
	221	Kopta Slough	SLC	700																																								
	218.5	Woodson Bridge SRA	DPR	325	✓	✓			✓	✓	✓						✓				✓		✓	35/R			✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓		✓
	218	Tehama County River Park	Tehama Co.	14	✓	✓	✓		✓					✓			✓				✓	✓							✓	✓	✓	✓	✓	✓	✓						✓	✓		✓
	218	Woodson Bridge RV Park	DPR	~12	✓	✓	✓		✓							✓		✓	✓						120				✓		✓		✓		✓			✓		✓				✓
	217	Foster Island	BLM	222				✓																													✓							
	216.5	Rio Vista Unit	USFWS	1202																																								
	214	Merrill's Landing Unit	DFG	172	✓	✓	✓																														✓				✓	✓	✓	✓
	209	Dicus Slough Unit	DFG	1712	✓		✓																														✓				✓	✓	✓	✓
Chico Landing	203	Wilson's Landing Unit	DFG	285	✓			✓																													✓				✓	✓	✓	✓
	202	McIntosh Landing North	USFWS	60																																								
	201	McIntosh Landing South	USFWS	71																																								
	200	Irvine Finch River Access	DPR		✓	✓		✓	✓	✓	✓			✓			✓		✓		✓		✓	6/NR				✓	✓	✓		✓		✓							✓	✓		✓
	199	Harley	TNC	103		✓																																						
	199	Sunset Ranch	TNC	111		✓	✓																																					
	198.5	Pine Creek Unit	USFWS	435																																								
	198	Vereschagen	TNC	177		✓		✓																																				
	197	Bratten	TNC	83																																								
	197	Gunhill	TNC	64																																								
	197	Kaplan	TNC	102																																								
	196.5	Pine Creek Landing	DPR		✓	✓	✓		✓		✓			✓				✓	✓											✓			✓		✓					✓			✓
	196.5	Scotty's Boat Landing (lease)	Private	~2	✓	✓	✓		✓					✓					✓	✓				✓		✓			✓		✓				✓				✓	✓	✓			
	196	Site near Pine Creek Landing	RB	~50																																								
	196	Pine Creek Unit	DFG	1060	✓	✓	✓	✓																													✓				✓	✓	✓	✓
	195.5	Indian Fishery/Chico Landing	DPR		✓	✓	✓		✓		✓							✓			✓		✓	✓						✓			✓		✓					✓	✓		✓
	194	Rx Ranch	TNC	262		✓																																						
	193.5	Capay Unit	USFWS	666																																								
	193.2	Big Chico Creek Day-use Area	DPR	~260	✓	✓	✓		✓		✓				✓					✓			✓													✓				✓	✓		✓
	192.5	Site 32F (Instr. #960756)	RB	33.7																																					✓			
	191	Phelan Island	USFWS	308																																								
	191	Sacramento River Parcel	RB	33.3				✓																																	✓			✓
	190.5	Murphy's Slough/Golden State Is.	RB	659																																								
	190	Sam's Slough	RB	70.2																																								
	187	Shannon Slough Unit	DFG	150	✓	✓		✓																													✓				✓	✓	✓	✓
	186.5	Jacinto Unit	USFWS	82			✓																																		✓		✓	✓
	186	Dead Man's Reach	USFWS	632																																								
	185	North Ord Unit	USFWS	43																																								
	184	Ord Bend Unit	USFWS	118																																								
	184	Ordbend Park	Glenn Co.	12	✓	✓		✓	✓	✓	✓			✓			✓					✓							✓	✓		✓		✓							✓			✓
	182.5	Ord Bend Unit	DFG	112	✓			✓																													✓				✓	✓	✓	✓
	182	South Ord Unit	USFWS	122																																								
	180.5	Jacinto Unit	DFG	283	✓			✓																													✓				✓	✓	✓	✓
	178.2	Site 85F (B808 P72 S 43)	RB	73.3				✓																																	✓			
Beehive Bend	177	Llano Seco Unit	USFWS	907																																								
	174.5	Oxbow Unit	DFG	94	✓			✓																													✓				✓	✓	✓	✓
	172	Site 86F	RB	29				✓																																	✓			
	172	Site 78F (B795 P140 S 67)	RB	122				✓																																	✓			
	172	Site 79F (B807 P293 S67)	RB	36				✓																																	✓			
	170.5	Site 86F (B807 P293 S 67)	RB	29			✓																																		✓			
	170	Beehive Bend	DFG	216	✓																																✓				✓	✓	✓	✓
	170	Site 79F (B795 P135 S67)	RB	122				✓																																	✓			
	169	Sul Norte Unit	USFWS	600																																								
	169	Butte City Launch Facilities	Glenn Co.	2	✓	✓	✓		✓	✓	✓			✓			✓												✓	✓					✓						✓			
	168	Packer Lake Unit	USFWS	375	✓	✓		✓							✓					✓																					✓			✓
	168	Codora Unit	USFWS	394																																								
Colusa	164	Princeton Unit North	DFG	102	✓	✓		✓												✓																	✓				✓	✓	✓	✓
	163	Drumheller Slough	USFWS	200																																								
	163	Princeton Unit East	DFG	551	✓	✓	✓													✓																	✓				✓	✓	✓	✓
	162	Princeton Unit South	DFG	150	✓			✓																													✓				✓	✓	✓	✓
	159	Stegemen Unit	DFG	154	✓			✓																													✓				✓	✓	✓	✓
	156.7	Moulton Unit North	DFG	106	✓		✓																														✓				✓	✓	✓	✓
	155	Moulton Unit South	DFG	131	✓			✓																													✓				✓	✓	✓	✓
	146.5	Colusa Unit North	DFG	119	✓			✓																													✓				✓	✓	✓	✓
	146.2	Beach at SRWA Colusa Unit	RB	50				✓																																	✓			✓
	145.9	Cobb's Bend (island)	RB	35			✓																																		✓			✓
	145.5	Cruise n' Tarry Marina	RB	22.2	✓	✓	✓							✓						✓																					✓			✓
	145.5	Ward	TNC	238				✓																																				
	145	Colusa-Sacramento River SRA	DPR	67	✓	✓		✓	✓	✓	✓			1			✓		✓		✓	✓	✓	14/R			✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓		✓
	145	Colusa Unit South	DFG	45	✓		✓																														✓				✓	✓	✓	✓
	144	Colusa Levee Scenic Park	Colusa City	2.19	✓	✓		✓	✓		✓											✓							✓	✓		✓	✓								✓			✓
	142	Bert's Steelhead Marina	Private	~1	✓	✓	✓		✓							✓	✓									✓		✓		✓				✓						✓	✓			

TABLE 2-2
FACILITIES AMENITIES MATRIX BY AGENCY/OWNER

| | | | ACCESS | | | SITE AMENITIES & USES | | |

Appendix O. Monitoring and Research Investigations at Sacramento River National Wildlife Refuge and vicinity.

Project Title	Participants	Affiliation	Funding Source	Site Locations	Documents
Birds and Bird Predators	Geoff Geupel Stacy Small Joanne Gilchrist	PRBO PRBO-PhD student PRBO	Various	SRNWR	Proposals Reports Manuscripts
State transition modeling, Classification of Vegetation Communities, Red Bluff to Colusa Reach, Sacramento River, CA	Mehrey Vaghti Steven Greco Alex Fremier Jay Lee Truil	UCDavis-MS student UCDavis UCDavis-MS student UCDavis-MS student	DWR	Emphasis on river bends at Pine Creek and below Woodson Bridge; approx. 100 vegetation survey locations.	Proposals Master's Thesis
Recruitment of herbaceous species	Karen Holl Elizabeth Crone	UCSC U of Montana		Dave Jukkola has shape file	Proposals Report
Terrestrial Inverts	John Hunt	CSUC-MS student	CALFED 97-NO3	Rio Vista, plus WCB lands south, Pine Creek & Phelan Island	Proposals Report
Ground water, soil development and nutrient cycling	David Brown David Wood Carey Wilder	CSUC CSUC CSUC-MS student	CSLFED 97-NO3	74387 (Brown, Wilder) 74388 (Wood, Hunt)	Proposals Reports
Salmonids, Salmonid Prey	Michael Marchetti Mike Limm	CSUC CSUC-MS student	CALFED Beehive Bend	N/A	Proposal Report
Stratigraphy, geomorphology & cottonwoods	Karin Hoover Walter Van Gronigen	CSUC CSU-MS student	CALFED Beehive Bend	Shaw Bar, RM 172 & RM 183, all on west side of river	Proposal
Evolution of backwater habitats	Matt Kondolf Herve Piegay Gundrun Bornette Ingrid Morken	UC Berkeley Nat'l Centr for Scientific Research, Lyon, FR; U Caude Bernard, Lyon, FR; UCB-MS student	TNC, DWR		Proposal

Project Title	Participants	Affiliation	Funding Source	Site Locations	Documents
Isotopic Studies, Aquatic Food Web Dynamics, Bats	Mary Power Bruce Orr Frank Ligon Bill Rainey Dixie Pierson Sapna Khandwala	UC Berkeley Stillwater Sciences Stillwater Sciences UC Berkeley ? Stillwater Sciences	CALFED 97-NO3		Proposal Report
Turtles	Dawn Wilson	CSUC	Various	Sam Slough, Murphy Slough, North of Pine Creek	Proposal Reports
Meander Migration Modeling	Eric Larsen	UC Davis	CALFED 97-NO2	RM 201-185	Proposal
Grassland Restoration	Jim Coleman Hall Cushman	Sonoma State U Sonoma State U	USFWS & Anderson Foundation	Llano Seco & Vermet Field	
Baseline Assessments of Future Restoration Sites	Jean Hubble David Wood John Hunt Matt Quinn Ryan Luster	CSUC CSUC CSUC-MS Student CSUC-MS Student TNC	TNC	Haleakala, Deadman's Reach, Capay, RX Ranch, Sunset Ranch	Proposal Reports
Grassland Restoration, Competition & Establishment	Matt Quinn Tom Griggs Dan Efseaff	CSUC CSUC	Sac River Partners	Llano Seco T4	Proposal Master's Thesis
Bird Food Identified Through Fecal Examination (feasibility study)	Scott Chamberlain Karen Holl Elizabeth Crone Aaron Gabbe Charles McClair	CSUC UCSC U of Montana UCSC UCSC	Research experience for undergraduate MSF (to Holl, Wood)	Sul Norte, Phelan Island	Proposal
Black Walnut Genetics	Paul Kirk Christina Schierenbeck	CSUC CSUC	CSUC Bio Dept		Proposal Master's Thesis
Soil Stratigraphy Mapping with Conductivity	Eileen Ernenwein Donald Sullivan	UDenver-PhD student UDenver			Proposal
Elderberry Associated Insects	Marcel Holyoak Teresa Talley	UCDavis UCDavis-post doc		Various riparian woodland sites with elderberry in the vicinity of Chico. Considered both natural and restored sites	Proposals

Project Title	Participants	Affiliation	Funding Source	Site Locations	Documents
Pollinators	Neal Williams	Princeton U	TNC Smith Fellow		Proposal
How Management Scenarios Affect Rates of Floodplain Sedimentation, includes dating sediments with Lead-210	Michael Singer Tom Dunne	UC Berkeley UCSB	CALFED		Proposal PhD Dissertation Reports
Species richness of medium-sized carnivores & riparian patch size	Earl Jeffrey Souza	CSUC	TNC	10 sites between Red Bluff & Colusa	Masters Thesis
Species-Area Relations of Breeding Birds on the Middle Sacramento River, CA	L. Breck McAlexander	CSUC			Report to TNC (1994) and Master's Thesis
Nest Site Selection & Nesting Success of the Western Wood Pewee (*Contopus sordidulus*) in the Sacramento Valley, CA	Carrie Bemis	CSUC-grad student		Sacramento River NWR, Flynn Unit & Woodson Bridge State Park	Masters Thesis Spring 1996
Fisheries Monitoring	Charles Brown David Grant	CDF&G CDF&G	CDF&G	Mouth of Stoney Creek at Phelan Island Unit	Brief Reports
Natural Process Restoration	Daryl Peterson Dave Wood	TNC CSUC	TNC	Sul Norte	Masters Thesis 2002
Survival & Growth of Valley Oaks at Restoration Sites	Tom Griggs Greg Golet	CSUC TNC	Some from TNC		Manuscript
Status of Yellow-Billed Cuckoo	Dave Gilmer Jim Snowden Steve Laymon Murrelet Halterman Gary Falxa	USGS-Dixon Kern River Research Ctr Kern River Research Ctr Kern River Research Ctr USFWS-Sacramento	USGS, USFWS	River wide	Report

Project Title	Participants	Affiliation	Funding Source	Site Locations	Documents
Vegetation Dynamics at Restoration Sites & Remnant Riparian Sites	Dave Wood Greg Golet Ryan Luster Joe Silveira Brianna Borders Dylan Van Dyne Matt Brown	CSUC TNC TNC USFWS CSUC-MS Student CSUC-MS Student CSUC-MS Student	CALFED-Beehive Bend, TNC Fresh Water Initiative		Proposals
La Barranca Gravel Pit Restoration Feasibility Study	Dan Efseaff Tom Griggs	CSUC Sac River Partners	AFRP grant to Sac River Partners		Proposal Report
Bank Swallow Surveys	Ron Schlorff Joe Silveira	CDF&G USFWS	CDF&G & USFWS		Annual Reports Publications
Indicators of Hydrologic Alteration (IHA) Studies	Shawn Pike Stacy Cepello	DWR DWR			
Cottonwood Recruitment Pilot Study	Mike Roberts Stacy Cepello	TNC DWR	CALFED97-N02		Final Report
Current Status Report on Cottonwood Recruitment	Karin Hoover Sara Nash	CSUC CSUC	CALFED - Beehive Bend	RM 165-206 (30 sites)	Draft Report
Channel Cut-Off Investigation	Eric Larsen Laura?	UCDavis			
Sediment Mobility Study	Koll Buer	DWR	DWR		
Water Temperature Regime Study	Cindy Lowney				Ph D Dissertation
Refuge Wildlife Surveys	Joe Silveira	USFWS	USFWS		Reports Manuscripts
Soil Vegetation Associations at Llano Seco, Chico, CA	Joe Silveira Tom Griggs Dean Burkett	USFWS, SSRP, NRCS	USFWS, SRP, NRCS	Llano Seco Unit (USFWS), Llano Seco Ranch	Soils (1998)
Competitive Effects of Intercropping Alfalfa with Valley Oak & Blue Elderberry Seedlings	Jean Hubbell	CSUC		Kopta & Llano Seco	Master's Thesis

Project Title	Participants	Affiliation	Funding Source	Site Locations	Documents
Influence of Riparian Vegetation on Water Temperature in the Sacramento River, CA	Cynthia L. Lowney	Water Resources			Report to USFWS
Sacramento River, Glenn, Butte & Tehama Counties: A Study of Vegetation, Deposition & Erosion and a Management Proposal	Thomas J. Kakremer	CSUC			Master's Thesis
Monitoring Riparian Landscape Change & Modeling Habitat Dynamics of the Yellow-Billed Cuckoo on the Sacramento River, CA	Steven E. Greco	UCDavis			Ph D Dissertation
Riparian Vegetation Distribution Along the Middle Sacramento River in Relation to Flood Frequency	Stacy Cepello	CSUC			Master's Thesis
Leaf Litter Decomposition Rate	Brianna Borders David Wood James Pushnik Dave Brown	CSUC CSUC CSUC CSUC CSUC		Princeton Ferry, River Vista, Phelan Island, Pine Creek, Shaw Bar, Flynn	Master's Thesis
Sediment Transport	Koll Buer				
Bank Erosion and Meandering Studies	Koll Buer				
Human Effects on Geomorphic Processes	Koll Buer				
Effects of Dams & Diversion on the River	Koll Buer				

Project Title	Participants	Affiliation	Funding Source	Site Locations	Documents
Hyporheic Zone (ground water, river water interactions)	Stacy Cepello Thomas Boullion				Proposal
Flows & Sediment Transport	Stillwater				
Cottonwood Root Growth Rates	Stillwater				
Processes that Create Off-Channel Habitats	Dietrich Kondolf				
Channel Substrate Comp and Permeability	Stillwater				
Frequency & Extent of Cottonwood Recruitment	USGS				
Further Refinement of the Meander Migration Model	Eric Larsen				
Effects of Bank Protection on In-Channel Habitat	Kondolf				

Appendix P. Integrated Pest Management Plan For Mosquito Control at the Sacramento National Wildlife Refuge Complex

The purposes of the Integrated Pest Management Plan (IPM) for Mosquito Control at the Sacramento National Wildlife Refuge Complex (SNWRC) are to: 1) identify mosquito control methods and materials currently approved for use on the SNWRC; 2) identify their use in an IPM program that is consistent with the goals of the SNWRC and minimizes public health risk from refuge-harbored mosquitoes; and 3) provide long-term planning to meet the Service's goal of reducing effects of pesticide use on Department of Interior trust resources to the greatest extent possible.

Copies of the plan are available for review at the Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, California 95988. (530) 934-2801.

Copies are also available via the internet at the following address
http://sacramentovalleyrefuges.fws.gov

Appendix Q. Integrated Pest Management Plan For Walnut Production on the Sacramento River National Wildlife Refuge

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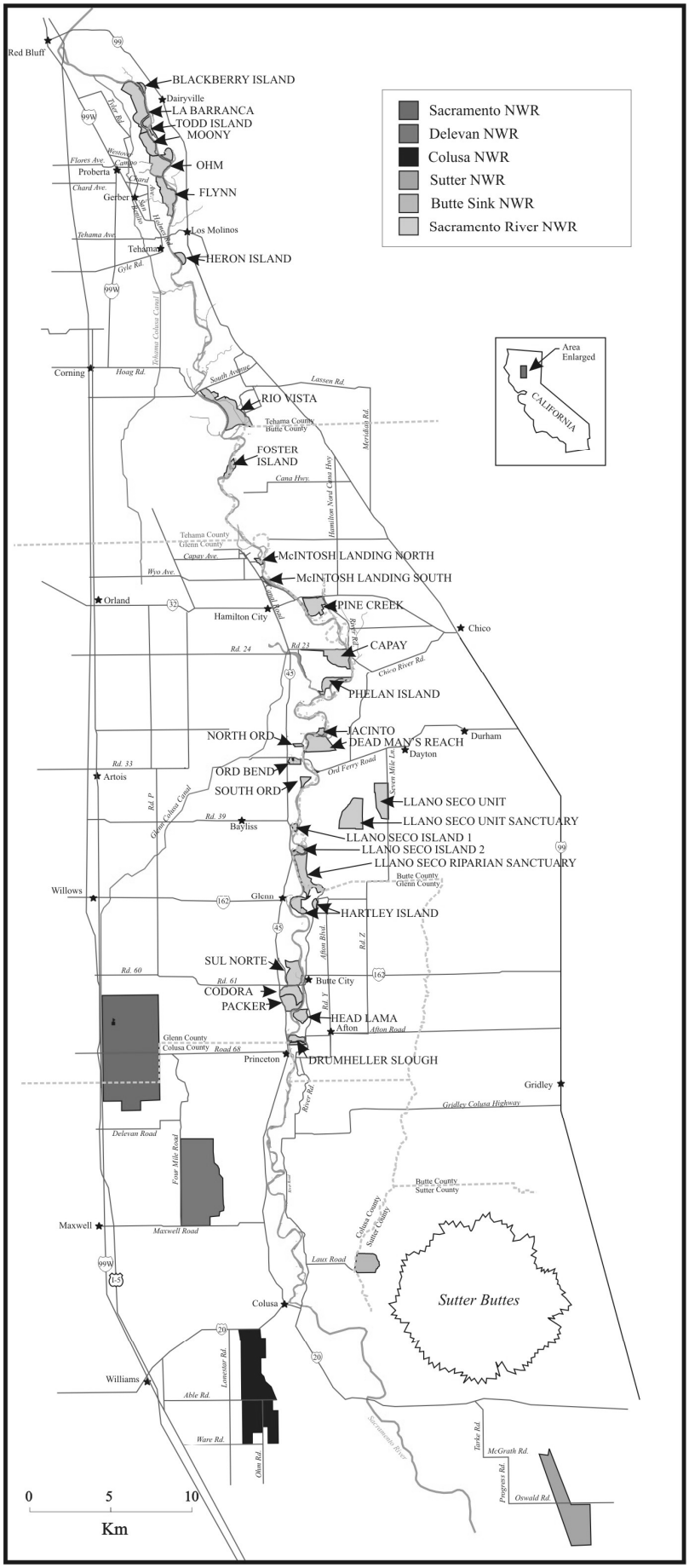
INTRODUCTION

The US Fish and Wildlife Service (Service) manages the Sacramento River National Wildlife Refuge (SRNWR), one of six national wildlife refuges in the Sacramento National Wildlife Refuge Complex (SNWRC) located within the Sacramento Valley of northern California (Figure 1). The primary objectives of the Sacramento River National Wildlife Refuge include: 1) provide habitat and manage for endangered, threatened, or sensitive species of concern; 2) protect and provide habitat for neotropical migratory land birds; 3) preserve a natural diversity and abundance of flora and fauna; 4) provide feeding and resting habitat for migrating and wintering waterfowl and other waterbirds; 5) provide opportunities for understanding and appreciation of wildlife ecology, the human role in the environment, and provide high-quality, wildlife dependent recreation and education; and 6) provide an area for compatible, management-oriented research. These objectives fall under a broader mission statement of the National Wildlife Refuge System, which is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

In 1989 Congress authorized formation of the Sacramento River National Wildlife Refuge (SRNWR) to preserve and restore riparian habitat along the Sacramento River between Red Bluff and Colusa. Since that authorization SRNWR has acquired 26 properties along the River towards a goal of 18,000 acres. Currently, those SRNWR properties consist of 10,304 acres including various riparian and agricultural lands of which 3,204 have been restored to native riparian species. While the Service did not wish to acquire or manage producing agricultural properties; most of the parcels offered by willing sellers included parts that were agricultural. The SRNWR currently has within its boundaries 1,529 acres of walnuts that are managed for wildlife habitat and commercial nut production. Through a partnership with The Nature Conservancy (TNC), walnut orchards are leased to farmers who commercially grow the walnut crop until the removal of the orchards.

SACRAMENTO NATIONAL WILDLIFE REFUGE COMPLEX



July 2003

Any net proceeds from the crop fund riparian restoration at SRNWR units. The two to five year goal is to eliminate these orchards and replace them with native riparian vegetation to provide habitat for indigenous aquatic and terrestrial species, some of which are threatened or endangered. In the interim the tenet farmers use Integrated Pest Management (IPM) for walnut production. Without immediate funds to restore the orchards to riparian habitat, it is important that the walnuts be managed rather than abandoned. While the Service is obligated to both fulfill its primary mission and refuge goals, failure to manage these walnut orchards would provide a habitat for pests, including insects, weeds, diseases, and vertebrates, to potentially cause off site impacts to neighboring walnut farmers along the River.

The purpose of this plan is to: 1) identify those walnut pest control methods/materials currently approved for use in the SRNWR; 2) incorporate their use into an IPM program consistent with the goals of the SRNWR; and 3) provide long-term planning to meet the Service's goal of reducing effects of pesticide use on Department of Interior (DOI) trust resources to the greatest extent possible.

REFUGE DESCRIPTION

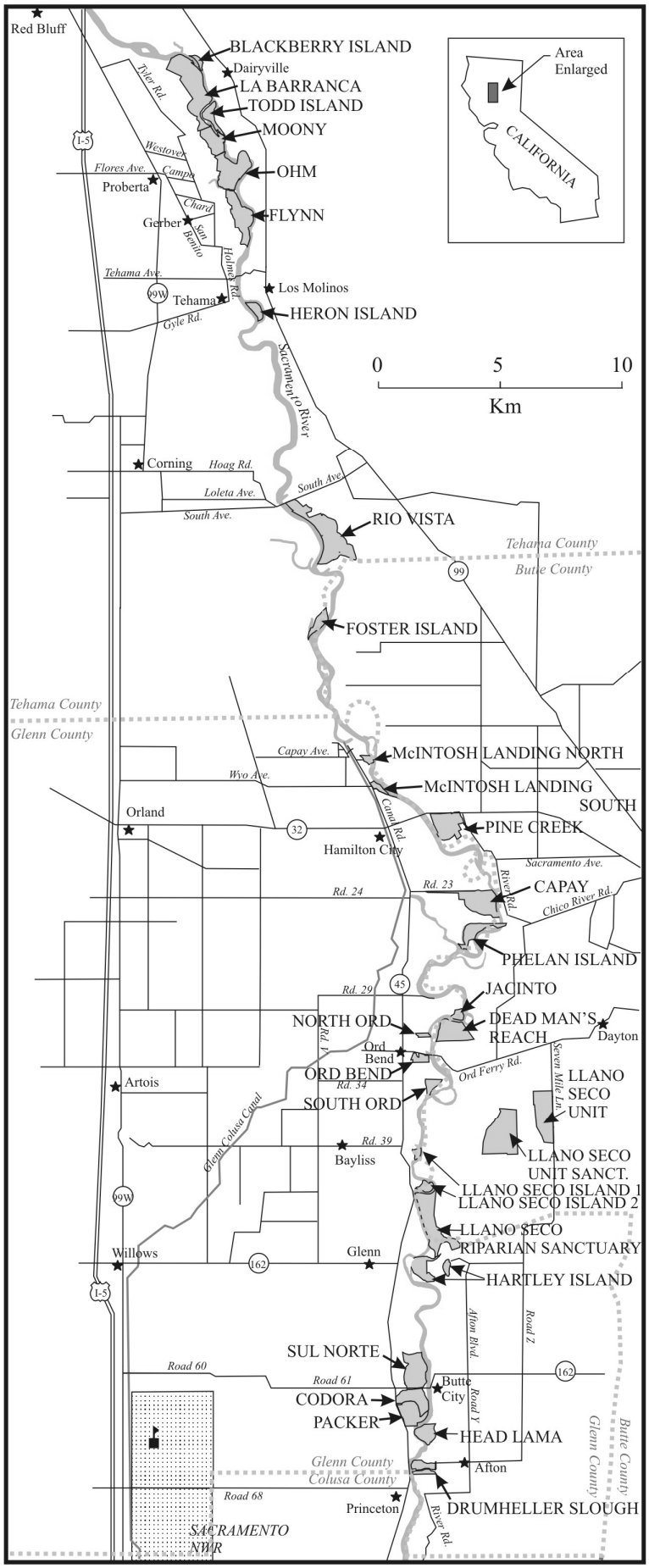
HISTORICAL

Vast acreage of natural wetlands was created when the Sacramento River flooded during annual winter storms. This cycle provided habitat for millions of waterfowl and other wildlife. In the early and mid-1900's levees were constructed along the rivers to reduce flood hazard to agricultural development. This reduced wetland habitat by approximately 95 percent in the Sacramento Valley. Due to loss of wetlands, crop depredation by waterfowl became a major problem. This problem and consideration for migratory bird conservation led to establishing a number of wildlife refuges, including those of the SNWRC during the period from 1937 to present. The SNWRC is composed of six refuges in the northern Sacramento Valley of California: Sacramento, Delevan, Colusa, Sutter, Butte Sink, and Sacramento River.

PHYSICAL

For the past twelve years the Service has been acquiring parcels of land to establish the Sacramento River National Wildlife Refuge (SRNWR) (Figure 2). The Service's goal is to purchase remnant forests and oxbow sloughs adjacent to or near the Sacramento River. These properties, along the riparian corridor, often include commercial farmland that includes English walnuts, *Juglans regia*, prunes, *Prunus domestica*, almonds, *Prunus amygdalus*, and various field crops. Currently the SRNWR has 2,685 acres of agricultural land that includes; 1,529 acres of walnuts (Table 1), 262 acres of almonds, no acres of prunes, and 100 acres of fallow fields. The remaining refuge acreage consists mostly of mixed riparian forest, cottonwood riparian forest, herbland cover, riparian willow scrub, valley oak woodland and savannah, elderberry savannah, gravel bar, grasslands and the 3,204 acres that have been restored to native riparian communities.

SACRAMENTO RIVER NATIONAL WILDLIFE REFUGE



June 2003

Soils on the SRNWR are primarily loamy to gravelly floodplain soils in an active meander belt. Slope on the SRNWR units range for 0-3 percent; elevation is 70–160 feet MSL; average rainfall is 17-24 inches. Maximum daily temperatures can exceed 90 degrees Fahrenheit from May into October.

The understory vegetation in the majority of walnut orchards is a managed cover composed of nonnative annual winter weeds; and annual and perennial summer weeds usually Bermuda grass, *Cyanodon dactylon.* The orchards are part of the river flood plain and have a year round cover of resident vegetation which limits the run off of pest control materials. The surface vegetation is mowed during the summer and winter; the walnut orchard units are not disked.

GENERAL WALNUT MANAGEMENT PRACTICES

Walnut production within the SRNWR requires progressive management to protect habitat and species while maintaining healthy, productive trees that avoid pest problems. Typical activities include: irrigation management to match tree-water use, mechanization for rapid walnut harvest, mechanized towers with hydraulic saws/clippers for pruning, mowing to control weed growth, herbicide "strip" sprays to control weeds on the bermed up tree rows, and ground driven "air blast" sprayers for pesticides, and occasionally aerial application of plant growth regulators.

The walnut orchards that are or may be acquired are primarily older orchards, 20 – 40 years of age. There are University Of California (UC) and privately selected cultivars (CV's) grown on these units including Ashley, Chico, Serr, Chandler, Hartley, Tehama, Vina, Blackmere, Franquette. The CV differences include maturity dates, height, and disease and insect susceptibility. Many of the orchard units are mixed with alternating CV's. While the shorter statured Vinas and Ashleys remain at 30 –40 feet many of the older blocks are more than 50 feet tall and fully canopied.

Table 1. Sacramento River National Wildlife Refuge Walnut Unit CV makeup.

Unit	**Acres**	**Varieties**	**Height (feet)**
La Barranca	404	Ashley, Chico, Serr, Hartley	35 – 50
McIntosh Landing South	28	Hartley	50
Pine Creek	65	Hartley	50
Jacinto	13	Hartley	50
Deadman's Reach	350	Hartley	35 – 50
Hartley Island	318	Ashley, Blackmere	40 – 50
Codora	285	Ashley, Chandler, Hartley, Tehama	40 - 50

PEST ABATEMENT ACTIVITIES

The University of California Integrated Pest Management Program (UC IPM) for Walnuts has been used as the guideline for management and monitoring decisions for the past eight years producing walnuts on the SRNWR properties. The objective of

controlling pests or avoiding their damage is favored by maintaining healthy, vigorous trees. Only tenet farmers who incorporate such practices as: pruning to keep an open canopy, adequate fertilization, optimal irrigation, and rapid harvest when using IPM practices can expect to realize sufficient revenues to avoid abandoning the walnut orchards.

There are many species that are considered pests in walnut production. For management decision making by the tenet farmers they are categorized into arthropods (insects and mites), diseases, weeds, and vertebrate pests. Because these orchard units will be removed and restored within two to five years some pest and disease problems will not be addressed, including Fall Webworm, *Hyphantria cunea*, Nematodes, *Pratylenchus vulnus* or *Macroposthonia xenoplax*, Blackline syndrome, Crown Rot, *Armillaria mellea*, or Deep Bark Canker, *Erwinia rubrifaciens*. The focus of the pest abatement activities will be on those programs that will reduce pests that could become a source of infestation to neighboring orchards outside the refuge or make commercial management unfeasible.

The primary pest Codling Moth, *Laspeyresia pomonella*, will be treated in depth because control of codling moth affects other pests and molds that make the crop unmarketable. The other significant pests; Navel Orange Worm, Web Spinning Mites, Walnut Husk Fly, San Jose Scale, Aphids, Walnut Blight, vertebrate pests and weeds will be addressed and control measures recommended.

PEST BIOLOGY FROM UC IPM WALNUT PEST MANAGEMENT

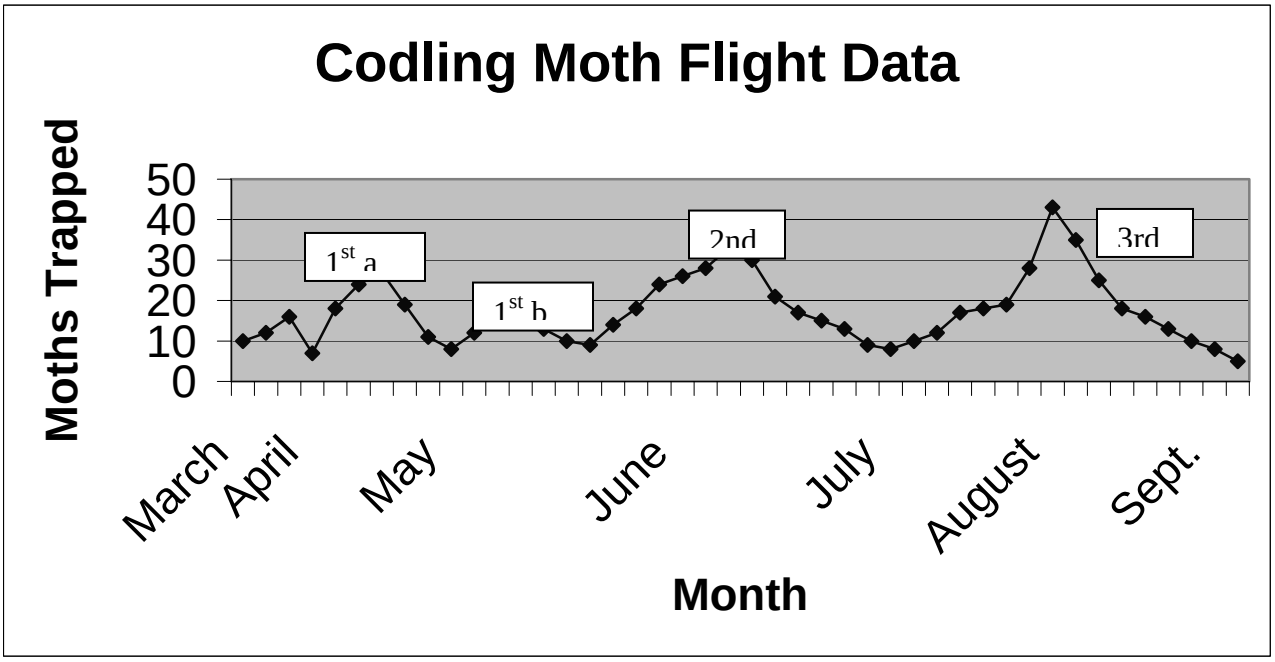
ARTHOROPOD PESTS

CODLING MOTH, *Laspeyresia pomonella*

Codling moth is the major pest of walnuts. Not only does it cause direct nut damage reducing a farmer's production and grade, but also its presence provides an entry point for secondary pests, such as the navel orangeworm. Further, extent and decision for types and timing of chemical treatment or other alternative management strategies required for its control, impacts the farmer's entire seasonal IPM program. There are several generations of codling moth:

Over-winter generation: Codling moth over-winters as mature larvae in a thick silken cocoon under loose scales of bark or in trash on the ground near the trunk. Adult emergence usually occurs in mid-late March just following budbreak of walnut CV's that leaf-out early in the season (e.g. Ashley, Chico, Serr). There are usually three complete subsequent generations and a partial fourth in Sacramento valley walnut orchards (see Fig. 3).

Figure 3. Codling moth seasonal populations.



1st generation: Adult codling moths emerging from the over-wintering population of mature larvae in mid – late March is referred to as the "first flight". When a sustained, 1st flight adult catch is obtained in pheromone traps, this is referred to as a "biofix" and developmental temperatures (50°F minimum and 88°F maximum) are recorded to determine and predict various life stages of this pest and best treatment times. The first flight of adult moths may have two distinct peaks of activity (peak 1a and peak 1b) and can last several months due to variable, often cool and rainy, spring weather. These moths begin to lay eggs when sunset temperatures reach 62°F that give rise to the "first generation" (Figure 3).

Each over-wintered female codling moth deposits about 30 eggs singly on leaves near nuts (later generations of females will lay an average 60 eggs on leaves or nuts). Duration of first generation codling moth egg laying is dependent on temperatures but typically lasts 4-6 weeks. The first eggs hatch after 5 to 20 days depending on the temperature but usually when the nuts reach a diameter of 3/8" – ½". Duration of egg hatch is important for timing sprays. In cool springs or cool locations, the flight of the over-wintering moths and subsequent egg laying lasts longer and may require two chemical treatments for adequate control.

The newly hatched larvae bore into nutlets through the blossom end. Most nuts damaged by 1st generation larvae drop to the ground, however nuts infested by larvae emerging late in the generation, as a result of flight peak 1b, remain in the tree.

2nd generation: Mature 1st generation larvae leave the nut after completing their development and pupate under loose bark on the tree. Adults of the first generation

begin to emerge from the end of May to as late as the last week of June depending on the season and location. Eggs laid by these 1st generation moths give rise to 2nd generation larvae. Because of higher temperatures at this time of year, eggs hatch and larvae develop faster than the 1st generation.
Newly hatched, second generation larvae enter the walnut husk anywhere on its surface but prefer the spot where two nuts touch. The larvae then proceed under the husk around the shell and enter the nut at the stem end, the weakest point of the shell seal. These larvae develop in the nuts, emerge and pupate under the tree bark, and emerge as adults by late July or the beginning of August. Nuts infested by this generation of larvae remain in the trees until harvest and thus have the potential to influence walnut quality and the farmer's grade sheet.

3rd and 4th generation: In the Sacramento Valley, 2nd generation adult codling moths produce a third generation of larvae in early August. This generation can cause significant damage at harvest by damaging kernels. Although these larvae leave the nuts when they are mature, only a few will pupate and then give rise to a 4th generation of larvae. The majority will spin cocoons and over-winter for the next year's population. Larvae developing as a fourth generation develop too late to cause economic damage to walnuts.

Occasionally some third generation codling moth larvae may be present in harvested nuts however most larvae found in nuts at harvest are the secondary pest, navel orangeworm that enters the nut through codling moth injury from late 1st, 2nd, or 3rd generation larval injury.

NAVEL ORANGEWORM, *Amyelois transitella*
Navel orangeworm (NOW) is the most common "worm" pest found in harvested walnuts and is usually regarded as the cause of worm damage and reason for reduced grade. However, it is a "secondary" pest. That is it cannot infest sound nuts (i.e. nuts that have not been previously injured) so its presence is often a direct result of nuts previously injured by codling moth, walnut blight, and/or sunburn. A grower's inability to manage these pests results in substantial NOW damage potential. NOW also infests nuts once hulls split prior to harvest so allowing nuts with split hulls to remain on trees past when they could be first harvested encourages infestation.

NOW over-winters as both larvae and pupae inside "mummy" nuts left in the tree following shaking and in trash nuts left on the ground, including those around hullers. Adult emergence begins in mid-March and may continue through early May – timing of adult emergence usually follows patterns of codling moth emergence closely. Female moths of the over-wintered generation lay their eggs singly on mummy nuts, current season's codling moth infested and/or blight infested nuts. The first generation, and most of the second, is completed in previous season's nuts or those infested with codling moth or infected with blight in the current season. In late summer, third generation larvae infest the crop as the husks begin to split. Females emerging at this time prefer to lay

eggs on the opened husk or on the exposed shell. Attention to mummy nut removal by dormant tree shaking and codling moth and blight control during the season minimizes the size of the generation that will infest nuts at harvest.

RED-HUMPED CATERPILLAR, *Schizura concinna*
Red-humped caterpillars damage walnut trees by feeding on leaves. Extensive feeding results in exposure of nuts and branches to sunburn, reducing both production and nut quality.

Three generations of red-humped caterpillars occur per year. The brown moths that give rise to first generation larvae emerge in early May. After mating, the females lay pearly white, spherical eggs in masses of 25 to 100 on the underside of leaves. The young larvae are quite gregarious and feed in large groups, quickly skeletonizing leaves. Once mature, they disperse and feed singly before falling to the ground to pupate. Additional generations occur in July and in September.
Usually red-humped caterpillar damage occurs before farmers or their Pest Control Advisors (PCAs) realize it; that is, it is too late for control as the "damage has been done". Because a number of natural enemies attack red-humped caterpillars, including two species of parasitic wasps, *Hyposoter fugitives* and *Apanteles* spp., and birds, they frequently do not recur preventing them from becoming a continually destructive pest in the orchard.

WALNUT HUSK FLY, *Rhagoletis completa*
Walnut husk fly (WHF) is a major pest of walnuts in the Sacramento valley. The fly oviposits in walnut husks during August and September prior to harvest. The maggots develop by feeding on husk tissue, which irreparably stains the walnut shell making it unsuitable for the in-shell trade. Nuts infested more than four weeks prior to harvest also sustain kernel color loss, reducing their grade. Black walnut, *Juglans hindsii*, which is found in the riparian areas, is the preferred host, but English walnut is also an excellent host for husk fly.

WHF has one generation per year. They over-winter as pupae in the soil and emerge as adults from late June until early September. Peak emergence is usually in mid-August. The female deposits eggs in groups of 15 below the surface of the husk. Eggs hatch into white maggots within 5 days. Older maggots are yellow with black mouthparts. After feeding on the husk for 3 to 5 weeks mature maggots drop to the ground and burrow several inches into the soil to pupate. Most emerge as adults the following summer but some remain in the soil for 2 years or longer. Some early maturing varieties, such as Ashley and Chico, can escape serious damage in most years simply because they harvest before serious damage occurs. Mid-late maturing varieties, such as Eureka, Chandler, and Hartley that have more exposure to WHF feeding before harvest are most susceptible to damage.

WEB-SPINNING SPIDER MITES

TWO-SPOTTED SPIDER MITE, *Tetranychus urticae*

PACIFIC MITE, *Tetranychus pacificus*

The web-spinning mites, Two-spot and Pacific, feed on the leaves causes stippling and leaf browning. Clusters of brown leaves are often the first sign of a mite population. Heavy populations produce copious webbing, and their feeding causes leaves to desiccate and drop. Defoliation early in the season will reduce nut yield and quality by shriveling kernels and increasing sunburn potential; defoliation late in the season will interfere with harvest. Early season infestations will also reduce subsequent crops as flower bud formation will likely be reduced.

Web-spinning mites over-winter as reddish orange, mature females in protected places on the tree, in the soil, and in trash on the ground. Eggs are spherical and translucent when first laid, becoming opaque soon before hatching. Immature mites molt three times before becoming adults. The first stage mites have six legs; later stages and adults have eight legs. During periods of active feeding the two-spotted mites have a dark spot on each side of the body, thus the name "two-spotted spider mite".

During warm weather in spring, over-wintered females begin feeding on walnut leaves and ground cover in the orchard. Colonies develop on the underside of leaves and also on the upper sides when heavy populations build up. These mites reproduce rapidly in hot weather and may become numerous in June or July. They produce many generations a year. If temperature and food supply are favorable, a generation can be completed in 7 days.

NON-WEB-SPINNING MITES

EUROPEAN RED MITE, *Panonychus ulmi*

The European Red Mite (ERM) populations develop in walnuts while weather is cool. While feeding by ERM does not result in leaf drop like web spinning mites, research has shown that when heavy populations are left un-treated for three years nut yield is reduced. In low numbers, that are by far the more common occurrence, the ERM can be beneficial by providing a food source for the western predatory mite, *Metaseiulus (Galendromus) occidentalis*, which can manage web spinning mite populations.

The ERM overwinters in the egg stage on twigs and branches. Eggs hatch in early spring when the walnuts leaf out. Immature mites are bright red; adult females have a brick red, globular body with four rows of long, curved hairs arising from white dorsal spots. Adult males are brownish and smaller than the females. ERM feeds on cell contents in leaf tissue. Initially, the feeding causes light leaf stippling. Prolonged feeding by a heavy population will gradually give leaves a bronzed appearance. They have multiple generations each season and do not produce webbing.

APHIDS

WALNUT APHID, *Chromaphis juglandicola*

Walnut aphid can be a serious pest of English walnut. Its feeding reduces tree vigor, nut size, yield, and quality. In addition to direct feeding damage, they excrete copious amounts of honey-dew that falls onto nuts, leaves and shoots. Honey-dew supports growth of the black sooty mold fungus. This fungus reduces light penetration to the leaf surface reducing its photosynthetic capacity. Being black, it also absorbs heat to predispose nuts to sunburn and subsequent kernel quality loss due to high temperatures. High populations of aphids may also cause leaf drop, exposing more nuts to sunburn. If heavy populations are allowed to develop (i.e. > 15 aphids per walnut leaflet) and remain for as little as 14 days uncontrolled, current seasons nut quality is reduced along with a substantial reduction in the following season's crop (Barnes, Sibbett, 1990.).

Walnut aphid over-winters in the egg stage on twigs. Eggs hatch as soon as leaf buds on early leafing CV's begin to open. These aphids settle on the leaflets (usually on the undersides of the leaf), mature, and reproduce without mating, giving birth to live nymphs. The aphids pass through many generations a year, depending upon temperature; hot temperatures seem to depress activity. In fall, wingless females mate with smaller, winged males and they lay the over-wintering eggs.

With the introduction of the wasp parasite, *Trioxys pallidus* by Robert Van Den Bosh in the early '70s, damaging populations of walnut aphid have generally disappeared statewide. Only in those cases where the parasite is killed with application of a broad-spectrum pesticide for control of another pest (e.g. codling moth) does walnut aphid become problematic.

DUSKY VEINED APHID, *Callaphis juglandis*)

The dusky veined aphid is a walnut pest that occurs mainly in the Sacramento valley. The life cycle of dusky veined aphid is similar to walnut aphid. It overwinters in the egg stage on twigs. Eggs hatch as soon as leaf buds on early cultivars begin to open where the young aphids settle on the leaflets, and they mature into larger, yellow aphids with dusky black spots, and reproduce without mating, giving birth to live nymphs. The aphids pass through many generations a year, depending upon temperature. In fall, wingless females mate with smaller, winged males and lay the overwinter eggs. In contrast to walnut aphid however, dusky veined aphids feed on the upper sides of leaves at the midrib. If 25% of a leaflet sample contains colonies of dusky veined aphids, economic quality damaged has been measured.

SCALE PESTS

Scales are insect pests that feed by extracting "plant sap" from limbs, branches, shoots, and leaves. When heavy infestations occur, substantial reduction and/or loss of tree growth occurs reducing production. Scales are classified as either "armored" or "un-armored". Armored scale adults have a hard, waxy coating that protects the insect from predation, parasitism, and, coincidently, chemical insecticides. Un-armored scales have no such protection, their body remains soft and exposed, and is more easily parasitized and controlled with insecticides.

ARMORED SCALES

SAN JOSE SCALE, *Quadraspidiotus perniciosus*

The San Jose Scale (SJS) produces three generations a year or more if warm weather extends into the fall. It overwinters mainly as first instar nymphs, a "black cap" stage. The wingless females molt twice and the winged males molt four times and mature at the same time as the females. San Jose Scale bear live young and these tiny "crawlers" begin emerging in May. The crawlers soon settle down, insert their feeding stylet, initiate feeding and secrete the white waxy cover that becomes the "armor". After two or three weeks these nymphs molt and complete their development. Heavy infestations of San Jose Scale kill scaffold limbs and branches within one to two years reducing production.

WALNUT SCALE, *Quadraspidotus juglansregiae*

The walnut scale is often tan or brown and the same color as the bark of the walnut tree, making it difficult to detect. The scale is found in daisy shaped groups formed by the male crawler. The walnut scale produces two generations a year. The second generation overwinters as second instar females and males. The young female crawlers are active in mid May after hatching, and another generation develops in Mid August. Similar to San Jose Scale, heavy infestations can cause bark and limbs to crack.

UN-ARMORED SCALES

FROSTED SCALE, *Lecanium pruinosum*

EUROPEAN FRUIT LECANIUM SCALE, *Lecanium corni*

These are two very similar un-armored (i.e. soft-bodied) scales. They suck plant juices from leaves and twigs and heavy populations reduce terminal growth and vigor, resulting in smaller nuts and poor kernel quality. The secreted honeydew may cover nuts and offering a substrate for growth of the sooty mold fungus, increasing the chances for sunburn damage.

They have one generation per season, over-wintering as nymphs on twigs and small branches. In the spring the nymphs grow rapidly, secreting large amounts of honeydew. Mating occurs in late spring and the females lay a large number of eggs, protected under her body, then dies. The newly hatched yellow crawlers, looking quite similar to walnut aphids, emerge from beneath the old female body and migrate to the underside of leaves where they feed much like aphids do. In fall the crawlers molt and move back to the maturing current season's shoots and permanently settle down to over-winter.

These soft scales are usually held in check by natural predators and parasites. It is only when the natural enemies have been eliminated, often through chemical upset, that these soft scales become a problem.

MICROBIAL PESTS

BACTERIAL DISEASES

WALNUT BLIGHT, *Xanthomonas campestris* pv. *juglandis*

Walnut blight is the only bacterial disease of walnut and infects leaves, flowers, and nuts. Economic loss occurs when nuts are infected. Nuts infected early in the season drop from the tree whereas those infected later, once shells begin to harden, have their kernels destroyed and provide a site for navel orangeworm infestation.

The walnut blight bacterium over-winters and survives either on or in dormant buds, catkins, and twig lesions from previous infections. When new tree growth resumes in spring the pathogen is moved to the new tissue in free moisture, usually rainfall. It enters the new plant tissue through natural openings such as the stomata. These primary infections produce more bacteria, which are spread to other sites in the tree, such as developing shoots, pistillate flowers, nuts and developing buds and catkins for the next season. Windblown raindrops or pollen can also carry walnut blight bacteria throughout the orchard. Thus, severity of blight each season depends upon amount of rainfall occurring during the primary infection period. Although all commercial walnut CV's are susceptible to blight, those that leaf out early in spring are most susceptible simply because of their coincident growth stage with highest probability for rain. Early leafing CV's such as Ashley, Payne, Vina, Sunland require major attention to blight whereas late leafing CV's such as Chandler require a minimal treatment regime. Interestingly, Serr, an early leafing CV, shows some field resistance to blight and is not severely infected even when conditions for infection occur.

VERTEBRATE PESTS

GROUND SQUIRRELS, *Spermophilus beecheyi*

Ground squirrels can live for five years and they emerge in February after winter hibernation from their burrows. The females have one litter of six to eight young in the spring. About six weeks after birth, the young emerge to feed above ground. The adults often go into a temporary state of inactivity (aestivation) for part of the hot summer and into hibernation in the winter. The young usually do not aestivate or hibernate during the first year.

Ground squirrels feed on young nuts and mature nuts on the ground or in the tree. They can climb trees and strip branches of large numbers of nuts. Ground squirrel burrows in the orchard can disrupt irrigation and cause erosion.

POCKET GOPHERS, *Thomoys* sp.

Gophers usually live alone, except for females with young or when breeding, in an underground burrow system that can cover 200 to 2,000 square feet. Gophers do not hibernate and may be active at any hour of the day. Gophers reach sexual maturity at about 1 year of age and can live up to 3 years. Litters of five or six gophers are produced by females up to three times per year. Gophers feed on roots and stems of weeds and occasionally they damage young walnut trees. They are a concern to walnut growers mainly because they dig burrows in the orchard, which interfere with mowing, harvesting operations, and irrigation.

WEED PESTS
Weeds cause many problems in walnut orchards if not well managed. Weeds: increase water use; enhance the potential for disease (e.g. crown rot) and rodent damage (meadow mice – *Microtis spp.)*; make it difficult to recover nuts from the orchard floor; and they increase management time, thus costs.

Weeds in areas between the tree rows, i.e. row middles, are allowed to grow and are mown 2-3 times annually. All of the orchards in the SRNWR area are mown and not disked as these orchards are on an active flood plain.

POTENTIAL CONTROL METHODS AND MATERIALS

CULTURAL CONTROLS
Good walnut cultural practices minimize pests and their control costs. Here are some examples:

Irrigation: Maintaining non-water stressed trees is one of the most important cultural practices farmers use to maximize yield and avoid pest problems. For example, allowing trees to stress from poor water management encourages spider mite infestations that would not occur in well-irrigated orchards. Nut sunburn readily occurs on stressed trees; sunburned nuts are predisposed to infestation by Navel orangeworm. Also, water stress predisposes walnut trees to infection by the deep bark canker bacterium and too much water encourages phytophthora infection. Water management is clearly a major component of an integrated pest management program.

Shaking "mummy" nuts and shredding: Old mummy nuts left in the trees following harvest are over-wintering sites for navel orangeworm (NOW). Dormant tree shaking to remove these nuts, then shredding them in the orchard destroys the over-wintering stages of this insect. The result is that there no longer is a resident population of NOW within the orchard to infest nuts injured in-season. This practice alone is a major part of any program to manage this insect pest.

Pruning: Dormant pruning complements other good cultural practices in a pest management program. It thins out wood within the tree, invigorates shoot growth and confines trees to their allotted space. As such, it is quite helpful in a pest management program, for example, encouraging tree vigor minimizes such diseases as branch wilt that infects via sunburn injuries and spider mites that often prefer non-vigorous trees; dense, shaded trees are often more prone to walnut blight due to higher humidity conditions within the orchard.

Mowing: Mowing is a direct weed control practice and a component of integrated pest management. Keeping weeds short minimizes problems weeds cause, such as, water use and rodent habitat. Although not well researched, mowing weeds or a cover crop also has

been suggested as a method of encouraging insect predators to move up into the tree-tops.

Harvesting: Prompt harvest and processing have long been shown to maximize kernel quality and minimize insect and mold damage. Once walnut hulls dehisce, the nut becomes a primary site for navel orangeworm infestation. Minimizing the opportunity time for infestation minimizes percent damage. Prompt harvest also minimizes damage from Walnut husk fly and kernel molds.

Rodex® Rodent Control: Recent development of a concussion device for control of pocket gophers and ground squirrels, Brand name "Rodex", has the ability to spot treat problem areas without use of anticoagulant baits, fumigants, or poisons. This method quickly exterminates existing pocket gophers and ground squirrels, collapsing the burrow system, and retarding re-colonization. The use of this method will be limited to less than 5% of the acreage selectively eliminating populations at pumps, levees, and neighboring farming and restoration borders where large populations cause damage.

Table 2. Cultural Control Methods for Walnut Pests

Control Technique	Objective	Usage	Advantage(s)	Disadvantage(s)
Irrigation	Create a healthier walnut tree to resist pests and to prevent sunburn.	100% - to produce healthy, productive walnut trees.	Reduces sunburn, secondary infestations of NOW, and maximizes production. Provides water for all species.	Minor expense
Shaking and shredding "mummy" nuts	To eliminate overwintering navel orangeworm from the orchard.	Preventative; tree shaking is occasionally used. All tenets mow the fallen walnuts by March 15 providing floodwaters allow.	Reduces NOW populations.	Tree shaking is expensive. Winter weather flooding often prevents the performance of this operation.
Pruning	To keep tree structure open and encourage air circulation to lessen impact of humidity on walnut blight. To provide conditions that minimizes spider mite infestations. A more open canopy allows more complete spray deposition when pest control measures must be applied.	Preventative; the use of pruning is primarily to increase production. Inadvertent pest control is obtained. Tenant farmers usually perform this operation up until the last two years of the orchard's life.	Reduces damage from walnut blight. Achieves better control of codling moth and other pests by ensuring conditions for optimal spray coverage.	Pruning is expensive and returns due to increased productivity are not realized for several years.
Mowing	Control weeds.	100% - Preventative.	Reduces need for herbicides.	Removes orchard vegetative structure, creates dust, may cause compaction.
Harvest	Prompt removal of the ripe walnuts.	Prevents damage from NOW, ants molds,	Prompt harvest minimizes pests and maximizes nut quality.	Not all walnut orchards can be harvested at one time. Some will be delayed due to infrastructure constraints.
Rodex® Rodent Control	Control pocket gophers, ground squirrels.	Selective control and preventative	Limits use of baits, fumigants, and poisons.	Equipment expense and labor.

BIOLOGICAL CONTROL

BIRDS, GENERAL

Codling moth: A USDA study in 1911 reported 36 bird species to be important codling moth predators (McAtee 1911). In California apple systems, a study funded by the Organic Farming Research Foundation showed up to 83 percent depredation of codling moth larvae by birds during the winter (Baumgartner 2000).

Currently few of the orchards in the SRNWR have high populations of codling moth, i.e. over 5% from harvest "crack out" results conducted by The Nature Conservancy (CERUS Consulting 2000). Surveys conducted on SRNWR properties indicate that bird species richness was highest in riparian vegetation, followed by restoration sites, and grasslands with orchards being lowest (Small et al 1999). The bird diversity increases at the restoration sites with age (Small et al 2000). Although lacking solid research of birds' diets surveyed by Point Reyes Bird Observatory (PRBO), considering Baumgartner's research, it is believed birds in general; particularly; scrub jays, American robin, European starlings, Brewers blackbirds, and many woodpeckers have a substantial influence on suppressing the Codling Moth populations year round.

Rodents: For the pocket gopher, *Thomomys sp*., barn owls, *Tyto alba*, can represent a substantial biological control that can be manipulated with the placement of barn owl nest boxes around and in the orchard. Research work in California examined contents of barn owl nest boxes in the San Joaquin and Sacramento Valley around prunes, vines and pecans. Results showed pocket gophers represented over 50 percent of the barn owl diet representing an average of 215 gophers 'taken' during the breeding and nestling phase, the balance consisted of *Microtus sp*, 30% and other birds 20%. (Gallaway et al 1999).

It is doubtful this level of efficacy would be achieved in these walnut units where abundant habitat and alternate prey exist. Further, barn owls prefer to hunt away from their nests and in open areas. In tall dense walnut orchards, some predation in the more open areas may occur, but would be considerably less than in vineyards or prunes.

BATS

MEXICAN FREE-TAILED, *Tadarida brasiliensis*

YUMA MYOTIS BATS, *Myotis yumanensis*

Recent research in California indicates that the indigenous migratory bats, such as, Mexican free-tailed and Yuma myotis bats, may particularly play a large role in insect control. Research shows they consume a considerable quantity and diversity of insects after they have migrated to the Sacramento Valley in summer; from April through September 50% - 90% of the diet consisted of moths (Long 1998). Bats are also known to chase away moths with echolocation; moths, including cutworms, armyworms, and bollworms turn and dive to the ground up to 130 feet away from bats. While work has not been done on codling moth or navel orangeworm in walnuts or other crops, bats may be a

substantial natural predator of these pests and bat habitat and populations should be encouraged.

PARASITIC ARTHROPODS

Trichogramma platneri

The parasitic wasp was first isolated in Yuba County California attacking codling moth eggs in walnuts in 1986 (Bob Hanke, pers. comm.). Now, these egg parasites can be purchased from several insectaries for release in walnut orchards. Through testing by the University of California (Mills et al 1995) a suggested level of augmentive releases has been established for this pest. The University of California Pest Management guidelines (Mills and Pickel 1999) suggest releasing 200,000 *T. platneri* every week for four weeks during the egg laying period for second and third generations of codling moth. These guidelines suggest this augmentive release program has given 50-70 percent control of codling moth when populations are low to moderate.

Application of *T. platneri* egg cards to every tree in the orchard eight times a season is labor intensive and expensive. Aerial applications of *T. platneri* with 98 percent survival and recovery is possible (Stocker 2000). The expense of 5 applications eliminates this as an option.

Mastrus ridibundus, Liotryhon caudatus, Mastrus rufipes

Three parasitoid species on codling moth have been introduced: *M ridibundus*, *L. caudatus* (ichneumonids), and *M. rufipes* (a braconid). The two ichneumonid species are cocoon parasitoids and the braconid wasp is a larval parasitoid that attacks the mid-stage codling moth larvae inside fruit. These parasitoids typically cause 30 – 50% parasitism of the codling moth in Kazakhstan apples (Mills 1997).

The two ichneumonid cocoon parasitoids were reared in the laboratory and there have been field releases of 41,000 *Liotryphon* and 95,500 *Mastrus* in walnut orchards throughout the Sacramento and San Joaquin Valleys between 1995 and 1997. In 1997 both species were recovered in walnut orchards outside of the release sites, indicating they had successfully overwintered. *M. rufipes* has failed to breed in captivity. As cocoon parasitoids the extent of these introductions on SRNWR walnuts has not been evaluated, but would be a very valuable research addition.

Trioxys pallidus

The parasitic wasp, *T. pallidus*, currently controls the walnut aphid. This wasp, introduced from France and Iran in the 1960's, has virtually eliminated walnut aphid as a pest in most orchards. Monitoring by TNC on properties farmed with existing IPM methodology for the past several years has confirmed an abundance of *T. pallidus* parasitized aphids exist indicating that the parasitoid is well established on the SRNWR walnut properties (CERUS Consulting 2000).

BACTERIAL AGENTS

B.t. (*Bacillus thuringiensis* var. kurstaki)

B.t. is a bacterium that has demonstrated selective larvacidal activity against all lepidopteran species including codling moth, navel orangeworm, and red-humped caterpillar. B.t. produces a crystalline protein (delta-endotoxin) that, when ingested by the susceptible insect, causes paralysis of cells in the gut, interfering with normal digestion and feeding. It must be applied prior to egg hatching and throughout the egg-hatching period. While the use of B.t. is common in apple orchards in Washington for codling moth control, it is relatively unused in walnut production in California. Several factors greatly reduce the efficacy of B.t. in walnut: tree height (often in excess of 40 to 50 feet tall), precludes the required thorough coverage, rapidly growing foliage during the first generation of codling moth would require frequent application for adequate control, and the protein has short term (5 day) effectiveness before it is degraded by sunlight. Because of the 5-8 applications per season this is an unused method for Codling Moth.

Table 3. Biological Controls of Walnut Pests.

Control Technique	Pest Control Objective	Usage	Advantages	Disadvantages
Birds, General	Encourage presence of general bird predators for control of codling moth, navelorange worm and other insect pests	Opportunistic and passive method of insect control.	Little supplemental expense.	A passive method of insect control that cannot be managed.
Barn Owl	Rodent control.	Opportunistic and passive.	Low cost.	Efficacy impaired in dense orchards. barn owls may not be active in densely canopied walnut orchards.
Bats	Encourage presence of general bat predators for the control of codling moth and navelorange worm.	Opportunistic and passive method of insect control.	Little supplemental expense.	A passive method of control but with abundance of habitat at refuge sites, it may not be worth time or labor to establish bat houses on these units.
Trichogramma platneri	Codling moth control.	Augmentive and opportunistic.	A control method using a California native parasitoid wasp. Does not impact secondary pests.	Expense. Cost of stapling *T. platneri* to tree leaves eight times a season is considerably more expensive than other control methods and is less effective than chemical control.
Mastrus ridibundus, Liotryhon caudatus, Mastrus rufipes	Codling moth control.	Opportunistic and passive.	Ease of establishment. These parasitic wasps may become established with little change in management.	None. Susceptibility to broad-spectrum insecticides unknown.
Trioxys pallidus	Control of walnut aphid.	Opportunistic and passive.	Currently well established in the units.	Susceptible to broad-spectrum insecticides.
Bacillus thuringiensis var. kurstaki	Control of red-humped caterpillar	Augmentive and active.	Does not impact secondary pests or wildlife.	Expense. The cost of lab and equipment to apply t bacteria.

CHEMICAL CONTROLS

TEBUFENOZIDE (Confirm)
Tebufenozide is an Insect Growth Regulator (IGR), which acts by binding to the ecdysone receptor protein causing the molting process of codling moth larvae to become lethally accelerated. When applied at 200 to 250 degree days (hours of temperature over a threshold, i.e. 14° C since egg laying) from biofix and thorough coverage is obtained, including combinations of ground and/or aerial applications on large trees, good control is obtained. Tebufenozide is the primary IPM pesticide material used by tenet farmers for codling moth control. Since the SRNWR abandoned the use of synthetic pyrethroids in 2000, the use of tebufenozide has accounted for 95% of the control of codling moth on the SRNWR walnuts.

Tebufenozide has moderate aquatic toxicity by Service standards and will be mitigated by the buffer zones of 200 feet by ground and 300 feet by aerial applications.

PHEROMONE MIXTURE, MATING DISRUPTION (Isomate C+)
Considerable interest in using codling moth mating disruption technology has existed since development of Codlemone, a synthetic sex attractant pheromone. However, success similar to that of apples and pears using a pheromone dispenser technique in other parts of the United States was not realized for walnuts in early California trials; the size and volume of large trees has kept most growers from utilizing the technique. Growers with young walnuts have used the technique but often report partial failures.

Two recent walnut studies however have shown this to be an effective method, albeit time consuming, control of codling moth. A three-year Walnut Biologically Integrated Orchard Systems program (BIOS) in San Joaquin County, using Isomate C Plus had comparable damage levels to the conventionally managed blocks (Grant 2000). Because the dispensers need to be hung during a short, two week period of time in late March, this method has not been adopted by tenet farmers. The option on some blocks will remain within this IPM plan in the event that other methods should fail to be efficacious.

PHEROMONE MIXTURE, MATING DISRUPTION (CheckMate CM-F, 3M MEC-CM)
In addition to the potential use of Isomate C+, which has been approved by the Service, two new sprayable formulations of codlemone have been granted registration by EPA in 2002. Both products have been field tested by local PCAs and the University of California on properties adjacent to refuge properties. The results have been encouraging in controlling codling moth mating disruption, although with high risk CVs and high moth populations the disruption failed and tebufenozide was needed to control the 2nd or 3rd generations (Cliff Kitayama pers. comm.)

These sprayable formulations of the codlemone are easily applied by the tenet farmers, which facilitates their use and adoption of mating disruption. If the methodology can be

proven successful and cost effective, pheromone disruption will be strongly supported on refuge properties because of its low impact to wildlife and natural predators.

MALATHION and NU LURE BAIT

Malathion, developed in 1950, is one of the oldest organophosphate insecticides. Even though it is toxic to aquatic insect species it is rapidly biodegraded. Malathion has been the chemical recommended for control of walnut husk fly. The current and recommended method is to apply malathion with a food attractant, Nu-Lure Bait, to every third row, with a coarse spray to the lower half of the tree. This is the site where walnut husk flies live after emerging from the ground.

SPINOSAD (GF-120 NF Naturalyte)

In 2002 the use of spinosad with a bait attractant was approved by US EPA for use in walnuts for walnut husk fly. The active ingredient is produced from the aerobic fermentation of the naturally occurring actinomycete, *Saccharopolyspora spinosa*. This natural product, approved for organic production systems by OMRI, has a novel mode of action that affects the insect nervous system at the nicotinic acetylcholine receptors. It provides excel control through both contact and ingestion, yet is generally safe to beneficial insects. The product will be tested on walnut orchards in the area and if it is efficacious, will be an improved alternative in the control of walnut husk fly.

CLOFENTEZINE (Apollo)

In most years mites are controlled in walnuts by good cultural practices (e.g. water management) or natural enemies such as the western predatory mite, *Metaseiulus (Galendromus) occidentalis*. In some seasons, however, they require control. Clofentezine has been recommended in the past on Service units because it is relatively nontoxic to fish. Because the miticide interferes with the breathing tube of the egg stage of the mite, it must be applied before a truly threatening population level has been reached contrary to IPM practices. More tenet farmers will be encouraged to use narrow range oils and partial treatments with clofentezine in mite hot spots as part of the IPM program.

NARROW RANGE OIL

Agricultural oils will effectively control many insect pests by suffocation. Narrow range oils are recommended in the UC IPM Guidelines for mites. Most of the tenet farmers have not used narrow range oil in the past because they were both concerned about phytotoxicity and there were more effective materials available. Now that the number of available products for mite control has been reduced to clofentezine more tenet farmers will be encouraged to try oil as part of their mite control programs.

COPPER HYDROXIDE (Kocide 101)

Copper is a broad-spectrum fungicide/bacteriocide. Copper, in the form of copper hydroxide, has been used for control of walnut blight for many years. Regular applications for control of walnut blight are made based on temperature and rainfall

events or every 10 to 14 days through the leaf out and bloom period. Presently there is not an IPM control program for walnut blight and the application of copper as a preventative is the only option.

MANGANESE ETHYLENEBISDITHIOCARBAMATE (Manex)
Some orchards have developed copper resistant strains of walnut blight. It is suggested that where such strains exist, Manex be included with the copper to increase control. For the past six years the State of California has issued a Section 18 Emergency Exemption label for the use of Manex.

ETHEPHON (Ethrel)
The plant growth regulator ethephon is an important and integral part of the SRNWR IPM plan for walnut production. Ethephon acts by liberating ethylene gas resulting in an acceleration of hull dehiscence. This can advance harvest by 10 to 16 days. Ethephon is used by many of the tenet farmers because it eliminates additional inputs of pesticides, facilitates an earlier harvest, and delivers a superior quality product. The use of ethephon to hasten harvest avoids damage from 4th generation navel orange worms and from walnut husk fly.

GLYPHOSATE (Roundup Ultra®)
Glyphosate is used on all of the walnut units for weed control. The absence of weeds in the tree rows, around the walnut trunks, and around sprinklers facilitates management and harvest. As noted above under "Weeds", absence also reduces problems associated with trunk girdling by *Microtus* sp and by crown and phytophthora rot root. Walnut unit farmers do not control weeds outside the orchard edge because they wish to maintain a solid vegetative filter strip around the perimeters to reduce off site movement of water, soil, nutrients or chemicals.

WALNUT PEST CONTROL TREATMENT EFFECTS

EFFECTS ON WALNUT PESTS
The primary insect pest species, codling moth, can be controlled with tebufenozide, pheromone mating disruption, or the combination of both products during years of heavy codling moth pressure. *T. platneri* releases can 50 to 70 percent control according to research but have never been utilized by farmers regionally and fail to control the populations during high pressure years. Walnut tree height of 45 plus feet has made the use of the insect growth regulator tebufenozide challenging because it is difficult to get the required full coverage in the upper third of the tree. Adequate control of codling moth may require both ground and aerial application of tebufenozide.

There is not a specific pesticide treatment for navel orangeworm, and the farmer tenets use secondary methods such as: shaking and shredding of mummy nuts, avoiding codling

moth damage, keeping the walnuts well watered to avoid sunburn, treating for walnut blight, and accelerating harvest with the growth regulator ethephon.

The third primary pest, walnut husk fly, is easily controlled by monitoring known areas of the orchard that harbor the pest and treating. By monitoring for gravid females and treating with malathion or spinosad combined with an attractant bait the pest is controlled and damage is avoided.

Mites can be controlled by an early application of clofentezine and narrow range oils for spot treatments based upon monitoring, although no farmer tenets have used this treatment for over five years. All other potential arthropod pests are rarely an economic problem and are controlled by the abundance of beneficial insects, birds, and bats.

The crop disease, walnut blight, is controlled by the farmer tenets preventatively with 2 to 4 ground and aerial applications of fixed coppers and Manex every 10 to 14 days during the susceptible stages of spring growth. This practice is usually done in late March and April, except when the orchard may be inundated by high water. Controlling blight reduces secondary infestations by navel orangeworm.

Vertebrate pest control measures are preformed at several spot locations on less than 5 percent of the walnut acres. Edges and structures, particularly pumps, levees, buildings, and adjacent, bare fields undergoing restoration favor squirrels. Damage to irrigation systems by gophers and squirrels sometimes require the farmer tenets to spot treat these mammals with the Rodex® concussion device.

Farmer tenets treat weeds with herbicides, glyphosate only on the tree rows and around structures - up to three times per year. Except for some shady orchards, 80% of the units are covered with vegetation and all perimeters of the orchards are 100% vegetated to provide buffer vegetation. These vegetated buffer edges are encouraged to prevent the off site movement of pesticides.

EFFECTS ON NON-TARGET ORGANISMS

Effects to non-target organisms can be: interference with normal biological systems and functions, loss of biomass, loss of diversity, interference with normal ecological relationships, bioaccumulation, and other known and unknown effects. The mission of SNWRC is to provide for the conservation of migratory birds, native anadromous fish, endangered and threatened species, native plants and other native animals and their habitats. There is concern that walnut pest control treatments interfere by reducing and contaminating existing food and water components of habitat. Rare insects or insects that may function as important pollinators for native plants, may also be impacted by walnut arthropod pest treatments. Significant bioaccumulation has not been associated with any of the approved chemical treatments referred to in this plan.

INVERTEBRATES IN AQUATIC ENVIRONMENTS

From Service data, invertebrates in aquatic environments are impacted by tebufenozide, malathion, spinosad, fixed coppers, and manganese ethylenebisdithiocarbamate. Wide unsprayed vegetated buffers (200 to 300 feet), reduced application rates (50 to 100 gallons per acre), low active ingredient concentrations, rapid degradation and soil binding, avoidance of applications during inversions or winds over 7mph, and the addition of drift control agents all reduce the opportunity for pesticides of concern to enter aquatic environments.

INVERTEBRATES OUTSIDE AQUATIC ENVIRONMENTS

Application of several of the pesticides are more likely to impact invertebrates that exist in orchards when they visit from the surrounding forests. For example, applications of malathion, tebufenozide, clofentezine, or spinosad can have an impact on arthropods which are not the target of concern including pollinators, beneficial insects, and the parasitoids of codling moth and aphids. Through the combined efforts of the Service and farmer tenets the broad spectrum and long lasting pyrethroids (Asana®) and organophosphates (Diazinon®, Sevin®, Imidan®) have been eliminated on the SRNWR over the past eight years. Impacts on other invertebrates, such as earth worms, snails, and nematodes may be short lived in an active flood plain orchard. These questions represent an area of considerable unknowns and opportunities for research on farm property that is acquired for eventual restoration.

SENSITIVE SPECIES AND HABITATS

Federal and State listed endangered and threatened species and federal candidate species, which occur or potentially occur at SRNWR are listed in Table 4. Because general pesticide toxicity levels for vertebrate species such as reptiles, birds, and mammals are at least a magnitude greater than terrestrial insects, it is likely that toxicity impacts in wetland or riparian habitats are not great because pesticides are not applied in riparian areas.

Table 4. Federal and State-listed Endangered, Threatened, and Candidate Species occurring or potentially occurring at Sacramento River National Wildlife Refuge.

Name	**Scientific Name**	**Status**
Bald Eagle	*Haliaeetus leucocephalus*	FT, SE
Giant Garter Snake	*Thamnophis gigas*	FT
Chinook Salmon, Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	FE, SE
Chinook Salmon, Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	FT, ST
Steelhead, Central Valley ESU	*Oncorhynchus mykiss*	FT
Valley Elderberry Longhorn Beetle	*Desmocerus californicus diamorphus*	FT
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	FC, SE
Willow Flycatcher	*Empidonax trailii*	SE
Bank Swallow	*Riparia riparia*	ST
Chinook Salmon, Central Valley fall-run and late fall-run ESU	*Oncorhynchus tshawytscha*	FC

ESU – Evolutionary Significant Unit
FE – Federal-listed Endangered Species
FT – Federal-listed Threatened Species
FC – Federal Candidate Species
SE – California State-listed Endangered Species
ST – California State-listed Threatened Species

Fish have been the focus of Federal and State clean water research and enforcement during the past 20 years. Studies have shown that lethal and sublethal effects from pesticides have impacted fish in the Sacramento River. Additionally both mining and urban usage have contributed to the levels of metals in the Sacramento River. Numerous cleanups, restrictions on discharge, and impending Total Maximum Daily Loads (TMDLs) have and are being undertaken (Cooke & Connor 1998). The implications of the past research on pesticides led the Service to ban the use of Diazinon in 1998 and pyrethroids in 2000 on the walnut properties.

Much of the current concerns about fish include not mortality but sub lethal behavior modifications including the inability to smell predators, inability to respond to scent signals given off by female fish about to release their eggs, and the inability to find migration routes. Considering the current use along Sacramento River drainages includes over 300,000 lbs of organophosphates(OPs) still applied to the region the, continued use of the spot treatment product, malathion is small. As noted above, the Service has not allowed any other OPs since 1998. Three pesticides used on the walnut properties are listed in literature indicating that they could be of concern to fish: Copper Hydroxide, Malathion, and Manex.

Research studies of, *Oncorhynchus mykiss*, have shown bioaccumulation of Copper (Kamunde and Wood 2003) with some studies showing minor accumulation giving the fish the ability to enhance tolerance to other metals during the migration along the river (Clearwater et al 2002). The current use on the Refuge properties is not considered detrimental for this metabolic metal. The approximately 10,000 lbs of metallic copper used on the properties for walnut blight is small in comparison to the regional use of over 4,000,000 lbs of copper on rice, walnuts, and peaches.

Malathion, used for the control of Walnut Husk Fly, is the only OP that is still used on refuge properties. As of 2003 the US EPA has not made an effect determination for malathion, a popular home and mosquito vector control product. With a variety of fish species researched, some of the potential effects of malathion at high dosage include behavioral signs and chronic effects of altered metabolism on immune organs (Galloway and Handy 2003). With regard to species of concern, studies with *Oncorynchus mykiss*, indicated that malathion-exposed fish exhibited large decreases in distance and speed after 24 hours exposure, however even with 96 hours of continuous exposure they recovered fully 48 hours later (Brewer et al 2001). The current usage on refuge properties is approximately 400 lbs compared to a regional background of 20,000 lb in use for public health and walnuts. Malathion is closely controlled on the walnut orchards to a coarse baited spray every other row to draw the WHF to the malathion. Rapid degradation and extensive buffer strips prevent off site movement of the active ingredient.

The third chemical that is considered for use on the SRNWR that could be implicated in affecting fish is Manganese Ethylenebisdithiocarbamate (Manex®). In research, the chemical manex has been implicated in carcinogenic and mutagenic effects in rats (Deveci 1999). In studies conducted on *Oncorynchus mykiss* the early fry stage appeared the most critical period (Van Leeuwen et al 1985). Manex® is currently used on the refuge properties in April in combination with copper to control walnut blight. The level of application averages about 1,000 lb per season on the refuge with regional use of over 500,000 lb.

Other species of concern that feed primarily on aerial insects probably have the greatest probability of being temporarily impacted by effects of pest control treatments. Although bats are not listed in Table 4, they would be a good example of a species group that could potentially be impacted by the loss of prey when the pest control treatments reduce populations of the nocturnal lepidopteron species.

Of the insectivorous birds listed in Table 4, Western Yellow Billed Cuckoo (YBCU), Willow Flycatcher (WIFL), and Bank Swallow (BASW) may be impacted by pest control treatments because their aerial invertebrate food base would be reduced. Pesticide applications made during June and July would coincide with YBCU and BASW nesting possibly impacting food resources available to feed nestlings although an abundance of non pest species rapidly recolonizes the walnut orchards from the adjacent wildlife areas.

Recent surveys have indicated that YBCU breed at the SRNWR in riparian vegetation. Swainson's Hawk (SWHA) and Bald Eagle (BAEA) are not insectivorous but will typically nest and/or roost in tall trees near open fields (SWHA) and open water (BAEA), possibly in walnut trees. Valley Elderberry Longhorn Beetles (VELB) may be present at the SRNWR on any areas containing blue elderberry plants, *Sambucus mexicana*. The use of buffers 300 feet or more between the walnut orchard pest control applications and blue elderberry plants should substantially help mitigate effect of applications of walnut pest control treatments on VELB. For the past five years, the Service at the SRNWR has only allowed the lepidopteron specific products, tebufenozide and pheromone disruption for the majority of the pest control applications. The application of malathion and eventually spinosad applied as a low volume bait only onto every third row of the orchard in combination with the 300 foot buffers substantially reduces any effect on VELB. The Giant Garter Snake (GGS) is an aquatic snake that inhabits relatively warm slow moving or standing water. The GGS does not occur near orchards at the refuge.

Introduction of parasitoids such as *T. pallidus* and *M. ridibimdis* or augmentive releases of the native, *T. platneri* may have a detrimental effect on native Ichneumonid and related wasps by reduction or competition for food sources. For the past ten years there has not been any known augmentive releases on the SRNWR properties. Resident populations of these biological control agents do reside in some of the walnut orchards after spreading from the University of California regional release programs.

TREATMENT THRESHOLDS

Treatment for the various pests of walnuts include both preventative treatments as is the case of Isomate C Plus which is applied to orchards before the emergence of codling moth larvae or copper hydroxide which is applied to walnut blight to keep the bacteria from spreading during rainy weather. The other treatments for walnut pests are primarily active controls in response to monitoring thresholds, orchard history, and the previous years pest levels of codling moth or walnut husk fly. The following Walnut IPM Treatment Summary (Table 5) outlines the anticipated active and preventative treatments during a normal year of walnut production with the treatment threshold and rate of treatment when required.

Figure 5. Walnut IPM Treatment Summary of Active and Preventive Chemical Controls

Pest/ Disease	**Treatment**	**When to Treat**	**Rate of Treatment**
Codling Moth	Tebufenozide (Confirm®)	Treat at 200 to 250 degree days after biofix for the overwintering, 1st and 2nd generations	1 to 2 pts per acre in 100 gallons of water
Codling Moth	Isomate C Plus®	Place pheromone dispensers in the upper third of the tree canopy before the first moth emergence in mid-March	Place 400 dispensers per acre
Codling Moth	Pheromone Mixture, Mating Disruption (3M MEC-CM®)	Apply at Biofix in the first generation and every 30 days up to five applications per season	Apply at 7.5 fl. oz./acre per application
Codling Moth	Pheromone Mixture, Mating Disruption (CheckMate CM-F®)	Apply at Biofix in the first generation and every 30 days up to five applications per season	Apply at 7.5 fl. oz./acre per application.
Walnut Husk Fly	Malathion with NuLure Bait	Monitor for flys with ammonium carbonate charged yellow sticky traps in areas of infestation. When eggs can first be squeezed from gravid females treat within 1 week	Apply 1.5 to 3 pt/acre mixed with NuLure bait every third row with a coarse spray to the lower half of the walnut tree
Walnut Husk Fly	Spinosad (GF-120 NF Naturalyte)	Monitor for flys with ammonium carbonate charged yellow sticky traps in areas of infestation. When eggs can first be squeezed from gravid females begin treatment.	Apply 1-3 fl. oz/per tree of undiluted spray solution. Repeat applications every 7-14 days.
Two Spotted Mite European Red Mite	Clofentezine (Apollo®)	Monitor regularly and treat if brown clusters of leaves are present on 10% of the trees and no predators are present	Apply 4 fl.oz/acre in 100 gallons of water
Walnut Blight	Copper Hydroxide (Kocide 101®)	Apply first treatment no later than first pistillate bloom, followed by additional treatments every 7 to 14 days depending on frequency of rainfall	Apply the equivalent of 4 lb of metallic copper per acre in 100 gallons of water
Walnut Blight	Manganese Ethylenebisdithiocarbamate (Manex®)	If registered in 2002 apply with each treatment of Kocide	Apply at 1.8 qts/acre of formulated product in 100 gallons of water
Weeds, General	Glyphosate (Roundup Ultra®)	Treat tree rows when weeds begin growing next to tree trunks or around buildings and irrigation structures	Apply 1 to 4 lb or a.i. per acre in 5 to 30 gallons of water

RESEARCH NEEDS

There are considerable areas to be researched regarding the effects of walnut management within the inner river area adjacent to the SRNWC units. The role of biological control from the riparian forest as well as the role of bats, birds, and generalist predators is yet not clearly understood. Success with pheromone disruption in walnuts in northern California is being explored but success has not been demonstrated on a large scale. Further research on the efficacy of pheromone disruption will be needed before this technology can be recommended for more than one third of the SRNWR walnuts.

Despite the existence of buffer strips to prevent off site movement or drift of the pest control materials there is still concern that the use of Malathion may have either a transitory or cumulative effects on the reduction of non-target aerial or terrestrial insects, especially those that are rare or serve as pollinators for rare plant species. Inventories of at risk species should be undertaken based on their susceptibility to Malathion treatments. Further field research on the alternative for walnut husk fly control, the spinosad bait, should be accelerated.

Research from other areas needs to continue to be evaluated for application to the SRNWR. Furthermore, as new methods or products become available to control walnut pests, those that can provide adequate control with less negative impacts than the existing methods should be evaluated for use on the refuge walnut units if appropriate and feasible.

SUMMARY

The SRNWR units, which contain managed walnut production units have in the past and are currently using the most efficacious methods of pest control for codling moth, navel orange worm, mites, and walnut husk fly all of which may require a chemical control. All decisions to use a chemical control are based upon monitoring by licensed Pest Control Advisors and are used when cultural and biological methods have failed to control the pests below significantly damaging levels. Failure to treat the pests codling moth and navel orangeworm, both of which have 3 or 4 generations, will result in population buildups that can impact neighboring walnut and almond orchards.

Failure to treat walnut husk fly or mites can cause a 10 to 20% portion of the crop to be unmarketable due to sunburn and secondary infestations from molds. Other preventative treatments, such as, copper hydroxide for the bacteria walnut blight are standard industry treatments that are required to prevent a 20 to 50% crop loss. It is important to keep the walnut crops managed by the tenet farmers who derive proceeds from the crop versus allowing the large units of walnuts to be unmanaged for years while funding is solicited for restoration. Currently there are not sufficient funds to restore the 1,529 acres of walnuts.

This IPM Plan will provide sufficient flexibility to keep the properties managed until further research and field experience with codling moth pheromone disruption and

spinosad bait can be evaluated and implemented. Until an acceptable pheromone disruption system is developed over the next three years, tebufenozide will be used as the primary codling moth control method on 95 percent of the acreage.

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Appendix R. Response to Comments

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1.0 INTRODUCTION

This appendix contains a detailed summary of all comments that were received in response to the Draft Comprehensive Conservation Plan/Environmental Assessment (Draft CCP/EA) for Sacramento River National Wildlife Refuge during the official public comment period. Public comments on the Draft CCP/EA were accepted from July 8, 2004 to August 20, 2004. Any additional comments received up until August 31, 2004 were also accepted and analyzed. Comments received after August 31, 2004 were reviewed for content, but were not used in the analysis.

All comments were reviewed and organized so that an objective analysis and presentation of the comments could be made (Section 2). Each piece of correspondence was assigned an identification number. Note that for simplicity sake, the word "letter" is generally used throughout this appendix to refer to any comment received, whether by letter, fax, postcard, email, comment sheet, or telephone call. A database was created to help analyze the nature and extent of the range of comments received. Service responses are included in Section 3. The names and affiliations of all of the people who commented are listed at the end of this Appendix (Section 4). Section 5 explains and summarizes the changes made between the Draft and Final versions of the Comprehensive Conservation Plan and Environmental Assessment. In cases where a letter pointed out a minor typographical or editorial error in the Draft CCP/EA/ the change was made in the Final CCP/EA, but no response is included in this summary.

2.0 QUANTITATIVE ANALYSIS OF COMMENTS RECEIVED

2.1 Summary of Comments Received on the Draft CCP/EA and the Response Process

The Service received a total of 1,187 comment letters (via letter, fax, postcard, e-mail, comment card, phone conversation) on the Sacramento River Refuge CCP/EA during the comment period.

2.1.1 Public Meetings

To facilitate public review and comment on the Draft CCP/EA, the Service hosted four public meetings (Table 1). Service staff made formal presentations and provided time for questions and comments at the meetings. Service staff and visual aids were also available at each topical station (refuge management, visitor services, wildlife and habitat, and fire and maintenance) to facilitate dialog. Hardcopies and CD copies of the Draft CCP/EA were available for the public to review and take with them.

At the meetings, the public was invited to provide comments on the contents of the Draft CCP/EA. Comment sheets were provided. The public meetings were attended by a wide

range of people, including federal, state, and local agency staff; representatives of organizations; neighbors of the Refuge; and other members of the general public. All four meetings were held in the evening from 6 p.m. to 8 p.m.

Table 1. Date, Location and Attendance During Public Meetings on the Draft CCP/EA

Date	Location	Attendance
July 20, 2004	Willows, CA	6
July 21, 2004	Chico, CA	42
July 27, 2004	Red Bluff, CA	22
July 29, 2004	Colusa, CA	19

2.1.2 Affiliations

Table 2 provides a summary of the affiliation of commentors. Names and entities of the commentors are listed at the end of this Appendix (Section 4). Many of the comments received had letterhead and signatures from various agencies, organizations, and businesses; however, unless the entity was specifically represented in the comment, the comment was left in the general public affiliation type.

Table 2. Commentor Affiliation

Affiliation Type	Number Of Letters Received
Federal Agencies	2
State Agencies	3
Local Agencies	4
Organizations	16
Businesses	9
General Public	1,153
TOTAL	**1,187**

2.1.3 Comment Media

Comments were received in a variety of formats during this process, including letters (and postcards), e-mails, faxes, phone conversations, and comment sheets distributed by the Service (primarily at public meetings and local businesses) to facilitate the comment process. A hardcopy of the Draft CCP/EA was placed at local businesses as well as local libraries for review (locations are listed in Appendix J). The distribution of media type is summarized below in Table 3. Note: no petitions were received as part of the comment process, although a few of the form letters contained up to 8 signatures. It should be recognized that the increased use of e-mail and other internet-based communication tools contributed to the large number of comments received on the Draft CCP/EA. The Service considered all comments received as part of the decision-making process.

Table 3. Type of Media Used

Type of Media	Number of Comments Received
Letter	126
E-mail	863
Fax	24
Phone Record	7
Comment Sheet	145
Letter & Email	11
Email & Fax	11
TOTAL	**1,187**

2.1.4 Place of Origin of Commentors

Although the Sacramento River Refuge is a relatively new refuge, it is well known and the anticipation of its opening to the public has been recognized throughout the CCP process. The greatest number of respondents (54 percent) was from California, with 38 other states or outside of the United States making up 1 percent or less. 407 commentors did not provide a place of origin (Table 4).

Table 4. Commentor State of Origin

STATE	# of respondents	STATE	# of respondents
Outside of the US	6	NC	6
AL	1	NE	1
AR	3	NH	1
AZ	3	NJ	2
CA	639	NM	1
CO	1	NV	2
DC	1	NY	15
FL	7	OH	4
GA	1	OK	2
HI	1	OR	9
ID	5	PA	2
IL	7	SC	2
IN	5	TN	1
KS	3	TX	12
LA	2	UT	2
MA	6	VA	4
MD	5	WA	8
MI	1	WI	1
MN	2	WV	1
MO	3	No state given	407

2.2 Quantitative Summary of Comments Received – Alternatives and Issues

Section 3 of this Appendix presents a summary of specific comments received, followed by the Service's responses. However, it is first useful to present a general summary of the nature of comments received, based on issue type. The information presented in this section includes a relatively quantitative analysis of the information received and analyzed. A more precise analysis was difficult due to the overlap of key issues and the open ended nature of the comment process. Data was recorded only for issues specifically identified by commentors. For example, if a letter specifically addressed only one key issue, it was tallied under that issue topic only, even though a position was implied on other key issues. Thus, evaluation and assessment of comments is strongly tied to the nature and content of the specific comments received. Service staff have read and reviewed every letter received during the comment process, and the information contained in those comments was used to help develop the Final CCP/EA, and refine the Preferred Alternative.

2.2.1 Alternative Support

The Draft CCP/EA presented an analysis of 3 alternatives: Alternatives A, B, and C. Commentors often expressed their explicit support for (or opposition to) a particular alternative by name. In many instances, commentors qualified their support for a given alternative, that is, they noted that they preferred a particular alternative overall, but also recommended certain additions or deletions of specific action components. For this analysis, the Service refers to this conditional support as support "with changes." Out of the 1,187 comment letters, 787 (66 percent) of the comments supported an Alternative. Out of those that expressed support for an Alternative, there was strong support expressed for Alternative C (86 percent, with and without changes). Alternative B, the Preferred Alternative was supported by 9 percent, with and without changes. In addition, almost all agencies and governments expressed support for the Preferred Alternative. Five percent supported either Alternative B or C. Very little support was given for Alternative A, the No Action Alternative. Table 5 summarizes the commentors' stated support for the given alternatives. Out of 1,187 comment letters, 400 (34 percent) did not express support for an Alternative. These commentors expressed either opposition or support for a specific issue.

Table 5. Support for Defined CCP/EA Alternative

Alternative	Number (percent)
Alternative A	3 (<1%)
Alternative B	54 (7%)
Alternative B with changes	15 (2%)
Alternative C	664 (84%)
Alternative C with changes	12 (2%)
Alternative B or C	39 (5%)
Total Comments on Alternative Preference	**787**

2.2.2 Issues

Table 6 contains a list of issues that were specifically mentioned in the comments received. It is important to note that comment letters may have contained more than one issue. Within a single comment letter, there may have been multiple comments on a specific issue; however, the issue was only recorded once per comment letter in this analysis. Either support or opposition was expressed for each of the issues, except for the no hunting issues which consisted entirely of those opposed to hunting on the Refuge.

After reviewing the 1,187 comment letters, 1,681 comments within 19 issues were identified. Many of these issues were also identified during the CCP scoping process. Out of the 1,681 comments, the majority dealt with hunting (57 percent) with 13 percent opposing hunting and 44 percent either supporting or specifically mentioning hunting in their comment.

Table 6. Comments Concerning Specific Issue

Issue	Number (percent)
Hunting	747 (44%)
Fishing	346 (21%)
Opposed to Hunting	219 (13%)
Refuge/River Access	178 (11%)
Agriculture	48 (3%)
Other	36 (2%)
Other Recreation	23 (1%)
Refuge Management	22 (1%)
Adjacent Landowner	12 (<1%)
Law Enforcement/Fire	11 (<1%)
Wildlife Observation	10 (<1%)
Flood Control	10 (<1%)
Boat Ramps	5 (<1%)
Questions	5 (<1%)
Environmental Education	2 (<1%)
Interpretation	2 (<1%)
Photography	2 (<1%)
Disabled Access	2 (<1%)
Camping	1 (<1%)
	1,681

3.0 SUMMARY OF COMMENTS AND SERVICE RESPONSES

This section provides a summary of the individual comments received on the Draft CCP/EA, followed by the Service's responses to those comments. The comments were organized into 14 topic areas many of which are issues identified in Table 2. The topic areas include:

- Floodplain Management/Hydrology
- Adjacent Landowner Concerns
- Biological Comments
- Refuge Management
- Biological Issues
- Biological Integrity
- Hunting
- Cultural Resources
- Sanctuary
- Public Access
- Policy
- Other CCP Comments
- EA Comments
- Praise

Within each topic area, similar or related comments were grouped by subtopic and presented as bulleted items. In many cases, the text in the bulleted comment is a quote from a particular letter; in some cases, very similar comments were merged into a single bullet or comments were paraphrased to make them more concise. Every effort was made to present all substantive comments in this summary; the specific comments presented here are a representative sample of all the comments received. A comment that addressed several issues was sometimes placed in a single bullet, in the section to which it was most closely related. Therefore, there is some overlap between topics. The Service response follows each group of comments. A copy of all of the original comments received on the Draft CCP/EA is maintained on file at Sacramento Refuge Complex headquarters.

3.1 Floodplain Management/Hydrology

Comment: While it is commendable that the Service recognizes the need to protect the integrity of the system of levees, weirs, and overflow areas the wording in Strategy 1.2.3 could and should be more strongly worded to state a Refuge goal is to retain and enhance existing flood flows. The words "coordination" and "studies" are a subterfuge for inaction within governments.

Service Response: Authorizing legislation of the Refuge is described in Chapter 1 of the CCP in the section titled Sacramento River National Wildlife Refuge. The purposes of the refuge are linked to the enabling legislation which is also described in Chapter 1 in the Refuge Purposes section. The process used to determine refuge goals, which are tied to

the purpose of the Refuge is explained in Chapter 2 in the Determining the Refuge Goals, Objectives, and Strategies section. Although the Service does recognize the importance of the Sacramento River Flood Control Project (SRFCP) and requirements to maintain flood control infrastructure, flood control was not defined as a specific purpose for which the Sacramento River National Wildlife Refuge was established.

Coordination and consultation with regulating agencies, environmental compliance including NEPA, and engineering/hydraulic analysis are required for federal actions beyond regular and reoccurring maintenance activities. This document, which involved coordination with other agencies and technical studies and analysis, is part of the process.

Comment: Restoring floodplain hydrology through refuge properties near Deer Creek, Tehama County.

Service Response: Chapter 5, Objective 1.2 describes the refuge management options for floodplain restoration and river processes. The benefits to allowing floodwaters to enter refuge lands should not only improve fish and wildlife habitat, but also provide additional acreage for floodwater storage. Prior to any restoration efforts including both re-vegetation and/or topographic modifications, the refuge conducts in depth ecological and engineering studies to determine the benefits to fish and wildlife as well as potential impacts to neighboring lands. A detailed feasibility study was conducted on the Rio Vista Unit (PWA, 2004) to determine the benefits and impacts to restoring floodplain topography on the property southeast of Woodson Bridge. The study indicated, by restoring historic topographic features on the Rio Vista Unit, there would be ecological benefits and minor local flood hazard reduction in the vicinity of the Rio Vista Unit. The Refuge is in the process of conducting preliminary endangered species consultation and engineering designs to improve drainage on South Avenue through Refuge lands.

Comment: The soils section and geology/hydrology section state that surface erosion and sedimentation rates would change minimally as a result of the proposed alternatives. These statements need clarification and qualification. If floodplain hydrology is restored erosion potential, deposition, and sedimentation should be expected to shift as the floodplain develops.

Service Response: Restoration of agricultural lands to riparian habitat involves normal agricultural practices including orchard removal, discing and land plain work for seedbed preparation and weed control.

Prior to any action involving floodplain changes the Refuge would consult with engineers to conduct hydraulic modeling of the restoration site and identify potential impacts. The Refuge and its restoration partners would design revegetation and other restoration activities accordingly. All restoration plans must be sent to the State Reclamation Board for review and comment. Projects with specific goals for increased flood water storage on

Refuge lands to reduce flood pressure on surrounding communities include La Barranca, Rio Vista, and Pine Creek.

Comment: If the intent of the Refuge is to return the floodplain between the levees to an open area as represented by these pictures in the Draft CCP, it would greatly benefit flood protection to properties in the Butte Basin.

Service Response: It is it the intent of the Refuge to restore, enhance and manage the natural, indigenous habitats and vegetation that once occurred and potentially would occur at the Refuge. These habitats include open grasslands, savannas, woodlands, and forests. The Refuge and associated restoration partners use hydraulic models to determine the impacts of restoration design (i.e., vegetation structure and density) on flood flow conveyance and levees. The Refuge has planted open habitats such as grasslands and savannas where needed to maintain flood flow conveyance and protect levees.

Comment: The second sentence in the second paragraph on page 23 of the Draft CCP is misleading and that riparian forests have not been weakened by dams and an altered hydrograph. The opposite is true with summer water flows augmented from Klamath River flows and reservoir releases.

Service Response: Modern flood control and water storage and conveyance systems on the Sacramento River have altered the hydrograph so the flow regime (i.e., timing, distribution, and volume of flow, over bank flooding) and associated physical processes of main channel migration (i.e., river meander), erosion, and deposition/sedimentation have been greatly altered. The Sacramento River is a meandering river and the vegetation, plants, fish, and wildlife are adapted to the seasonal, convulsive nature of these physical processes. Riparian trees and shrubs survive prolonged flooding during dormancy and subsequent drought by tapping into the water table. As trees fall into the river due to erosion on one side of the river, corresponding deposition creates a substrate for seedbed, while seedling roots follow a trailing water table. Over time, the meandering Sacramento River built natural levees that valley oak forests eventually became established and thrived upon. The extent of these forests can be surmised by the extent of Columbia-class soils in the Sacramento Valley. The Sacramento River riparian corridor was a large, diverse mosaic of vegetation, sand and gravel bars. Modern flood control and water storage and conveyance structures ultimately made it possible to clear oak woodlands and riparian forest for agriculture. This change to agricultural land use is largely responsible for the loss of 98 percent of California's riparian habitats. It should also be noted that flows of the Sacramento River are augmented by water from the Trinity River, not the Klamath River.

3.1.1. Restoration

Comment: Consider the impacts of vegetation, sediment transport, and geomorphology on the hydraulic capacity of the River. Evaluation should include hydraulic modeling to determine effects on bank stabilization and channel capacity.

Service Response: Restoration planning activities (Restoration EA, USFWS 2002) fall under the NEPA process for environmental and public involvement compliance. These documents include planning, restoration design, hydraulic analysis, impact analysis, and public involvement. The use of computer models that describe water flow is a standard engineering practice employed to evaluate changes in water flow resulting from a project. There are many different models employed for this purpose, however they are all based on the physics that describe moving water. The basic approach is to calibrate the various model parameters such as water depth and velocity to a known set of conditions on the landscape. Project conditions such as a levee, a bridge, or a change in land cover use are then input into the computer model. The model is then used to compare the resulting project conditions to without project conditions to aid in project design. The detailed, site specific design and collaboration takes place once funding is secured. During the restoration planning process, the Service and its partners are relying more on the expertise and experience of local landowners or tenant farmers, restoration ecologists, and engineering and hydraulic engineers to assist in the design of restoration projects. All site plans are reviewed by the State Reclamation Board, adjacent landowners, and the SRCAF. Although it is the intent of the refuge to restore or enhance all refuge properties in order to fulfill the purposes and accomplish the goals of the Refuge by providing high quality riparian habitat, properties not covered in the Restoration EA (USFWS 2002) will require further analysis and public involvement. It is the responsibility of the refuge manager to ensure that any Refuge actions (e.g. restoration projects) are in compliance with NEPA and other applicable laws and regulations.

Comment: Restore drainage swales/topography through refuge lands prior to restoration

Service Response: The Refuge will focus on the restoration and enhancement of historic topographic features during the planning stages of restoration design on future projects to enhance ecosystem restoration and reduce localized flood hazards prior to implementation. Under Objective 1.2 Floodplain and River Process of the CCP, the Service has identified strategy 1.2.1 as the method for improving the restoration planning process.

Changed CCP, Chapter 5, Floodplain and River Process strategy 1.2.1 to include topographic features: Modify privately constructed levees, *restore or enhance topographic features*, and other bank stabilization features on Refuge lands….

Comment: Statement on page 48 of the Draft CCP and text about bank erosion rates on the Sacramento River is misleading and does not attempt to address how Tehama County is much different than that of counties downstream.

Service Response: The Service added text to this section of the CCP to clarify differences in erosion rates among Red Bluff to Ord Bend, Ord Bend/Llano Seco to Princeton, and Princeton to Colusa.

Comment: Potential impacts of construction projects associated with the CALFED feasibility study currently being conducted for the protection of the M&T Pumping Plant is not included in the Draft EA.

Service Response: Additional text describing the feasibility/NEPA process was added to River Management section in Chapter 4 of the CCP. Chapter 5, Objective 1.2: Floodplain and River Process section identifies the units of the Refuge that require technical investigation pertaining to future management decisions. Strategy 1.2.3 identifies the need to work with Federal, State, county, levee and irrigations districts to investigate best management practices for habitat and flood management purposes through technical studies and agency coordination. There has been no action proposed as a result of the M&T Pumping Plant Feasibility Study. Therefore, the results are not covered under this NEPA process and documentation. The results of the feasibility study will determine the need for additional environmental and/or NEPA compliance.

Changes to the CCP document to include in Chapter 5, under strategy 1.1.4 bullet 2 added the M&T Pumping Plant Feasibility study. Under strategy 1.2.3, changed text to say: Work with Federal and State agencies, counties, and levee and irrigations districts to investigate best management practices for habitat, *water diversion* and flood management purposes through technical studies, coordination and cooperative projects.

3.1.2. Feasibility Studies and Other Investigations

Comment: CCP lacks an adequate description of future conditions since current feasibility studies (Llano Seco and La Barranca) are not cited as projects or alternatives. If the feasibility studies being conducted at Llano Seco Riparian and Pumping Plant were referenced in CCP, the subsequent conclusions would justify need for EIS.

Service Response: Additional text explaining the Feasibility Study/NEPA process was added to River Management section in Chapter 4 of the CCP. Chapter 5 identifies these studies and describes the strategies (Riparian Vegetation and Habitat Strategy 1.1.4 and Floodplain and River Processes strategies 1.2.1-1.2.3) used to address floodplain management issues. The future conditions on the Llano Seco and La Barranca properties have yet to be determined. These site specific projects are currently being analyzed and will be covered under separate environmental compliance when necessary. The results of

the feasibility studies and subsequent NEPA process for each project will dictate whether an EIS is needed.

Comment: Are the feasibility studies at Llano Seco and La Barranca part of No Action alternative?

Service Response: Yes, these feasibility studies are part of the No Action Alternative. Please see the Technical Analysis section of Chapter 4 of the CCP for more details.

Comment: The CCP must disclose linkages to Anadromous Fish Restoration Program (AFRP) goals and objectives for this project.

Service Response: Please refer to Appendix M of the CCP which has been revised to include a description of many federal, state and local programs. The program goals of AFRP that relate to the CCP have also been listed.

3.2 Adjacent Landowner Concern Theme

Comment: Concern from adjacent land owners regarding the following issues: trespass, hunting and weapons restrictions, wildfire, buffer zones, access roads, long-term maintenance funding, and cooperation.

Service Response: Trespass on private lands is a problem throughout the country. The Refuge works with its neighbors to develop strategies to discourage trespass and protect both the resources on the Refuge as well as those of the neighbors. Currently, the Refuge has 2 law enforcement officers (funding for a third officer in fiscal year 2005) that patrol along the Sacramento River Refuge. The Refuge has posted boundaries on an annual basis and more recently began constructing gates and fences at access points to reduce the potential of trespass. Each gate is signed with access restrictions and a contact number for more information. As the Refuge extends over 77 river miles on 26 separate properties, we rely heavily on information provided by our neighbors to identify specific issues or concerns they may be having with regard to Refuge properties. The Refuge also works within the parameters of an MOU with State Parks and Department of Fish & Game to conduct law enforcement activities along the Sacramento River.

Hunting was identified by Congress as a priority public use activity on National Wildlife Refuges in the 1997 amendments to the National Wildlife Refuge Administration Act of 1966. Although the Proposed Action of the CCP opens approximately 50 percent of the Refuge to hunting over the next 15 years, the other half of the Refuge will be open to Big 5 uses or will be closed to all public uses (sanctuary). For example, the majority (571 acres) of the Dead Man's Reach Unit has been identified as more suitable for the fishing, wildlife observation, photography, environmental education, and interpretation (Big 5 uses). In Chapter 1, under Refuge River Jurisdiction, the Service acknowledges the State's "public trust easement" in the area between the low water mark and the ordinary

high water mark. This acknowledgement is illustrated in the proposed public uses (Big 6: hunting, fishing, wildlife observation, photography, interpretation, and environmental education) allowed on refuge lands below the high water mark as interpreted to be those lands below cut banks including gravel and sandbars including 66 acres on the Dead Man's Reach Unit. Safety and maintaining consistency with Department of Fish & Game regulations on state lands adjacent to the Sacramento River Refuge is critical; hence, **hunters are restricted to the use of shotguns and archery equipment while hunting the Refuge**. All other types of firearms are prohibited while on the Refuge.

Fire prevention and hazard reduction programs are also described in Chapter 4 of the CCP. In 2002, the Refuge began to implement the Wildland Urban Interface program on Refuge units to reduce the threat of wildfires on urban areas and landowners adjacent to the Refuge. Projects under this program include prescribed burning to reduce fuels, permanent and seasonal fire break construction, and educational signage. Development and design of site specific projects includes involvement from local landowners, rural, county and state fire fighting departments, the refuge manager and the Complex fire management officer. Site specific restoration designs, developed in cooperation with our neighbors, take into account law enforcement access, boundary signing, fire breaks, and maintaining low growing vegetation to reduce potential impacts around the perimeter boundaries of each unit.

Vehicle access is limited to state and county roads. All but eight of the Refuge units that are proposed to be opened to the public require access via boat only. Those units that are located adjacent to public roads will be accessible by vehicle in that parking lots will be developed at the road, but access to the interior of the units will be pedestrian only. The gravel road located off of River Road in Butte County is not considered a public road and it is not proposed to be open to the public for access to Dead Man's Reach. Access is by boat only.

Funding for annual maintenance staffing and equipment is dependant on the federal budget that is developed by Congress and the President annually. The current and proposed annual staffing and equipment needs are maintained in the national data base and can be found in Chapter 6 under Funding & Staffing.

In Chapter 5 of the CCP, under Goal 3 Partnerships, cooperation and coordination with neighbors is discussed in strategy 3.2.1 through 3.2.6 Private Landowner Cooperation Strategies.

Comment: Concerned about the impacts of unmonitored, un-buffered hunting and the lack of mitigation aimed at protecting neighbors from potential safety, trespass, and annoyance issues.

Service Response: Appendix B contains the Service's required compatibility determinations (CD) for public uses on the Sacramento River Refuge. Included in this

section is the CD for hunting. The compatibility determination includes a description of use, anticipated impacts and how they are addressed, and stipulations necessary to ensure compatibility. The description of use includes weekly law enforcement patrols and field checks to monitor use and address potential conflicts. The Refuge Complex currently has 2 refuge officers (funding for a third officer in 2005) available to cover the 10,000 acres analyzed in this plan. Potential conflicts will be minimized by closing all boundaries with adjacent private land to discourage trespass, maintaining boundary signs and posting public information signs were appropriate. Hunting is not allowed on Refuge units that are either small in size or are located near private residences, businesses, or occupied buildings. The Service has modified Rio Vista and Ohm Units in order to address comments on the Draft CCP expressed by Refuge neighbors over hunting activities potentially occurring near permanent residences. The Service has also added a refuge specific regulation which does not allow hunting within 50 feet of any landward boundary adjacent to privately owned property. In addition, as per Fish and Game regulations, it is unlawful to hunt or discharge while hunting, any firearm or deadly weapon within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith. The 150-yard area is a "safety zone".

Of the almost 1,200 comment letters we received, 784 respondents supported either Alternative B or C compared to the three comment letters supporting Alternative A. In addition, 219 letters were against hunting, but did not indicate a preferred alternative. From these comments, we conclude that growing public sentiment is to open some of the Refuge to public use.

Comment: Squirrels and other rodents are an ongoing problem with adjacent agricultural operations; the Refuge should control at Service expense.

Service Response: In Chapter 5 of the CCP, under Goal 3 Partnerships, cooperation and coordination with neighbors is discussed in strategy 3.2.1 through 3.2.6 Private Landowner Cooperation Strategies. The Refuge is now incorporating perimeter firebreaks and law enforcement patrol access roads into restoration planting designs. These maintained perimeters along private properties engaged in orchard operations have served to reduce the impacts of ground squirrels and other rodents on adjacent properties (Charles R. Crain, Jr. personal communication). The Refuge and its partners have also attempted to biologically control rodents associated with orchard operations by installing owl boxes in strategic locations near these "open" boundaries in an attempt to minimize the impacts of wildlife on adjacent lands. These strategies are designed on a case-by-case basis working with the adjacent landowner so that both parties are satisfied with the outcome.

3.2.1 Relationships

Comment: The Refuge should sustain and improve the relationship with adjoining landowners.

Service Response: In Chapter 5 of the CCP, under Goal 3 Partnerships, cooperation and coordination with neighbors is discussed in Private Landowner Cooperation Strategies 3.2.1 through 3.2.6.

Comment: How will you maintain contact with adjacent neighbors to discuss mutual concerns as stated in Strategy 3.2.1?

Service Response: The process for maintaining contact with adjacent landowners is outlined in the CCP, Chapter 4 Cooperation with Adjacent Landowners. The refuge manager is the primary contact for cooperation with adjacent landowners and public agencies. He will keep the line of communication open to help identify any issues at an early stage and attempt to resolve any conflicts that may exist.

3.2.2 Elderberry Beetle

Comment: Concern regarding conservation guidelines for valley elderberry longhorn beetle, buffers around elderberry plants, and weed control.

Service Response: Conservation guidelines for the valley elderberry longhorn beetle (VELB) are out of the scope of this document. The conservation guidelines were issued by the Sacramento Fish and Wildlife Office to assist those needing incidental take authorizations in developing measures to avoid and minimize adverse effects on the VELB. The Refuge does not enforce Endangered Species Act regulations on private lands. However, the Refuge self-imposed, 100-foot valley elderberry shrub-free buffer (Appendix A, Environmental Assessment, Mitigation Measures) is intended for the boundaries between private orchards, levees, roadways and that of Refuge restoration sites so that agricultural pesticide drift from these neighboring private orchards and facility maintenance operations will not affect VELB habitat in restoration sites or adjacent landowner operations.

Comment: Concern about the 100-foot valley elderberry shrub-free buffer adjacent to neighboring private property and importance of valley elderberry shrub restoration adjacent to existing habitat to valley elderberry longhorn beetle dispersal.

Service Response: The Refuge acknowledges the importance of existing "old growth" riparian forest as a source for dispersing VELB. The 100-foot valley elderberry shrub-free buffer is intended for the boundaries between private orchards and Refuge restoration sites so that agricultural pesticide drift from these neighboring private orchards and fields will not affect VELB habitat in restoration sites.

3.2.3 Other Adjacent Landowner Issues

Comment: The gravel bar area to the northeast and on the opposite side of the river from Ohm is an area of disputed ownership.

Service Response: The ownership of this property is in question due to the meander of the River. The issue has been referred to our Solicitor's Office for resolution. In the interim, the area has been designated as an "Area of Disputed Ownership" and the use (e.g. Sanctuary) will not be designated until the issue is resolved.

Comment: Two individuals have easements to walk and/or picnic on the Mooney Unit. Another individual has a lifetime easement to hunt on this property, accompanied by one guest, during the State season for game birds and mammals. The hunting easement holder believes that his easement is *exclusive* and will be violated if the Refuge opens this unit up to the public.

Service Response: The Service and the individual holding the lifetime easement have worked out an agreement regarding the Mooney Unit. This unit and the northern 62 acres of the Ohm Unit will be closed to waterfowl hunting. However, these areas will be open to other hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Contact the refuge manager for details.

3.3 Refuge Management

Comment: Impacts of restoration on farmland, cooperative land management agreements and coordination with agencies.

Service Response: To date, the Refuge and its partners have restored approximately 3,700 acres of frequently flooded farm ground to high quality riparian habitat. Under Alternative B, the Refuge proposes to restore or enhance 5,855 acres of high quality floodplain riparian habitat over a 15 year period by converting the remaining frequently flooded 1,200 acres of orchard lands, 724 acres of row crops, and 870 acres of fallow ground to habitat. Impacts to local economy and agricultural industry were analyzed in the Environmental Assessment Proposed Sacramento River National Wildlife Refuge (USFWS 1989) and the Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge (USFWS 2002). From a regional standpoint, the proportion of lands removed from agricultural production is relatively small. These lands are also susceptible to regular flooding and erosion. Short term losses to the local economy may be partially offset by increased opportunity for public use activities and tourism and the impacts to the farming community will not be significant.

The Cooperative Land Management Agreements, whereby tenant farmers continue to work active refuge orchards until restoration funds become available or the orchard is no longer productive, allow the local farmer to phase out those portions of an orchard that were sold on a willing seller basis. Although, this does not directly mitigate for the land use change, it does allow for those that may be affected to modify long-term plans over a 3-10 year period of time.

The Service is a signatory of the Sacramento River Conservation Area Forum (SRCAF). The SRCAF (SB 1086) acts as the forum for private landowners, stakeholders, conservation groups, federal, state and local government agencies to communicate, coordinate and inform the public on activities occurring along the Sacramento River. The Refuge is an active participant in this process. Refuge staff provided regular briefings on refuge operations, new projects, and CCP status over the past 3 years. Refuge staff conducted two briefings for the SRCAF Technical Advisory Committee and Board members prior to release of the Draft CCP. The Refuge also coordinates with the State Reclamation Board Engineer to review site specific restoration plans prior to the Refuge finalizing the plans.

Comment: Some of the land (2,685 acres as indicated in the Farming Compatibility Determination) that may be acquired or converted is under the Williamson Act contract.

Service Response: Currently, there are no Refuge lands under Williamson Act contract. Since a Williamson Act contract runs with the land and is binding on all successors, the Refuge will coordinate with the California Department of Conservation if any of the properties that the Refuge wishes to purchase in the future has a Williamson Act contract.

Comment: Suggestion to plant food plots for wildlife in the interim between agriculture and habitat restoration.

Service Response: The Refuge acknowledges the utility of food plots to certain game species. However, it is the goal of the National Wildlife Refuge System to maintain biological integrity, diversity and environmental health. The Refuge plans to accomplish this through restoration, enhancement and management of natural, indigenous habitats and vegetation that will benefit the broadest range of plants and wildlife indigenous to the middle Sacramento River. It is the policy of the Refuge to maintain commercially productive agricultural lands until funding becomes available for riparian habitat restoration. The only interim crops planted prior to restoration are those cover crops which suppress non-native weeds and invasive exotic plants, and do not interfere with restoration. Therefore, these cover crops must be either seedless or produce infertile seeds.

3.3.1 Refuge Easement Lands

Comment: Why didn't the Draft CCP/EA include the easement lands?

Service Response: In Chapter 1 of the Draft CCP under the section "The Sacramento River National Wildlife Refuge", the Service described what areas of the Refuge were covered under the CCP. The Llano Seco Unit and Llano Seco Unit Sanctuary were acquired under a separate authority, the North American Wetlands Conservation Act of 1989, and are considered part of the North Central Valley Management Area (NCVMA), a separate unit of the National Wildlife Refuge System. Therefore, these units and the

easements east of Angel Slough on Llano Seco are not included in this CCP. They will be included within the CCP for the NCVMA.

The Service has added a description of Llano Seco Riparian Easement (east of Angel Slough) at the end of Chapter 3 and in Chapter 4, at the end of the section on Habitat Management.

3.4 Biological Issues

3.4.1 Invasive/Exotic Species

Comment: Identify invasive exotic species monitored and controlled and how the Refuge prioritizes weed control.

Service Response: In Chapter 4, the Service added Table 7 (Invasive Exotic Plant Species at Sacramento National Wildlife Refuge Complex) and text explaining prioritization of exotic species for mapping and control at the Refuge. The text in Chapter 5, Exotic, Invasive Species Control Strategies was also modified to acknowledge utility of Table 7 in managing invasive plant species.

Comment: Concerned about use of introduced species as biological control agents for agricultural pest and unknown potential negative affects on non-target native species. Also concerned that use of introduced species as biological control is in conflict with the mission of the Refuge.

Service Response: No introduced species will be used as biological control agents for controlling agricultural pests on the Refuge. Species addressed under biological control in Appendix Q (Integrated Pest Management Plan for Walnut Production) currently exist on the Refuge or are too expensive/labor intensive to be used to control agricultural pests. Currently the least toxic pesticides and herbicides which effectively control target species are used on refuge agricultural lands (Appendix Q. Draft Integrated Pest Management Plan for Walnut Production on the Sacramento River National Wildlife Refuge). Often, these pesticides are less toxic to non-target organisms that those used prior to acquisition as a unit of the Refuge or on nearby private agricultural lands. These agricultural lands are monitored for pest applications so the fewest pesticide applications possible are used. Several research and monitoring projects at the Refuge have included orchards and agricultural lands, so that the affects of agriculture on habitat and the affects of habitat on agriculture are beginning to be investigated. The goal of the Refuge is to restore riparian habitats when funds become available and crop production proceeds are used for restoration activities.

Comment: The Draft CCP identifies birds as important biological control agents as stated in Appendix Q. Suggested that the Refuge plant hedgerow restoration in agricultural complexes.

Service Response: Planting hedgerows of trees and shrubs in a walnut orchard would make orchard floor management more difficult. Even if carefully designed and managed, the hedgerow could serve as isolated, fragmented habitat with potential negative effects to ground and open cup nesting birds (i.e., increased predation and nest parasitism).

Comment: Urge that controlling invasive species be given top priority and that all scientifically approved methods be used.

Service Response: Controlling invasive or exotic species was identified as an objective of the Refuge (Objective 1.9) and will be managed accordingly. Comment noted.

3.4.2 Fish Comments

Comment: Draft CCP has not adequately address fish issues.

Service Response: Commentor has not specified what is inadequate about fish issues addressed in the CCP. It would be remote and speculative for FWS to guess at the impacts to which the commentor is referring. We disagree with assertion that the CCP does not adequately address fish issues.

Comment: Suggestion that the CCP provide a description of how the USFWS intends to monitor anadromous fish resources and provide measures for success for these activities.

Service Response: The Service does not intend to monitor fish populations on the Refuge. What the Service proposes is to coordinate fish monitoring on the Refuge with the fisheries experts, who will determine measures of success. Objective 1.7.6, states: Coordinate research investigations and monitoring at the Refuge which focuses on population demographics, habitat use and requirements, and health of anadromous and other native fishes. Coordinate with CDFG fishery investigations (Lower Stony Creek Fish Monitoring; Redd Surveys), USFWS–Red Bluff Fish and Wildlife Office population surveys (escape/passage at Red Bluff Diversion Dam), USFWS–California/Nevada Fish Health Center disease investigations and monitoring, NOAA– Fisheries investigations and universities conducting salmonid research (University of California, Davis; California State University, Chico) and research regarding other anadromous and native fish species.

Comment: The fisheries resources section of the CCP should be reviewed by an experienced fisheries biologist with knowledge of the Sacramento River. Concerned about the lack of linkage to Central Valley Project Improvement Act (CVPIA) and Anadromous Fish Restoration Program (AFRP) and requested mutual goals and objectives of these programs be made and that the measures of success be disclosed.

Service Response: The Service contacted the following fisheries managers during the CCP process: P. Ward (CDFG); J. Smith, T. Kisanuki, P. Parker, J. Willamson (USFWS–

Red Bluff Fish and Wildlife Office); K. True (USFWS CA-NV Fish Health Center); and, M. Tucker, M. Aceitano, R. del Rosario, and L. Mahan (NOAA– Fisheries). These fisheries experts were asked to review and provide comment on the CCP. Appendix M has been revised to contain a description of CVPIA and AFRP and the goals that relate to the CCP.

Comment: Typo in Table 7 of the Draft CCP where it states "row" but perhaps should state "roe."

Service Response: The Service appreciates the commentor pointing out the typing error in the document. It has been corrected and it now states "growth" not "row" or "roe".

Comment: Do not believe pink, chum, and coho salmon occur in the project area.

Service Response: All three of these species are listed in the Sacramento River Conservation Area Forum Handbook (2003) as occurring in the Sacramento River. While never abundant in the Sacramento drainage, a small population of Coho salmon once spawned in the McCloud River, Upper Sacramento River, and tributaries of San Francisco Bay (Frantz, T.C. 1979-1981. Job progress reports; Lake Tahoe. Nevada Department of Wildlife F-20–R-16–17. 82 pp. in Moyle 2002)
The Service has removed pink and chum salmon from the Refuge species list (Appendix G). However, Coho salmon will remain on the Refuge species list since it would not be inconceivable to find non breeding individuals in the middle Sacramento River.

Comment: Objective 1.2 is too subjective and commentor suggests that the Service elaborate on the terms "enhance, restore, and maintain" and refer them to specific goals and objectives.

Service Response: The statement referred to in the comment is found under the rational section of Objective 1.2 and states: "Modifying or removing existing privately-constructed levees that are present and restoring floodplain topography within Refuge boundaries will provide conditions for erosion, sediment deposition, and over-bank flooding. These natural processes will enhance, restore, and maintain floodplain habitats for salmonids, other native fish, and migratory landbirds and waterbirds, including species that breed, migrate and winter along the middle Sacramento River." Although, it is unclear what the commentor is asking the Service to elaborate upon. We have revised and expanded Objective 1.2: Floodplain and River Processes and its rationale.

3.4.3 Farming

Comment: Concerned about impacts of pesticides on the valley elderberry longhorn beetle, a federally listed threatened species. Commentor also states that farming does not meet the objective to aid in or benefit wildlife management of the area as required in 50 CFR 29.2.

Service Response: The Refuge farming program is managed under Cooperative Land Management Agreements (CLMA) with two local non-profit conservation groups under authority of 50 CFR 29.2. The intent of the Refuge is to restore riparian habitats when funds become available. Cooperatively managed crop production proceeds are used by our non-profit conservation group partners directly on refuge restoration activities. Alternatives to the farming program were analyzed in the Environmental Assessment for Cooperative Farming on the Sacramento River Refuge Tehama, Butte, and Glenn Counties, California (1994) and again in the EA for the Draft CCP. Currently the least toxic pesticides and herbicides which effectively control target species are used on refuge agricultural lands (Appendix Q. Draft Integrated Pest Management Plan for Walnut Production on the Sacramento River National Wildlife Refuge). Often, these pesticides are less toxic to non-target organisms than those used prior to Refuge acquisition or on nearby private agricultural lands. These agricultural lands are monitored for pest applications so the fewest pesticide applications possible are used. Several research and monitoring projects at the Refuge have included orchards and agricultural lands, so that the affects of agriculture on habitat and the affects of habitat on agriculture are beginning to be investigated. The Refuge consulted with and received concurrence from both the Sacramento Fish & Wildlife Office and from NOAA-Fisheries for threatened, endangered, and candidate species consultation. Concurrence letters for ESA consultation will be included as a stipulation in the Farming CD.

3.5 Biological Integrity

Comment: A thorough discussion and investigation of the biological integrity, diversity, and environmental health of a refuge must occur before planning can ensue.

Service Response: The Service has provided a thorough discussion and investigation of the biological integrity, diversity and environmental health of the Refuge. The Threats and Opportunities section of Chapter 1 of the CCP discusses threats to riparian habitats, migratory birds and anadromous fish. Appendix G lists the vertebrate animals and vascular which occur, or potentially occur, on the Refuge. Chapter 3 discusses the Refuge environment including hydrology, geology, soils, vegetation, vertebrate and invertebrate wildlife, and threatened and endangered species, which are also listed in Table 5. The annual habitat management plan for the Refuge, discussed in Chapter 4, has an inventory of the various vegetation types by acreage for individual tracts of each Refuge unit. These also include restored habitats. Special resource issues are tracked in this database including special status species and invasive species and the status of surveys and vegetation management treatments.

Comment: FWS regulations require that before hunting, trapping, or fishing can occur, a determination must be made that wildlife are surplus to a balanced conservation program on any wildlife refuge area and to determine this, the population requirement of wildlife species shall be determined by population census, habitat evaluation, and other ecological investigation and that these investigations has to consider both the population size and

requirements of the target species. An attempt to determine compatible wildlife-dependent recreation for the Refuge until this process has been completed may violate these FWS mandates and this is especially true for hunting since it directly impacts wildlife species.

Service Response: The Service has determined hunting of dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer to be a compatible wildlife-dependent recreation (Appendix B). California Fish and Game Department (2004) also has determined that fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources.

The Office of Migratory Bird Management sets the general frameworks through their annual regulations permitting the sport hunting of migratory birds. The individual States set seasons within those frameworks. If necessary, the Service develops regulations that may be more restrictive than State hunting regulations in order to protect resources on a refuge-by-refuge basis (i.e., species hunted). Otherwise, the Service observes State regulations on all refuges open to hunting.

U.S. Fish and Wildlife Service Regional and Refuge biologists along with scientists from the U.S. Geologic Survey–Biological Resources Division (Office of Migratory Bird Management) and university researchers meet twice annually with State flyway representatives to discuss inventory data and survey reports for migratory game bird populations which are hunted, proposed for hunting and closed to hunting. The Service bases its migratory waterfowl season length and bag limits for the various species on these surveys. The annual breeding ground survey is one of the most important surveys and has been conducted since 1955. This cooperative effort between the Service and the Canadian Wildlife Service covers Canada, Alaska, and the northern United States prairies where 90 percent of the continental waterfowl populations breed. Results are summarized in various publications, including the annual fall flight forecast. Other important data include harvest and survival rate estimates from band returns. Whether to open a season for a species or not and the establishment of the season length and bag limits are determined by the population objectives for each species. A species must have a harvestable surplus to be considered for hunting. Population objectives for each species are calculated using data from population surveys and banding data. The National Environmental Policy Act process has been followed to insure that migratory bird hunting does not reduce these populations to unsustainable levels.

Current management for mourning doves consists of annual population trend surveys, harvest surveys, and the establishment of annual hunting regulations. Since 1960, management decisions have been made within the boundaries of 3 zones that contain mourning dove populations that are largely independent of each other: the Eastern, Central and Western Management Units. Since 1966, Mourning Dove Call-count Surveys have been conducted annually in the 48 conterminous states by state and federal

biologists to monitor mourning dove populations. In 1992, the U.S. Fish and Wildlife Service and state wildlife agencies initiated the national cooperative Harvest Information Program, which enables the Service to conduct nationwide surveys to provide reliable annual estimates of the harvest of mourning doves and other migratory game bird species. The resulting information on status and trends is used by wildlife administrators in setting annual hunting regulations. In 2001, a National Mourning Dove Planning Committee was formed to further develop guidelines that could be used for regional harvest management. The committee produced The Mourning Dove National Strategic Harvest Management Plan. The implementation of the plan began in July 2003 with the initiation of a national pilot reward-band study. Currently population models are being finalized which will aid in the preparation of regional harvest management plans for 2005. Demographic models and data collection programs to support needs of regional harvest management plans will be established in 2005.

Resident game species are protected by both Federal and State laws and regulations to ensure that harvest rates do not negatively impact populations. The potential impacts of hunting on resident upland game birds and deer are discussed and evaluated in the California Environmental Quality Act process. This process results in periodically updated and publicly reviewed documents. Based on the findings of these documents, the State insures that game animal hunting in California does not have adversely impact its wildlife populations (CDFG 2004).

Wildlife populations along the Sacramento River are currently hunted on both private and public lands, such as Sacramento River Wildlife Area (State), Todd Island and Foster Island (Bureau of Land Management). No impacts to those local populations have been documented (CDFG 2004). Hunting is a highly regulated activity, and generally takes place at specific times and seasons (dawn, fall and winter) when the game animal is less vulnerable (e.g., breeding season) and other wildlife-dependent activities (e.g., bird watching, environmental education and interpretation) are less common, reducing the magnitude of disturbance to Refuge wildlife. Managed and regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

Two species, the ring-necked pheasant and turkey, were introduced into the area years ago. These non-native species have more potential to compete for habitat with native species, however no such competition has been noted along the river (CFDG 2004). In addition, selected game species are not known to prey upon other species at unacceptable levels. The potential for competition and predation exists whether the populations are hunted or not; however, removing individuals of non-native species by hunting could conceivably reduce this potential (CDFG 2004).

Comment: supporting recommendations in the Defenders of Wildlife Report, Science-Based Stewardship: Recommendations for Implementing the National Wildlife Refuge System Improvement Act, for a standardized sequence for refuge planning; biological inventory; identification of plan goals; identification of threats; choice of focal species;

comprehensive conservation plan; monitoring and implementation; plan amendment. Also support for the recommended steps for implementing biological inventory.

Service Response: Chapter 4 of the plan discusses current Refuge management and programs. Appendix O shows the inventory and monitoring surveys and research investigations conducted at the Refuge. Currently, the Refuge and its partners collaborate with these investigations when seeking funds and implementing them in the field. Some of these inventory surveys (e.g., western yellow-billed cuckoo collaborative survey with U.S. Geological Survey) and monitoring surveys (e.g., bank swallow collaborative survey with CDFG) represent key focal species of the Riparian Conservation Plan. A recent survey of the valley longhorn elderberry beetle (River Partners 2004) has documented the colonization of this federal-threatened species on planted elderberries at Refuge lands. PRBO has conducted monitoring investigations of the status of breeding landbirds at the Refuge since 1993. Demographic and habitat data are being used track the success of riparian restoration and model landscape level responses. Ecosystem components which decrease the health of landbird populations are being identified, as well as management actions necessary to reverse declining populations. Other research conduced at the Refuge focused on the utility of monitoring indicator species as a means to track ecosystem health (Stillwater Sciences), such as recommended by the Defenders report. Many of the reports and publications from these investigations are posted on the Sacramento River portal web site.

The Refuge will continue to support inventories, surveys, monitoring, and research investigations of Refuge natural resources. The Compatibility Determination for Research (Appendix B) discusses the guidelines for appropriate investigations at the Refuge. Inventory and monitoring surveys and research investigations must be designed to aid in the implementation of sound management practices to increase biological diversity and integrity at the Refuge and ecosystem health.

Chapter 5 presents the planned refuge habitat restoration and management strategies and wildlife surveys. Implementation of the plan will result in increased habitat for threatened and endangered species, migratory birds and anadromous fish. The increased inventory and monitoring surveys by Refuge staff and partners will track the status of these management strategies.

Comment: How will endangered species be protected if 55 percent of the refuge is opened to hunting?

Service Response: The proposed action allows for almost 80 percent of the Refuge to be opened to public use including over half of the Refuge open to hunting. Hunting, as well as all other Refuge uses, have been designed to minimize impacts to listed species and thereby determined compatible with the purposes for which the Refuge was established (Appendix B). An Intra-Service Section 7 consultation was completed with the Sacramento Fish and Wildlife Office and NOAA-Fisheries. Concurrence with the

Proposed Actions (implementing the CCP on the Refuge) may effect, but is not likely to adversely affect endangered, threatened, or candidate species.

3.6 Hunting

3.6.1 Opposition to Hunting on the Refuge

- I wish to express my opposition to the proposal to open the Sacramento River National Wildlife Refuge to "sport" hunting.
- Please maintain the true meaning of "refuge" to the Sacramento River National Wildlife Refuge by not opening it to hunting.
- Hunting on Sacramento River Wildlife Refuge lands will only exacerbate impacts to already stressed populations of wildlife and increase the likelihood of poaching.
- The National Wildlife Refuge System was established more than 100 years ago as a safe haven for endangered species and other plants and animals. At a time when state and national trends demonstrate that hunting is on the decline, the limited financial resources available to the refuge would be better spent on protecting habitat and endangered species than on a hunting program.
- Most visitors to refuges do not hunt, but come to experience nature in a peaceful surrounding.
- Our nation's wildlife refuges should be managed for the benefit of wildlife, not managed for the benefit hunters. It is time to make our wildlife refuges true sanctuaries as they were originally intended.
- Plants and wildlife belong to all of us, and a minority segment of the population must not be allowed to destroy them for fun and entertainment.
- The refuge was created to protect our nation's animals. (Dictionary definition of "refuge" given).
- The overwhelming majority of visitors to the national wildlife refuge system come to see and take photographs of wildlife and surrounding natural habitat.
- Support the continuation of the ban on hunting along the Sacramento River Refuge.
- Allowing hunting would appease a small group of Americans, as the vast majority of us are not hunters, and it's time our values were listened too.
- Do not want to have to be concerned about being shot-or denied access to this special place during the hunting season.
- Hunting will increase the likelihood of poaching.
- The overwhelming public opposition to the allowance of consumptive use activities on National Wildlife Refuges and the tiny percentage of Californian's who engage in hunting, proposal to expend limited resources on the establishment of a new hunting program is fiscally irresponsible.

In addition to opposition to hunting on Refuge lands, several commentors expressed their opposition to trapping on the Refuge and other federally managed lands.

Service Response: The Service appreciates the effort so many commentors took in providing input on the subject of opening Sacramento River Refuge to hunting. Out of the 1,681 comments, the majority dealt with hunting (57 percent) with 13 percent opposing hunting and 44 percent either supporting or specifically mentioning hunting in their comment (Table 6). Although there was public opposition to allowing hunting on Sacramento River Refuge, the majority of the comments that the Refuge received on the Draft CCP/EA supported hunting on the Refuge. Of the almost 1,200 comment letters received only 219 people/organizations opposed hunting (Table 6). 784 people/organizations supported hunting by supporting Alternative B or C (Table 5) and 747 people/organizations specifically mentioned hunting in their comments (not opposing). It is important to note that the public comment process is not a voting contest.

National wildlife refuges exist primarily to safeguard wildlife populations through habitat preservation and management. The word "refuge" includes the idea of providing a haven of safety for wildlife, and as such, hunting might seem an inconsistent use of the National Wildlife Refuge System (Refuge System). However, habitat that normally supports healthy wildlife populations produces harvestable surpluses that are a renewable resource.

One of the five goals of the Refuge System is "To foster understanding and instill appreciation of native fish, wildlife, and plants and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent recreational uses. Such uses are hunting, fishing, wildlife observation and photography, and environmental education and interpretation." The Service recognizes hunting as an acceptable, traditional, and legitimate form of wildlife-oriented recreation and, in some instances, as a management tool to effectively control wildlife population levels.

In the 1997 amendments to the National Wildlife Refuge Administration Act of 1966, Congress identified hunting as one of six priority public uses of the Refuge System. These priority uses are to receive enhanced consideration, in planning and management, over all other public uses. All uses must also be determined to be compatible with Refuge purposes before they can be allowed. Appendix B contains the compatibility determinations for all of the uses on the Refuge including: hunting; fishing; wildlife observation, wildlife photography and interpretation; environmental education; research; camping and recreational boating; farming; grazing; and mosquito and other vector control. Each of these uses was found compatible on the Sacramento River Refuge. The Proposed Action was designed to provide quality hunting opportunities, improve wildlife sanctuary, ensure compatibility, provide clear, accurate hunting information, and reduce conflicts with other users as much as possible.

The Service must coordinate hunting on refuges with other compatible wildlife-dependent public uses to minimize conflicts. We may use time and space scheduling to ensure quality experiences for both hunters and non-hunters. We ensure that adverse impacts to other wildlife, particularly threatened and endangered species, do not occur.

Although hunting directly impacts individual animal, the amount of harvest is not expected to have a measurable effect on Refuge population levels, especially since hunting activity is not expected to be high along the river. In addition, hunting is monitored, regulated, and designed to ensure that harvest does not reduce populations to unsustainable levels. Fish and wildlife resources found along the Sacramento River are healthy and robust enough to support regulated hunting and fishing, complimenting the other activities available to the public in their enjoyment of their public resources (CDFG 2004).

The Service recognizes the majority of the people that visit refuges visit for wildlife observation and to experience nature, however, just as the comment process is not a voting contest, neither is the number of people within each interest group. The Proposed Action represents a balanced approach for wildlife-dependent recreation providing areas for wildlife sanctuary, for wildlife observation, and for hunting.

The Service disagrees with the statement that the establishment of a new hunting program is fiscally irresponsible. The Service also disagrees with the statement that hunting will increase the likelihood of poaching.

3.6.2 Support for Hunting on the Refuge

- Hunting is a part of our natural heritage and does not need to interfere with other wildlife related activities at the refuge.
- Hunters in general appreciate the wild places and a potential partner in habitat improvement projects.
- Hunters have been at the forefront of the conservation effort and continue to support effective management of our shared natural resources through the donation of their time and financial resources to conservation groups.
- Opening the refuge to hunting and fishing is consistent with Federal and State laws and the purpose of the Sacramento River Refuge.
- I feel that a portion of most refuges should be open to hunting, fishing and trapping.
- I urge you to adopt Alternative C so that hunters and other recreational users can enjoy new much-needed outdoor opportunities.
- I support Alternative B or C because management under either option would provide valuable wildlife-dependent recreational opportunities for the public particularly hunting. Hunting has been identified as a priority use of the National Wildlife Refuges and will not prevent the Service from ensuring that the Sacramento River Refuge furthers the mission of the National Wildlife Refuge System.
- Hunting has proven a valuable wildlife management tool that helps maintain healthy game populations.
- Revenues generated from the sale of hunting license and stamp fees, as well as federal taxes on firearms and ammunition, also generate significant funding to protect habitat.
- Over the last several decades in California, hunter access and opportunity has steadily decreased. Unfortunately, most hunters have only limited access to private property,

while the costs for joining private clubs continue to rise. Other factors, such as the continued loss of wildlife habitat and farmland, have recently combined to further limit hunting here.

- While I do not hunt or fish on public land, I strongly encourage and support public access and use of public lands.
- Support maximizing the amount of hunting and fishing available on the refuge.
- Historical use under private property has allowed hunting and fishing.

Service Response: The Refuge acknowledges the important contributions by hunters in wildlife conservation. By respecting seasons and limits, purchasing all required licenses, and paying federal excise taxes on hunting equipment and ammunition, individual hunters make a big contribution towards ensuring the future of many species of wildlife and habitat for the future. By paying the Federal excise tax on hunting equipment, hunters are contributing hundreds of millions of dollars for conservation programs that benefit many wildlife species, hunted and non- hunted. Each year, nearly $200 million in hunters' federal excise taxes are distributed to State agencies to support wildlife management programs, the purchase of lands open to hunters, and hunter education and safety classes. Proceeds from the Federal Duck Stamp, a required purchase for migratory waterfowl hunters, have purchased more than five million acres of habitat for the Refuge System lands, including many acres of the Sacramento National Wildlife Refuge Complex. These lands support waterfowl and many other wildlife species, and are often open to hunting. However, none of the land on Sacramento River Refuge has been purchased with these funds.

The Refuge agrees with the comments that hunting is a priority use on refuges, hunting is a valuable wildlife management tool, and that hunter access and opportunity have decreased in California. The Proposed Action is designed to provide quality hunting opportunities on Sacramento River Refuge and to reduce confusion for hunters on Refuge and CDFG lands.

Although the Service received comments opposing trapping, trapping is not a proposed use on Sacramento River National Wildlife Refuge.

Private property was only accessible to a small number of hunters prior to it becoming part of the refuge.

3.6.3 Additional Areas Requested to be Opened or Remain Opened to Hunting

Comment: Boat access only units should be opened to hunting.

Service Response: Many of the boat access units will be opened to hunting. Out of the 26 units on the Refuge, 18 units (or portions of them) are boat access only. Hunting will be allowed on all or a portion of 17 of the 18 units. See Table 9 and Figure 28 for additional information.

Comment: Boat access only excludes disabled hunters.

Service Response: Boat access only units may exclude some disabled hunters from some parts of the Refuge. The Service intends to have parking lots on areas with public road access to the Refuge unit entrance. This will provide access for disabled hunters from the parking lot to a trail. The Service does not have the authority to allow access to the Refuge across private property. Therefore, 13 of the 21 units that will be opened to the public and do not have public roads are accessible by boat only. In the future, if new properties are acquired and access becomes available, the Refuge may wish to make changes to the CCP.

Comment: Open more of Llano Seco area to the public for hunting, fishing, hiking and exploring.

Service Response: Acquired in 1991, the Llano Seco Ranch Riparian Easement consists of 1,281 acres located between river miles 183 and 178. It is bordered to the north by the Ord Ferry Bridge and to the south by the Llano Seco Unit, Riparian Sanctuary. This is an easement on private property and the Service does not have the authority to open this easement to public use. The Llano Seco Riparian Sanctuary and Llano Seco Islands 1 and 2, also acquired in 1991, consist of 906 acres and are located between river miles 183.5 and 175.5. The Riparian Sanctuary was originally acquired for a sanctuary. The Proposed Action also designates this property to be a sanctuary since there is no vehicle access to the property, there are sensitive resources on the property, and public access could potentially negatively impact the private land easement. Llano Seco Island 1 and 2 are proposed to be open to Big 6 activities via boat access.

3.6.4 Regulate/Monitor Hunting

Comment: In the absence of any way to regulate hunter access to the Refuge, keep track of how many hunters are using the Refuge, enforce harvest limits, or restrict hunters to the portions of the Refuge where hunting is allowed, refuge managers would have no way of carrying out their duties to protect wildlife populations or to protect other members of the public who use the Refuge.

Service Response: There are numerous methods and techniques that have been developed for estimating the number of visits on refuges. These methods may be applied to a variety of different situations including areas not accessible by roads, areas that have more than one activity occurring at a time, or areas that have multiple access points. The following methods of estimating the number of visitors will be used on Sacramento River Refuge: direct observations, traffic counters, patrols, self-registration, extrapolations from limited data using stratified samples, and best professional judgment. Harvest limits will be estimated using stratified sampling, self-registration, patrol, and direct observations.

A team of specialists are completing the FWS Visitation Estimation Handbook that will be used on all National Wildlife Refuges. It will take into account staffing levels, Refuge acreage, volunteer support, access points, monitoring sites, etc. Given multiple variables, estimation methods will be presented for use on various areas. Currently, there are interim guidelines for visitation monitoring on National Wildlife Refuges for the Refuge Management Information System - Public Education and Recreation section.

The Service added the information on estimating refuge visits to the Hunting Plan C-13, monitoring use levels and trends.

There are many ways that hunters will be regulated. There will be two full-time and one part-time law enforcement officers on the Refuge Complex dedicated to enforce harvest limits and regulate hunters. They are familiar with the areas of the refuge that are accessible for hunting. Some areas are so dense with vegetation that access is limited. They are also familiar with problem areas for illegal activities so they will be able to efficiently patrol and focus on specific problem areas when needed.

Signs and information will help guide hunters to the proposed areas open to hunting. All Refuge lands have boundary signs and signs designating the appropriate uses, which will support enforcement (CCP, Figure 26 & 27). Hunting maps and refuge information will be available at well-known locations including hunter forums, public facilities, websites, sporting goods stores and kiosks where hunters have obtained information in the past.

Comment: For hunting to be acceptable, it would have to be regulated to limit the number of hunters to a sustainable level. The most reasonable way to do this is to require hunters to check in at a central location and to pay a user fee to support refuge activities.

Service Response: There are numerous acceptable methods and techniques that have been developed for estimating number of visits on refuges. Some of these methods including direct observations, traffic counters, patrols, self-registration, extrapolations from limited data using stratified samples, and best professional judgment will be used on Sacramento River Refuge. Harvest will be estimated using stratified sampling, self-registration, patrol and direct observations.

The programs that use a central check-in and user fees are generally areas that have heavy use, need quotas, etc. The hunting program on the California Department of Fish and Game Sacramento River Wildlife Management Area has operated for a number of years without the need for a centralized check-in or user fees. In our professional judgment, the hunting program on the Sacramento River Refuge will also not need to have hunter quotas at this time. However, the Hunt Plan includes the option for implementing quotas if monitoring efforts by the refuge biologist, law enforcement officers, or manager indicates the need for increased regulation of the activity.

Comment: Concerned about the Refuge allowing open-range hunting. The completely new and unfamiliar hunting format being proposed needs to be complemented by significant and corresponding amounts of outreach efforts, safeguards, monitoring and maintenance.

Service Response: See response above. The hunting program proposed by the Service does not constitute open-range hunting nor is it new and unfamiliar. This format is currently used on California Fish and Game (CDFG) lands in the Sacramento River Wildlife Management Area, lands along the river owned by Bureau of Land Management, and on private lands.

Although hunting will be new to the Sacramento River Refuge; it is not new to other areas along the River including the Sacramento River Wildlife Management Area where hunting has been operating successfully for years. CDFG's hunting program is also 7 days a week as the Service proposes for Sacramento River Refuge. Specific information about the hunting program can be found in the Hunting CD (Appendix B) and the Hunting Plan (Appendix C).

The Service does agree that outreach, monitoring and maintenance will need to take place to provide a quality hunting experience and to provide assurance for our neighbors. Hunting on the Refuge will be regulated and monitored.

Comment: The Hunting CD proposes to inform hunters through signs. This is inadequate to reach all hunters unless signs are posted at every accessible access point along the entire perimeter of the refuge.

Service Response: The Service disagrees with the comment that signage is an inadequate means of informing hunters. The Service intends to post the Refuge boundary including vehicle and boat access locations. Most boat accessible properties have limited access points due to the dense vegetation, steep slope of the river bank, or terrain that prohibits the ability to dock a boat Signs will be posted at the most opportune boat accessible locations. In addition, signs designating appropriate Refuge uses will be posted. Refuge information and hunting maps will be provided at well known locations including hunter forums, public facilities, websites, sporting goods stores and kiosks where hunters have obtained information in the past.

Comment: The CCP states that the use of federally approved non-toxic shot will be required for all hunting except deer. Lead shot is traditionally and legally used in California to hunt doves. It is unclear how the Refuge will overcome the inevitable confusion over the legality of lead shot use and how effectively the regulations will be enforced.

Service Response: The Service will require the use of non-toxic shot for dove hunting on the Sacramento River Refuge. Initially, educating the public on lead shot requirements for dove hunting on refuge lands may be challenging. However, the Service's adaptive management philosophy allows staff to respond to site specific issues by modifying strategies of implementation for signing, education, and enforcement. Refuge regulations will be posted and will available in our brochures and on our website. Refuge regulations will be enforced by refuge officers and coordinated patrol with Service special agents, state game wardens, state park rangers and deputy sheriffs.

Comment: Hunting must be limited to a smaller area, and high-quality habitat must be given priority for designation as a no-hunting zone.

Service Response: Hunting activities actually need to take place on fairly large areas of land in order to offer a situation for "fair chase" of game species. We have proposed wildlife observation activities in smaller areas where visitor needs can be met by constructing facilities i.e. trails, restrooms, etc. and yet be able to financially maintain them. High-quality habitat has been designated as sanctuary (Chapter 5, Objective 1.10).

Comment: Without a significant budget increase, refuge personnel will not have the time or resources to conduct the "random, weekly field checks" that the Hunting CD proposes.

Service Response: The field checks will be planned and coordinated with staff and other agencies. The word "random" was changed to planned and coordinated field checks in the Hunting CD (Appendix B) and the Hunting Plan (Appendix C). This will make more efficient use of the law enforcement officers' limited time.

Comment: The activities of hunters pose a hazard to other visitors on the Refuge. Limiting the area open to hunting would make the Refuge more accessible to the public as a whole and better achieve the goal of increasing visitor knowledge and appreciation of wildlife.

Service Response: We recognize the concern that some visitors will be uncomfortable visiting areas where hunting occurs. Therefore, we have proposed to set aside areas that do not allow hunting and will be developed for wildlife observation, photography, education, and interpretation. These areas will have trails, kiosks, parking areas, and port-a-potties (Table 9 in the CCP). Refuge units that allow hunting are also proposed. Hunting will be limited to designated seasons and will not occur year-round. By providing areas for both consumptive and non-consumptive uses, the Service can increase the knowledge and appreciation of fish and wildlife resources for both consumptive and non-consumptive users.

Comment: Efforts to manage and regulate hunting can detract from other refuge programs. The CCP allocates a mere $5,000 for outreach, education, and monitoring. This

amount falls short of the funds that would be required to adequately study and monitor the effect of hunting on target and non-target populations.

Service Response: The estimated annual increase in budget of $5,000 for outreach, education, and monitoring is in addition to current funding that provides for 3 refuge officers to patrol the Refuge Complex. The $5,000 additional budget would be used for signs, press releases, and brochures. Three officers to patrol monitor and educate the public on approximately 10,000 acres in addition to coordinated efforts with state and local law enforcement agencies would be considered more than appropriate in national wildlife refuge settings.

Comment: Disagree with the statement made in the Hunting CD that hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat.

Service Response: The statement in the Hunting CD regarding ….a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat…does not imply that "consumptive" users have a greater appreciation for wildlife than "non-consumptive" users. It does however; suggest that hunting and or fishing is one mode of access to and appreciation for wildlife and the outdoors similar to a beginning bird watcher seeing a connection between bird diversity and different habitats. There are many conservation groups that stress the importance of conservation and habitat restoration that also support recreational hunting. This is where the connection is made between hunting and conservation.

Comment: Hunting program should include opportunities for training, testing and trialing hunting dogs.

Service Response: Comment noted. The Service will not be allowing training, testing, or trialing of hunting dogs on the Refuge. Opportunities for these activities exist on other areas (e.g. State Wildlife Areas). Dog testing, training and trialing may also interfere with priority Big 6 uses.

Comment: Make regulations uniform with other agencies controlling the land along the river (as stated in the Comprehensive Management Plan for the Sacramento River Wildlife Area by CDFG)

Service Response: The Service agrees with this comment. The Refuge has tried to make regulations uniform with the different agencies along the river whenever possible. For example, whenever possible Refuge units adjacent to CDFG lands were designated open to Big 6 uses which are consistent with CDFG regulations. There will still be some exceptions to this and Refuge visitors will be responsible for knowing them. For example, CDFG allows coyote, squirrel and rabbit hunting on their lands in the Sacramento River Wildlife Management Area. The Refuge; however, does not allow hunting for these

species. Refuge boundaries and access points will be posted and clear and accurate Refuge hunting information will be provided.

Comment: Using 0 or 00 buckshot as referred to in the Draft CCP is illegal along the river according to state law (Title 14, section 353 (b)). The only legal method is by firing single slugs.

Service Response: Commentor is correct. The Service has revised the appropriate sections in the CCP, Hunting Plan and the Hunting CD.

3.6.5 Navigable Waterways and Hunting

Comment: Request for liberal interpretation of navigable waterways.

Service Response: In Chapter 1, under Refuge River Jurisdiction, the Service acknowledges the State's "public trust easement" in the area between the low water mark and the ordinary high water mark. This acknowledgement is illustrated in the proposed public uses (Big 6: hunting, fishing, wildlife observation, photography, interpretation, and environmental education) allowed on Refuge lands below the high water mark as interpreted to be those lands below cut banks including gravel and sandbars. The Proposed Action allows hunting on over 50 percent of the Refuge, including lands above the high water mark on identified units (Figure 28). During high water events, those lands that have been identified for Big 6 public uses would be accessible by boat and hunting would be permitted. However, those lands that have been identified as sanctuary or allow for the Big 5 public uses would not be open to hunting during high water events. One of the purposes of the Refuge is to provide high quality habitat, including sanctuary from hunting and disturbance, to migratory birds and endangered species.

3.6.6 Huntable Species

Comment: Allow hunting of non-native wild pigs, coyotes, squirrels etc.

Service Response: Species legal to hunt on the Refuge include dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer. All other species that are considered legal game species by California Fish and Game are still not legal to be hunted on the Refuge.

Comment: Work with CDFG to add a special late season deer hunt (late September through late December) for the Refuge and CDFG lands along the river.

Service Response: Comment noted. In the future, the Service and CDFG may be able to offer this type of hunt.

3.6.7 Other Hunting Comments

Comment: All proposed hunt units of 100-200 acres or more be provided with land access in addition to river access.

Service Response: Vehicle access to the Refuge is limited to public roads. Eight of the 26 Refuge units are located adjacent to public roads will be accessible by vehicle. At these 8 units, parking lots will be developed, but access to the interior of the units will be by pedestrians only. Units that are not accessible by public roads, regardless of size, will be boat access only.

Comment: Until the time cultivated agricultural land is developed into the refuge, if the agricultural leasee's are requesting depredation permits for controlling wildlife we propose public hunting become the first priority.

Service Response: Agricultural leases on the Refuge are managed under a Cooperative Land Management Agreement (CLMA). Cooperative farmers and nonprofit conservation organizations that manage the agricultural operations on these units abide to the conditions of the CLMA. A compatibility determination with stipulations (Appendix B) and Integrated Pest Management Plan (Appendix Q) have also been completed. Depredation permits will not issued on these Refuge-owned properties. Tenant farmers knowingly accept the risk of crop depredation from wildlife when farming on a National Wildlife Refuge.

Comment: Areas open to hunting should be off-limits to users other than those holding a valid hunting license and in possession of a legal firearm or weapon during the appropriate seasons.

Service Response: Areas on the Refuge open to hunting will be open to all uses determined compatible. These uses include hunting, fishing, wildlife observation, photography interpretation, environmental education. Signs will be posted to inform hunters as well as non-hunters when the unit is open to hunting. The Refuge boundary will also be posted with signs to ensure that Refuge visitors know when they are entering or exiting a Refuge unit. Using the Refuge specific information and regulations provided, visitors may choose when, where and how they would like to visit the Refuge.

Comment: Existing private facilities (campgrounds, marinas) should be thought of as partners and be a part of whatever long range plan is adopted. Bank protection is important.

Service Response: Existing private facilities including campgrounds and marinas are considered Refuge partners. Bank protection is an important issue identified in Objective 1.2 of the CCP.

3.7 Cultural Resources

Comment: Under the Cultural Resources Section of the CCP add more information about the recent history of the Sacramento Valley including River boat trade, ferries, agriculture, etc.

Service Response: Comment noted. The Service has revised this section of the CCP to include more information about the recent history of the Sacramento Valley.

3.8 Sanctuary

Comment: Both Alternative B and C are deficient in the amount of sanctuary (16 percent) and with current staffing the Refuge does not have the resources to monitor public use impacts at the Refuge. Recommends increasing the amount of sanctuary at the Flynn, Rio Vista, Phelan Island, Capay and Sul Norte units.

Service Response: The rational for determining public use and sanctuary areas at the Refuge are explained in Appendix L of the CCP. We have added 341 acres of sanctuary along the central-eastern portion of Rio Vista, which increases overall sanctuary to 20 percent. We believe much of the Refuge will serve as "sanctuary" because of the dense structure of riparian vegetation and access to most units is by boat only. The Refuge is in the process of adding an additional full-time law enforcement officer, which will greatly increase natural resources monitoring. The CCP also calls for periodic surveys of public use to determine impacts to Refuge natural resources. Identified public use impacts will be addressed through education and when necessary, additions to Refuge sanctuary. In addition, Objective 1.10 Wildlife and Cultural Sanctuary, also makes provisions for the establishment of short-term sanctuaries to protect transient sensitive fish, wildlife and other natural resources; examples include breeding colonies, nest/roost trees, sensitive vegetation and areas with sensitive plants.

Comment: Clarify the planning process that has led to the designation of sanctuary.

Service Response: The process for determining the public use on a particular refuge unit is explained under Objective 1.10 Wildlife and Cultural Sanctuary. Appendix L also contains a list of specific issues that were considered when designating the amount of public use at each refuge unit.

Comment: Keeping only a small portion of the refuge off-limits to public use is insufficient to support the diversity of species that use the Sacramento River Refuge." Commentor also expressed concerned with lack of sanctuary for migratory birds because of the limited size of the Refuge.

Service Response: The Service has increased the amount of sanctuary on the Refuge from 16 percent to 20 percent. The sanctuaries are located within separate reaches of the

River which distributes wildlife for resting, feeding, nesting, and fawning. In addition, the density of the riparian forests provides additional sanctuary for wildlife species. Many of the areas used by wintering waterfowl are already open to public use because they are accessed by hunters during high water flooding events. Likewise, the mallards, wood ducks, common mergansers, and Canada geese, which breed at the Refuge, occupy the main channel or sloughs and oxbows connected to the main channel, which currently receive public via boat access. The riparian habitat restoration (revegetation, private levee removal, topographic restoration) undertaken by the Refuge has increased habitat for endangered species (e.g., bald eagle, valley elderberry longhorn beetle, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, bank swallow, western yellow-billed cuckoo), anadromous fish (e.g., fall-late fall run Chinook salmon), migratory birds (e.g., red-shouldered hawk, mourning dove, rufous hummingbird, Pacific-slope flycatcher, black-headed grosbeak, spotted-towhee), and resident species (e.g., wild turkey, deer). Habitat restoration has increased the natural diversity of Refuge lands and monitoring results from PRBO have demonstrated that as these revegetated sites mature, avian diversity increases. Public use will result in local disturbance of species, but the habitat structure will provide sanctuary, and the restoration projects will continue to increase natural diversity.

Comment: There is no information regarding where these lands (sanctuary units) are located, how they were chosen, whether they include a representative sample of wildlife habitats, how the designation would be enforced, etc.

Service Response: The location and description of sanctuary units was described in the Draft CCP. Sanctuaries were described in Chapter 5 in Table 8, in Objective 1.10, and in Figure 27 Visitor Services Alternative B maps. Appendix L described the rationale behind the public use determinations for each unit. The Hunting Plan (Appendix C) described the method of enforcement for the sanctuaries as well as the rest of the Refuge.

3.9 Public Access

Comment: Recommend that a separate Public Access Plan be developed.

Service Response: Public access is addressed in Goal 2 Visitor Services, in Chapter 5 of the CCP. Many of the items that would be included in a public access plan can be found within each of the objectives and strategies of the Visitor Services goal and in the step down plans listed; therefore, a public access plan is not necessary. Several studies were used in determining public use trends along the Sacramento River including Sacramento River Public Recreation Access Study (EDAW 2003), Sacramento River Recreation Survey (DWR 1980) Public Opinions and Attitudes on Recreation in California (California DPR 1998), and Outdoor Recreation in American Life: A National Assessment of Demand and Supply (Cordell et al. 1999). Please refer to the Public Use section of Chapter 3, Goal 2 of Chapter 5, and Appendix N for additional information.

Comment: Alternative B states vehicle access would be allowed on designated roads and parking areas only. A detailed planned road system in the refuge is not clear in the CCP.

Service Response: The Service acknowledges the importance of minimizing the number of roads to decrease habitat fragmentation, which influences emigration, immigration, and wildlife population dynamics.

There is no planned public access road system for the Refuge. The roads referred to are entrance roads to the 8 Refuge units that are accessible by vehicle. There are also parking areas proposed for these units. There are also interior roads that will be utilized for refuge maintenance and monitoring, but these roads will not be opened to the public. Currently, there are no facilities at these areas for parking. If visitors and school groups want to access these areas for wildlife observation, education, interpretation, or photography they will need a place to park. Foot trails will be maintained on each of these areas.

3.9.1 Boat Ramps

Comment: Environmental justice requires public access from roads and trails since not all people can afford to own or rent a boat and additional boat ramps are needed on the river.

Service Response: Executive Order 12898 (Environmental Justice) states: each Federal agency shall conduct its programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under, such, programs, policies, and activities, because of their race, Color, or national origin. The Service has made reasonable accommodations for access, given the constraints at each site (lack of legal land access, high cost of boat ramp construction and maintenance) and our mission.

Within the large alluvial Sacramento River system, the very nature of changing sedimentation and accretion patterns and a dynamic meander pattern pose a challenge to determining the best location for boat ramps and similar facilities. A number of the existing facilities have costly maintenance needs, and some are now closed because of siltation and channel meander. Providing additional boat ramps on the river is not a high priority for the Refuge. Even if there was funding for constructing boat ramps, there is very little money available for maintenance costs. It has be estimated that annual boat ramp maintenance (i.e. dredging and ramp repair due to erosion) can cost tens of thousands of dollars annually, which makes it unfeasible for the refuge. Instead, the Refuge has assisted its partners including Tehama County with routine maintenance of their boat ramp by providing equipment and an operator.

3.9.2 Visitor Parking Lots

Comment: The CCP proposes to build and maintain eight new parking lots on the Refuge in the Wildlife Observation, Wildlife Photography and Interpretation CD. However there is no description of the proposed location, and no information about the expected impact of these parking lots.

Service Response: The parking areas proposed are for the Refuge units that are accessible to vehicles. Currently, there are marginal facilities located at the entrance roads for parking on these areas. These facilities would be the footprint for improved parking and access for refuge visitors.

The proposed areas that will need parking lot improvements were listed in the Table 8 of the Draft CCP. The average size of the parking lots is 25 'x 85' to accommodate a combination of up to 10 vehicles or a bus. The parking lots are proposed to be graveled, have drainage to address runoff, and would be constructed in areas that do not have support wildlife habitat. Impacts from these improved parking areas would be negligible.

If visitors and school groups want to access these areas for wildlife observation, education, interpretation, or photography they will need a place to park. Without the improvements to parking lots, the visitors to these proposed areas will not have access.

Comment: The Wildlife Observation, Wildlife Photography and Interpretation Compatibility Determination does not contain information on the impacts of increased visitor load on wildlife. A legitimate CD must include why the use is being proposed, where the use would be conducted, anticipated impacts of the use, and an explanation describing how the proposed use would or would not materially interfere with or detract from the fulfillment of the purposes of the Refuge.

Service Response: There is an understanding that increased visitor use, consumptive and non-consumptive, will increase impacts on wildlife. This disturbance is recognized and addressed in the Hunting Plan and the Anticipated Impacts of Use section in the Wildlife Observation, Wildlife Photography and Interpretation CD. The Service agrees with the content required for a "legitimate" CD (50 CFR 26.41(12)). Although all of the information was stated within the Draft CCP, the CD has been revised to include this information as well.

3.10 Policy

Comment: Service policy of requiring pre-approval by the Service before a pesticide can be used on refuge land has resulted in lengthy delays and sometimes denial of the use of certain needed pesticides even though these products are thoroughly tested and approved for use on these sites by both the USEPA and California EPA.

Service Response: The Refuge must follow the U.S. Fish and Wildlife Service pesticide use policy. Under this policy, the refuge manager may allow the use of certain mosquito control pesticides (which include several larvicide products) without higher level review. More toxic chemicals such as adulticides and organophosphate larvicides require annual review/approval at the Regional Office (Sacramento, California or Portland, Oregon) or Washington D.C. Office level. By their nature, NWRs are places of wildlife concentration, and the Service pesticide review process considers this in evaluating the use of any pesticide, regardless of U.S. or California EPA registration. Service approval/disapproval of a particular pesticide use of Refuges is based on a review including their toxicity to non-target organisms, presence of sensitive species, persistence of the chemical/carrier in the environment, application rate, method, and frequency, and the availability of alternative products.

Refuge staff will continue to work with local Mosquito Abatement Districts by meeting before the potential mosquito season on Refuge lands to discuss ways of reducing mosquito production and minimizing public health risk by allowing mosquito control, when necessary, based on mosquito population data and public health risk thresholds. In fact, the Districts are currently allowed to use a "package" of mosquito control products, including a variety of larvicides, a pupicide, and adulticides when treatment thresholds have been reached. The compatibility determination for mosquito and other vector control (Appendix B) and the Draft Integrated Pest Management Plan (Appendix Q) provide additional information about this process.

Comment: FWS does not provide any funding to the counties for control of Refuge produced mosquitoes.

Service Response: All of the Refuge units are owned in fee title by the Service; therefore, they do not provide property tax revenues to county governments. However, the Service does provide refuge revenue sharing payments to the counties in which these parcels are located. These annual revenue sharing payments were instituted to help mitigate the effects of property acquisition. The county can use the refuge revenues sharing payments for any government purpose.

Comment: From the County's perspective, land taken out of agricultural production is off the tax rolls. The County needs tourism opportunities to contribute to the local economy and offset these losses.

Service Response: The Service does provide refuge revenue sharing payments to the counties in which Refuge units are located. These annual revenue sharing payments were instituted to help mitigate the effects of property acquisition. The Sacramento River corridor offers substantial opportunities for both land-based recreation uses (e.g., hunting, wildlife viewing, hiking) and water-based uses (e.g., boating, fishing, swimming). Trends for the Pacific region indicate wildlife viewing and nature study are expected to increase by 65 percent and double the number of days per year per person in the next 40

years. Fishing is expected to increase, while hunting is expected to decrease (Appendix N, EDAW Table 4.2-11). The increase in recreation opportunities provided by the Refuge will help offset the local losses from the agricultural economy.

3.10.1 Refuge River Jurisdiction

Comment: Concern over total closure of River due to impacts on anadromous fisheries utilizing the river year round.

Service Response: The CCP/EA does not suggest the possibility of closing down the Sacramento River to public use. Rather, in Chapter 1 under the Refuge River Jurisdiction section, the Service acknowledges the State's "public trust easement" in the area between the low water mark and the ordinary high water mark. This acknowledgement is illustrated in the proposed public uses (Big 6: hunting, fishing, wildlife observation, photography, interpretation, and environmental education) allowed below the high water mark on refuge lands. These lands are interpreted to be lands below cut banks including gravel and sandbars.

Comment: CCP cites several statutes and cases apparently to support the USFWS assertions that it has, or will in the future exercise jurisdiction over portions of the Sacramento River. The commentor cites a section from the River Jurisdiction section of the CCP: "For example, in the U.S. v. Hells Canyon Guide Service case, the District Court maintained that the Property Clause of the Constitution gave the government power "to regulate conduct on non-federal land (the Snake River that runs through the National Forest) when reasonably necessary to protect adjacent Federal property or navigable waters." In addition, this case stated "Congress' power over Federal lands includes the authority to regulate activities on non-federal waters in order to protect the archaeological, ecological, historical and recreational values on the lands" (United States v. Hells Canyon Guide Service; U.S. District Court of Oregon, Civil No. 79-743; 5-6; 1979)."

Service Response: This comment takes this quote out of context. The intent of the Refuge River Jurisdiction section of the CCP is to clarify State and Federal laws dealing with jurisdiction on and under water bodies. This section explains that Federal Courts have clarified these statutory authority issues in regards to Federal agencies (including National Wildlife Refuges) that own and manage lands that encompass portions of water bodies. The Federal Courts have consistently maintained that Federal agencies have jurisdiction over ***recreational uses*** on these water bodies when the water body is integral to the primary purposes for which the park, forest, or wildlife refuge was established. It is the policy of the Sacramento River Refuge to recognize the rights of the public to use, consistent with State and Federal laws, the waters below the ordinary low water mark and the "public trust easement" in the area between the ordinary low water mark and ordinary high water mark.

3.11 Other CCP Comments

Comment: Provide an annual seminar on proper river etiquette and how to minimize the impact on the river shores.

Service Response: Comment noted. The Service, at this time, will not offer an annual seminar on proper river etiquette. There a numerous outreach efforts planned to inform visitors about the Refuge. Many of these efforts are outlined under Goal 2 Visitor Services in the CCP. Refuge visitors will be informed of laws and regulations and these laws and regulations will be enforced by refuge law enforcement officers.

Comment: Are there plans to charge for access to use these lands?

Service Response: There is no entrance fee planned for the Sacramento River Refuge at this time.

Comment: Please encourage citizen volunteers for appropriate projects and participation within the refuge.

Service Response: The National Wildlife Refuge System Volunteer and Partnership Enhancement Act of 1998 (P.L. 105-242) strengthens the Refuge System's role in developing relationships with volunteers. Volunteers possess knowledge, skills, and abilities that can enhance the scope of refuge operations. Volunteers enrich Refuge staff with their gift of time, skills, and energy. The Service developed Objective 2.7 to develop a volunteer program that will support and help implement the Refuges special events, restoration, and maintenance programs.

Comment: I fear, like many, that uncontrolled areas (primarily parking areas) will get excess litter. Perhaps come up with some sort of ticket and receipt that is placed on the car and carried with you.

Service Response: Signs and information will help guide Refuge visitors. All Refuge lands will be posted with boundary signs and informational signs designating the appropriate uses, which will support enforcement. Hunting maps and refuge information will be available at well-known locations such as hunter forums, public facilities, websites, sporting goods stores, and kiosks.

Currently, the Refuge has 2 law enforcement officers that patrol along the Sacramento River Refuge boundaries daily. The Refuge will be hiring an additional full time officer to support changes to refuge management proposed in this plan. All laws and regulations, including littering, will be strictly enforced.

Comment: I strongly urge the prohibition of all off-road vehicles on refuge land.

Service Response: The Service has not proposed, and will not allow, off-road vehicles on the Refuge.

Comment: No vehicle access other than some parking areas. No buildings, signs, interpretive centers etc.

Service Response: Due to the nature of the Refuge, many of the units will not have vehicle access. Only 8 of the 26 Refuge units will have parking areas established adjacent to public roads. The Service has no current plans for any buildings; however, in the future when funding permits an interpretive center/office may be developed. Signs will be a part of the Refuge too. Signs are important to inform refuge visitors about what uses are allowed on each unit and what uses are not allowed. Boundary signs are also important to reduce trespass on our neighbors.

Comment: Open 73 percent of the refuge to hunting and fishing, but gradually phase out farming operations. Phase out of certain agricultural operations will overall benefit the Pacific flyway.

Service Response: The Service agrees with comment about phasing farming out gradually; however, only half of the Refuge will be opened to hunting as stated in the Proposed Action. Phasing out farming allows the Refuge to continue to financially support restoration activities and reduces the local economic impact of removing agricultural operations. Agricultural areas provide habitat for many species of wildlife but species diversity will increase further once the areas are restored.

Comment: Hope to get more disabled people into the field with Alternative C.

Service Response: Alternative C would not have provided any additional opportunities for disabled hunters to get into the field than Alternative B, except for the additional acreage open to hunting.

Comment: There will not be any method implemented to regulate fishing.

Service Response: This comment misquotes the statement on B-11 of the CCP which reads, "…there will not be any method implemented to regulate fishing quotas." This statement referenced the anticipated limited numbers of anglers on Refuge lands due to limited boat access and opportunities. The methods of implementing the fishing program can be found in the Fishing Plan (Appendix D).

Comment: Maps on Page 79 of the Draft CCP are helpful but would be more beneficial if adjacent roads could be labeled and adjacent properties labeled public or private ownership.

Service Response: The unit maps, Figures 11-24, are in the Refuge Unit Description section include a brief summary of the size, location, and land use/composition. The purpose of these maps is to supplement this section by depicting the existing habitat. Figure 28, the Visitor Services Alternative B maps, have labeled roads, creeks, public facilities, and adjacent public lands that may be more helpful in identifying the nearest access point or a familiar landmark.

Comment: Refuge website should include links to local businesses.

Service Response: The Service cannot promote local businesses on the Refuge website, but we could list the Chamber of Commerce as local resource.

Comment: Recommend that implementation of the CCP is evaluated by an advisory committee comprised of public and private members.

Service Response: Comment noted. The Service does not intend to form an advisory committee at this time.

Comment: Support building of bat boxes as an inexpensive and effective method of mosquito control that has few side effects for other wildlife species.

Service Response: Comment noted.

Comment: Sacramento River Refuge should become its own entity within the national refuge system once the CCP has been finalized.

Service Response: Comment noted. The Sacramento River Refuge is currently managed as part of the Sacramento National Wildlife Refuge Complex. It is not feasible to de-complex the Sacramento River Refuge from the Sacramento Refuge Complex until full funding and staffing are reached.

Comment: Suggest adding a map that indicates those lands taken by legislative fiat to "protect" some endangered species.

Service Response: All of the lands within the Sacramento River Refuge have been purchased from willing sellers. Therefore, this comment does not pertain to the Refuge and is outside the scope of this CCP.

Comment: Why doesn't the planning hierarchy include any local landowners on the planning team?

Service Response: Planning teams, as defined by the Service's planning policy (602 FW1) are: "interdisciplinary in membership and function. Teams generally consist of a planning team leader, refuge manager and staff biologists, a state natural resource agency

representative, and other appropriate program specialists (e.g., social scientist, ecologist, recreation specialist). We also will ask other Federal and Tribal natural resource agencies to provide team members, as appropriate. The planning team prepares the CCP and appropriate NEPA documentation."

Therefore, no local landowners were included on the planning team. The Refuge; however, has invited local landowners and any other member of the public to participate in the CCP planning process. Appendix J contains a list of people that received planning updates, copies of the plan or came to public meetings regarding the CCP. Appendix J also contains a list of the outreach that was conducted by the Refuge to ensure that the public including refuge neighbors and local landowners knew about the CCP.

Comment: Planning assistance from local law enforcement staffs to aid one full-time refuge officer is worrisome. As noted under Objective 4.1 there have been thefts and equipment loses in recent months and local law enforcement units are needed in these areas rather than on Refuge lands.

Service Response: This comment is incorrect. Objective 4.1 actually states: Provide visitor safety, protect resources, and ensure compliance with regulations through law enforcement. Increase the number of law enforcement officers (from 1 to 2) and increase the monitoring of significant resource sites from quarterly to monthly by 2010.

The rationale states: "A common belief among neighboring landowners is that public ownership, easements, or access could result in increased vandalism and theft of agricultural equipment, poaching, and disregard of private property rights. A well-planned and coordinated program will be necessary to successfully address these concerns. The elongated and fragmented layout of the Refuge, which crosses through four counties, requires law enforcement coordination on the Federal, State, county, and local levels. Enforcement is further complicated because many units are accessible only by water."

Comment: There are no references in the CCP that Refuge lands are adjacent to PCGID/PID infrastructure.

Service Response: The Refuge clearly understands that this infrastructure exists and knows its location. We have revised Figures 16, 18, 20 and 23 so that the major pumping plants, including PCGID/PID, are now identified.

Comment: Requests the FWS disclose how program success will be measured.

Service Response: The CCP develops objectives within Chapter 5. These objectives are written to be specific, measurable, achievable, results-oriented and time-fixed. Therefore measures of success for the CCP will be based upon individual objectives which have quantitative elements built in to see if they are met. For example, Objective 1.3 states:

implement 8 surveys by 2005 and 4 additional surveys by 2015. This objective will be met if the surveys are conducted during the set timeframe.

Comment: Request documents elucidate statements on scientific principals of sound fish and wildlife management. How does CCP fit with goals of CVPIA, AFRP, AFSP, EWP, and existing Biological Opinions?

Service Response: Please refer to Appendix M which has been revised to include a description of many federal, state and local programs. The program goals that relate to the CCP have also been listed.

Comment: Request more detail on what is meant by active and passive management practices.

Service Response: Active (or cultural) and passive restoration management practices are described in detail in Chapter 5, Objective 1.1. The glossary (Appendix H) also contains a definition of cultural restoration and passive restoration which are as follows:

> **Cultural Restoration (also Active Restoration):** Restoration that uses horticultural and agricultural techniques for plant establishment. Common practices of cultural restoration includes: propagating seeds, acorns and cuttings in a greenhouse; planting these propagules in rows so that irrigations systems may be installed and maintained and weeds can be sprayed and mowed. Specific human actions taken to reestablish the natural processes, vegetation and resultant habitat of an ecosystem.
>
> **Passive Restoration:** Restoration is defined as the return of an ecosystem to an approximation of its former unimpaired condition. Passive restoration is defined as restoration that relies on natural processes for plant establishment. These processes include: flooding, sediment deposition, erosion, and seed dispersal from local or upstream plant sources. Allowing an ecosystem to restore its natural processes, vegetation and resultant habitat without human actions.

Comment: Request an update on the status of biological assessments and biological opinions relating to the CCP.

Service Response: The Refuge completed and Intra-Service Section 7 consultation with the Service (Sacramento Fish and Wildlife Office) and NOAA-Fisheries. As stated in the Draft CCP, copies of these consultations and the concurrence letters are provided in the Final CCP in Appendix F.

Comment: Recommend that the FWS provide a comprehensive list of other plans which are likely to impact management of the Refuge. Also suggest providing details of the

plethora of the Federal laws, Executive Orders, regulations and conservation initiatives that pertain to the CCP.

Service Response: The Draft CCP contained information about these conservation initiatives, plans, laws regulations, and Executive Orders in Chapters 1-5, as well as in the Draft EA. Details of these plans, laws, and regulations have been expanded upon in the revised Appendix M in the Final CCP.

Comment: How does the CCP relate to CALFED?

Service Response: Established in May 1995, the California Bay-Delta Program (CALFED) is a cooperative effort of federal and state agencies working with local communities to improve the quality and reliability of California's water supplies and revive the San Francisco Bay-Delta ecosystem. CALFED's mission is to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. The CALFED Ecosystem Restoration Program goals (Appendix M) which are consistent with the goals, objectives and strategies of the CCP.

Comment: Suggestion to add columns to Table 2 containing goals of the programs and measures of success for these programs.

Service Response: Table 2 contains a list of partners in habitat acquisition, restoration and management with the Service. It is not a list of programs that would contain measures of success. A list of plans and programs and their respective goals can be found in the revised Appendix M.

Comment: Commentor was unable to find any reference or introduction to Figure 8 in the Draft CCP.

Service Response: The reference to Figure 8 is on the preceding page (page 33) of the Draft CCP. This figure is copied from Exhibit 1 of the Service's Refuge Planning Policy Overview (602 FW 1).

Comment: The Draft CCP states "farmers have shown a willingness to work with the Service to cooperatively assist in the management of the Sacramento River Refuge." The commentor states in order for this section of the CCP to be accurate the Service must disclose the concerns of agriculture as they relate to the development and implementation of the CCP.

Service Response: The referenced quote was taken out of context. The Cooperative Land Management Agreement/Cooperative Agreement section of the CCP states: "Farmers and private nonprofit conservation organizations have shown a willingness to work with the Service and have the expertise and resources necessary to cooperatively assist in

management of Sacramento River Refuge. The completion of defined land management activities by the cooperators will provide direct and substantial overall benefits to Refuge habitat and the associated wildlife." What is written in the CCP is not related to the stated comment.

In response to the comment about disclosing the concerns of agriculture, the Service has made numerous efforts throughout the CCP process to request comments on the CCP. Appendix J contains a list of outreach that the Service conducted over the three year long CCP process. Many comments about agriculture were received and these have been incorporated into the CCP. If the commentor has additional comments, they were not specified in the comment and the Service will not speculate.

Comment: Suggests that contact with private landowner be maintained and the concerns of landowners addressed.

Service Response: The Refuge has been and will continue to work with numerous adjacent landowners. As explained in Chapter 4 in the Cooperation with Adjacent Landowners section and Chapter 5, Goal 3 Partnerships, the Refuge wants to create and maintain partnerships with federal, state, local agencies organizations, schools, corporations, and private landowners. Although there is no set framework, since each partner will have its own concerns, the Refuge will create a process that is mutually beneficial for all partners. The primary contact for the cooperation with partners is the refuge manager.

Comment: Recommends that the final environmental documents and CCP provide examples of adaptive management.

Service Response: Examples of adaptive management were discussed in the Draft CCP in several places. In Chapter 4, habitat management plans were discussed. This annual plan uses adaptive management to guide management activities for the Refuge for that upcoming year. The habitat management plan is a vital link in adaptive management because it provides a way to track the results of management decisions and associated actions. Also in Chapter 4 under the section on migratory bird management and in Chapter 5 in the overview of the landscape ecology approach section, three examples of adaptive management strategies are given where survey information is applied to improve restoration designs on the Refuge.

3.12 Environmental Analysis Comments

Comment: In the EA, the Service states that riparian restoration under Alternative B and C is not significant. What does this mean?

Service Response: In development of the environmental consequences section of the EA, the Service has provided impacts analysis consistent with NEPA implementing

regulations at 40 CFR 1502.16(a) and 40 CFR 1502.16(b). Here NEPA implementing regulations require discussions of environmental consequences to address "[d]irect effects and their significance" and "[i]ndirect effects and their significance."

In describing the significance of impacts, the Service defers to NEPA Implementing Regulations at 40 CFR 1508.27.

> "Significantly" as used in NEPA requires considerations of both context and intensity:
> (a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.
> (b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. "

Thus, while the Service believes the environmental effects of implementing the CCP will result in improved conditions for fish and wildlife resources along the Sacramento River, when considered within the context of the worsening environmental conditions occurring throughout the Sacramento River Valley, we do not believe the magnitude of anticipated improved conditions attributable to CCP implementation represents a significant beneficial effect as defined in NEPA Implementing Regulations at 40 CFR 1508.27.

We described the differences between public use levels under Alternatives B and C when compared to Alternative A as "substantial" in an effort to denote that we anticipate markedly differing levels of public use under different alternatives. However, despite the fact that we anticipate markedly different levels of public use under Alternatives B and C when compared to Alternative A, we do not anticipate public use levels under any of the alternatives to result in significant impacts to the human environment (40 CFR 1508.27).

Comment: The greatest concern we have is the conclusion of FONSI. This determination is arbitrary and capricious.

Service Response: In the Draft CCP, the Service did not make a determination or otherwise rendered a Finding of No Significant Impact. The function of the EA is to assist with making a determination as to whether an EIS must be prepared (40 CFR 1501.4(c)). In the environmental consequences section of the EA, the Service provided impacts analysis consistent with NEPA implementing regulations at 40 CFR 1502.16(a) and 40 CFR 1502.16(b). Here NEPA implementing regulations require discussions of environmental consequences which address "[d]irect effects and their significance" and "[i]ndirect effects and their significance."

Comment: The EA does not disclose and assess potential impacts to land and facilities owned and operated by PCGID/PID.

Service Response: PCGID/PID did not comment during the scoping period or at any other time during the CCP process until their comment letters on the Draft CCP/EA. Also, in those comment letters, they have not stated what the impacts to the facilities are; therefore, the Service will not speculate what these impacts or concerns are. The Refuge is working with PCGID/PID on a feasibility study to protect their pumping plant and restore the riparian sanctuary described in the Technical Analysis section of Chapter 4 of the CCP. This study was funded by CALFED.

Comment: Considering the CCP management objective and the size of project area, the appropriate framework for environmental review is an EIS.

Service Response: The Service disagrees with the assertion that the CCP management objective and the size of project area argue for preparation of an EIS. The level of detail provided in the CCP is appropriate. Significance of impacts to the human environment determines whether preparation of an EIS is warranted. Thus, an EA provides a discussion of the magnitude of the impacts within the context of the situation for each impact topic.

Comment: Commentor claims to provide new information to the CCP process in their comment letter, previously not addressed or disclosed.

Service Response: The Service received the above-mentioned comment letter; however, the commenter has not provided any new information in their letter. The Service has reviewed and developed a response to the substantive comments brought forth in all of the comment letters received during the comment period (Appendix R).

Comment: CCP activities are likely to have significant direct adverse impacts and cumulative impacts on the operation of PCGID/PID pumping plant and fish screen.

Service Response: It is important to note that the commentor has only generally asserted that CCP implementation is likely to have significant direct adverse impacts and cumulative impacts on the operation of PCGID/PID pumping plant and fish screen, but has not provided any information as to what those impacts might be. It would be remote and speculative for FWS to guess at the impacts to which PCGID/PID is referring. The Refuge is working with PCGID/PID on a feasibility study described in the Technical Analysis section of Chapter 4 of the CCP.

Comment: Language should be added to the introduction of the EA to state that "pursuant to Council on Environmental Quality regulations, the principle purpose for drafting and EA is to determine if there are significant impacts and if and Environmental

Impact Study is requires. If significant impacts are identified, the need to prepare an EIS is triggered."

Service Response: This sentence in the EA has been revised to read "…..in accordance with National Environmental Policy Act (NEPA), amended and it's implementing regulations."

Comment: The CCP and the EA should be stand alone documents

Service Response: The draft CCP and EA were developed consistent with NEPA implementing regulations to reduce excessive and duplicative paperwork by incorporating by reference (40 CFR 1500.4 (j)), integrating NEPA requirements with other environmental review and consultation requirements (40 CFR 1502.25), and combining environmental documents with other documents (40 CFR 1500.4 (o)). The final CCP will be a stand alone document.

Comment: The EA is silent to potential harmful impacts to PCGID/PID pumping plant and fish screen.

Service Response: It is important to note that the commentor has only generally asserted that CCP implementation is likely to direct adverse impacts on the operation of PCGID/PID pumping plant and fish screen, but has not provided any information as to what those impacts might be. It would be remote and speculative for FWS to guess at the impacts to which PCGID/PID is referring.

Comment: Disagree with the determination that "all activities proposed under Alternative B are not expected or intended to produces significant levels of environmental impacts that would require mitigation measures."

Service Response: Commentor asserts that impact conclusions are not justified, yet commentor does not specify what is inadequate about the analysis. The Service disagrees with the comment and believes that the conclusions are warranted.

Comment: Provide greater detail why mitigation measures are anticipated and suggests that EIS is needed because FWS is planning mitigation measures.

Service Response: FWS is proposing mitigation measures in an effort to avoid having CCP implementation result in significant adverse effects. Regarding the suggestion that mitigation measures trigger preparation of an EIS, it is important to note that an agency may support a conclusion of less than significant effects by showing that mitigation measures will significantly compensate for a proposed action's adverse environmental impacts (Friends of Endangered Species v. Jantzen, 760 F.2d 976, 987 (9th Cir. 1985)).

Comment: The loss of jobs associated with agriculture is an unacceptable adverse effect that demands much more detailed analysis and further demonstrates the need for an EIS.

Service Response: It is important to note "that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment" (40 CFR 1508.14). In assessing the physical and biological effects of changing land use on certain pieces of land, the EA has appropriately addressed the interrelated potential social and economic impacts.

The agricultural sector of the regional economy would be most affected by riparian habitat restoration. The reestablishment of riparian habitat would result in small reductions to agricultural production, local agricultural jobs, and personal income. These changes were analyzed in the Restoration EA in Section 4.4 Effects on the Social and Economic Environment (USFWS 2002). The Service has taken the effects on Prime and Important Farmland into account as it has considered alternatives to the CCP. Alternative B was developed because it would lessen these impacts. No significant positive or negative economic impacts are expected from implementation of the proposed alternative.

The report entitled "Socioeconomic Assessment of Proposed Habitat Restoration within the Riparian Corridor of the Sacramento River Conservation Area" (Jones & Stokes 2003) looked at an estimated 42,543 acres study area to generally define and broadly communicate the economic consequences that may result from the establishment of a riparian corridor along the Sacramento River between Red Bluff and Colusa. This economic analysis focused on evaluating two kinds of effects associated with establishing a riparian corridor along the Sacramento River: changes in regional economic activity and fiscal conditions, and changes in resource costs and benefits. The agricultural sector of the regional economy would be most affected by riparian habitat restoration. The conversion of 9,390 acres of agricultural land to riparian habitat would result in small reductions to agricultural production, local jobs and personal income. These reductions would be relatively small when taken in the context of the 4-county agricultural economy. County tax revenues would see minor adjustments. The easily quantified benefits of the restoration would be small in comparison to the losses, but the potential for substantial local benefits in the recreation sector and societal benefits from the improvement in habitat conditions in the Sacramento Valley is large. The key to realizing substantial recreation-related benefits would be the expansion of public access and recreation-related facilities along the Sacramento River.

Comment: Commentor stated that they would appreciate receiving the comments made by other reviewers of this EA.

Service Response: The Service incorporated the comments by reviewers prior to the release of the Draft CCP/EA. The CCP and EA reflect the combined contribution of the CCP core team, extended team, and the reviewers.

Comment: Appendix 1 objectives and goals are presented in subjective terms.

Service Response: The goals and objectives that are referred to in Appendix 1 are directly from Chapter 5 of the CCP. As much as possible, the objectives are written to be specific, measurable, achievable, reasonable, and time-fixed. This allows the reader to obtain the quantitative elements to measure success right in the objective. These objectives are restated in Appendix 1 to compare each under each alternative of the EA.

3.13 Praise

- As adjacent landowners we have historically relied upon this good neighbor policy and its incumbent good-faith on the part of the Service and the Refuge management to employ sound preventative and precautionary measures and to respond to incidents and problems as they occur.
- M&T Chico Ranch would like to take this opportunity to acknowledge the importance of the CCP and recognize the efforts of the USFWS in this endeavor to date.
- The environmental education program described on page 157 is good.
- The website described on page 161 is good.
- Wish to compliment the authors on a very complete and easily readable report. Especially noteworthy is the intent to work with "many partners to protect and restore riparian habitat along the Sacramento River and its watershed."
- The policy of not planting elderberry bushes within 100 feet of the Refuge boundary with private agricultural operations is appropriate.
- Defenders of Wildlife approves of the decision that was made to keep the majority of the refuge lands closed to camping, but to allow limited camping on gravel bars below the high water mark.
- Plan B allows for great public access for non-consumptive purposes.
- Alternative B is a nice compromise between development and wildlife sanctuary. Like the idea of providing land to be kept aside for a wildlife sanctuary while improving other parts of the refuge for public access and appreciation.
- Plan C create maximum opportunity for public use and enjoyment for the citizens of this county.
- We at Kittle's Outdoor & Sport Co. support conservation efforts along the river and are in favor of option C. Thank you for allowing us to share the Draft with the public. It seems to be very comprehensive.
- Plan B better serves the needs of the community. Hunting and fishing have significant historical and cultural value as does farming and eliminating it under option C is not good.
- I fully support Alternative B to preserve natural habitats for the use and enjoyment of the public as well as the animals that live there.

- We are especially supportive of Alternative B which would optimize habitat restoration and public use of the Refuge.
- Plan is impressive and appears very well thought out. The different uses of these refuges are very diverse and I am pleased with the plan.
- On behalf of The Nature Conservancy I wish to commend your project team for the Draft CCP.
- It is an excellent and inclusive document that will serve as an effective guide for the management of the Refuge.
- The plan has a strong technical basis and the detailed plans for implementation reflect all of the hard work and thought that went into the document.
- The extensive public outreach efforts that were included in the planning process are well chronicled and the plan clearly reflects much of the public input was received.
- The plan will be an important tool to help implement the goals and principles of the Sacramento River Conservation Area Forum Handbook.
- I am very excited to see wildlife habitat restored along the river.
- If this Refuge is managed like the others in the Complex it will no doubt provide high quality habitat and high quality recreational opportunities.
- We join you in your mission of preserving and protecting these public treasures while encouraging compatible public utilization and enjoyment.
- As a hunter and fisherman, I congratulate you for your conservation efforts in restoring wildlife habitats along the Sacramento River.
- I attended your public comment meeting in Red Bluff. Thank you for this meeting and the presentation. I also want to thank all your personnel that were present. Most questions were answered during that meeting. The CD provided me with excellent materials to make my own assessment and evaluation.
- I attended the Colusa meeting. Thanks for the time and effort. Good job.
- The USFWS and CDFG are doing a good job in the re-establishment of wildlife within California.
- I commend you for your thorough job. Keep up the good work.

Service Response: Comments noted.

4.0 LIST OF PEOPLE AND ENTITIES THAT PROVIDED COMMENTED

4.1 Federal Agencies

Agency	Signature
USFWS, Red Bluff Fish and Wildlife Office	Parker, T.
USFWS, Regional Office	Vallentine, N.

4.2 State Agencies

Agency	Signature
California Department of Conservation	O'Bryant, D
California Department of Fish and Game	Curtis, B.
California Department of Fish and Game	Hoffman, P.
California Department of Water Resources	Ng, M.

4.3 Local Agencies

Agency	Signature
Butte County Mosquito and Vector Control	Camy, J.
Glenn County Board of Supervisors	Freeman, G.
Glenn County Mosquito and Vector Control	Cavier, J.
Tehama County Flood Control and Water Conservation District	Ohlin, E.

4.4 Organizations

Organization	Signature
Abbey of New Clairvaux	Brother Regis
Animal Protection Institute	Engebretson, M.
Association of Veterinarians for Animal Rights	Barnato, T.
California Bowmen Hunters	Becker, J.
California Waterfowl Association	Hennelly, M.
Central Valley Project Water Association	Birk, S.
Chico Area Flyfishers	Miller, D.
Chico Chapter of California Deer Association	Wood, A.
Defenders of Wildlife	Matson, N.
Fresno County Sportsman's Club	Woods, G.
Fresno Chapter Quail Unlimited	Woods, G.
Princeton Cordora Glenn Irrigation District/ Provident Irrigation District	Boyd, L.
Sacramento River Preservation Trust	Merz, J.

Straight Arrow Bowhunters	Bostain, S.
The Fund for Animals	Handley, V.
The Nature Conservancy	Zeleke, D.

4.5 Businesses

Business	**Signature**
3B's Ranch	Bocks, C.
Chico Sportsman's Den	Ebright, D.
Crain Orchards, Inc.	Crain, C.
Crain Ranch	Crain, H.
Keyawa Orchards, Inc.	Keyawa, R.
Kittles's Outdoor and Sport Club	Kittle, P.
M&T Chico Ranch	Heringer, L.
Western Outdoor News	Karr, B.

4.6 General Public

Adolf, N.
Ahre, D.
Alcisto, P.
Alexander, D.
Alexander, A.
Allen, T.
Alonso, M.
Alvarez, C.
Amaral, L.
Amaral, C.
Amaral, D.
Amaral, D.
Amaral, D.
Amaro, B.
Anchors, J.
Anders, C.
Anderson, S.
Anderson, A.
Andoe, D.
Andrews, M.
Anello, D.
Arendt, R.
Arendt, S.
Aries, J. and H.
Artley, R.
Aureala, W.
Austin, G.
Ave, M.
Ave, J.
Baccam, T.
Bachelor, M.
Baer, W.
Baer, K.
Bailey, T.
Baker, G.
Ballard, L.
Ballon, A.
Barber, B.
Barbour, T.
Barcilon, D.
Bard, B.
Barden, D.
Bariola, S.
Barnhart, M
Barranco, M
Bates, J
Baum, B.
Baxter, J.
Beaham, P.
Beaham, T.
Beaver, E.
Beavers, N.
Begley, R.
Belkin, D
Belkin, M.
Beltramo, J.
Beltramo, J.
Benamati, R.
Bender, D.
Bender, E.
Bender, M.
Bender, R.
Benson, C.
Berger, B.
Bergstrom, B.
Berry, J.
Berryhill, T.
Betagna, N.
Bethel, C
Betts, J.
Bianchi, R.
Biggs, S.
Billeci, F.
Bird, D.
Bitker, M.
Black, D.
Black, M.
Blackwell, D.
Blackwell, D.
Blackwell, D.
Blackwell, P.

Bloxham, T.
Blue, B.
Bock, R.
Boelens, R.
Bohli, B.
Bohnemeyer, M.
Bohnemyer, S.
Bonds, J.
Bourdon, J.
Boyd, D.
Boyes, B.
Branco, C.
Bratt, S.
Breglia, A.
Brigantino,T.
Britton, R.
Bronner,B.
Brooks, J.
Brott, S.
Brott, S.
Brown, R.
Brown, V.
Brown, V.
Browne, D.
Browne, J.
Bruce, D.
Brugger, R.
Bruhn, S.
Bruno, E.
Bulloch, R.
Bunch, R.
Bundy, M.
Buriani, D.
Buriani, N.
Buriani, R.
Buriani, R.
Burke, J.
Burkett, B.
Burkett II, R.
Burns, P.
Burres, E.
Burroughs, K.
Butler, J.
Buzzell, M.
Calais, C.
Calbreath, L.
Campbell, M.
Candler, R.
Capriola, R.
Caracci, J. and V.
Cardella, S.
Carlson, D.
Carlson, D.
Carlson, D.
Carman, T.
Carney, M.
Carney, R.
Carpenter, T.
Carr, G.
Carter, G.
Carter, M.
Cartwright, S.
Caruso, G.
Case, M.
Case, M.
Case, M.
Cassaretto, T.
Cassianna, E. and F.
Cassillas, D.
Castellano, E.
Castro, D.
Cerro, P.
Cerro, R.
Chaddock, D.
Chamberlain, S.
Chan, C.
Chapman, E.
Chartier, M.
Chase, C.
Chauvin, R.
Chavarria, M.
Chavarria Patino, M.
Chesney, T.
Chikato, M.
Chikato, M.
Childs, S.
Chin, K.
Chokrevski, M.
Christensen, E.
Christensen, M.
Cianelli, T.
Cierley, H.
Clapp, G.
Clapp, K.
Clapp, S.
Clark, B. and C.
Clarkson, J.
Claypool, R.
Clement, R.
Cloninger, J.
Cloud, M.
Cockrell, A. and D.
Conn, T.
Connel, D.
Connell, D.
Connors, P.
Constantini, T.
Cook, B.
Cooper, S.
Copeland, R.
Copland, S.
Corbin, B.
Cordeau, S. and K. Harding
Cornelisun, R.
Cornish, K.
Cory, D.
Cose, E.
Cose, K.
Cotton, T.
Countryman, G.
Cowan, B.
Craig, T. and E.
Crane, J.
Cress, G.
Crete, C.
Crisitia, N.
Croff, W.
Cronin, S.
Crowe, B.
Cullins, W.
Cullins, W.

Cumming DuCoeur, E.
Cunha, M.
Curnow, C.
Currey, D. and H.
Currey, D.
Dailey, M.
Damaso, M.
Damitz. G.
Damitz. G.
Damitz. G.
Damitz. G.
Daniel, B.
Dardzinski, M.
Davanis, T.
David, M.
Deitz, J.
Deitz, J.
Deitz, R.
Delbridge, G.
Delorey, G.
Dematteis, P.
DeMello, S.
Deming, S.
Dengler, R.
Denison, J.
Deniz, S.
Denson, L.
Depew, G.
Derdivanis, J.
Deschene, J.
DeWitt, R.
Dicherry, D.
Dick, J.
Dickson, M.
Dietrich, D.
DiGioia, E
DiMarco, J.
DiNicola, B.
Dinwiddie, D.
Dirkson, K.
Dixon, K.
Dodd, B.
Dodd, E.
Glenn Dodge, G.
Domras, R.
Donald, F.
Donley, C.
Donnelli, G.
Donnici, A.
Doob, J.
Dorow, M.
Dorrell, D.
Doucette, C.
Douglas, M.
Douglas, R.
Dross, T.
Drost, C.
Drummond, A.
Duda, T.
Dufek, D.
Duffy, D.
Dunlap, J.
Durrant, T.
Dwinger, D.
Dwinger, T.
Dyrssen, D.
Eaton, H.
Eddy, D.
Edmonds, D.
Edwards, W.
Ehrich, T.
Eichert, K.
Eisenman, M. and C.
Eitel, R.
Embree, D.
Emmons, M., T., D., and D.
Engberg, D., C. and C.
Engbretson, J.
Engle, R.
Engurasoff, G.
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Enright, R.
Ereth, K.
Erickson, C.
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Ernenwein, R.
Erwin, J.
Estensen, D.
Estes, D.
Esteve, G.
Eugene, J.
Eusebio, M.
Everly, F.
Everson, G.
Ewing, D.
Eyre, T.
Falletti, R.
Farley, D.
Farmer, G.
Farnung, B.
Farrar, A.
Farrey, R.
Fast, M.
Fava, G.
Feldheim, C.
Feltman, S.
Fendrich, C.
Ferrill, H.
Fetzer, P.
Figone, J.
Figone, J.
Figone, P.
Figone, A.
Filsinger, L.
Finkle, P.
Fischer, Philip
Fischoff, R. and S.
Flores, J.
Flowers, B.
Flowers, D.
Flynn, B.
Fole, J.
Foley, T.
Forberg, J.
Forberg, J.
Forrester, C.
Foster, T. and R.
Foster, J.
Foster, M.
Foust, J.
Foy, M.

Frank, G.
Frediani, T.
Freeman, D.
Fritsch, S.
Frulan, B.
Fryer, W.
Fulton, C.
Gagliano, M.
Gaines, F.
Gales, C.
Garbato, K.
Gardner, W.
Gargano, L.
Garkow, I.
Gary, R.
Gaumer ,D.
Gaumer, G.
Gaumer, J.
Gaumer, T.
Gebke, S.
George, L.
George, R.
George, D.
George, B.
George, T.
German, B.
Gerula, T.
Getchell, T.
Getchell, M.
Ghelfi, P.
Gifford, J.
Gilbert, D.
Ginotti, F.
Glennon, J.
Go, A.
Godsey, B.
Goetter, S.
Gong, A.
Gonsalves, J.
Gonzalez, P.
Goodenough, B.
Goodman, D.
Gork, J.
Goss, S.
Gotfried, J.
Gotfried, C.
Gragg, L.
Graham, B.
Graham, C.
Graham, J.
Graham, R.
Gray, A.
Gray, R.
Gray, R.
Green, E.
Gremore, S.
Griffith, J.
Gromer, D.
Grossman, M.
Grotz, R. T.
Gruendler, D.
Grunert, P.
Guadagnin, D.
Gurton, W.
Gustin, M.
Haigh G.
Haigh, J., T. and D.
Hailstone, J.
Hall, A.
Hall, R.
Hamilton, J, M, and R.
Hamilton, M.
Hamre, L.
Haner, L.
Haney, R.
Hankins, D.
Hanson, B.
Hardesty, S.
Hardy, T.
Harp, R.
Harp, R.
Harp, B.
Harris, G.
Harris, J.
Harrity, J.
Hart, G.
Hartman, C.
Hartman, J.
Hartman, T.
Haseleu, E.
Hass, M.
Hauqe, E.
Hauser, D.
Hay, E. P.
Hazlehurst, J.
Hazlehurst, J.
Heckler, D.
Hedglin, H.
Hedgpeth, B.
Heins, B.
Heins, B.
Heintzman, C.
Hembree, G.
Henry, M.
Heqwer, E.
Herendeen, C.
Herink, M. and M.
Herman, L. and D.
Herman, M.
Hermansen, T.
Herreid, M.
Herrell, B. and P.
Herrick, J.
Hesse, J.
Heywood, G.
Hiebert, A.
Higginson, M.
Hildabridle, J.
Hile, C.
Hilf-Barr, T.
Himmer, K.
Hisey, B.
Hitt, J.
Hobbs, D.
Hobbs, J.
Hobbs, J.
Hobson, A. D.
Holberton, T.
Holland, H.
Holloway, J.
Holloway, L.
Holt, D.

Hopkins, B.
Hopkins, B.
Hord, K.
Horgan, T.
Horsley, D.
Horsley, M.
Horsman, J and J. Flowers
Horvath, E.
Howard, W.
Huff, E.
Huff, D.
Hughes, D.
Hull, E.
Hunt, G.
Hunt, P.
Hunter, J.
Hunter, T.
Husa, R.
Hutchinson, J.
Huws, R.
Imam, B.
Ireland, J.
Jacobson, R.
James, L.
Jamex, R.
Jandon, J.
Janis, F.
Jasper, M.
Jefferson, K.
Jennings, A.
Jensen, J.
Jerez, M.
Jessen, P.
Jessen, P.
Jessen, P.
Jett, A. and B.
Johnson, C.
Johnson, K.
Johnson, M.
Johnson, R.
Johnson, R.
Johnson, R.
Johnston, T.
Jones, S.
Jordan, P.
Justice, B.
Kammerer, C.
Kawanishi, A.
Kazemian, L.
Keatay Battocchio, C.
Keister, R.
Keith, J.
Keith, S.
Keller, D.
Keller, M.
Kelley, R.
Kelly, B.
Kelly, C.
Kelly, D.
Kelly, L.
Kelly, P.
Kelly, R.
Kent, B.
Kenyon, D.
Kerock, S.
Kestler, T.
Keys, P.
Kiesow, J.
Kim, S.
King, D.
Kirchdoerfer K. and D. Baechle
Kirk, P.
Kisthardt, A.
Kleinman, D.
Kliebe, L.
Kliebe, R.
Kline, D.
Klingman, A.
Knappick, R.
Knowles, E.
Kobseff, M.
Koehly, J.
Kompelien, K.
Kotysan, J.
Kozick, J.
Kraemer, L.
Kraemer, T.
Kreceman, J.
Kreins, J.
Krummes, S.
Kumke, G. and A.
Kyles, P.
Labrucherie, L. and S.
LaCombe, M.
Ladd, V.
LaForce, C.
Lamora, K.
Lander, R.
Langlois-Yallop, C.
Lantsberger, P.
Lantsgerger, J.
Lares, C.
Larkin, D.
Larson, E.
Larson, R.
Lasater, M.
Laursen, R.
Lavagnino, D.
Lavender, T.
Lavin, J.
Lavish, J.
Lawson, B.
Layne, K.
Layne, K.
Leauy-Nunez, E.
Ledinsky, D.
Lee, A.
Leeflang, A.
Leger, R.
Leininger, R.
Leland, S.
Leland, E.
Lemmo, E.
Lenz, D.
Lepe, B.
Lerch, J.
Lerche, J.
Lesniak, S.
Lewer, P.
Lewis, D.

Lewis, D.
Light, J.
Limas, J.
Limon, X.
Liolis, D.
Lobdell, C.
Lobdell, C.
Lobdell, R.
Long, K.
Long, S.
Longhauser, J.
Lopez, R.
Lopresto, J.
LoVullo, J.
Lowell, D.
Lubofsky, T.
Ludwig, J.
Luger, M.
Luger, D.
Lyman, G.
Lynch, S.
Lynch, P.
Lyon, D.
Lyon. B.
Lyon, R.
Lyon, S.
Macdonald, E.A.
MacFarlane, G.
Machado, E.
MacKay, B.
MacKay, B. and J.
MacKinnon, J.
Madok, J.
Madrid, B.
Magnifico, L.
Mahue, K.
Malik, A.
Mallia, D.
Mallia, D.
Malone, M.
Marcillac, G.
Marcu, K.
Margiotta, P.
Marsh, J.
Martignoni, S.
Martin, R.
Martincic-Norton, M.
Martinelli, P.
Marunich, M.
Marvier, S.
Mathews, T.
Matsuno, A.
Mattews, J.
Matthers, W.
Matthes, B.
Mattos, J.
Mavros, E.
Maxey, R.
Mayer, K.
Mayfield, S.
McCall, R.
McClintock, C.
McCullough, J.
McDermott, D.
McDonald, M.
McGlone, R.
McGowan, B.
McGuinness, P.
McGuire, M.
McLaughlin, H.
McMaster, F.
McMaster, L.
McNab, R.
McNeil, K.
McNulty, A.
McQuillen, H.
Mello, C.
Mello, E.
Merwarth, C.
Messerli, J.
Mikesell, T.
Mikkelson, B.
Miller, B.
Miller, K.
Miller, M.
Miller, T.
Miller, D.
Miller, R.
Miller, J.
Mills, I.
Minch, D.
Minior, S.
Mitchell, M.
Moe, R.
Mohlenbrok, D.
Moody, S.
Moore, J.
Moore, J.
Moore, T.
Moore, P.
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5.0 Summary of Changes

This section explains and summarizes the major changes made between the draft and final versions of the CCP.

5.1 Refuge Acres

The Refuge acres have changed since the Draft CCP and now more accurately represent the legal boundaries. Table 7 summarizes these changes.

Table 7 Refuge Acres Changes

Refuge Unit	Draft Acres	Final Acres
Blackberry Island	63	52
La Barranca	1,073	1,066
Todd Island	165	185
Mooney	344	342
Ohm	750	757
Flynn	552	630
Heron Island	116	126
Rio Vista	1,202	1,149
Foster Island	150	174
McIntosh Landing North	60	63
McIntosh Landing South	71	67
Pine Creek	603	564
Capay	667	666
Phelan Island	308	308
Jacinto	82	69
Dead Man's Reach	634	637
North Ord	43	29
Ord Bend	118	111
South Ord	122	122
Llano Seco Riparian Sanctuary	751	751
Llano Seco Island I	56	56
Llano Seco Island II	100	99
Hartley Island	397	487
Sul Norte	590	590
Codora	394	399
Packer	375	404
Head Lama	129	177
Drumheller Slough	226	224
Total Refuge Acres	**10,141**	**10,304**

5.2 Visitor Services Changes

Changes in the Refuge acreages (Table 7) and changes in the amount of sanctuary have changed the percentages that were used in the Draft CCP. Table 8 shows the draft and final acreages (and percentages) for sanctuary, Big 5 and Big 6 uses.

Table 8 Visitor Services Changes

	Draft Alt B	**Draft Alt C**	**Final**
Sanctuary	1,663 (16%)	1,663 (16%)	2,043 (20%)
Big 5	2,907 (29%)	1,124 (11%)	2,938 (28%)
Big 6	5,571 (55%)	7,354 (73%)	5,323 (52%)

5.2.1 Sanctuary Acres

The Service has revised the amount of sanctuary acres proposed between the draft and final CCP from 1,663 acres (16 percent) to 2,043 acres (20 percent). The additional sanctuary acres were added to the Rio Vista and Ohm units (additional 341 and 156 acres respectively). Sanctuaries are areas on the Refuge that are closed to public use. The CCP states that hunting will not be allowed on Refuge units that are small in area and close in proximity to urban areas and private dwellings. In order to be consistent with this statement, the visitor service uses were changed from Big 6 to sanctuary on the areas of Rio Vista and Ohm units that are adjacent to private residences.

5.2.2 Hunting

Many comments were given from adjacent landowners concerning hunting and trespassing. The Service added the following regulation to the Refuge Hunting Plan (Appendix C): "Hunting is not allowed within 50 feet of any landward boundaries adjacent to privately owned property. As per Fish and Game regulations, it is unlawful to hunt or discharge while hunting, any firearm or deadly weapon within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith. The 150-yard area is a "safety zone". In addition, Big 6 acres were reduced when sanctuary was added to Rio Vista and Ohm units.

5.3 Changes to CCP

5.3.1 Technical Analysis

The Service added a section titled Technical Analysis in Chapter 4 and in Objective 1.2 Floodplain and River Processes in Chapter 5 to address comments received regarding ongoing feasibility studies.

5.3.2 Other Changes

In response to a comment received, the Service added a description and a map of Llano Seco Riparian Easement and Table 7 Invasive Exotic Plant Species at Sacramento National Wildlife Refuge Complex.

5.4 Changes to Appendix M

The Service revised Appendix M which now contains a list of other laws and executive orders that may affect the CCP or the Service's implementation of the CCP. It also contains an overview of polices and plans that are relevant to Sacramento River Refuge.