

## *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 assess the current habitat and facilities conditions and results of management actions. The habitat management plan is a vital link in adaptive management because it provides a way to track the results of management decisions and associated actions. For example, if it is noted that a certain management action did not yield the expected results, changes are made to the management plan to modify that management activity. Management activities include facilities maintenance (e.g., roads, fire breaks, fences, gates, boundary signs), vegetation management (i.e., herbicide application, prescribed fire and grazing, mowing and discing, irrigation), vegetation, plant, and wildlife inventory and monitoring surveys, habitat restoration and restoration monitoring, public use monitoring and facilities maintenance, and law enforcement issues.

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



### **Habitat Restoration**

*Photo by Skip Jones*

#### *Water Management*

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

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

#### *Riverbank Management*

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

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

### *Technical Analysis*

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

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

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

The cooperative project at the Llano Seco Riparian Sanctuary/PCGID/PID Pumping Plan is example of an 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, discing, tilling, herbicide/pesticide application, fire, grazing, and irrigation.

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

Species <sup>1</sup>	Common Name	Habitat <sup>2</sup>	Location <sup>3</sup>
ASTERACEAE [Compositae]	<b>SUNFLOWER FAMILY</b>		
<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]	<b>MUSTARD FAMILY</b>		
<i>Lepidium latifolium</i>	BROAD-LEAVED PEPPERWEED	SFM, riparian habitats, fields, levees, ditch banks	S <sup>6</sup> , C, B, Su
CHENOPODIACEAE	<b>GOOSEFOOT FAMILY</b>		
<i>Salsola soda</i>	FLESHY-LEAVED RUSSIAN-THISTLE	Alkali meadows, non-native alkali grassland	C
CONVOLVULACEAE	<b>MORNING-GLORY FAMILY</b>		
<i>Convolvulus arvensis</i>	BINDWEED	Vernal pools	B
FABACEAE	<b>LEGUME FAMILY</b>		
<i>Robinia pseudoacacia</i>	BLACK LOCUST	Riparian Forest	S
HALORAGACEAE	<b>WATER-MILFOIL FAMILY</b>		
<i>Myriophyllum aquaticum</i>	PARROT'S-FEATHER	Wetlands, ditches	B
JUGLANDACEAE	<b>WALNUT FAMILY</b>		
<i>Juglans californica</i> var. <i>hindsii</i> <sup>4</sup>	NORTHERN CALIFORNIA BLACK WALNUT	Riparian Forest	S
MORACEAE	<b>MULBERRY FAMILY</b>		
<i>Ficus carica</i>	FIG	Riparian Forest	S
MYRTACEAE	<b>MYRTLE FAMILY</b>		
<i>Eucalyptus camaldulensis</i>	RIVER RED GUM	Various	C
ONAGRACEAE	<b>EVENING-PRIMROSE FAMILY</b>		
<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 <sup>1</sup>	Common Name	Habitat <sup>2</sup>	Location <sup>3</sup>
<b>PHYTOLACCACEAE</b>	<b>POKEWEED FAMILY</b>		
<i>Phytolacca americana</i>	AMERICAN POKEWEED	Riparian, disturbed	S
<b>SCROPHULARIACEAE</b>	<b>FIGWORT FAMILY</b>		
<u><i>Kickxia elatine</i></u>	SHARP-LEAVED FLUELLIN	Various disturbed	S, B
<b>SIMAROUBACEAE</b>	<b>QUASSIA FAMILY</b>		S, C, B, Su
<i>Ailanthus altissima</i>	TREE-OF-HEAVEN	Riparian Forest	S <sup>6</sup>
<b>TAMARICACEAE</b>	<b>TAMARISK FAMILY</b>		
<i>Tamarix parviflora</i>	SMALL-FLOWERED TAMARISK	Riparian habitats	S
<i>Tamarix ramosissima</i>	SALT-CEDAR	Riparian habitats	S
<b>POACEAE [Gramineae]</b>	<b>GRASS FAMILY</b>		
<i>Arundo donax</i>	GIANT-REED	Riparian habitats, ditches	S, C
<i>Crypsis schoenoides</i> <sup>5</sup>	SWAMP-TIMOTHY	Vernal pools	C
<i>Crypsis vaginiflora</i> <sup>5</sup>	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

<sup>1</sup> Non-native plants are indicated by an italic, non-serif typeface (Arial font). Severe problem plants indicated by underline.

<sup>2</sup> SFM – Seasonal-flooded Marsh.

<sup>3</sup> S – Sacramento River, C – Colusa Basin, B – Butte Basin, Su – Sutter Basin

<sup>4</sup> Feral hybrid with commercial English walnut (*J. regia*).

<sup>5</sup> Highly invasive species of most vernal pool types in the Great Valley.

<sup>6</sup> Monitored on the Refuge and treated with herbicides by The Nature Conservancy, River Partners, and Refuge staff.

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

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

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

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

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

### *Mosquitoes*

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

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

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

### *Vegetation Management*

#### Riparian Grassland/Savannah Units

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



### **Native Grass Restoration**

*Photo by Joe Silveira*

#### Riparian Forest Units

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

#### Croplands

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

beans, wheat, and corn. These areas usually receive physical and chemical manipulations, as well as irrigation. Grazing 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 <sup>1</sup>	Habitat Needs <sup>2</sup>	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

<sup>1</sup> Codes: FE = Federal endangered; FT = Federal threatened; FC = Federal candidate; CE = California endangered; CT = California threatened; CSC = California Species of Concern. <sup>2</sup> 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.

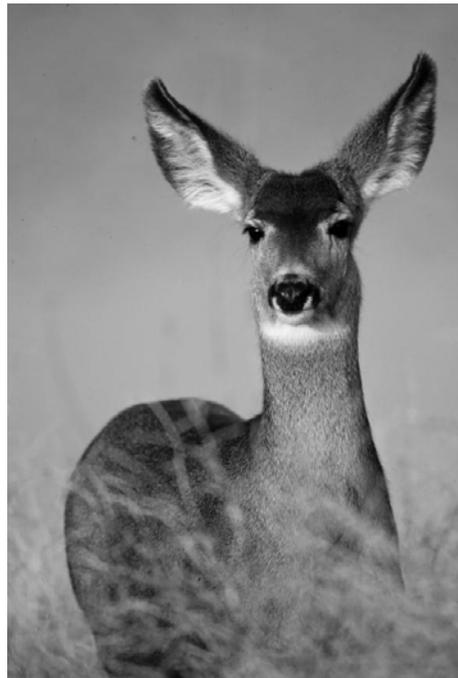
The giant garter snake is found in stable, slow water areas not typically associated with the main channel of the Sacramento River. They are, however, found in drainage and irrigation systems, and potentially in slow backwaters and freshwater marsh. Refuge management activities which occur in potential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

