3.4 TERRESTRIAL RESOURCES

This section discusses existing vegetation and wildlife resources in the San Joaquin Valley with emphasis on biological communities where implementation of the instream flows for SJRA will have the greatest effect. Sensitive features, such as wetlands, and rare, threatened, endangered, and sensitive (RTES) species are specifically addressed. Information for this section was primarily derived from existing data. Site visits were conducted to assess vegetation resources.

3.4.1 Vegetation

This description of vegetation growing within the boundaries of the riparian corridors of the project area is based on the ecological relationships between vegetation, soils, and hydrology (which the fluvial system creates). This section, along with Appendix C, describes the current status of vegetation growing within the riparian corridor along the Stanislaus, Tuolumne, Merced, and San Joaquin rivers (the project area). This vegetation description is based on the ecological relationship between vegetation growing within the project area's riparian corridors and the fluvial system. Appendix C contains a description of vegetation resources in the San Joaquin River and the East San Joaquin Basin Ecological Zones.

3.4.1.1 Background

The term riparian describes a unique physical environment and associated plant vegetation that occurs along banks of freshwater bodies, watercourses, estuaries, and surface-emergent aquifers and adjacent areas. The groundwater in these areas provides soil moisture sufficiently in excess of that available through local precipitation, and is capable of supporting vegetation requiring moderate amounts of water (Warner et al. 1984). The extent of groundwater influence defines the riparian corridor width and the plant assemblages that grow there.

A riparian plant's life has four stages: initiation, establishment, maturity, and senescence (Figure 3.4-1). Initiation starts after a seed lands on exposed, moist substrate and germinates; this stage continues through the first growing season. The establishment stage begins after the first growing season and continues until the plant has enough resources to begin sexual reproduction. When a plant flowers and produces seed, maturity starts. Eventually seed production and reproductive capacity decline, and the mature plant enters senescence. Within the project area, riparian stands growing on what are now terraces (floodplains prior to flow regulation) are predominantly senescent with no younger age classes to replace them. Historically, large floods created gaps in the riparian vegetation where new sediments could be deposited, and younger age classes could regenerate. Because the magnitude and frequency of these floods have been virtually eliminated, remaining mature stands are in decline because there are no younger age classes to replace trees when they die.

Vegetation growing within the riparian corridor forms a mosaic of patches; individual patches are called stands. The list of plant species comprising the stand defines the composition of a particular plant series. Plant series are the latest classification term used to describe riparian vegetation (Sawyer and Keeler-Wolf 1995). Plant series consist of uniform patches of vegetation, usually comprised of multiple species, but always having one or two species that dominate. Series are stratified into a canopy, shrub and ground layer, with the series name determined by the species of greatest relative abundance within the highest strata (Sawyer and Keeler-Wolf 1995).

The types of riparian vegetation that would be affected by the project alternatives are divided into three groups: aquatic vegetation, emergent marshes, and terrestrial vegetation with plant series endemic to each group. Aquatic vegetation is commonly referred to as a lacustrine wetland because it grows in open, still water. Section 3.5 contains a more detailed discussion of aquatic resources. Cowardin et. al. (1979) referred to terrestrial and emergent vegetation within the riparian corridor as forested palustrine and palustrine wetlands. Holland (1986) classified riparian vegetation in further detail however his classification was never published for public use, and the scale of his descriptions are geographically broad (e.g., Valley, foothill, grasslands). The plant series classification remains as providing the greatest detail geographically and is generally consistent in species composition. The series classification is compared to Holland's system (see Table 3.4-1 on the following pages).

The proposed project would release different magnitudes of water into rivers within the project area. These releases would only affect vegetation within the immediate area of the rivers, and are not expected to have any significant effects on vegetation growing outside of the riparian corridor. Because the proposed project and alternative would only affect vegetation growing within the riparian corridor, a boundary limiting the evaluation scope was defined. Since it is difficult to detect the groundwater limits within the riparian corridor, another more practical boundary was used. The bankfull channel is well defined along each river, is the immediate area that may be potentially impacted by the pulse flows, and was established as the limit for evaluating project effects.

Vegetation patterns within each river's riparian corridor result from the interactions of fluvial geomorphology, hydrology, and a particular plant species' physiologic tolerances. Important hydrologic processes include magnitude and timing of flow inundation, and groundwater table fluctuation. Important fluvial geomorphic processes include channel migration and avulsion, fine sediment deposition on floodplains and terraces, point bar scour, and woody debris transport. Fluvial geomorphic processes are a product of variable discharges, which create and maintain an alternate bar morphology. The alternate bar morphology is a geomorphic template that structures the basic riparian vegetation patterns (Figure 3.4-2). The alternate bar morphology is divided into geomorphic units: riffles, pools, runs, point bars, floodplains, terraces, sloughs/oxbows, and backwaters. The channel region below the floodplain is called the bankfull channel.

Table 3.4-1: POTENTIALLY OCCURRING PLANT SERIES ALONG THE SAN JOAQUIN RIVER AND TRIBUTARIES

VEGETATION SERIES	NDDB/HOLLAND TYPE SYNONOMIES	NATURE CONSERVANCY STATUS
Arroyo willow series (RpScr)	Southern cottonwood-willow riparian forest (61330 *in part*)	G3 S3
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley mixed riparian forest (61420 *in part*)	G2 S2.1
	Southern willow scrub (63320 *in part*)	G3 S3.2
Black willow series (RpScr; RpWld)	Southern cottonwood-willow riparian forest (61330 *in part*)	G3 S3
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley mixed riparian forest (61420 *in part*)	G2 S2.1
	Southern willow scrub (63320 *in part*)	G3 S3.2
Blue elderberry series (RpScr;RpWld;VFGr)	Elderberry savanna (63430)	G2 S2.1
	Mexican elderberry series	
Box elder series (RpScr; RpWld)	Southern cottonwood-willow riparian forest (61330 *in part*)	G3 S3
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley mixed riparian forest (61420 *in part*)	G2 S2.1
	Southern willow scrub (63320 *in part*)	G3 S3.2
Bulrush series (MshSw)	Coast and Valley freshwater marsh (52410 *in part)*	G3 S2.1
Bulrush- cattail series (MshSw)	Coast and Valley freshwater marsh (52410 *in part*)	G3 S2.1
Buttonbush series (MshSw; RpScr)	Buttonbush scrub (63430)	G1 S1.1
California walnut series (CmWld; RpWld)	California walnut woodland (71210)	G2 S2.1
	Walnut forest (81600)	G1 S1.1
Cattail series (MshSw)	Coast and Valley freshwater marsh (52410 *in part*)	G3 S2.1
Common reed series (MshSw)		n/a

Table 3.4-1: POTENTIALLY OCCURRING PLANT SERIES ALONG THE SAN JOAQUIN RIVER AND TRIBUTARIES (CONT.)

VEGETATION SERIES	NDDB/HOLLAND TYPE SYNONOMIES	NATURE CONSERVANCY STATUS
Ditch-grass series (MshSw)	Coastal brackish marsh (52200 *in part*)	G2 S2.1
	Cismontane alkali marsh (52310 *in part*)	G1 S1.1
	Alkali seep (45320 *in part*)	G3 S2.1
Duckweed series (MshSw)	Coast and Valley freshwater marsh (52410 in part)	G3 S2.1
Dusky willow series (MshSw)	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley mixed riparian forest (61420 *in part*)	G2 S2.1
	Great Valley willow scrub (63410 *in part*)	G3 S3.2
	Southern willow scrub (63320 *in part*)	G3 S3.2
Eucalyptus series EXOTIC		n/a
Edible fig series EXOTIC		n/a
Fremont cottonwood series (RpWld)	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley mixed riparian forest (61420 *in part*)	G2 S2.1
Hind's Walnut stands (RpWld; CmWld)	Hinds walnut woodland (71220)	G1 S1.2
Kentucky bluegrass series (VFGr)	Valley and foothill grasslands (42000)	n/a
Mixed willow series (RpScr; RpWld)	Freshwater swamp (52600 *in part*)	G1 S1.2
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley mixed riparian forest (61420 *in part*)	G2 S2.1
	Great Valley willow scrub (63410 *in part*)	G3 S3.2
	Southern willow scrub (63320 *in part*)	G3 S3.2
Mosquito fern series (MshSw)	Coast and Valley freshwater marsh (52410 *in part*)	G3 S2.2
Narrowleaf willow series (RpScr)	Southern cottonwood-willow riparian forest (61330 *in part*)	G3 S3
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley willow scrub (63410 *in part*)	G3 S3.2
Nodding needlegrass series (VFGr)	Valley needlegrass grassland (42110 *in part*)	G3 S3.1
Northern claypan vernal pools (VnPl)	Northern claypan vernal pool (44120)	G1 S1.2

Northern hardpan vernal pools (VnPl)	Northern hardpan vernal pool (44110)	G3 S4
Oregon ash series (RpScr; RpWld)	Southern cottonwood-willow riparian forest (61330 *in part*)	G3 S4
	Great Valley mixed riparian forest (61420 in part)	G2 S2.1
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
	Great Valley willow scrub (63410 *in part*)	G3 S3.2
Purple needlegrass series (VFGr)	Valley needlegrass grassland (42110 *in part*)	G3 S3.1
Shining willow series (RpScr; RpWld)	Freshwater swamp (52600 *in part*)	G1 S1.2
	Southern cottonwood-willow riparian forest (61330 *in part)*	G3 S3
	Great Valley mixed riparian forest (61420 in part)	G2 S2.1
	Great Valley cottonwood riparian forest (61410 *in part*)	G3 S2.1
Shining willow series (RpScr; RpWld)	Great Valley willow scrub (63410 *in part*)	G3 S3.2
	Pacific willow series	
Pondweeds with floating leaves series (MshSw)	Coast and Valley freshwater marsh (52410 *in part*)	G3 S2.2
Pondweeds with submerged leaves series (MshSw)	Coast and Valley freshwater marsh (52410 *in part*)	G3 S2.3
Quillwort series (MshSw)	Freshwater marsh (52400 *in part*)	G4 S4
Tree of heaven series **EXOTIC**		n/a
Valley oak series (RpWld)	Great Valley valley oak riparian forest (61430)	G1 S1.2
	Valley oak woodland (71130)	G2 S2.1

Table 3.4-1: POTENTIALLY OCCURRING PLANT SERIES ALONG THE SAN JOAQUIN RIVER AND TRIBUTARIES (CONT.)

Nature Conservancy Heritage Program Status Ranks
Global ranks

G1= Fewer than 6 viable occurrences worldwide and/or 2000 acres
G2= 6-20 viable occurrences worldwide and/or 2,000-10,000 acres
G3= 21-100 viable occurrences worldwide and/or 10,000-50,000 acres
G4= Greater than 100 viable occurrences worldwide and/or greater than 50,000 acres
G5= vegetation type is demonstrably secure due to worldwide abundance

State ranks
S1= Fewer than 6 viable occurrences statewide and/or 2000 acres
S2= 6-20 viable occurrences statewide and/or 2,000-10,000 acres
S3= 21-100 viable occurrences statewide and/or 10,000-50,000 acres
S4= Greater than 100 viable occurrences statewide and/or greater than 50,000 acres
S5= vegetation type is demonstrably secure statewide

Threat Ranks
0.1 = Very threatened
0.2 = Threatened
0.3 = No current threats known

References:
Hickman J.C. (Ed.) 1993. *The Jepson Manual Higher Plants of California*. University of California Press, Berkeley.

Sawyer J.O. and Keeler-Wolf T. 1995. *A Manual of California Vegetation* California Native Plant Society.

Annual hydraulic regimes are often illustrated with an annual hydrograph (Figure 3.4-3). The annual hydrograph is broken into components to illustrate certain trends in timing, magnitude and duration of discharge during portion of the water year. Individual hydrograph components affect riparian vegetation growing on geomorphic units differently, and the cumulative effects are summarized in Table 3.4-2 on the following pages.

Historically, spring snowmelt floods rose and fell gradually; and after the peak, river water levels declined gradually through summer months (Figure 3.4-3). This annual trend in discharge affected initiating and establishing vegetation, creating observable patterns in established vegetation. Some plant species evolved rapidly growing roots, which "follow" dwindling sub-surface soil moisture created by flow recession (Segelquist et al. 1993). Falling groundwater tables during summer months created soil moisture gradients, which placed strong selective pressures on vegetation. Plants whose roots could not keep up with the groundwater drawdown died. These gradients, combined with local soil differences, caused distinctive "zonation" patterns in riparian vegetation. In many locations, plants germinated but were later unable to survive because of insufficient soil moisture. Desiccation mortality may prevent a plant's transition into the establishment stage for many successive years, causing distinct age classes between successful cohorts. Before flow regulation, inundation discouraged seed germination in the bankfull channel. Spring snowmelt floods would inundate substrate on which seeds could potentially land and germinate. Riparian hardwoods disperse most of their annual seeds during the spring snowmelt, resulting in a sparsely vegetated bankfull channel.

Each woody riparian species (and life stage) responds differently to hydrologic and fluvial processes. Particular plant life stages are more vulnerable to the effects of flow variation and fluvial processes. Initiating and early establishing plants are especially susceptible to mortality created by inadequate substrate and water availability. If initiating plants survive the summer, they are still susceptible to inundation or scour-induced mortality during winter and spring flood events. Once plants escape a two- to four-year window and develop deeper and more extensive root systems, the risk of scour induced mortality decreases. Ultimately, mortality of maturing plants depends on channel migration, being pushed over by flood debris, or disease. These periodic and spatially variable disturbance patterns and mortality agents perpetuated the plant series diversity that was once found along the rivers within the project area.

Prior to human intervention, the riparian corridor was several miles wide in places where the rivers lacked confinement, creating true riparian "forests". The dynamic interaction between initiation and maturation on one hand, and mortality on the other, maintained riparian stand species and structural diversity. The struggle between plants' physiological tolerances and fluvial and hydrologic processes resulted in noticeable patterns in species location on specific geomorphic surfaces. Riparian plants initiate and establish after floods of specific recurrence intervals (Auble et al 1994, Bradley and Smith 1984, Osterkamp and Hupp 1984). A study by McBain and Trush (1998) suggests that these

Table 3.4-2: THE COMBINED INTERACTIVE EFFECTS OF INDIVIDUAL HYDROGRAPH COMPONENTS AND FLUVIAL GEOMORPHOLOGY ON RIPARIAN VEGETATION

Hydrograph Component	Geomorphic Feature				
	Point Bar	**Floodplains**	**Terraces**	**Outside of Meander Bends**	**Oxbows**
Winter/Spring baseflow	**Promote inundation mortality of seedlings** **Prevent germination by inundating the active channel margins**	Recharges ground water promoting late fall/early winter growth and maximum growth after plants break dormancy	Recharges ground water in excess of precipitation facilitating maximum growth in establishing mature and senescent vegetation	Sustains ground water promoting late fall/early winter season growth	Recharges and maintains ground water tables sustaining off-channel wetlands
Winter floods	**Significantly mobilize channel bed scouring previous years seedlings**	Builds and fertilizes floodplain by fine sediment and detrital deposition Promotes inundation mortality in physiologically sensitive plant species Deposits seeds, establishing a short term seed bank waiting for suitable germination conditions	Deposits seeds, establishing a short term seed bank waiting for suitable germination conditions	Channel migrates against the outside of the bend, causing limited mortality to mature and senescent vegetation, introducing large woody debris	Over bank flow can refill sloughs and oxbows potentially introducing more plant species
Extreme winter floods **(during normal or above normal water years)**	**Move and reorganize inchannel woody debris** **Realign channel by jumping channel or cutting off sharp meander bends creating wetlands**	Significantly scour around mature, and senescent vegetation, creating new seed beds Mobilize woody debris jams; locally removing or pushing over establishing, mature, and scenescent vegetation Fine sediment deposition promotes root suffocation	Builds and fertilizes terrace through fine sediment and detrital deposition Promotes inundation mortality in physiologically sensitive plant species Fine sediment deposition promotes root suffocation	Channel migrates against the outside of the bend, causing limited mortality to mature and senescent vegetation, introducing large woody debris	Oxbow may be recaptured by the channel and the wetland reoccupied by the main channel Fine sediment and detrital deposition creates greater topographic variation and increases nutrient availability

Table 3.4-2: THE COMBINED INTERACTIVE EFFECTS OF INDIVIDUAL HYDROGRAPH COMPONENTS AND FLUVIAL GEOMORPHOLOGY ON RIPARIAN VEGETATION (CONT.)

Hydrograph Component	Geomorphic Feature				
	Point Bar	**Floodplains**	**Terraces**	**Outside of Meander Bends**	**Oxbows**
Snowmelt peak	Prevents germination by inundation of point bar Scour establishing seedlings Promote inundation related mortality	Encourages seed germination by providing high soil moisture Discourages germination near the active channel by inundation	Encourages seed germination by providing high soil moisture	Channel migrates against the outside of the bend, causing limited mortality to mature and senescent vegetation, introducing large woody debris	Surface and ground water recharges creating the specialized environmental conditions required by ephemeral herbaceous plant species
Snowmelt recession	**Prevent plant germination by inundation**	Facilitates seed germination over a wide elevation range Drops in river stage causes desiccation mortality to plants that had germinated earlier in the spring	Drops in river stage causes desiccation mortality to plants that had germinated	Recharges ground water promoting maximum growth after breaking dormancy	Water table draw down causes desiccation related mortality
Summer baseflows	**Plant germination on point bar occurs too late in the growing season to permit survival through next year's flow regime** **Sustains herbaceous perennials surviving along the summer baseflow water surface elevation**	Desiccate seedling germinated through the late winter and spring	Low water tables create drought stress among plants leading to desiccation related mortality Sustaines herbaceous perennials surviving among the summer baseflow water surface elevation	Desiccate seedlings that germinated through the late winter and spring	In below normal water years, some portions could dry up causing widespread mortality to aquatic and emergent vegetation

relationships historically existed on the Tuolumne River and presumably existed along the other rivers in the project area as well (Table 3.4-3).

Table 3.4-3: COMMON PLANT SERIES FOUND ALONG THE TUOLUMNE RIVER, THE ASSOCIATED RANGE OF DISCHARGES THAT THE SERIES FALLS WITHIN AND THE RECURRENCE INTERVALS OF THE DISCHARGES PRE- AND POST-NEW DON PEDRO DAM (NDPP).

Plant Series	Recurrence Interval Range	Pre-NDPP Magnitudes (cfs)	Post-NDPP Magnitudes (cfs)
Narrow-leaf willow	summer baseflow to 1.5 year flood	150 to 8,500	150 to 3,020
White alder/Box elder	1.5 to 5 year flood	8,500 to 25,000	3,020 to 7,500
Fremont Cottonwood	5 year to 20 year flood	25,000 to 51,000	7,500 to 12,800
Valley oak	20 year to the 100 year flood	51,000 to 89,000	12,800 to 18,000

Source: McBain and Trush, 1998.

Over the years intensive land management has reduced riparian vegetation in the San Joaquin Valley to less than two percent of its historic coverage (CALFED 1998). Where riparian stands have persisted, older senescent Fremont cottonwood and valley oaks stands have been infiltrated by exotic plants and younger willow, alder and box elder stands are encroaching into the bankfull channel. Flow regulation, combined with human disturbance, has simplified channel morphology and eliminated the extent and diversity of historic riparian vegetation. Senescent stands are relics of pre-flow regulation flow regime vegetation, while in most locations the once extensive native riparian forests have been reduced to a narrow band often no more than one tree wide along the river's bankfull channel.

Relic stands have canopy parasites (e.g., mistletoe) and liana (vine) development between the ground and canopy. Parasite loads in the canopy increase with age, and liana development is indicative of a low frequency disturbance regime. If a stand has a no liana development, but a large parasite load in the canopy, it is an old stand with a high frequency of disturbance. Where relic stands are present in the project area there is often visible mistletoe, but lianas have been removed by humans or are not well developed. This is because the old trees are valued for esthetic and shade value but not the habitat complex that they create. Intensive land management by mowing or clearing has kept the older trees, but removed all the vegetation on the ground and shrub layers around them; the canopy remains, but the other habitat created by the associated liana and shrubs is removed.

The combination of contemporary hydrologic and geomorphic processes, human disturbance, and each riparian plant's specific physiologic tolerances interactions has resulted in a narrow riparian corridor with low species diversity. Periodic and spatially variable disturbance patterns perpetuated the plant diversity that was once found along the rivers within the project area. Human induced changes to hydrology and fluvial geomorphology have resulted in some plant species to increase cover and dominate the riparian corridor (narrowleaf willow) and others to decrease in cover and eventually disappear (western sycamore, Fremont cottonwood and valley oak).

3.4.1.2 Current Conditions

Common, Exotic, and Rare Plant Stands

Both native and exotic plants comprise riparian vegetation growing on terraces, floodplains, and within the active channel. General riparian vegetation types within the project area consists of riparian woodland, riparian scrub, vernal pools, valley/foothill grasslands, marches/swamps, wet meadows, and cismontane woodland. These general vegetation types are further subdivided into individual stands composed of a plant series. Table 3.4-4 on the following pages lists the plant series that are potentially found within riparian corridors in the project area, other common habitat type synonymies, and the relative abundance of each series in the Central Valley. Along all of the rivers in the study area, the riparian scrub type vegetation series are the most prevalent, and often grow within the active channel.

Human impacts have reduced the riparian vegetation in the Central Valley to a fraction of its previous extent; however, it is difficult to say that this vegetation type is threatened when plants that comprise it are common. The Nature Conservancy has characterized California's general vegetation types in terms of relative abundance. Where there is only between 2,000 and 10,000 acres of the specific vegetation type left in the state, the vegetation type has been identified as "threatened". Using their classification, all native terrestrial vegetation within the riparian corridor is very threatened to threatened (Table 3.4-4). Some aquatic and emergent vegetation is very threatened (e.g., ditch grass series), while others are common with no threat of extinction (e.g., pondweeds with floating leaves series).

No plant series is unique to a specific river. Fremont cottonwood, valley oak and black willow series are the most impacted by human disturbance because they grow on terraces and floodplains. Terraces and floodplains typically have Class 1 soils, making them extremely productive and economically valuable. Agricultural development has reduced riparian vegetation in many locations to one tree width along the river as a buffer. This one tree width buffer is not connected with or contiguous with any other trees or shrubs along the channel, causing further fragmentation of the remaining vegetation and migration corridors.

Exotic plant series are proliferating throughout the riparian corridor, displacing native plants and preventing native plant regeneration. Exotic plants are effective interspecific competitors, and often grow in pure stands that exclude other plant species from growing. Four exotic plant species represent 67 percent of all mapped exotic plants in the Tuolumne River riparian corridor: Eucalyptus, edible fig, common reed, and tree of heaven. These species form large stands and interfere with native hardwood recruitment and regeneration.

Most remaining large tracts of relic riparian vegetation are associated with state, federal or county parks. Large relic stands (>5 acres) preserved by parks are subjected to different types of human activities, which often conflict with riparian vegetation use by wildlife. Roads and campgrounds create openings and clear the dense understory. The presence of dogs, trails, and noise also impacts relic stands. Dogs are prey-driven animals, and most will readily pursue anything that flees. Non-burrowing wildlife species may be driven out of the riparian vegetation within parks where there is no refuge from dogs. Planned and un-planned trails sub-divide habitat, and small animals may find this a barrier. The management of these relic stands prohibits their temporal evolution and disturbance by the river; this strategy prevents a change to the relic stand's current condition. Although the parks represent most of the largest tracts of relic riparian vegetation, they are riparian vegetation museums where stand evolution is incompatible with long term park management activities.

Vernal pools and great valley grass lands both fall within the project area (the San Joaquin River north of Bear Slough and including the confluence areas with backwater effects). However, they do not rely solely on the fluvial system for survival. Vernal pools are not subject to the changes in groundwater created by the rising and falling of the river stage, and rely solely on rainfall for the moisture to sustain them. Great valley grasslands and vernal pools have the highest number of rare, threatened or endangered plants of any vegetation type within the project area; however, the pulse flows of various project alternatives are not anticipated to affect them (see Section 4.4.1).

Common, Exotic, Rare, Threatened, or Endangered Plant Species

Common riparian plant species make up the majority of canopy structure and understory; there are no endangered plants associated with it. Valley grasslands and vernal pools have a very high species diversity and several endangered plants; however, they are not further evaluated because the proposed project alternatives will not affect them. See Appendix D for a complete listing of threatened and endangered plant species evaluated for the proposed and alternative actions. Fremont cottonwood, white alder, box elder, valley oak, black willow, and narrowleaf willow are the primary riparian vegetation constituents throughout the project area's riparian corridors.

Exotic plants are widespread throughout the project area and are affecting native plant regeneration, and canopy and understory structure. Aquatic exotic plants brought from tropical countries have been favored by higher water temperature created by flow regulation and low gradient river reaches. Eucalyptus, edible fig, common reed (*Arundo donax*), and tree of heaven already form large stands and are interfering with native hardwood recruitment and regeneration. White mulberry, yellow flag iris, and weeping willow are just beginning to proliferate and will soon out-compete indigenous riparian plant species.

Aspects of Common Species Annual Life History

Riparian plants have adapted to survive within the fluvial environment by timing different stages of their annual life history to coincide with changes in discharge associated with different hydrograph components. Dormancy and seed dispersal are the two annual life history stages that are most likely to occur during the different fall and spring pulse flow alternatives associated with this project. These will affect each species differently because of the timing of individual seed dispersal periods (Figure 3.4-4).

Plant dormancy along the San Joaquin River and its tributaries is correlated with the onset of late fall and early winter storms. These storms are colder and cause a rise in river stage, and also coincide with a shorter photoperiod. Drought stress, a change in temperature, or flooding can induce plant dormancy. Plants are the most vulnerable to mortality agents during the growing season, and dormancy is a way for the plant to protect its resources from environmental stresses created during drought, in-climate temperatures, or flooding. Plant physiologic processes such as respiration and photosynthesis are reduced during dormancy, and their need for oxygen and mineral nutrients is negligible. Many riparian plants will only go dormant if exposed to environmental stress, such as a storm or flood. Otherwise, they maximize their photosynthetic potential each year by continuing growth as long as possible. If fall pulse flows occur before dormancy, it is conceivable, however improbable, that inundation could cause stress and mortality.

Spring pulse flow timing, magnitude, and duration may provide the conditions necessary for hardwood regeneration in certain locations along the San Joaquin River and its tributaries. Historically, the timing of seed dispersal for the dominant species on the floodplain coincided with each river's snowmelt peak and the subsequent receding line. For example, Fremont cottonwood drops its seeds during the first two weeks of May, and narrowleaf willow drops it seeds during late May and early June; their seeds have a short life span of seven to ten days (Young and Young 1992). In contrast, box elder and white alder drop their seeds in the late summer and fall, and the seeds are viable for a minimum of a year (Young and Young 1992).

Different seed dispersal strategies lead to unique germination and establishment patterns along the bankfull channel, floodplains, and terraces. For example, because white alder and box elder disperse seeds in the fall, the pattern of alder and box elder stand establishment is a function of flows that raft seeds to a place where they can germinate and establish. Fremont cottonwood seed dispersal takes place in the late spring when floodplain soils are moist; the soil moisture being fed subsurface by high ground water tables recharged by the snowmelt peak, and sustained by the slow flow recession into the summer. Spring pulse flows could potentially affect the quantities, size, distribution, and species composition of regenerating riparian vegetation.

3.4.2 Wildlife

In the context of the proposed actions of this project, wildlife in the San Joaquin Valley are a less important feature than the aquatic resources (discussed in Section 3.5). This is because the proposed project involves the potential redistribution of water in the San Joaquin River Basin. Since none of the proposed project alternatives involve transport of water away from existing upland areas, this section addresses wildlife in the context of habitats that depend upon water to support wildlife.

The diversity and types of wildlife within the San Joaquin River Basin are related to the quality and areal extent of terrestrial habitat. Many of the wildlife species that formerly dominated the landscape (elk, bison, and other large mammals) required extensive desert scrub, large seasonal wetlands, extensive grasslands, and broad riparian corridors. Mountain meadows typically had less than 20 percent shrub canopy, with trees widely scattered around the perimeter. Wet meadows supported rushes, grasses, and perennial sedges. The soil remained wet late into the summer while in some places it remained permanently wet. The dry meadows were dominated by perennial grasses and forbs with some sedges. The riparian deciduous corridors were located along streams or ponds. These areas provided a narrow band of deciduous trees and shrubs along the margins.

Consequently, in the proposed project, the chief habitat used by wildlife species is riparian. Based on the interaction of a unique physical environment and the associated vegetation that occurs along the banks of the San Joaquin River tributaries, riparian corridors include surface and groundwater (sufficiently in excess of local precipitation) capable of supporting vegetation requiring moderate amounts of water. Plants in these areas undergo ecological succession from: 1) initiation (when the seeds fall on exposed, moist substrate and starts germination); to 2) establishment (from the end of the first growing season until the plant begins sexual reproduction); to 3) maturation (the active production of flowers and seeds); to 4) senescence (from when seed/flower production declines until plant death).

Historically, large floods (during wet years) created gaps in the riparian vegetation. Due to excessive erosion associated with flooding, open areas were created where new sediments associated with the flood events could be deposited. During normal years riparian vegetation was established, and seral stages of ecological succession followed. With the occurrence of dry years, seed production was limited, no new areas were opened for deposition, no sediments were transported, and no new plants could start their life cycle.

The plants growing in the riparian corridor formed a patchwork distribution responding to the availability of adequate water. The patterning of vegetation within the riparian corridor resulted from not only plant specific physiologic tolerances but also interactions of fluvial geomorphology, and hydrology. As a result of naturally occurring spring snowmelt floods, water levels rose and fell gradually. Following peak water levels, there was a gradual decline during summer months which created patterns in the vegetation along the waterway's riparian corridor. Each riparian plant species (and each life stage) respond differently to hydrologic and fluvial processes. Initiation and establishing stage plants were susceptible to mortality due to inadequate substrate and water availability. Establishing plants were susceptible to inundation or scour-induced mortality from subsequent year flooding. The longevity of maturation plants depends on channel migration and damage from debris from major floods as well as disease. The dynamic interactions between the four life stages and mortality results in structural diversity of riparian habitat. The interactions of contemporary hydrologic and geomorphic processes, anthropogenic management of water resources, and each riparian plant's specific physiologic tolerances resulted in a "narrow window" for survival of the riparian plants.

With development in the Valley, the natural processes of ecological succession (time, human activities, and natural changes) all resulted in changes in the structure and composition of the plant community. Superimposed on these changes are the ecological successional patterns from a grass forb stage, to a shrub/seedling/sapling stage, to a pole/medium tree stage, to a mature large tree stage (all with associated changes in the soils). As a result of the natural ecological succession and the anthropogenic influences of development, vegetation and wildlife now associated with natural terrestrial, agricultural, urban, riparian, and wetlands habitats exists.

As a result of habitat disruption or elimination, common wildlife species today include foxes, coyote, badgers, skunks, and opossums (an introduced species) which feed on insects, reptiles, rabbits and rodents. Their utilization of the habitat is inextricably linked to three major life history activities of the wildlife: breeding, feeding, and resting.

While the CALFED (1997) ecological zone classification system (fully described in Section 3.5.1) has been used to subdivide the project area, the wide distribution of wildlife does not facilitate such description within the same zones. Consequently, this section highlights common wildlife species of the San Joaquin Valley, and draws particular attention to wildlife species associated with riparian habitat. Representative avifauna include waterfowl (associated with the Pacific Flyway) which overwinter in valley wetlands. In addition, upland game birds (doves, pheasant, quail, and chukar) and shorebirds (terns, plovers, sandpipers, egrets, and gulls) inhabit the study area. Raptors (bald eagles, prairie falcons, and owls) feed in the riparian and wetlands habitats of the valley. Passerines, including warblers, blackbirds, sparrows, flycatchers, and swallows, utilize the diverse habitats of the San Joaquin River Basin for nesting and overwintering.

Riparian habitat includes areas in or adjacent to drainageways and flood plains which are characterized by species and/or life forms significantly different from those of the surrounding non-riparian habitats. Nutrients, water, and detrital materials are transported into riparian areas from surrounding upland areas. The importance of riparian habitat is demonstrated in that some of the highest densities of breeding birds are found in riparian habitats, and more than 60 percent of all vertebrates spend some portion of their life cycle in riparian habitat (Ohmart and Anderson 1982). Some of the riparian habitat has a lush canopy with associated shade and cover which provides habitat for a myriad of insects. Rough, ever-sloughing bark of common riparian trees attracts wood-boring larvae and provides forage for bark-gleaning and trunk-scaling birds. Woodpeckers, warblers, flycatchers, and owls are common inhabitants of this habitat. The tall trees also attract wintering and breeding raptors.

In addition to birds, riparian habitat is important to large mammals because it affords food, water, and cover. Herpatofauna (turtles, snakes, and amphibians such as salamanders) are dependent on riparian habitat for at least some stages of their life cycle. Many of these species are aquatic or semi-aquatic and lay open eggs (nonshelled) in water or very moist areas. Many also prefer rotting logs or dense ground cover (provided by leaf litter from the riparian vegetation). Many of these species are insectivorous or carnivorous. Herptiles also depend on this habitat for dispersal and genetic continuity between populations.

A number of mammals make use of the diverse habitats afforded by the San Joaquin River Basin (Table 3.4-5). Many of these are transients between the upland and riparian habitats. The San Joaquin pocket mouse prefers dry, open grasslands or scrub areas of fine textured soils. Feeding on seeds and some green vegetation and insects, this nocturnal mouse digs burrows for cover and may become torpid during extreme heat or cold. Heermann's kangaroo rat is found in the foothills and valley. It is common to the grasslands, scrub, mixed and montane chaparral, and early successional stages of valley hardwood and hardwood-conifer habitats. Feeding mostly on grains but also eating some forbs and green grass, this rat prefers food from red brome, foxtail, fescue, mouse barley, wild oats, lupine, lotus, and clover. It burrows in fine, deep, well drained soils. Muskrats are abundant in riparian areas, especially in fresh emergent wetlands as well as valley foothill and montane riparian habitats, aspen, and lacustrine riverine habitats. Muskrats are mainly herbivorous and prefer roots and basal stems of plants but also consume crayfish, molluscs, turtles, and fish

Table 3.4-5: MAMMALS COMMONLY OCCURRING IN THE SAN JOAQUIN VALLEY

COMMON NAME	NATIVE	INTRODUCED
Virginia Opossum		*
Ornate Shrew	*	
Broad-footed mole	*	
Yuma myotis	*	
Western pipstrelle	*	
Big brown bat	*	
Red bat	*	
Hoary bat	*	
Townsend’s big-eared bat	*	
Pallid bat	*	
Brazilian free-tailed bat	*	
Desert cottontail	*	
Black-tailed hare	*	
California ground squirrel	*	
Botta’s pocket gopher	*	
San Joaquin pocket mouse	*	
Heermann’s kangaroo rat	*	
Beaver	*	
Western harvest mouse	*	
Deer mouse	*	
California vole	*	
Muskrat	*	
Black rat		*
Norway rat		*
House mouse		*
Coyote	*	
Gray fox	*	
Ringtail	*	
Raccoon	*	
Long-tailed weasel	*	
Badger	*	
Western spotted skunk	*	
Striped skunk	*	
Bobcat	*	
Mule deer	*	

Source: Zeiner et al, 1990.

opportunistically. Coyote are common in brush, scrub, shrub, and herbaceous habitats. They also frequent younger stands of deciduous and conifer forests with low to intermediate canopy. An omnivorous opportunist, coyote eat primarily rats, mice, ground squirrels, gophers, and carrion.

A number of anthropogenic activities including livestock grazing, mining, intensive recreational activities, impoundment construction, logging (and associated road construction) have had dramatic impacts on the diversity of wildlife found in these riparian habitats. Although extensive efforts have been taken to slow habitat alteration, a number of species have declined in abundance, some to near extinction (Table 3.4-6). Species included in this list are those associated with habitat types that may potentially be affected by project alternatives. Species that were considered for this list are contained in Appendix D.

Table 3.4-6: STATE AND FEDERAL THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE WILDLIFE SPECIES THAT MAY OCCUR IN THE PROJECT AREA.

Species	Status[a] Federal/ State	Habitats
		Invertebrates
Conservancy fairy shrimp *Branchinecta conservatio*	E/--	Large, deep vernal pools in annual grasslands
Longhorn fairy shrimp *Branchinecta longiantenna*	E/--	Small, clear pools in sandstone rock outcrops of clear to moderately turbid clay- or grass-bottomed pools
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Riparian and oak savanna habitats with elderberry shrubs; below 2,000 feet elevation
Vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Vernal pools; sandstone rock outcrop pools
Vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pools; ephemeral stock ponds
		Amphibians and Reptiles
California tiger salamander *Ambystoma tigrinum californiense*	C1/SSC	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy
California red-legged frog *Rana aurora draytonii*	T/SSC	Permanent and semipermanent aquatic habitats such as creeks and coldwater ponds with emergent and submergent vegetation and riparian species along the edges; may estivate in rodent burrows or cracks during dry periods

Table 3.4-6: STATE AND FEDERAL THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE WILDLIFE SPECIES THAT MAY OCCUR IN THE PROJECT AREA (CONT.)

Status[a]

Species	Federal/ State	Habitats
Giant garter snake *Thamnophis couchi gigas*	T/T	Sloughs, canals, and other small waterways, where there is a prey base of small fish and amphibians; requires grassy banks and emergent vegetation for basking, and areas of high ground protected from flooding during winter
Western pond turtle *Clemmys marmorata*	--/SSC	Permanent ponds, lakes, streams, and irrigation ditches; basking sites, such as logs, rocks, mud banks, or mats of floating vegetation required; nests constructed in sandy banks or on hillsides up to 325 feet from water
Birds		
Aleutian Canada goose *Branta canadensis leucopareia*	T/--	Winters in the San Joaquin Valley; forage on pastures, harvested fields, and wetlands; roost on flooded fields and ponds at night
Bald eagle *Haliaeetus leucocephalus*	T/E	Requires large, old-growth trees or snags in mixed stands near large bodies of water or free-flowing rivers with abundant fish. Roosts communally in winter in dense, sheltered, remote conifer stands in proximity to feeding areas.
American peregrine falcon *Falco peregrinus anatum*	E/E	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large populations of other bird species
Bank swallow *Riparia riparia*	--/T	Nests in bluffs or banks adjacent to water where the soil consists of sand or sandy loam to allow digging; the state's largest breeding populations are along the Sacramento River, and along the Feather and Lower American Rivers, in the Owens Valley
California yellow warbler *Dendroica petechia brewsteri*	--/SSC	Nests and feeds in riparian deciduous habitats; preferred species include cottonwoods, willows, and alders
Cooper's hawk *Accipiter cooperii*	--/SSC	Dense stands of live oak, riparian deciduous, or other forest habitats near water used most frequently
Greater sandhill crane *Grus canadensis tabida*	--/T	Summers in open terrain near shallow lakes or freshwater marshes; winters in plains and valleys near bodies of fresh water
Loggerhead shrike *Lanius ludovicianus*	--/SSC	Found in a wide variety of lowland habitats including valley foothill hardwood, hardwood-conifer, valley foothill riparian, and pinyon-juniper
Long-billed curlew *Numenius americanus*	--/SSC	Breeds on grazed, mixed-grass and short grass prairies, and wetlands; feeds in a variety of wetlands, and flooded or wet fields
Mountain plover *Charadrius montanus*	C/SSC	Frequents open plains below 3,200 feet elevation with low herbaceous or scattered shrub vegetation; plowed fields with little vegetation; avoids high and dense cover

Table 3.4-6: STATE AND FEDERAL THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE WILDLIFE SPECIES THAT MAY OCCUR IN THE PROJECT AREA (CONT.)

Species	Status[a] Federal/ State	Habitats

Northern harrier *Circus cyaneus*	--/SSC	Frequents meadows, grasslands, open rangelands, and wetlands; nests in emergent wetland or along rivers or lakes; less frequently nests in grasslands and grain fields
Prairie falcon *Falco mexicanus*	--/SSC	Associated primarily with perennial grasslands, savannas, rangelands, and some agricultural fields; uses open terrain for foraging and nests in adjacent canyons, cliffs, or rock outcrops
Sharp-shinned hawk *Accipiter striatus*	--/SSC	Prefers, but not restricted to, riparian habitats; forages in openings at edges of woodlands, brushy pastres, and shorelines where there is an abundance of migrating birds
Short-eared owl *Agio flammeus*	--/SSC	Winters in the Central Valley; usually found in open areas with few trees, such as grasslands, prairies, irrigated lands meadows, and wetlands
Swainson's hawk *Buteo swainsoni*	--/T	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields
Western least bittern *Ixobrychus exilis hesperis*	--/SSC	Nests in fresh emergent wetlands in the Central Valley; rests, roosts, and hides in dense emergent vegetation; often feeds along the edge of emergent vegetation on the open-water side
White-tailed kite *Elanus leucurus*	--/P	Forages in agricultural areas and grasslands; uses trees with dense canopies for cover; nests in dense oak, willow, or other tree stand
Willow flycatcher *Empidonax traillii brewsteri*	--/E	Riparian areas and large, wet meadows with abundant willows for breeding; usually occurs in riparian habitats during migration
Mammals		
Giant kangaroo rat *Dipodomys ingens*	E/E	Restricted to flat, sparsely vegetated areas with native annual grassland and shrubland habitats; requires uncultivated soils consisting of dry, fine, sandy loams for burrowing
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	Construct burrows in alkali marshes and on plains. Unable to use cultivated lands. Prefer areas with scattered woody shrubs such as saltbush, and a sparse covering of grasses and forbs. A critical element of their habitat is slightly elevated terrain where they can build burrows above the winter and spring floods.
Fresno kangaroo rat *Dipodomys nitratoides exilis*	E/E	Use sandy loam soils for excavation of burrows in gently undulating to level terrain in mildly to moderately alkaline areas. Herbaceous vegetation with scattered shrubs preferred.

Table 3.4-6: STATE AND FEDERAL THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE WILDLIFE SPECIES THAT MAY OCCUR IN THE PROJECT AREA (CONT.)

Species	Status[a] Federal/ State	Habitats
Riparian woodrat *Neotoma fuscipes riparia*	C/SSC	Prefers areas with a mixture of trees and shrubs with moderate canopy and brushy understory. Requires cavities in trees, snags, or logs for nesting. In the San Joaquin Valley, suitable habitat restricted primarily

		to riparian areas where trees and brush are found. Only known from along the San Joaquin, Stanislaus, and Tuolumne rivers.
Riparian brush rabbit *Sylvilagus bachmani riparius*	C/SSC	Occupy dense thickets of riparian shrubs including wild rose (*Rosa* sp.), willows (*Salix* sp.), and blackberries (*Rubus* sp.). Also uses weedy fields adjacent to shrubs. Currently only known on the lower Stanislaus River and possibly in the vicinity of the confluence of the Stanislaus and San Joaquin rivers.
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	Saltbush scrub, valley grassland, oak woodlands, and freshwater scrub. Principally occurs in the San Joaquin Valley.

Status[a]
Federal
E = Listed as endangered under the federal Endangered Species Act
T = Listed as threatened under the federal Endangered Species Act
PE = Proposed for federal listing as endangered under the federal Endangered Species Act
C1 = Category 1 candidate for federal listing. Category 1 includes species for which U.S. Fish and Wildlife Service has on file enough substantial information on biological vulnerability and threat to support proposals to list them.

Status[a]
Federal
-- = No status

State
E = Listed as endangered under the California Endangered Species Act
T = Listed as threatened under the California Endangered Species Act
SSC= Species of special concern
P = Fully protected in California
-- = No status

3.4.2.1 Natural Terrestrial Habitats

Annual grassland and valley foothill hardwood are the dominant natural terrestrial habitat types in the San Joaquin River region constituting approximately 58 percent of these habitats (USBR 1997d). Many wildlife species use annual grasslands for foraging, but some require special habitat features such as cliffs, caves, ponds, or habitats with woody plants for breeding, resting, and escape cover. Annual grasslands in the San Joaquin region are found in the lower foothills and often comprise the understory in oak savannas. Annual grasslands are largely used for livestock grazing but also provide habitat for wildlife. Reptiles that breed in annual grasslands include the western fence lizard, common garter snake, and western rattlesnake. Mammals commonly found in this habitat include black-tailed jackrabbit, California ground squirrel, western harvest mouse, California vole, badger, and coyote. Common birds that breed in annual grasslands include horned lark, and western meadowlark. Numerous threatened, endangered, or sensitive species use annual grasslands for breeding and foraging including burrowing owl, short-eared owl, white-tailed kite, prairie falcon, and San Joaquin kit fox.

Valley foothill hardwood habitat varies from savanna-like to forest-like stands with partially closed canopies dominated by valley oaks (Conard et al. 1977). Denser hardwood stands are associated with valley soils along natural drainages (Mayer and Laudenslayer 1988). Valley foothill hardwood stands are often associated with riparian habitat along the Stanislaus, Merced, and Tuolumne rivers. Hardwood stands provide food and cover for a variety of wildlife, with oaks supplying an important food resource to some birds and mammals. TES species that may be found in this habitat include white-tailed kite, short-eared owl, and riparian woodrat.

3.4.2.2 Agricultural Lands

Agricultural habitats are generally of lower value to wildlife than are natural habitats. The major agricultural habitats in the San Joaquin River region are irrigated pasture, orchards, vineyards, grain, grasslands, and cotton (USBR 1997d). Agricultural areas interrupt riparian vegetation along the Stanislaus, Merced, and Tuolumne rivers (see Section 3.4.1) resulting in the fragmentation of natural habitats. Fragmentation greatly reduces the potential of riparian and valley hardwood stands to fulfill habitat requirements and act as corridors for many wildlife species. In addition, agricultural areas create abrupt edges with natural habitats creating conditions less-preferable by native species. Nonetheless, wildlife species have adapted to these intensively managed areas and use them for foraging and occasionally for breeding. Irrigated pasture provides the highest quality habitat for wildlife and may be used by RTES species. Irrigated pasture, grain, and grasslands used for hay production offer foraging opportunities for black-bellied plover, killdeer, long-billed curlew, white-faced ibis, red-tailed hawk, white-tailed kite, and prairie falcon (USBR 1997b). Small mammals occupying pasture habitat include California vole, Botta's pocket gopher, and California ground squirrel (USBR 1997b). Ground-nesting birds, including ring-necked pheasant, waterfowl, and western meadowlark, occupy pasture habitat if adequate residual vegetation is present (USBR 1997b).

Orchard and vineyard habitat includes intensively managed cultivated fruit or nut-bearing trees, and grape vines planted in rows (USBR 1997b). Understory vegetation is usually absent, but in some areas grasses and other herbaceous plants are allowed to grow along tree rows and between vineyard rows to reduce erosion (Mayer and Laudenslayer 1988). Some wildlife species have adapted to orchard and vineyard habitats. Deer and rabbits browse on the trees or vines, and squirrels and numerous birds feed on fruits or nuts (Mayer and Laudenslayer 1988). Other wildlife species associated with vineyards include deer mouse, mourning dove, and black-tailed hare. In addition, nuts and fruits from orchards provides food for a variety of animals including American crow, scrub jay, yellow-billed magpie, northern mockingbird, black-headed grosbeak, California ground squirrel, western gray squirrel, coyote, and raccoon (Mayer and Laudenslayer 1988). Orchard and vineyard habitat provides little habitat value for RTES species.

Cotton is an annual crop which is planted in spring and harvested during the fall. Crop rotation, usually between annual and perennial plants, is a common practice applied to conserve soil nutrients in order to maintain soil productivity. Cropland vegetation is grown as a monoculture, using tillage or herbicides to eliminate unwanted vegetation (Mayer and Laudenslayer 1988). Today, many species of rodents and birds have adapted to croplands but are controlled by fencing, trapping, and poisoning to prevent excessive crop losses (CA Dept. Food and Agri. 1975). Croplands flooded for weed control, leaching, irrigation, or waterfowl hunting serve as freshwater wetlands for a variety of wetland wildlife such as shorebirds, wading birds, and gulls (Mayer and Laudenslayer 1988).