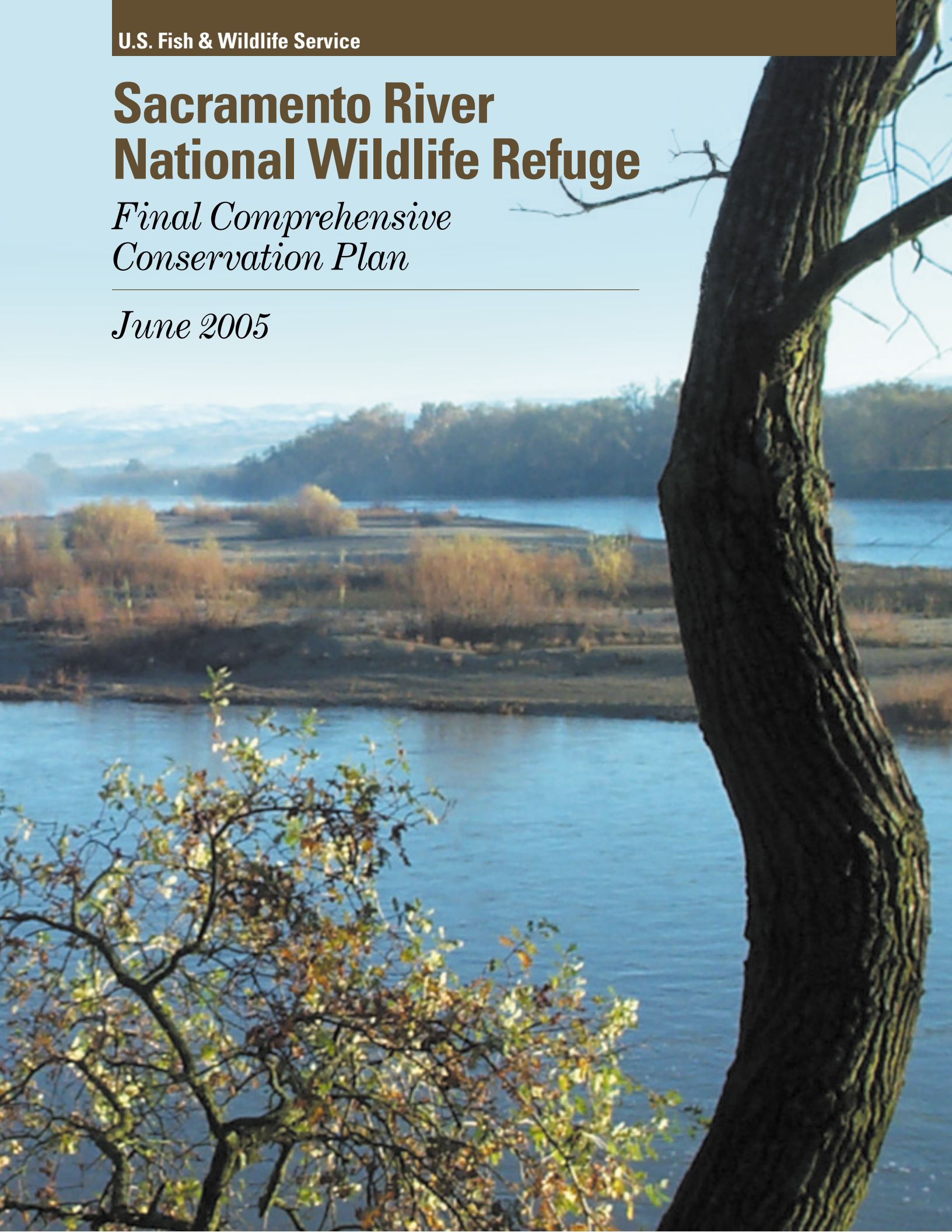


Sacramento River National Wildlife Refuge

*Final Comprehensive
Conservation Plan*

June 2005





U.S. Fish & Wildlife Service

Sacramento River National Wildlife Refuge

Comprehensive Conservation Plan

Vision Statement

“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.”

U.S. Fish & Wildlife Service
California/Nevada Refuge Planning Office
2800 Cottage Way, Room W-1832
Sacramento, CA 95825

June, 2005

Sacramento River National Wildlife Refuge

Final Comprehensive Conservation Plan

Prepared by:
U.S. Fish and Wildlife Service
Region 1

California/Nevada Refuge Planning Office
2800 Cottage Way, W-1916
Sacramento, CA 95825

Sacramento National Wildlife Refuge Complex
752 County Road 99 W
Willows, CA 95988

Approved: Stu Thompson
California Nevada Operations Manager

Date: 3/21/2005

Implementation of this Comprehensive Conservation Plan and alternative management actions/programs have been assessed consistent with the requirements of the National Environmental Policy Act (42 USC 4321 et seq.)

U. S. Department of the Interior
Fish and Wildlife Service
California/Nevada Refuge Planning Office

FINDING OF NO SIGNIFICANT IMPACT

**Environmental Assessment for Management of
Sacramento River National Wildlife Refuge**
Tehama, Butte, Glenn and Colusa Counties, California

The U.S. Fish and Wildlife Service (Service) has completed the Comprehensive Conservation Plan (CCP) and the Environmental Assessment (EA) for Sacramento River National Wildlife Refuge (Refuge). The CCP will guide Refuge management for the next 15 years. The CCP and EA (herein incorporated by reference) describe the Service's proposals for managing the Refuge and their associated effects on the human environment under three alternatives, including the no action alternative.

Decision

Following comprehensive review and analysis, the Service selected Alternative B for implementation because it is the alternative that best meets the following criteria:

- Achieves the mission of the National Wildlife Refuge System.
- Achieves the purposes of the Sacramento River National Wildlife Refuge.
- Will be able to achieve the Service's vision and goals for the Refuge.
- Maintains and restores the ecological integrity of the habitats and populations on the Refuge.
- Addresses the important issues identified during the scoping process.
- Addresses the legal mandates of the Service and the Refuge.
- Is consistent with the scientific principles of sound fish and wildlife management and endangered species recovery.
- Facilitates priority public uses which are compatible with the Refuge purposes and the Refuge System mission.

Alternative Considered

Following is a brief description of the alternatives for managing Sacramento River Refuge, including the selected plan (Alternative B). For a complete description of each alternative, see the draft EA.

Alternative A

Under the No Action Alternative, the Refuge would continue to be managed as it has in the recent past. The Refuge currently has no unit-wide management plan. 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

The focus of the Refuge would remain the same: to provide habitat and maintain current active management practices; restore the 9 units identified in the Environmental Assessment for Proposed Restoration Activities on Sacramento River National Wildlife Refuge (USFWS 2002) for threatened and endangered species, migratory and resident birds, and other wildlife. The Refuge would remain closed to visitor services other than the limited existing opportunities for fishing at Packer Lake. Current staffing and funding levels would remain the same.

This Alternative was not selected for implementation because it does not include needed improvements for habitat restoration, for management of migratory birds and special status species and it does not accommodate the growing demand for wildlife-dependant recreation.

Alternative B (Selected Plan)

Under Alternative B, the Refuge would use active 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 cultivated and natural recruitment restoration techniques as determined by site conditions. Public Use opportunities would be optimized to allow for a balance of Big 6 wildlife-dependant public uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) throughout the entire Refuge river reach in coordination with other agencies and programs. Staffing and funding levels would need to increase to implement this alternative.

The Service would manage migratory birds threatened and endangered species the same as under Alternative A. However, the Refuge would prepare a surveying and monitoring plan for special status species, and substantially expand research on the ecology and management of special status species. Special regulations and temporary closures would be instituted for the protection of wildlife species and their habitats during critical periods of their life cycles. In cooperation with partners, the Refuge would continue to monitor restoration projects, avian bird populations, migratory waterfowl and other wildlife. The Refuge would develop and implement a long-term monitoring program to assess the success of current management and restoration activities.

Under Alternative B, the Service would improve and expand visitor services with a focus on a balance of Big 6 wildlife-dependent public use opportunities distributed throughout the entire Refuge. New visitor services projects under this alternative include: developing interpretive kiosks, creating a new refuge brochure, and constructing walking trails and parking facilities on vehicle accessible units. Hunting opportunities would increase under

Alternative B. Approximately 52 percent of the Refuge would be opened to hunting of dove, waterfowl, coot, common moorhen, pheasant, quail, snipe, turkey and deer. Hunting will be limited to shotgun or archery only. Twenty-three riverbank miles and seasonally submerged areas would be opened to sport fishing consistent with State regulations. Camping would be allowed on gravels bars below the ordinary high water mark.

This alternative was selected for implementation because it includes needed improvements in migratory bird and special status species management and makes an important contribution to regional biodiversity. It also provides a balanced mix of compatible wildlife-dependant recreation opportunities to meet the growing demand in the region. Implementation of this alternative will require additional staff and funding.

Alternative C

The Refuge would use active and passive management practices to achieve and maintain full restoration of all units under Alternative C. The agricultural program would cease immediately and remaining orchards would be removed. Restoration of these sites would be implemented as funding becomes available. Additional NEPA compliance documents may be needed depending on the size and scope of the restoration activities. Management and restoration of riparian habitats, threatened and endangered species and cultural resources would be the same as Alternative B.

Public use opportunities would be maximized to allow for all Big 6 wildlife-dependent public uses throughout the majority of the Refuge. In addition, staffing and funding levels would need to increase substantially to implement the alternative. Hunting opportunities would increase to 69 percent of the Refuge. Hunting would be allowed on most of the units open to the public. The Service would manage the hunting, fishing, wildlife observation, photography, environmental education and interpretation programs similar to Alternative B.

Alternative C was not selected for implementation because of the negative effects of the immediate removal of agriculture from the Refuge. These negative effects include the loss of funding for restoration activities, the potential for non-native or invasive plant species to invade these units which may impact biodiversity, unmanaged pests that may impact adjacent landowners and agricultural operations, and the abrupt impact on the local economy. Lastly, the topic of hunting dominated the comments received on the Draft CCP. Although the majority of the comments received were in favor of hunting, a great deal were against hunting. By opening 69 percent of the Refuge to hunting, more contact between hunters and other visitors may lead to increased competition for recreation space.

Effects of management of the Refuge in the human environment

As described in the EA, implementing the selected alternative will have no significant impacts on any of the environmental resources identified in the EA. A summary of the impacts analysis and conclusions follows:

Soils

The overall effect on soils from implementation of the selected alternative is negligible. The surface erosion potential is low, and because restoration site preparation activities would be conducted in small increments, any temporary increase in erosion and sedimentation rates resulting from the project would likely be minor. Any temporary increase in erosion and sedimentation rates would be offset by the substantial long-term reduction in erosion and sedimentation rates that would result from taking the Refuge units out of agricultural production and restoring them to native riparian habitat. Long-term pesticide and herbicide applications would also be reduced or eliminated under the selected alternative, leading to a positive or negligible effect on soils.

Geology and Hydrology

Potential changes in water surface elevations were evaluated in hydrologic models to assess the potential effects of converting agricultural land to riparian habitat on 9 units of the Refuge under the Restoration EA (USFWS 2002b). Any future restoration plans outside of these 9 units would be evaluated on an individual basis to assure that restoration projects would have a neutral affect on water surface elevations and no adverse effects to adjacent properties. As agricultural operations cease and Refuge lands are restored to riparian habitat, the need for flood protection of these properties is reduced. By restoring the floodplain hydrology on Refuge lands, flooding on neighboring agricultural operations may be reduced.

Air Quality

Under the selected plan, both short and long-term increases in pollutant emissions are expected. Short-term increases in dust and tailpipe emissions due to restoration projects which disturb the soil and/or require the use of heavy equipment work will occur. Long-term minor increases in tailpipe and fugitive dust emissions due to increased visitor trips and the construction of parking lots will also occur. However, the selected plan would have an overall positive effect on air quality with the implementation of full restoration over time.

Limited prescribed fire will be used under the selected plan to control nonnative weeds which may also temporarily impact air quality. Burning vegetation could temporarily and substantially increase PM10 concentrations in the areas. Adverse impacts from prescribed fire are expected to be minimal due to the small burn size and measures to avoid adverse impacts described in the Fire Management Plan.

Water Quality/Contaminants

Land-disturbing construction activities would occur under the selected alternative, but would have minimal impacts on water quality. To prevent groundwater contamination, the Refuge would identify and protect wells expected to be exposed to inundation, or would abandon and seal the wells according to county specifications. With the conversion of agricultural lands to riparian, the selected alternative would result in an overall long-term reduction in pesticide applications within the Sacramento River floodplain. Over time, the selected alternative is expected to result in positive effects on water quality on the

Sacramento River. Restoring the floodplain hydrology on Refuge lands reduces the need for flood protection of these properties and may also reduce flooding on neighboring agricultural operations. Sediment and contaminant levels could also be reduced. These effects, although beneficial, are not significant.

Vegetation

The riparian restoration would have beneficial long-term impacts on the Refuge. Approximately 2,372 acres of land on 9 existing units will be planted or allowed to revegetate with native vegetation based on the Restoration EA. The additional 3,255 acres that would be restored under selected alternative would have additional beneficial effects. 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. In the context of the large amount of habitat lost along the Sacramento River compared to the amount of habitat that would be restored, the beneficial effects are not significant.

Restoration activities under the selected alternative would not have adverse effects on special-status plants or sensitive natural communities since these activities are limited to existing fallow or agricultural areas. Special-status plants and sensitive natural communities would benefit from implementation of the selected alternative. The selected plan would utilize herbicides for weed maintenance in existing riparian areas and in restoration sites, and for weed maintenance in orchards. Use of herbicides would have a positive effect on vegetation, since the control of nonnative weeds would result in an increase in native species with minimal environmental cost.

Increased public use will cause small dispersed impacts to some vegetated areas. Areas with special-status plants and sensitive natural communities would be avoided in the placement of trails, parking lots, and other public use facilities. Foot traffic would likely increase in areas that are most easily traversed and the small amount of trampling that would result would have temporary and small-scale impacts on vegetation.

Wildlife Resources

The selected alternative will result in short-term and long-term benefits and potentially some adverse impacts on wildlife. The restoration of 2,372 acres covered under the Restoration EA and the additional 3,255 acres of habitat under the selected plan could temporarily disturb wildlife in these units. However, once restoration is completed there will be a long-term benefit to wildlife due to improved habitat conditions. These effects though beneficial are not significant.

Increased public use under the selected alternative would result in disturbance to wildlife. Due to the inaccessible "jungle-like" nature of a mature riparian forest; disturbance would be limited to those habitats that are more open to foot travel. There would also be increased public education, trails and signage, and law enforcement, all of which would help to alleviate the degree of disturbance.

Special Status Species

Under the selected plan the federally-listed endangered Chinook salmon (winter-run ESU); federally listed threatened bald eagle, giant garter snake, Chinook salmon (spring-run ESU), steelhead, Valley elderberry longhorn beetle; and federal candidate western yellow-billed cuckoo and Chinook salmon (fall- and late-fall run ESU) would continue to benefit from the Service's efforts to improve habitat quality. Short and long-term benefits for special status wildlife species due to restoration of riparian habitat would occur under the selected plan. The Section 7 consultation with USFWS (2004) and NOAA-Fisheries (2004) concluded that the selected plan is not likely to adversely affect any of the special status species occurring on the Refuge.

Every effort would be made to incorporate existing elderberry shrubs in agricultural habitats into the restoration plans, although an occasional shrub may be affected. This effect would be infrequent and offset by the substantial increase in Valley elderberry longhorn beetle (VELB) habitat created by restoration activities. Public education efforts and increased law enforcement should help to decrease the potential for negative impacts to VELB and associated habitats. Adjacent landowners have expressed concerns that planting elderberry shrubs near their properties could lead to the spread of VELB onto their properties, with resulting special-status species issues. The selected alternative leaves a 100-foot-wide corridor along the inside of the Refuge perimeter in which no elderberry shrubs would be planted, reducing the likelihood that VELB would colonize elderberry shrubs on adjacent properties.

Adverse effects to giant garter snake (GGS) could occur if restoration activities were to occur in potential GGS habitat. Specified measures would be taken to protect GGS and its habitat when threatened by restoration activities. Increased public use due to implementation of the selected alternative is unlikely to cause any adverse effects on GGS. It is unlikely that wildlife-dependant public use activities (hunting, fishing, wildlife observation and photography, environmental education and interpretation) will affect this species in these habitats.

The selected alternative would provide positive effects for special status wildlife species since additional acreage would be restored to riparian habitat. However, the beneficial short and long-term effects on wildlife would not be significant. The implementation of could create some disturbance to special status species due to increased public use. To alleviate any negative effects, areas that are known to have sensitive species would have restricted public access and may have temporary closures instituted for protection during critical lifecycle periods.

Fisheries Resources

The implementation of riparian restoration in the selected alternative would result in long-term beneficial effects on fish in the Sacramento River, including winter/spring run Chinook salmon, steelhead, and Sacramento splittail. The resulting riparian habitats would provide shaded riverine aquatic habitat and large woody debris, increasing cover, food, and other main channel and floodplain habitat components for fish. These effects,

although beneficial, are not significant. The loss of riparian habitat on the Sacramento River has contributed, in part, to the decline of our native fisheries resources. The Refuge encompasses only a small portion of the Sacramento River, therefore, is only part of what maybe required for the continued long-term survival of our fisheries resources.

Temporary impacts on fish species could occur during restoration implementation resulting in a temporary increase sediment load in the river. Increased input of sediment has the potential to increase turbidity, possibly reducing the feeding efficiency of juvenile and adult fish. Because the Sacramento River is typically a turbid system, additional sediment input from restoration activity would be comparatively minimal and would not have any noticeable effect to the overall condition of the river. The selected alternative would allow fishing at the Refuge, but is not expected to significantly affect fish harvest since most areas along the river are accessible by boat only and are already being fished.

Visitor Services

Under the selected plan, the Service will improve and expand all visitor services on the Refuge as funding becomes available. There would be an increased promotion of the Refuge with schools, the development of an educator-led curriculum for Refuge resources, and additional refuge signs, trails, restrooms, and parking lots under the selected alternative. Visitation may increase to approximately 5,500 total annual visits. The public would be allowed daytime access to much of the Refuge for hunting, fishing, wildlife observation, photography, interpretation, and environmental education. The selected alternative balances these public uses with the mission of the Service and the purposes of the Refuge. Sensitive areas for wildlife, plants and cultural resources have been set aside as sanctuaries (20%) and will be closed to the public. The remaining 80 percent of the Refuge that allows wildlife-dependent public uses have been carefully planned. Approximately 52 percent of the Refuge will be opened to hunting and 23 riverbank miles will be opened for fishing. Compatible locations of trails and facilities including restrooms and parking lots have been chosen to minimize disturbance to wildlife. Areas outside the trails and facilities, will not receive as much visitation or as concentrated visitation due to the thick “jungle” nature of the riparian habitat. The overall increase in wildlife-dependent recreational opportunities is not significant.

Public Review

The planning process incorporated extensive public involvement in developing and reviewing the CCP. This included four public workshops, four planning updates, and public review and comment on the planning documents. The details of the Service’s public involvement program are described in the CCP and EA.

Conclusions

Based on review and evaluation of the information contained in the supporting references, I have determined that implementing Alternative B as the CCP for management of Sacramento River National Wildlife Refuges is not a major Federal action that would significantly affect the quality of the human environment, within the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969, as amended. Accordingly, the Service is not required to prepare an environmental impact statement.

This Finding of No Significant Impact and supporting references are on file at the U.S. Fish and Wildlife Service, Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, California, 95988 (telephone 530-934-2801) and U.S. Fish and Wildlife Service, California/Nevada Refuge Planning Office, 2800 Cottage Way, Sacramento, California, 95825 (telephone 916-414-6504). These documents can also be found on the Internet at <http://pacific.fws.gov/planning/>. These documents are available for public inspection. Interested and affected parties are being notified of this decision.

Supporting References

U.S. Fish and Wildlife Service. 2005. Final Comprehensive Conservation Plan for the Sacramento River National Wildlife Refuge.

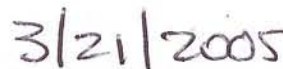
U.S. Fish and Wildlife Service. 2004. Informal Intra-agency Section 7 Evaluation for the Draft Comprehensive Conservation Plan and Environmental Assessment for the Sacramento River National Wildlife Refuge, Butte, Glenn and Tehama counties, California (1-1-04-I-2214).

U.S. Fish and Wildlife Service. 2002. Final Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge (Ryan, Ohm, Haleakala, Pine Creek, Kaiser, Phelan Island, Koehnen, Hartley Island, and Stone Units). Report prepared by Jones and Stokes, Sacramento, California for the U.S. Fish and Wildlife Service, Willows, California.

U.S. National Oceanic and Atmospheric Administration – National Marine Fisheries Service. 2004. 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.



Manager, California/Nevada Operations
Sacramento, California



Date



Illustration by Jennifer Isola

Table of Contents

Chapter 1. Introduction and Background	1
Introduction.....	1
Need for This CCP	3
Legal and Policy Guidance	3
The U.S. Fish and Wildlife Service	6
The National Wildlife Refuge System	6
The Sacramento National Wildlife Refuge Complex	7
The Sacramento River National Wildlife Refuge	9
Refuge Units.....	12
Land Acquisition	12
Oil and Gas Extraction.....	12
Refuge Purposes	13
The Refuge Vision	14
Existing and New Partnerships	15
Ecosystem Context	18
Threats and Opportunities	22
Conservation Priorities and Initiatives	25
Wilderness Review	26
Refuge River Jurisdiction	27
Chapter 2. The Planning Process.....	31
Introduction.....	31
The Planning Process.....	32
Planning Hierarchy	33
The Planning Team	33
Core Team	33
Expanded Team	34
Pre-Planning	35
Public Involvement in Planning.....	35
Public Outreach.....	37
Issues, Concerns, and Opportunities	37
Development of the Refuge Vision.....	38
Determining the Refuge Goals, Objectives, and Strategies.....	38
Goals	39
Objectives, Rationale, and Strategies	39
Development of the Refuge Management Alternatives.....	40
Alternative A: No Action	40
Alternative B: Optimize Habitat Restoration and Public Use (Proposed Action)	40
Alternative C: Accelerated Habitat Restoration and Maximize Public Use.....	41
Selection of the Refuge Proposed Action.....	41
Plan Implementation.....	42
Chapter 3. The Refuge Environment	43
Geographic/Ecosystem Setting	43

The Sacramento River Ecosystem.....	43
Physical Environment.....	46
Climate and Air Quality	46
Geology, Hydrology, and Soils	48
Contaminants and Water Quality.....	49
Vegetation	50
Agricultural	50
Riparian Habitats	51
Fish and Wildlife.....	54
Social and Economic Environment	67
Transportation	67
Employment	67
Local Economy.....	68
Land Use and Zoning.....	69
Demographics.....	69
Cultural Resources	70
Public Use	73
Trends.....	73
Environmental Education	75
Interpretation.....	76
Refuge Unit Descriptions.....	76
La Barranta.....	76
Blackberry Island	77
Todd Island	77
Mooney	78
Ohm.....	78
Flynn.....	79
Heron Island.....	82
Rio Vista	82
Foster Island	85
McIntosh Landing North	85
McIntosh Landing South.....	85
Capay	88
Phelan Island.....	91
Jacinto	91
Dead Man's Reach	91
North Ord	92
Ord Bend	92
South Ord	92
Llano Seco Riparian Sanctuary and Islands 1 and 2	94
Hartley Island	94
Sul Norte.....	97
Codora	97
Packer.....	99
Head Lama	99

Drumheller Slough	100
Llano Seco Riparian Easement	102
Chapter 4. Current Refuge Management and Programs	105
Habitat Management	105
Water Management.....	106
Riverbank Management	106
Technical Analysis	107
Control of Invasive Exotic Species	108
Mosquitoes	112
Vegetation Management.....	112
Riparian Grassland/Savannah Units	112
Riparian Forest Units	113
Croplands	113
Orchardlands.....	114
Cooperative Land Management Agreements/Cooperative Agreements	114
Habitat Restoration.....	115
Riparian Grassland/Savannah Restoration	115
Riparian Forest Restoration	116
Fish and Wildlife Management	117
Migratory Bird Management.....	117
Threatened and Endangered Species Management	117
Fisheries Management	121
Game Management.....	121
Monitoring, Research, and Investigations	122
Wildlife Disease Monitoring and Treatment	123
Other Wildlife Management Activities.....	123
Cooperation with Adjacent Landowners.....	123
Fire Prevention and Hazard Reduction	124
Law Enforcement and Resource Protection	125
Cultural Resource Management	126
Facilities Maintenance	126
Safety.....	127
Visitor Programs and Facilities.....	127
Environmental Education	128
Fishing.....	128
Outreach.....	129
Refuge Fee Program.....	129
Hunting	129
Chapter 5. Planned Refuge Management and Programs	131
Overview of Refuge Management Goals, Objectives, and Strategies.....	131
Organization	132
Refuge Management Goals, Objectives, and Strategies.....	132
Goal 1: Wildlife and Habitat	132
Objective 1.1: Riparian Vegetation and Habitat.....	135
Objective 1.2: Floodplain and River Processes.....	143

Objective 1.3: Threatened & Endangered Species.....	146
Objective 1.4: Migratory and Resident Landbirds.....	147
Objective 1.5: Winter Migratory Landbirds.....	149
Objective 1.6: Waterfowl and other Waterbirds.....	150
Objective 1.7: Anadromous Fisheries and Native Fisheries.....	151
Objective 1.8: Native Plant Species	153
Objective 1.9: Exotic, Invasive Species Control	154
Objective 1.10: Wildlife and Cultural Sanctuary	155
Goal 2: Visitor Services	156
Objective 2.1: Hunting.....	157
Objective 2.2: Fishing	163
Objective 2.3: Wildlife Observation and Photography.....	165
Objective 2.4: Environmental Education	167
Objective 2.5: Interpretation	169
Objective 2.6: Public Outreach	170
Objective 2.7: Volunteers	171
Goal 3: Partnerships.....	173
Objective 3.1: Partnerships.....	173
Objective 3.2: Cooperation with Adjacent Landowners:.....	175
Goal 4: Resource Protection.....	176
Objective 4.1: Law Enforcement.....	176
Objective 4.2: Safety	178
Chapter 6. Management Plan Implementation	185
Implementation.....	185
Funding & Staffing.....	185
Step-Down Management Plan Summaries.....	190
Hunting Plan	190
Fishing Plan.....	191
Fire Management Plan	191
Draft Integrated Pest Management Plan.....	192
Habitat Management Plan	192
Cultural Resource Management Plan	193
Restoration and Enhancement Plan	193
Compatibility Determinations	193
Compliance Requirements	194
Monitoring and Evaluation	194
Adaptive Management.....	195
CCP Plan Amendment and Revision	195

Figures

Figure 1. Sacramento River National Wildlife Refuge.....	2
Figure 2. Watershed/Ecosystem Setting.....	19
Figure 3. Life History Characteristics of Four Races of Chinook Salmon in the Central Valley of California.....	21
Figure 4. Riparian Bird Focal Species.	22
Figure 5. Potential Effects of Altered Hydrology on Breeding Bird Populations.	24
Figure 6. Contributing Factors for the Decline in Anadromous Salmonids of the Pacific (NOAA-NMFS).	25
Figure 7. The CCP Process.....	32
Figure 8. Relationships between Service, System and other planning efforts.	34
Figure 9. Typical Plant Communities and Successional Stages on the Sacramento River.	45
Figure 10. Typical Life Cycle of Anadromous Salmonids.	59
Figure 11. Map of La Barranca, Blackberry Island, Todd Island and Mooney units.....	80
Figure 12. Map of Ohm and Flynn units.....	81
Figure 13. Map of Heron Island Unit.....	83
Figure 14. Map of Rio Vista Unit.....	84
Figure 15. Map of Foster Island Unit.....	86
Figure 16. Map of McIntosh Landing North and South units.....	87
Figure 17. Map of Pine Creek Unit.....	89
Figure 18. Map of Capay and Phelan Island units.....	90
Figure 19. Map of Jacinto, Dead Man's Reach, North Ord, Ord Bend, and South Ord units.....	93
Figure 20. Map of Llano Seco Island 1 and 2 and Llano Seco Riparian Sanctuary.	95
Figure 21. Map of Hartley Island Unit.....	96
Figure 22. Map of Sul Norte, Codora, Packer and Head Lama units.....	98
Figure 23. Map of Drumheller Slough Unit.....	101
Figure 24. Llano Seco Conservation Easement.....	103
Figure 25. Potential Public Use / Biological Activity Time Frames	160
Figure 26. Sacramento River Refuge Public Use Sign.....	162
Figure 27. Public Use Sign Placement.....	162
Figure 28. Map of Visitor Services Alternative B	181

Tables

Table 1. Sacramento River National Wildlife Refuge: Location and Size, June 2005 ¹	10
Table 2. Partnerships in habitat acquisition, restoration, and management.	17
Table 3. Public Scoping Meetings.	36
Table 4. Refuge Issues Identified Through Public Comment.	36
Table 5. Special status wildlife species occurring or potentially occurring at Sacramento River Refuge.	61
Table 6. Ranks of three wildlife dependent activities	74
Table 7. Invasive Exotic Plant Species at Sacramento National Wildlife Refuge Complex.	109
Table 8. Habitat restoration and management for selected special status wildlife species occurring or potentially occurring at Sacramento River Refuge.	119
Table 9. Anticipated Restoration and Public Use Matrix.	137
Table 10. California Hunting Seasons 2003-2004.	159
Table 11. Maintenance Management System Backlog for Sacramento River Refuge.	186
Table 12. RONS Project Summary for Sacramento River Refuge, 2004.	187
Table 13. Staffing Plan.	189

Appendices

Appendix A	Environmental Assessment
Appendix B	Compatibility Determinations
Appendix C	Hunting Plan
Appendix D	Fishing Plan
Appendix E	Fire Management Plan
Appendix F	Compliance with Section 7 of the Endangered Species Act
Appendix G	Wildlife and Plant Species Lists
Appendix H	Glossary
Appendix I	Bibliography
Appendix J	Consultation and Coordination with Others
Appendix K	List of Planning Team Members and Preparers
Appendix L	Rationale for Public Use Determinations
Appendix M	Applicable Laws and Executive Orders and Relationships to Federal, State, and Local Policies and Plans
Appendix N	Referenced Tables from Sacramento River Public Recreation Access Study
Appendix O	Monitoring & Research Investigations at Sacramento River Refuge
Appendix P	Integrated Pest Management Plan for Mosquito Control
Appendix Q	Integrated Pest Management Plan for Walnut Production
Appendix R	Response to Comments

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

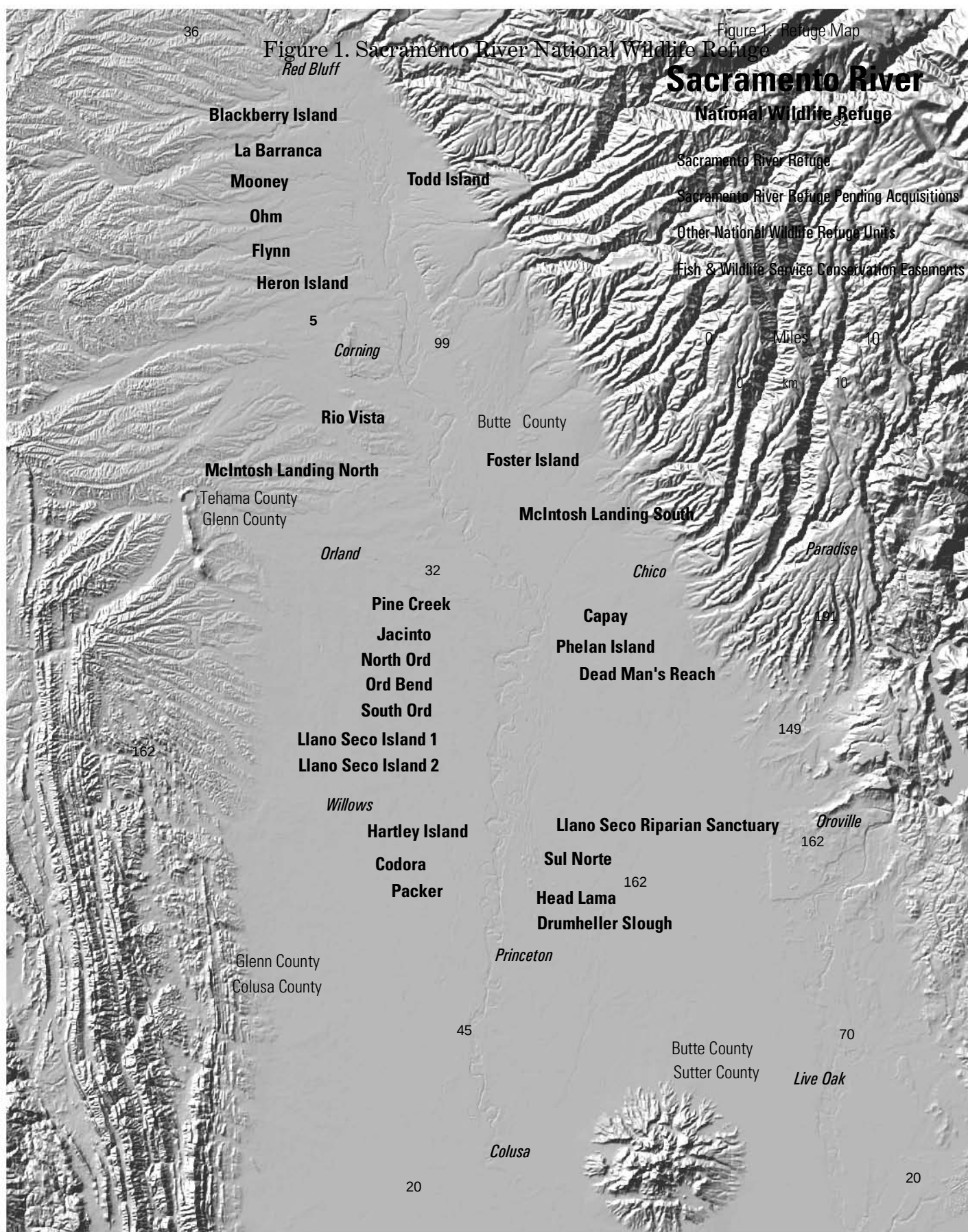
Introduction

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



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 2005¹.

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	
<i>Llano Seco Riparian Easement</i>	<i>138L</i>	<i>Butte</i>	<i>1,281</i>	<i>1991</i>

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 policies 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



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 their 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.

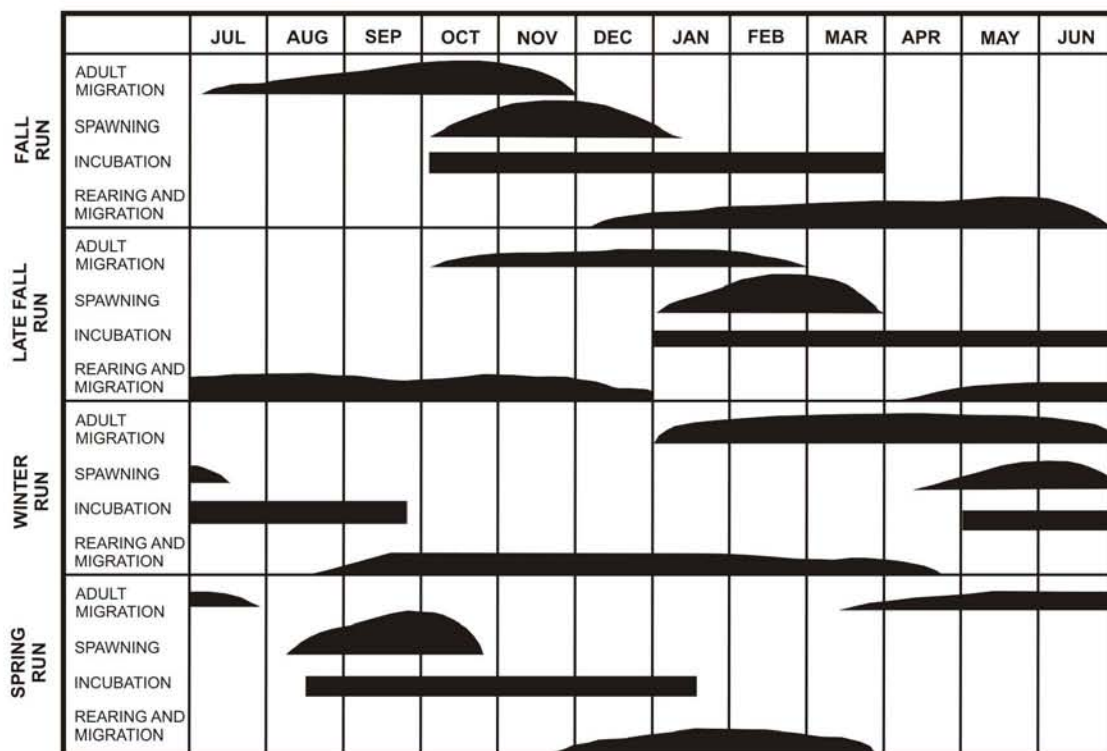
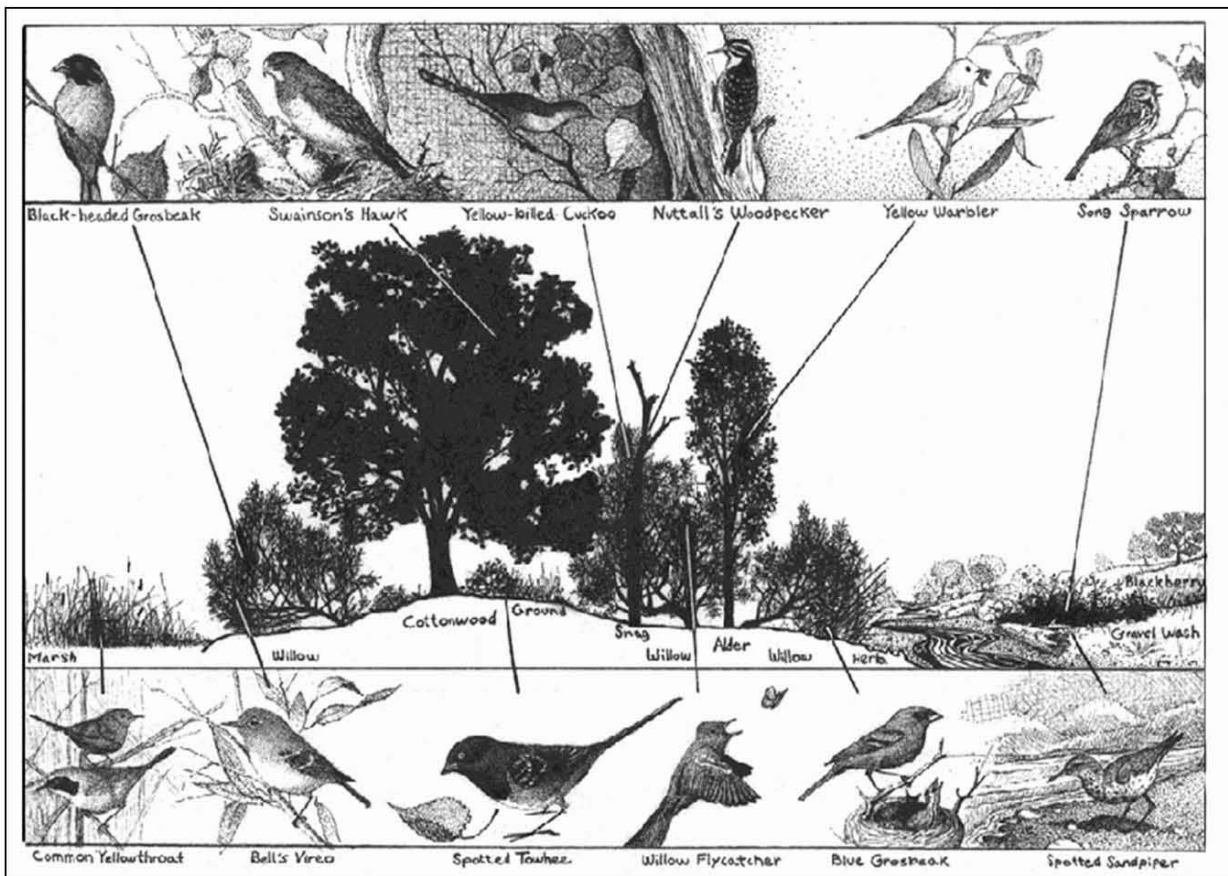


Figure 4. Riparian Bird Focal Species.



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.

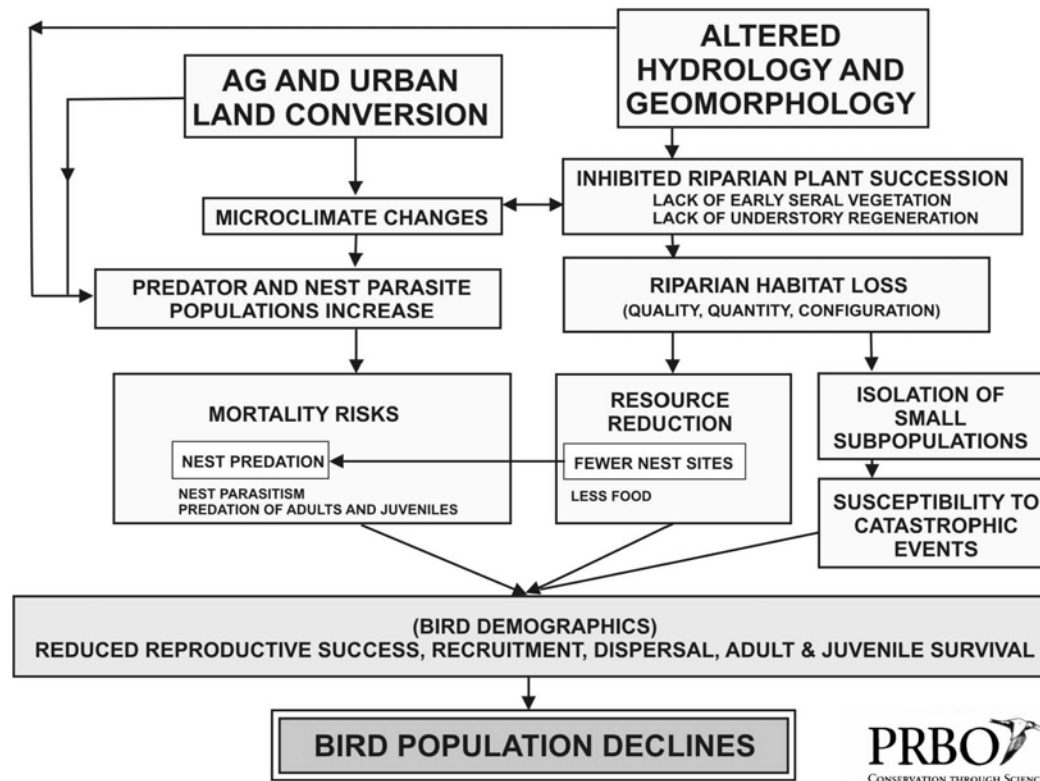
Threats and Opportunities

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.

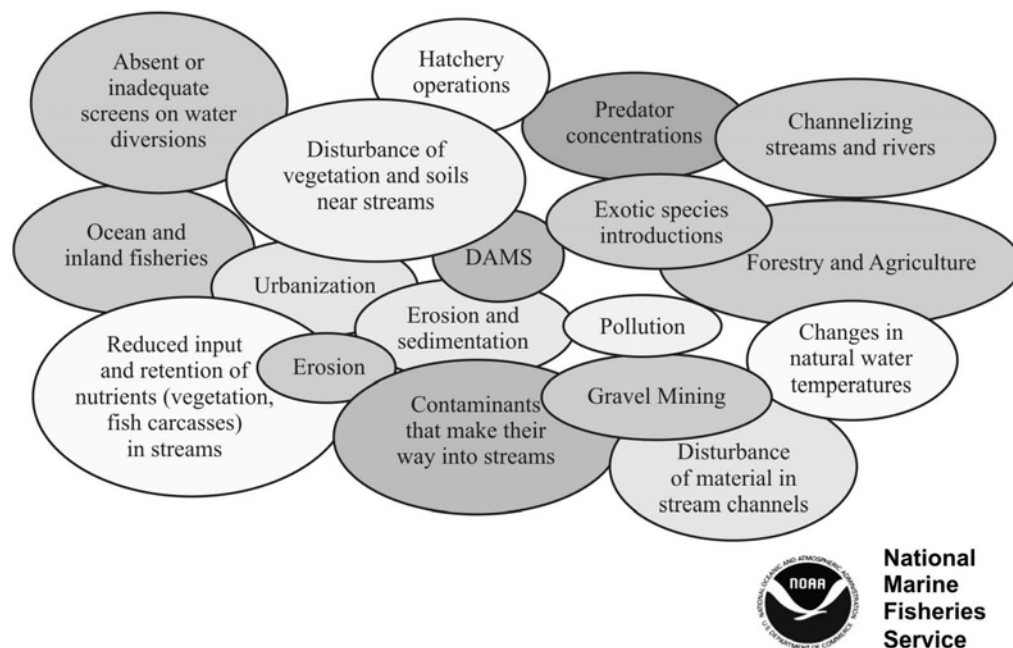
The species most adversely affected are those dependent upon the Sacramento River and riparian habitats during all or a portion of their life history (National Oceanic and Atmospheric Administration–National Marine Fisheries Service 1997; Riparian Habitat Joint Venture 2004). Riparian forest and habitat 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 Royce 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 policies 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



Acorn Woodpecker

Photo by Steve Emmons

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.

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:

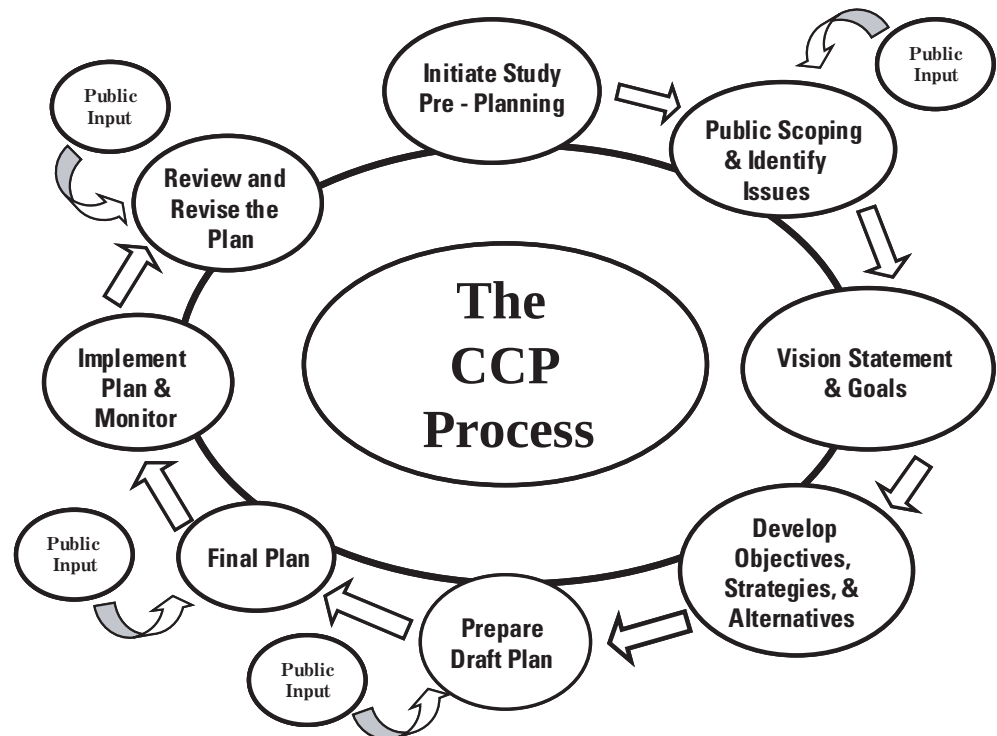
The Planning Process

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.

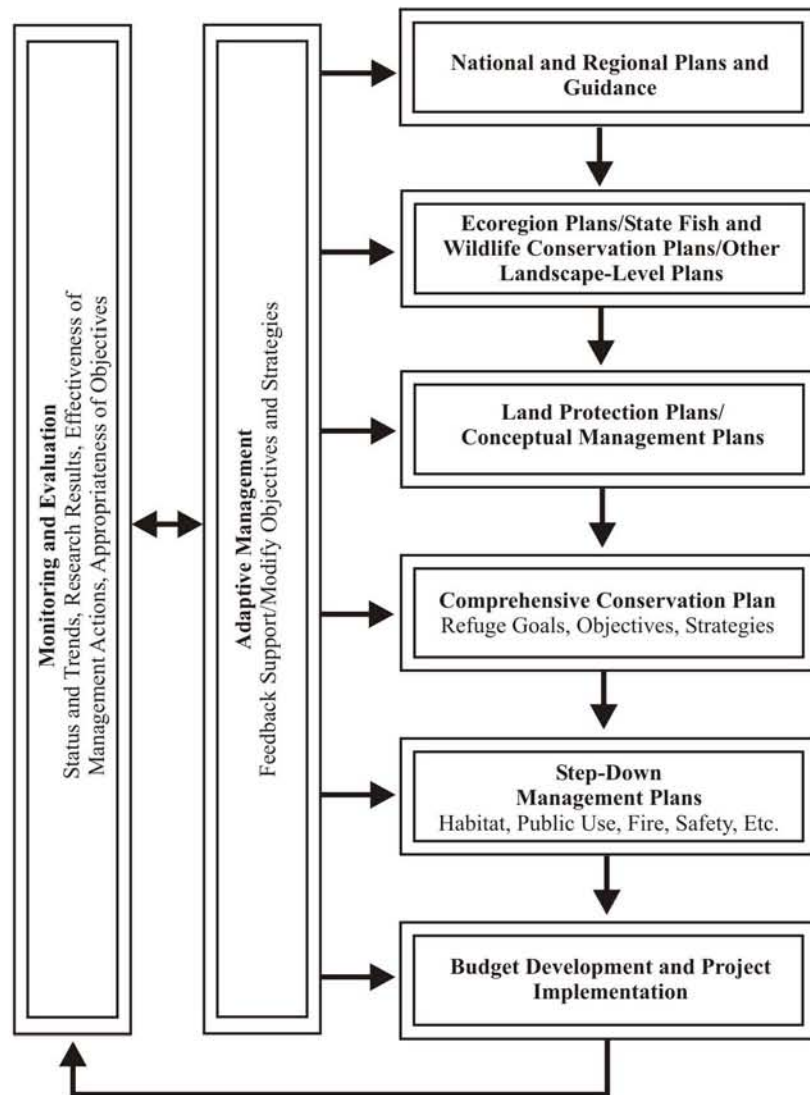
The Planning Team

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 (283¹)
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

¹Total 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).

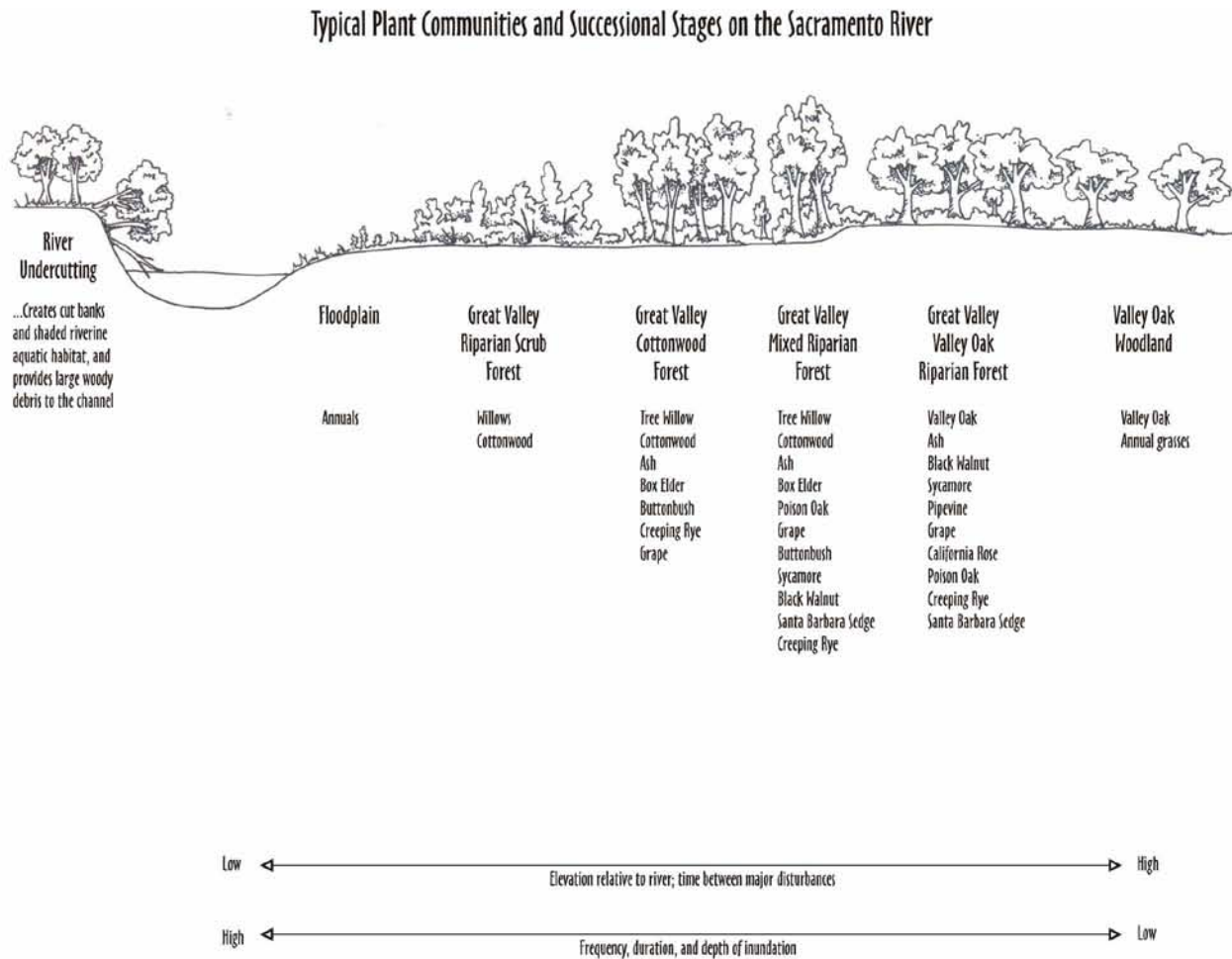
Natural processes such as flood events, erosion, channel migration and fire play an important role in creating various ages and kinds of riparian habitats. The presence of fire in the landscape has been one of the major evolutionary factors determining the composition of flora throughout California. 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°F with extremes of 118°F and 15°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 (NO_x). On-road motor vehicles and other mobile sources are the largest contributors to NO_x 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 phthalate diazinon, n-butyl phthalate 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

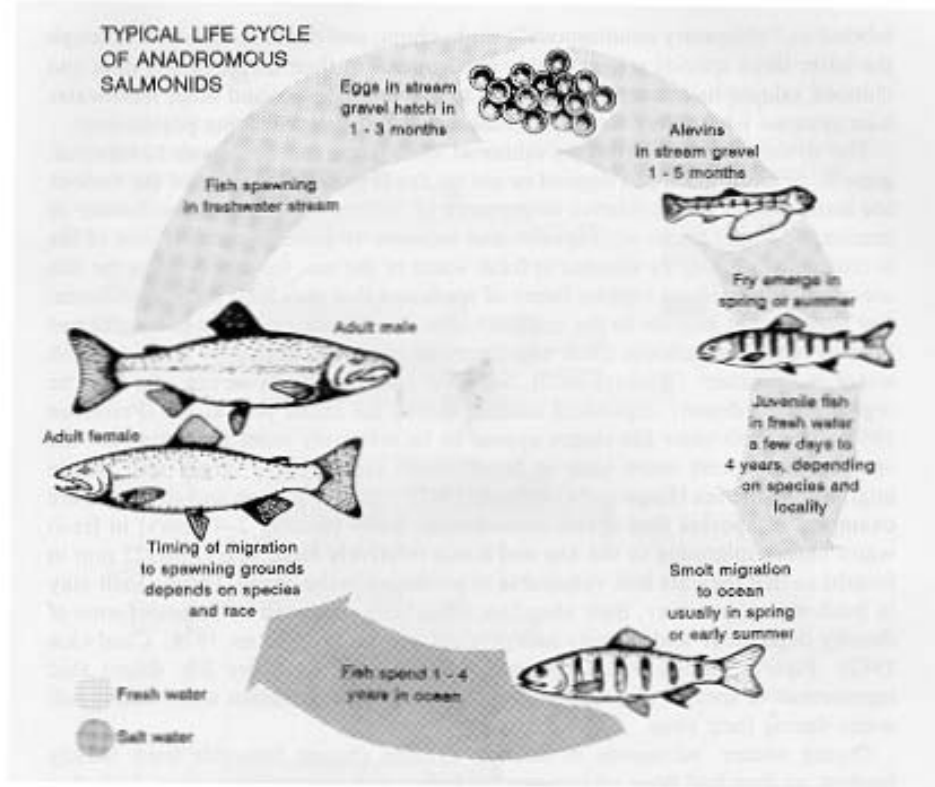
USFWS Photo

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

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

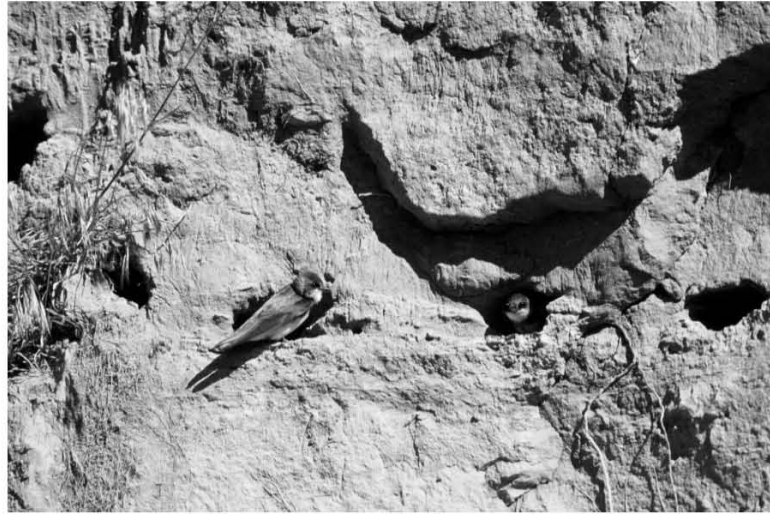
The bald eagle (federally listed threatened species and State-listed endangered species) nests in Lake, Mendocino, Trinity, Siskiyou, Modoc, Shasta, Tehama, Lassen, Plumas and Butte counties, and in the Lake Tahoe Basin. The bald eagle occurs throughout the year at and in the vicinity of Sacramento River 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 an 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, Kellogg'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).



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.

California Quail

Photo by Steve Emmons

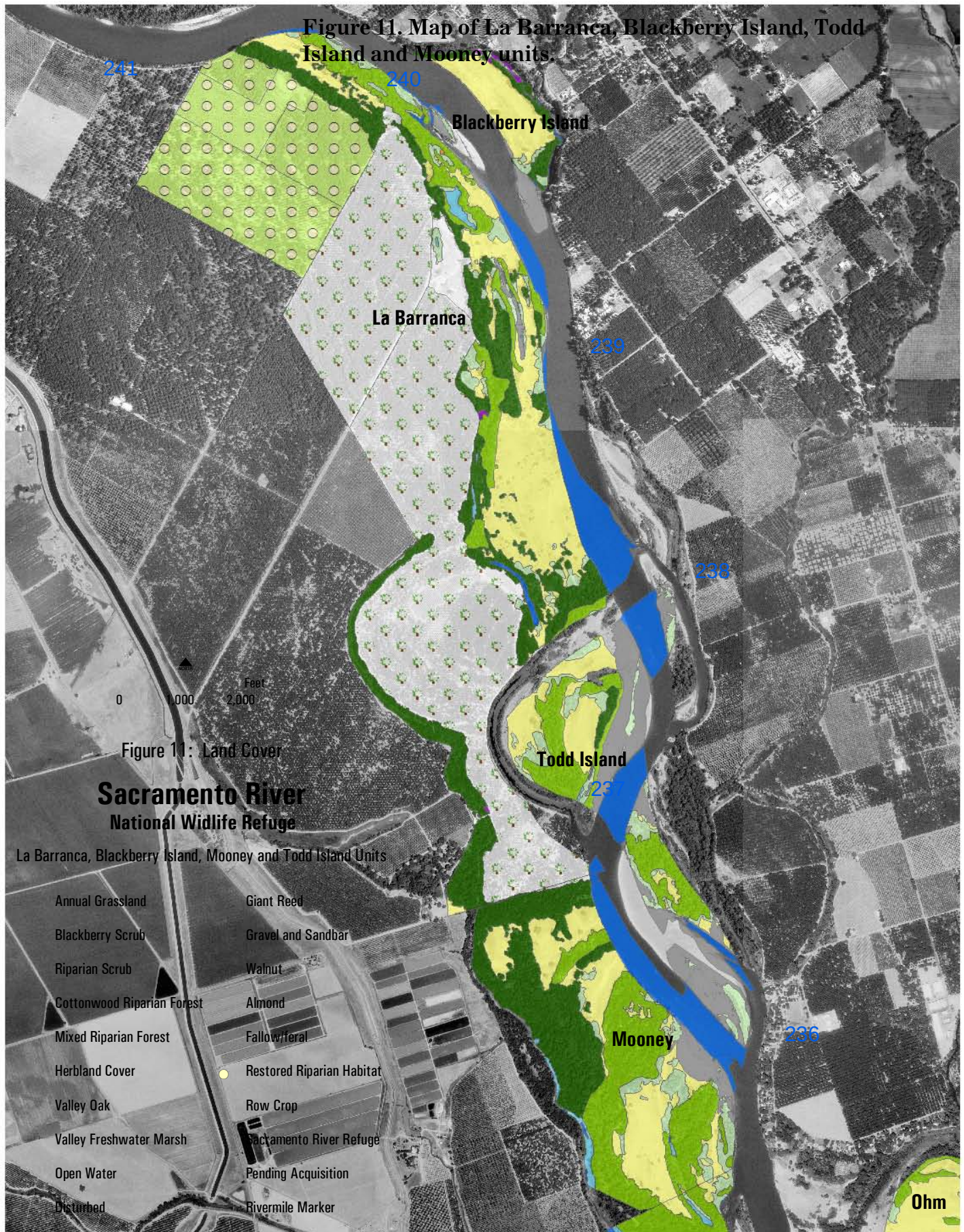
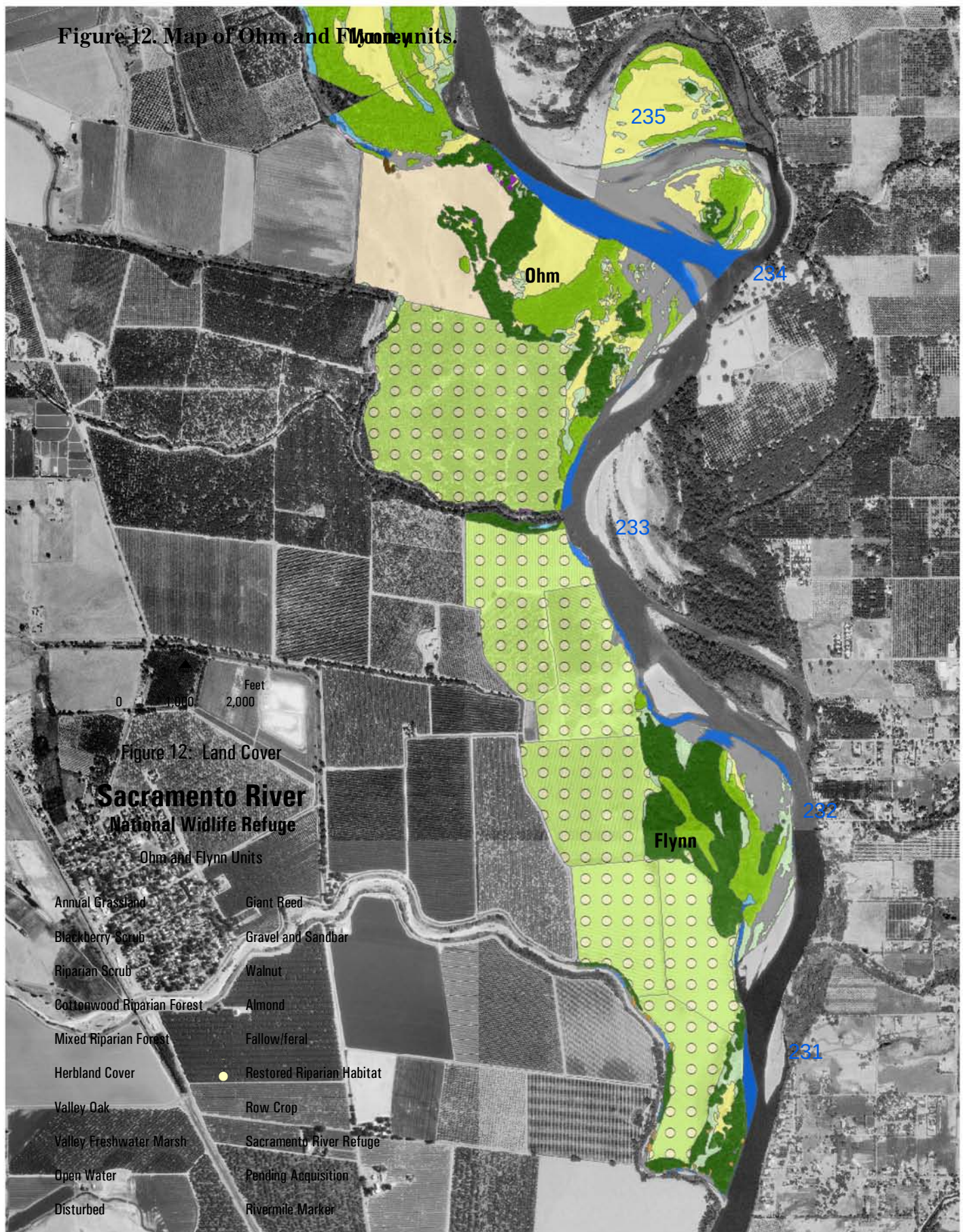


Figure 12. Map of Ohm and Flynn units.



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

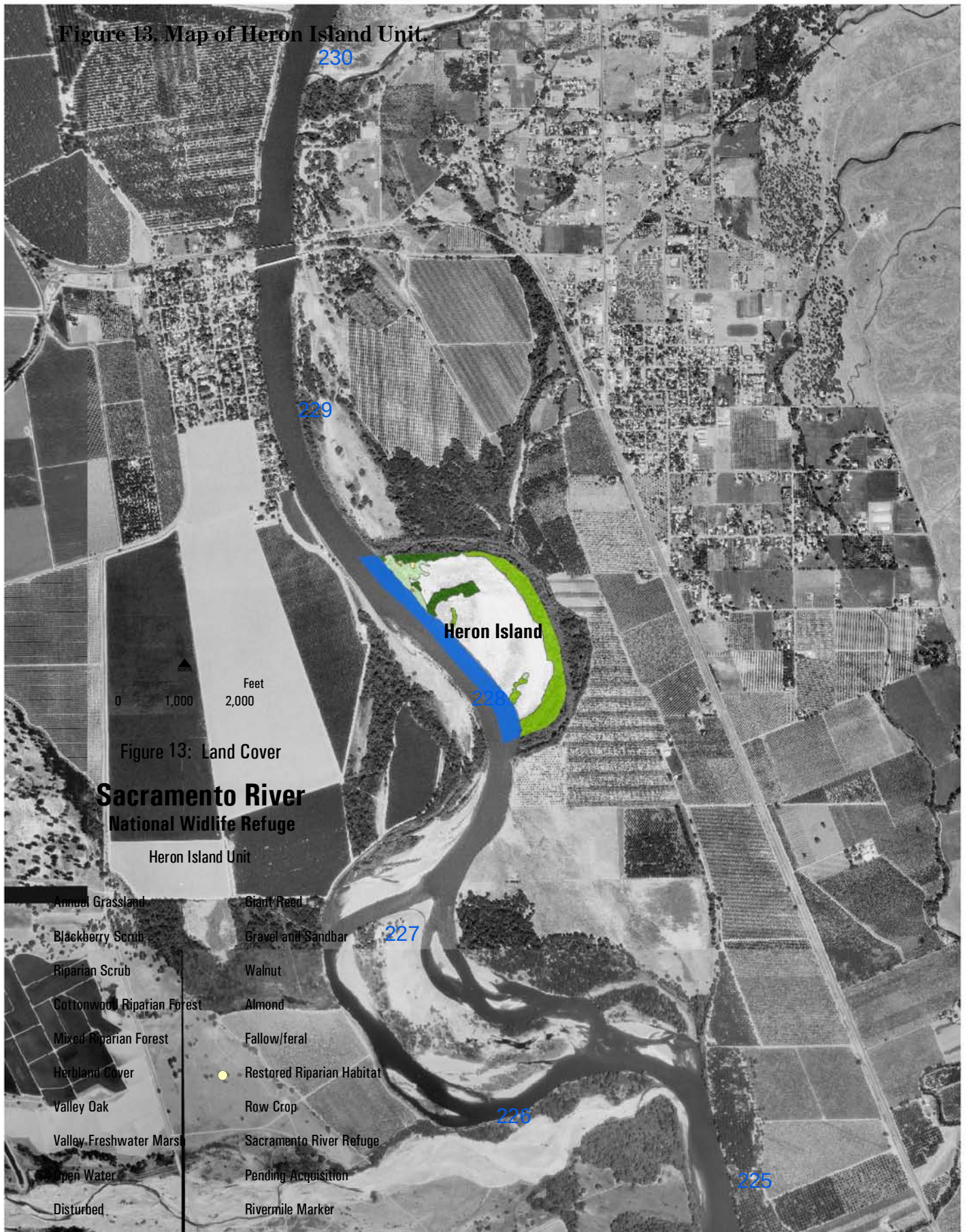
Acquired in 1991, the Rio Vista Unit (Figure 14) is 1,149 acres and is located between river miles 218 and 215.5. This unit is bordered on the north by South Ave (A-9) and on the south by the Merrill's Landing Unit of the CDFG Sacramento River Wildlife Area.

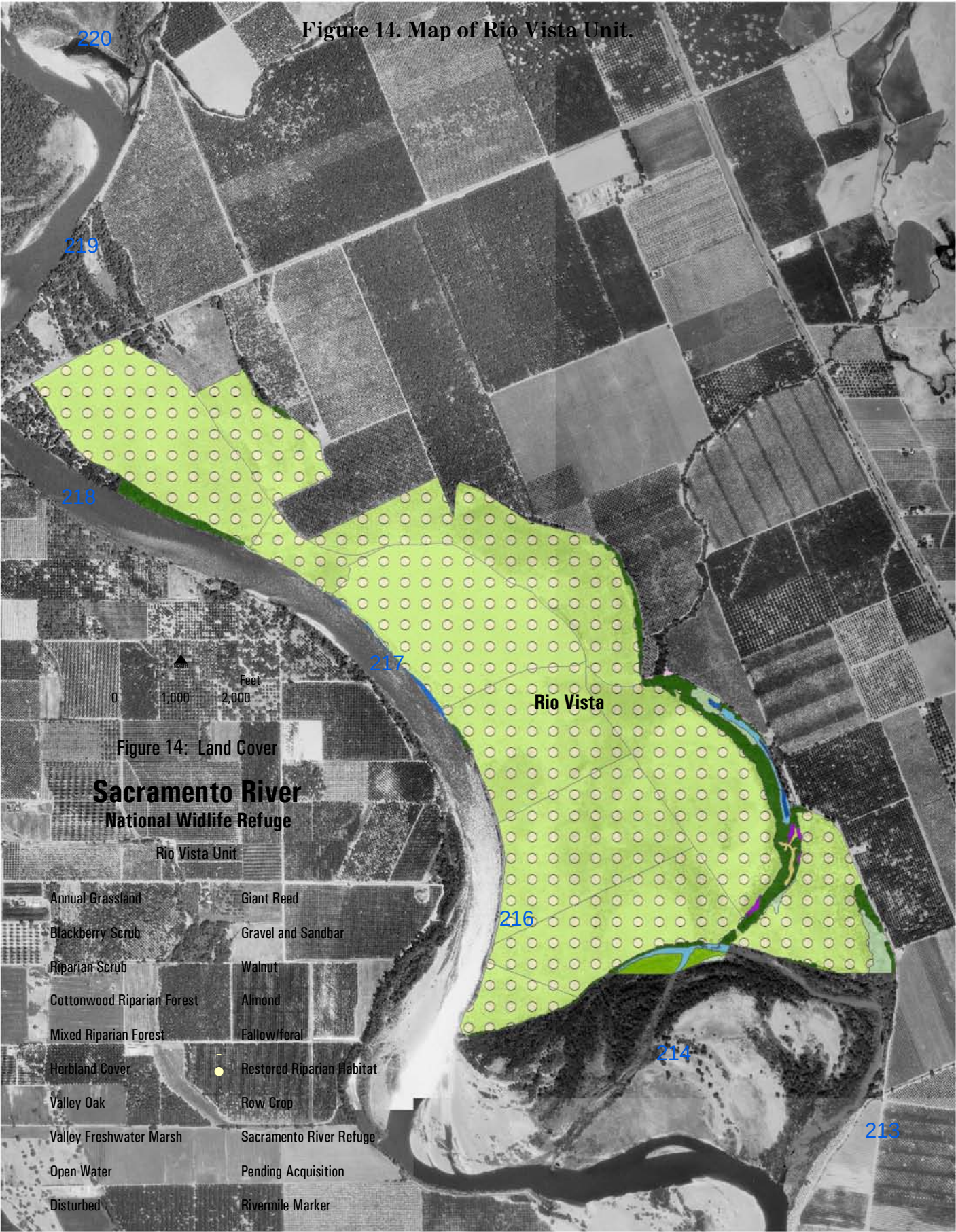
The unit's 86 acres of pre-existing riparian habitats consist mainly of mixed riparian forest, with some cottonwood riparian forest and riparian scrub.

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.





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.

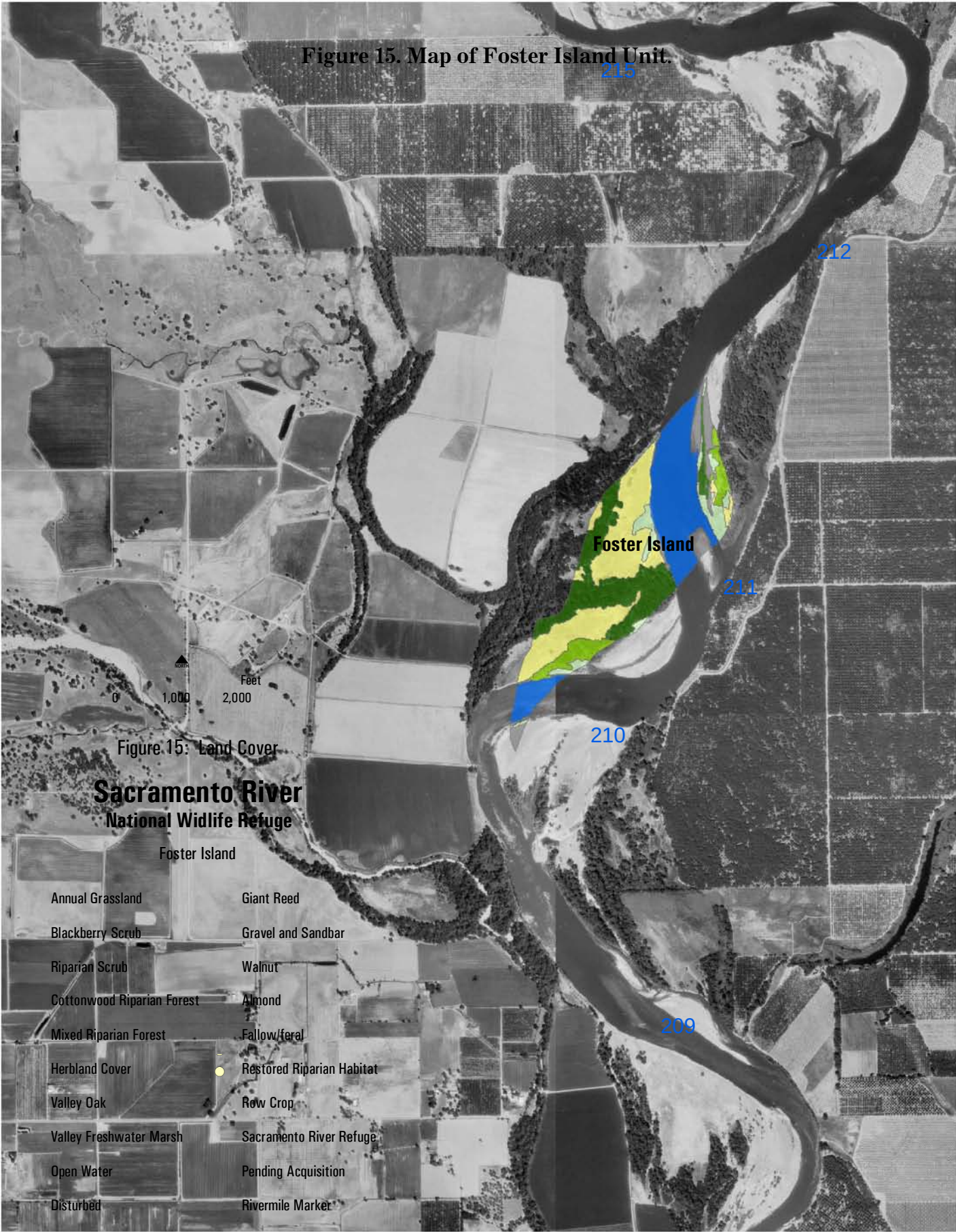
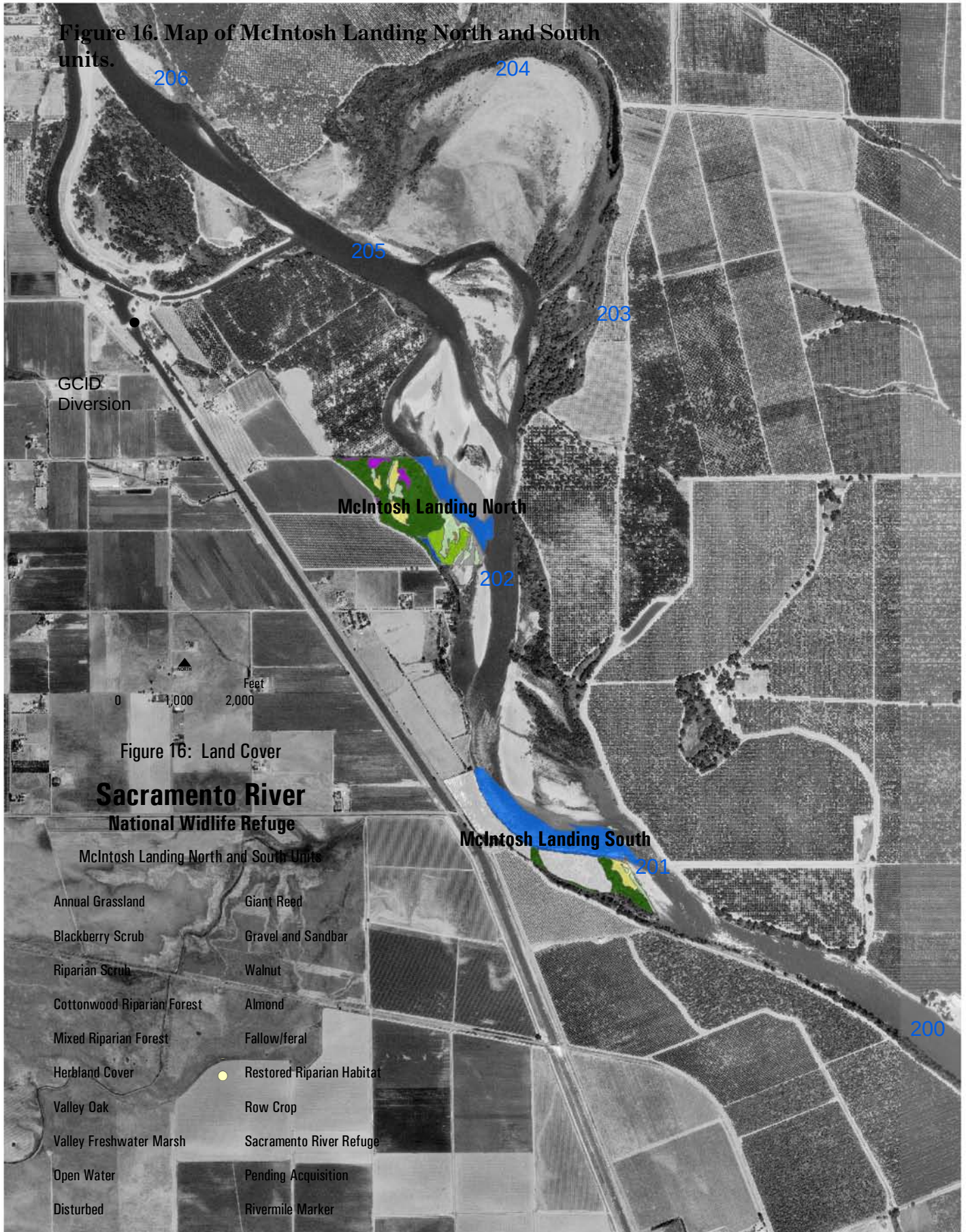


Figure 16. Map of McIntosh Landing North and South units.



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. Map of Pine Creek Unit.

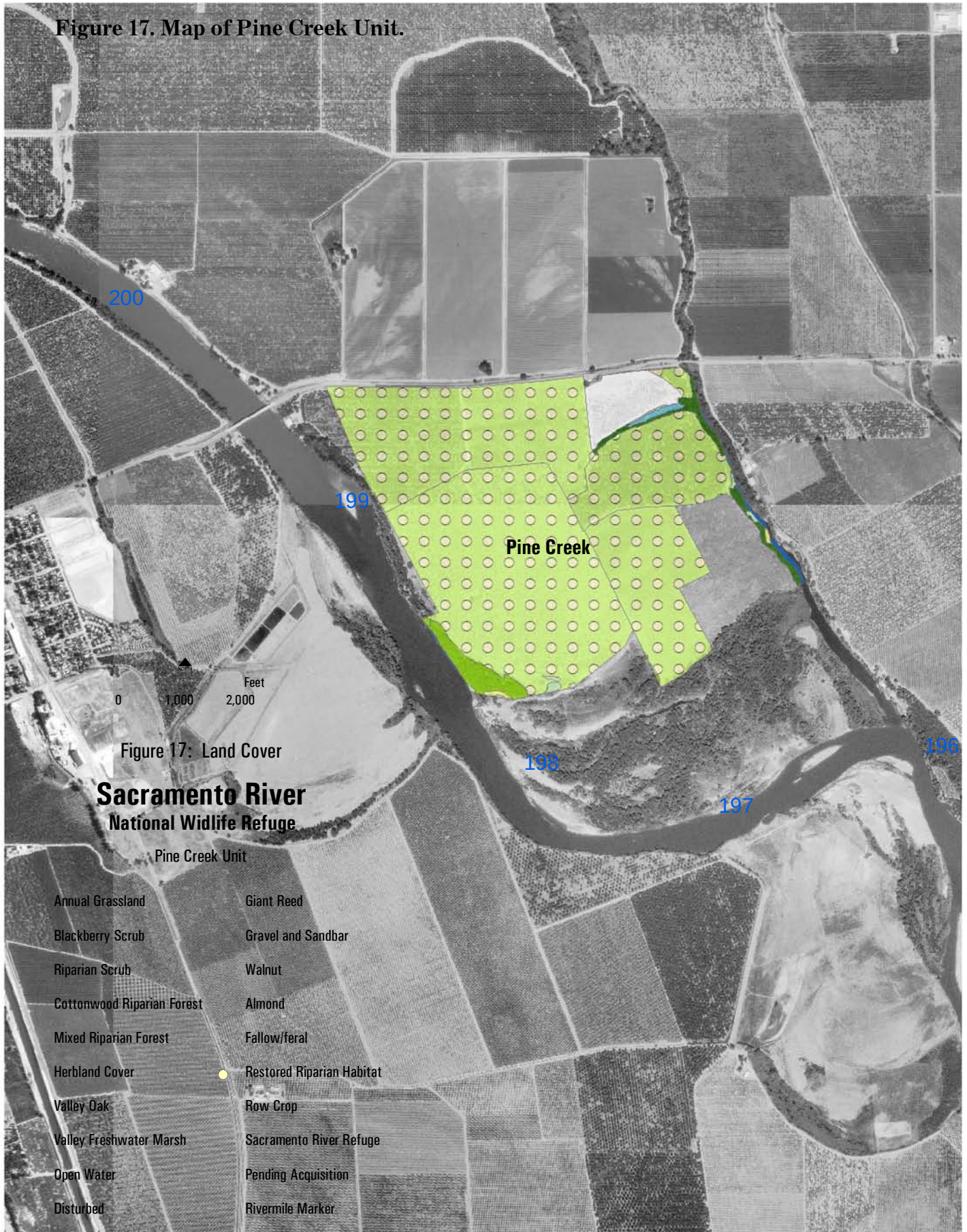


Figure 18. Map of Capay and Phelan Island units.



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).

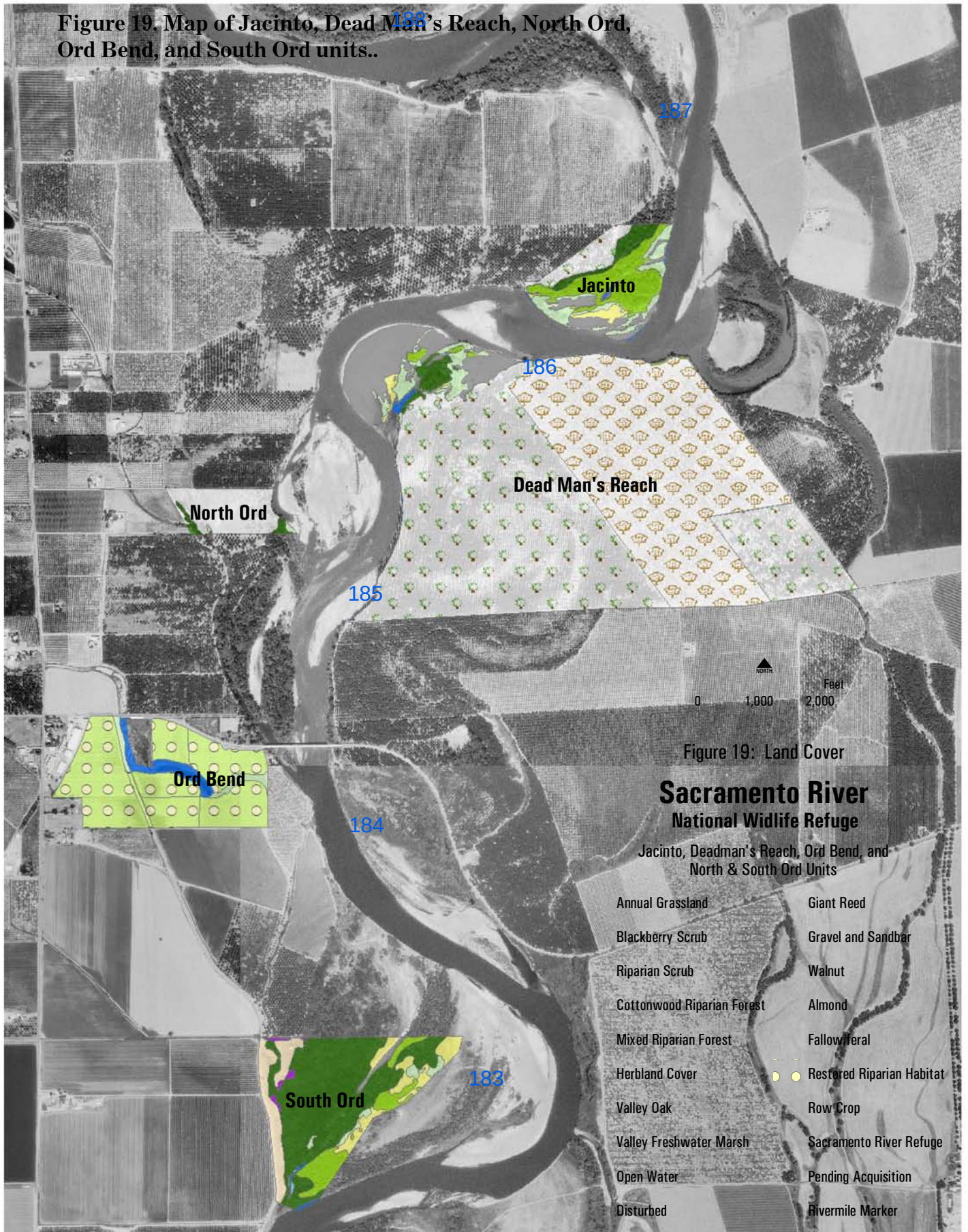
Special wildlife use includes waterbird use on the Army Corps of Engineer's (ACOE) borrow site on Stony Creek tributary, and a Valley elderberry longhorn beetle exit hole sighting (first fresh exit hole observed on the Refuge). Special vegetation profiles include a high terrace, most of which is outside 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 fire 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. Map of Jacinto, Dead Man's Reach, North Ord, Ord Bend, and 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).

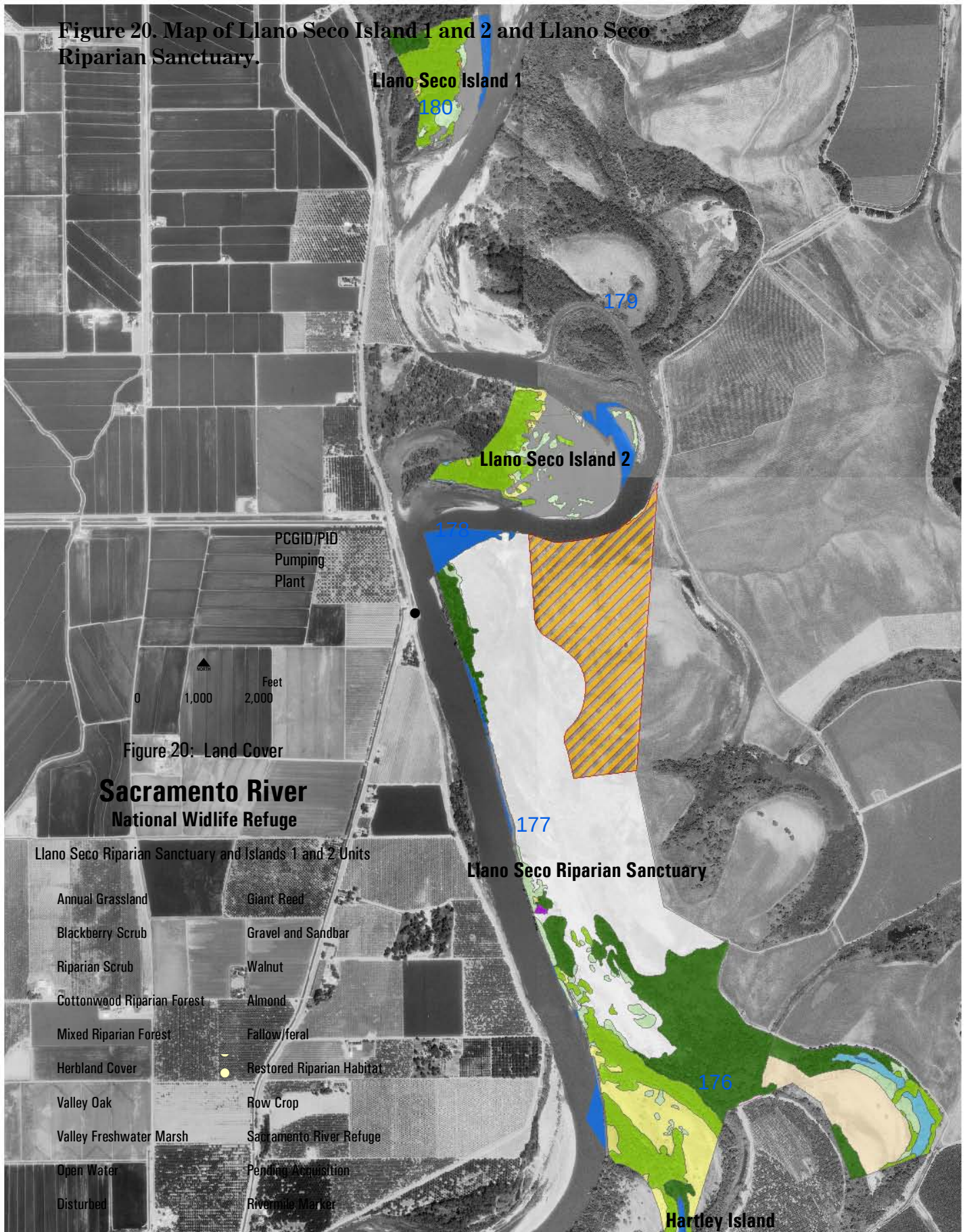
Special wildlife use includes California quail in mixed riparian forest at Goodman opening, multiple bank swallow colonies, and yellow-billed cuckoo sightings. Special vegetation profiles include a natural succession from wheat cropping at Goodman opening into blue elderberry, coyote bush, creeping wild-rye 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. Map of Llano Seco Island 1 and 2 and Llano Seco Riparian Sanctuary.





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.

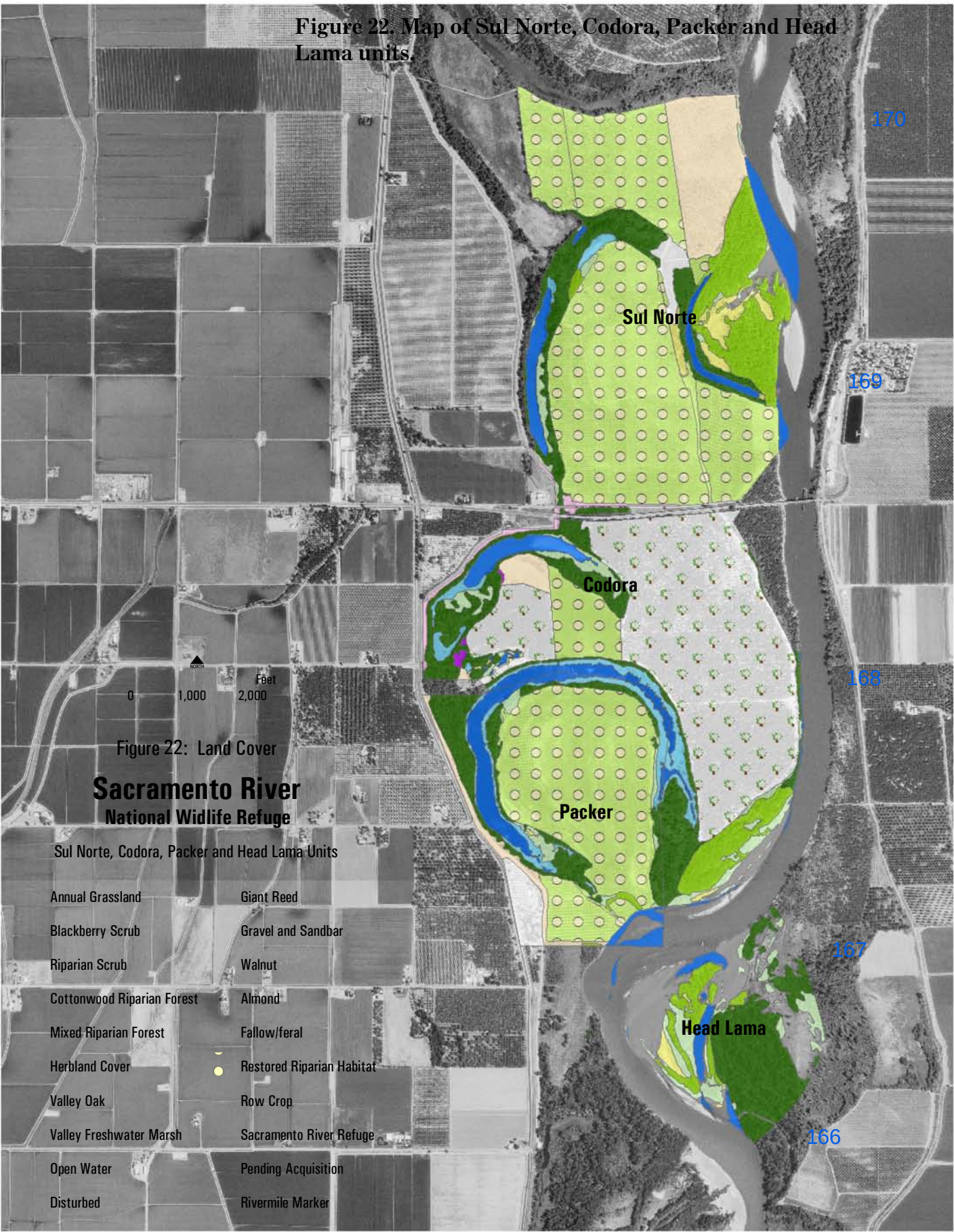
In 1998, 241 restored riparian acres were planted into mixed riparian forest and savanna. This was replanted again in 2000. In 1999, a research project to determine the feasibility of natural recruitment on mid-terrace floodplain soils was conducted on 20 acres (Peterson 2002). This restoration technique 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. Map of 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. Map of Drumheller Slough Unit.



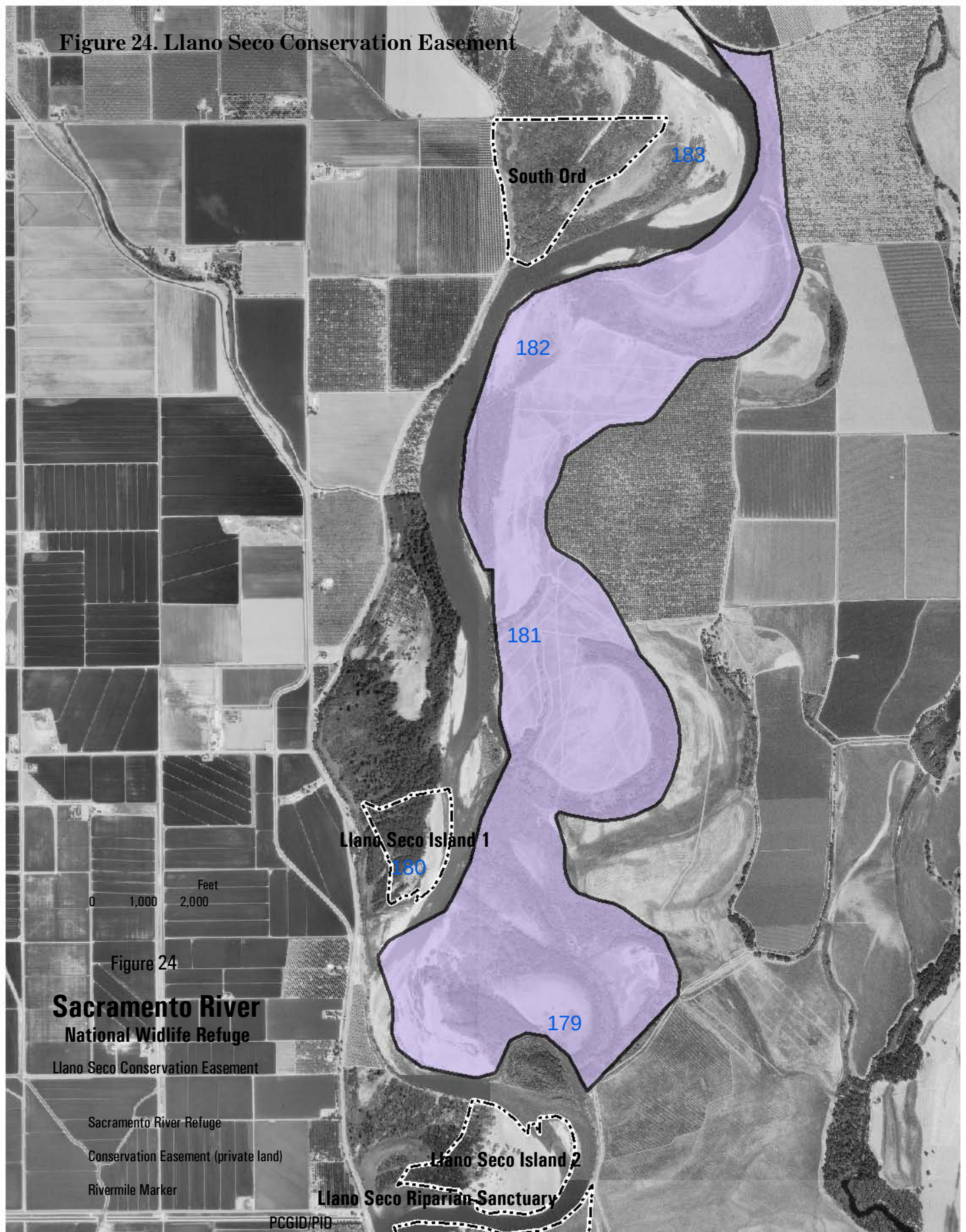
Llano Seco Riparian Easement

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

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

Riparian Grassland/Savannah Restoration

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.

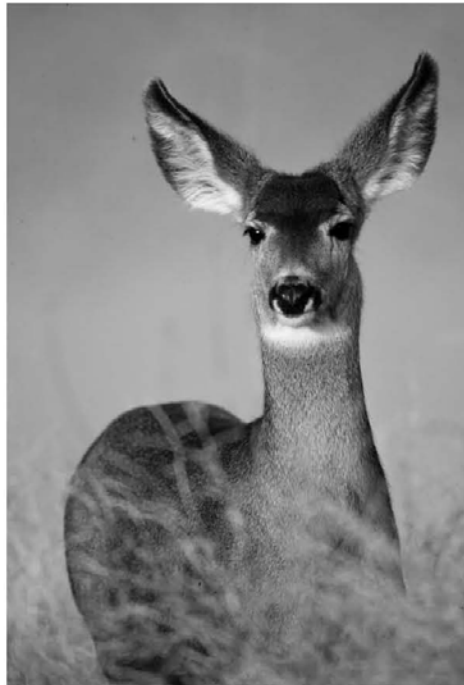
The giant garter snake is found in stable, slow water areas not typically associated with the main channel of the Sacramento River. They are, however, found in drainage and irrigation systems, and potentially in slow backwaters and freshwater marsh. Refuge management activities which occur in potential 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

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

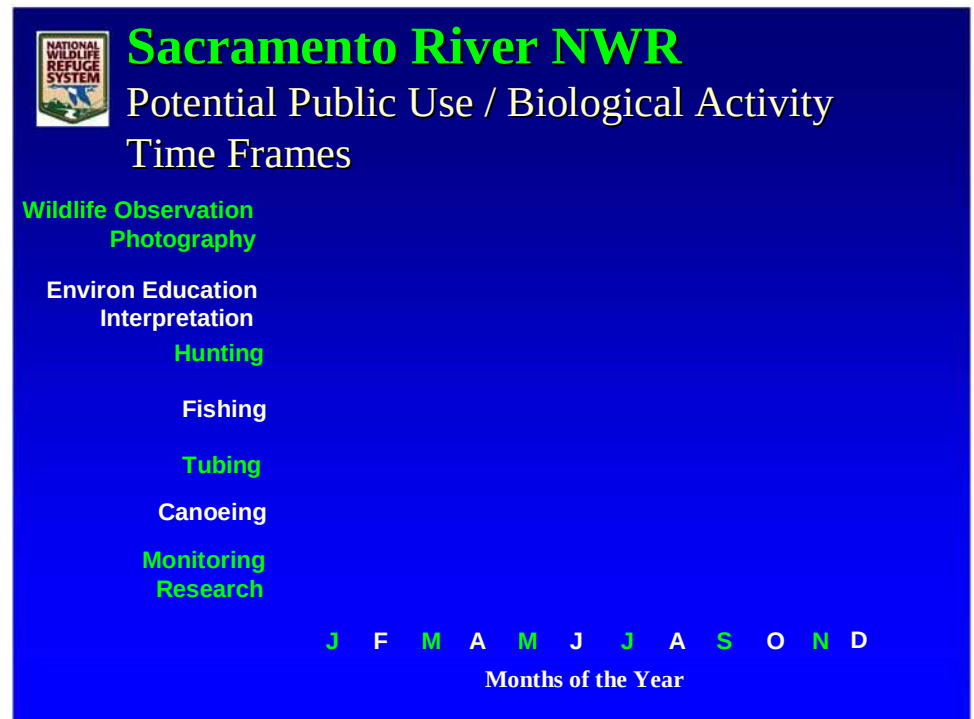
- 2.1.1: Implement the Sacramento River Refuge Hunting Plan by 2005.
- 2.1.2: Identify Refuge units open to hunting, target species, and Refuge-specific regulations through news releases, the Sacramento River Refuge general brochure, Sacramento Refuge Complex web site, and other publications by 2005.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

¹See 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.
- 4.2.10: 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

Figure 28

Visitor Services

Sacramento River NWR

North Units

Unit Boundaries

All Priority Uses (Big 6)

Open to hunting (Sept - May), fishing, wildlife observation, photography, interpretation, and environmental education.

Active agricultural operations: 2 - 10 year deferral of opening to hunting, fishing, wildlife observation, photography, interpretation, and environmental education until operations ceased and restoration established.

Closed to waterfowl hunting. Open to other hunting, fishing, wildlife observation and photography, interpretation, and environmental education. Contact Refuge Manager for details.

Limited Priority Uses (Big 5)

Open to fishing, wildlife observation, photography, interpretation, and environmental education. Closed to hunting.

Active agricultural operations: 2 - 10 year deferral of opening to fishing, wildlife observation, photography, interpretation, and environmental education until operations ceased and restoration established.

Sanctuary

Sanctuary/Buffer Area: closed to all public use

Other

DFG Lands

State Parks

BLM Lands (Proposed open to Big 6)

TNC (Pending FWS Acquisition)

Area of Disputed Ownership

River Access

Trail

Parking

No Firearms Allowed

Closed Boundary

River Mile Markers

Restroom

Flynn

Ohm

Coyote Creek

Heron Island

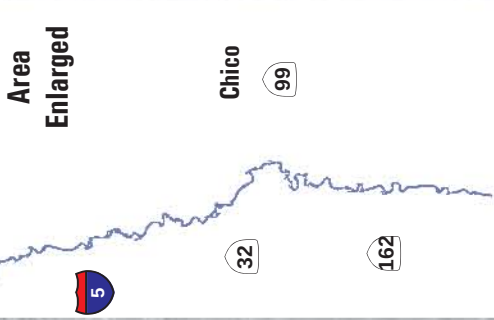
Tehama Boat Launch

La Barranca

Todd Island (BLM)

Mooney

NOTE: Due to a pre-existing hunting easement, the following special rules apply within the dotted areas of Mooney and Ohm units: closed to waterfowl hunting; open to other hunting, fishing, wildlife observation, photography, interpretation, and environmental education. Contact Refuge Manager for details.



Note: Boundaries shown are approximate.

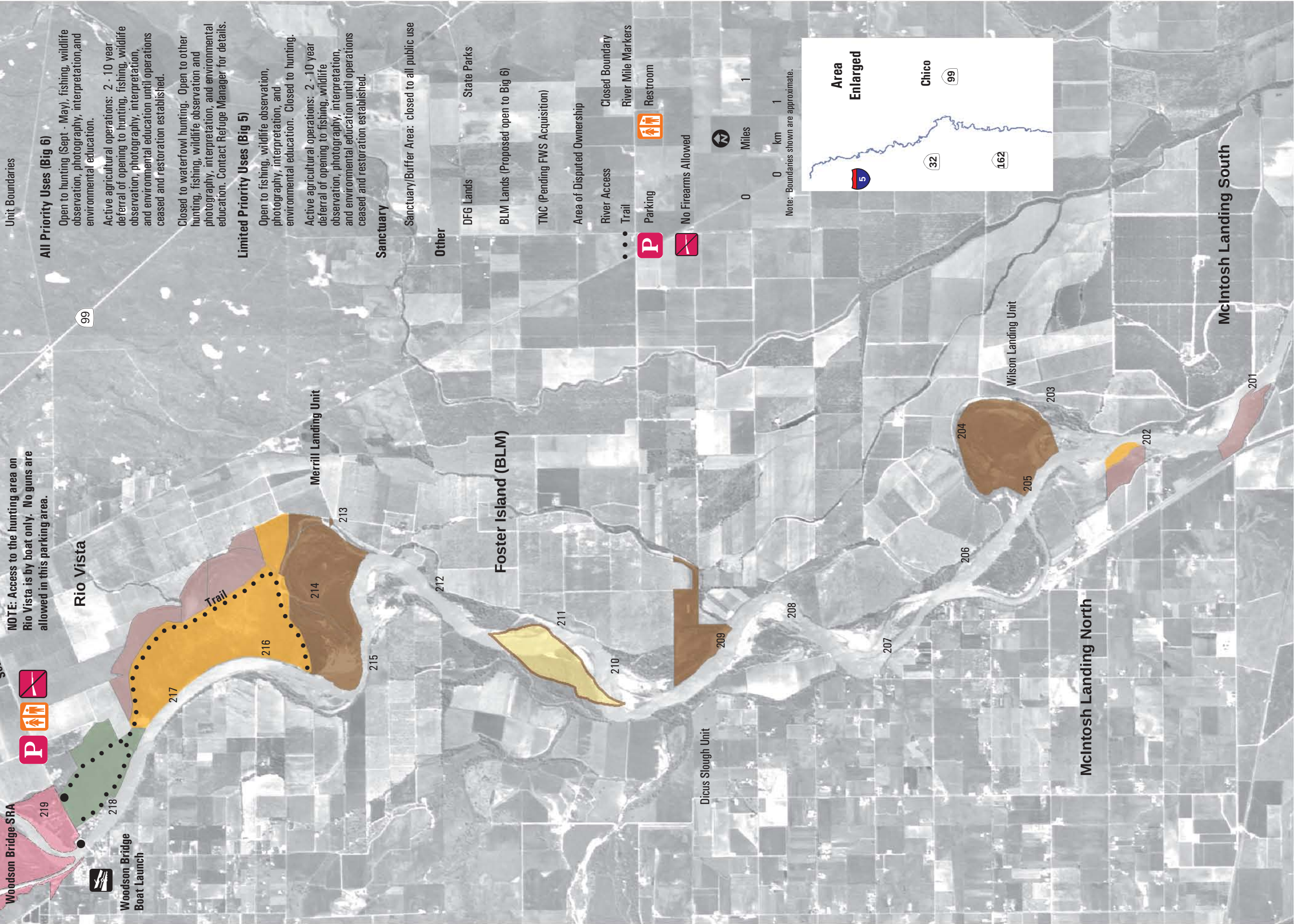
0 1 Miles

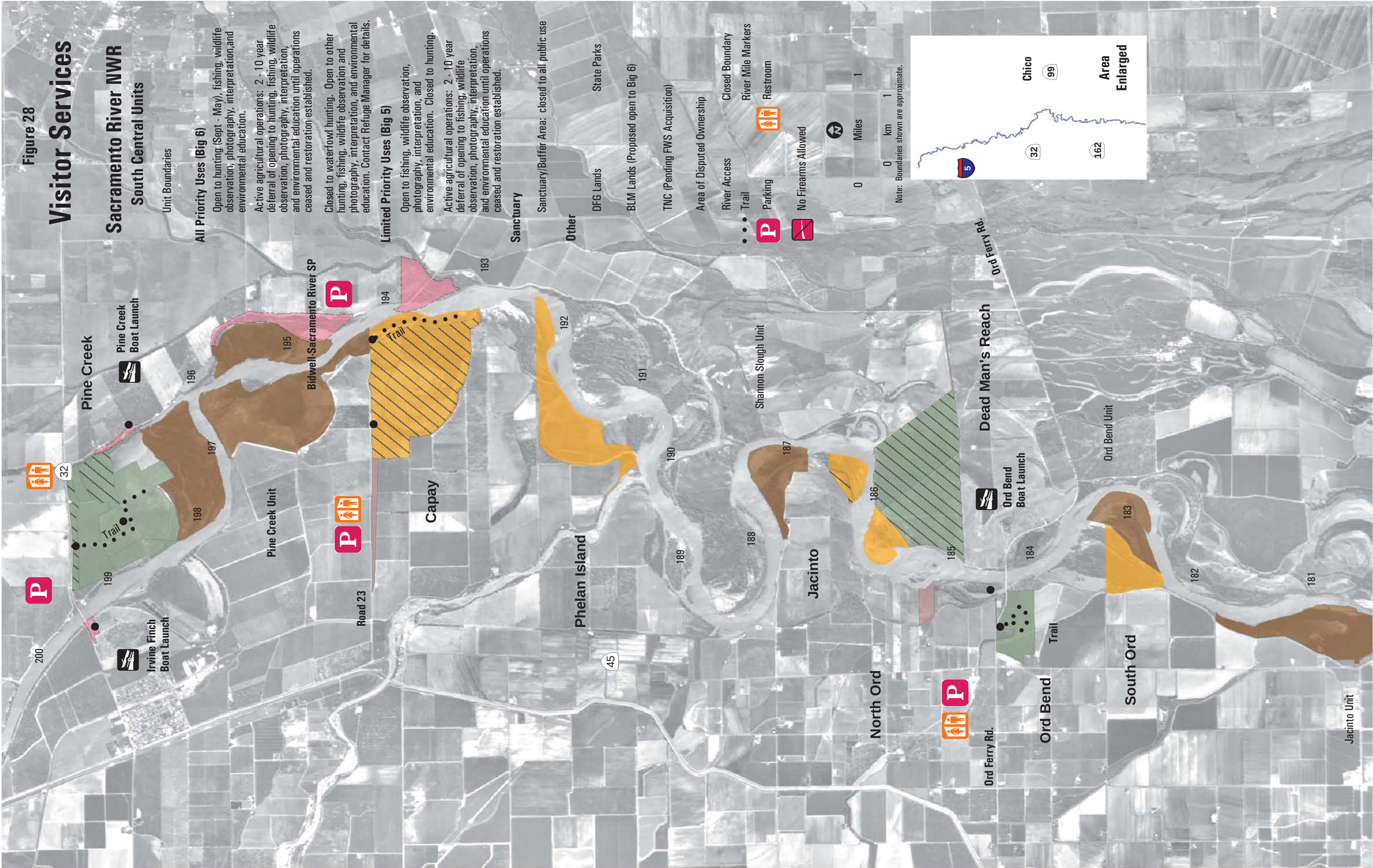
0 1 km

Figure 28

Visitor Services

Sacramento River NWR North Central Units





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	FTE¹
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