

**CHAPTER III**  
**ENVIRONMENTAL CONSEQUENCES**

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## Chapter III

### ENVIRONMENTAL CONSEQUENCES

This chapter describes projected conditions for vegetation and wildlife resources under the No-Action Alternative, then compares the impacts of Alternatives 1 through 4 with the No-Action Alternative. The chapter begins with a summary of the methodology used in assessing impacts on vegetation and wildlife. For a more detailed explanation of methodology, refer to the Vegetation and Wildlife Methodology/Modeling Technical Appendix.

#### IMPACT ASSESSMENT METHODOLOGY

Implementation of the CVPIA may change land uses, agricultural practices, and operation of CVP facilities and other water delivery systems. These changes could affect vegetation and wildlife. This impact analysis focuses on changes in habitat rather than changes in population sizes of individual species. Population sizes were not evaluated because they can be affected by factors beyond the control of CVP, such as the condition of waterfowl breeding habitat in Canada, and because consistent population models were not available for all species in all affected areas.

Detailed, site-specific cause-and-effect relationships were not evaluated. Rather, data from existing models were used to evaluate general relationships and trends.

Data used in the analysis of impacts on vegetation and wildlife include surface water hydrology (PROSIM and SANJASM technical appendices), crop data, and acres of retired and fallowed land (Agricultural Economics and Land Use Technical Appendix), and urban development (Municipal and Industrial Land Use and Demographics Technical Appendix).

#### IMPACT MECHANISMS RELATED TO NATURAL TERRESTRIAL AND AGRICULTURAL HABITATS

Implementation of the CVPIA could result in land use changes that would directly or indirectly affect the acreage and condition of natural terrestrial and agricultural habitats. This analysis considers existing natural and agricultural habitats, lands retired or fallowed from agricultural production, and the use of pesticides associated with land retirement or fallowing.

The following assumptions about land use were used in the analysis:

- Urban development in the action alternatives will not change compared to urban development under the No-Action Alternative.
- The amount of currently uncultivated land will not change compared to the amount uncultivated under the No-Action Alternative.

Acreages of habitat types were obtained from the Central Valley Production Model (CVPM), which estimates acreages of irrigated and nonirrigated land, as explained in the Agricultural Economics and Land Use Technical Appendix. The land uses presented for the No-Action Alternative are based on land use information presented in DWR Bulletin 160-93. Acreages of irrigated lands are identified by six major crop types: irrigated pasture, orchard and vineyard, row crop, grain, rice, and cotton. Nonirrigated land includes dry pastures and natural vegetation. All nonirrigated land is in the Central Valley; therefore, all nonirrigated lands are assumed to be grasslands or valley foothill hardwoods, the dominant natural vegetation in the Central Valley.

The projections of changes in land use for the alternatives are based on projected changes in surface water available for agricultural and municipal water users. Under Alternatives 1 through 4, simulated CVP operations were modified to increase surface water flows in CVP-controlled streams, a move toward meeting the target flows developed in the Anadromous Fish Restoration Program (AFRP). In addition, under Alternatives 2 through 4, surface water diversions were acquired in various amounts to aid in meeting those target flows. The CVPM used a numerical analysis to project changes in agricultural cropping patterns based on changes in surface water diversions. It was assumed that acquired water diversions could not be replaced by additional groundwater pumping under water acquisition programs in Alternatives 2 through 4. The cropping pattern changes projected by the CVPM were used in the analysis of vegetation and wildlife resources.

### **Lands Fallowed to Obtain Water**

Irrigated lands could be fallowed to meet restoration objectives in the CVPIA. The amount of land would vary by alternative. The land would be obtained from willing sellers; therefore, it is not possible to accurately identify restoration opportunities.

The numbers of acres by crop type to be fallowed in each of 21 CVPM subregions were obtained from the CVPM model. Because decisions regarding the management of fallowed lands have not yet been made, the following assumptions were used in the analysis:

- If small amounts of land were to be fallowed (less than 100,000 acres in a region), all the land could remain in private ownership. All fallowed land would be planted with a cover crop for the first few years to establish an annual grass or similar vegetation to reduce erosion and minimize air quality effects. These parcels would be small and isolated, providing limited value for wildlife.
- If intermediate amounts of land were to be fallowed (between 100,000 and 300,000 acres), the government could obtain conservation easements on 15 percent of the parcels because it is assumed that some of the parcels would be adjacent to refuges or SNAs or be sufficiently large to provide potential habitat for special-status species. All parcels could remain in private ownership, and conservation easements could be used to restore natural vegetation and provide wildlife habitat. The remaining 85 percent of the parcels would be owned and managed as described under the first assumption above.
- If large amounts of land were to be fallowed (more than 300,000 acres), conservation easements could be obtained on 45 percent of the fallowed land. All parcels could remain in

private ownership, and conservation easements could be used to restore natural vegetation and provide wildlife habitat. The remaining 55 percent of the parcels would be owned and managed as described under the first assumption.

### **Retirement of Drainage Lands**

The federal government and DWR are authorized to purchase land from willing sellers to conserve water or improve the quality of an irrigation district's agricultural wastewater. For this assessment, it is assumed that 45,000 acres of land would be acquired under the No-Action Alternative and that an additional 30,000 acres of land would be retired under each of the action alternatives.

Opportunities for habitat restoration were evaluated through review of maps of soil resources (SCS, 1993), historical and recent vegetation maps (Griggs et al., 1992; CALVEG), the distribution of SNAs, and the distribution of special-status plants and wildlife (Williams et al., 1992) and described for Alternative 1b.

### **Pesticide Use**

Detailed data evaluating the effects of pesticides on plants and wildlife in the project area are not available. Therefore, the potential impacts of pesticides on native vegetation and wildlife are described in a qualitative manner and used to distinguish impacts among alternatives. It was assumed that the amount of herbicides and insecticides used would be approximately proportional to the amount of land under irrigated agriculture. It was also assumed that the changes in rodenticide use would be proportional to changes in the acreage of orchards in each region.

## **IMPACT MECHANISMS RELATED TO RIPARIAN AND WETLAND HABITATS**

### **River Stage**

The extent and condition of riparian communities and wetlands in the riparian zone were assessed using simulated river stages at locations considered representative of study rivers or river reaches (Table III-1). Simulated flows from the surface water models were converted to stages (depths in feet) using non-linear regressions, as described in the Fish Habitat Water Quality Methodology/Modeling Technical Appendix. Impacts were determined by comparing stages under Alternatives 1 through 4 to the stages under the No-Action Alternative.

Average monthly stages for an average year (average of the 69-year simulation), dry years (1928-1934 simulation), and wet years (1967-1971 simulation) were evaluated. Impacts on the extent and condition of riparian plant species were assessed by determining the percentage change in stage during months when river stage would affect critical phases in the life cycle of riparian plants. Spring and summer stages often were considered critical, and fall and winter stages generally were considered relatively unimportant.

TABLE III-1

**LOCATIONS OF RIVER STAGE GAUGES AND THE RIVERS AND  
RIVER REACHES THEY REPRESENT**

<b>River or River Reach</b>	<b>Location</b>	<b>Model Node</b>
Upper Sacramento River (Keswick to Colusa)	Below Red Bluff Diversion Dam	PROSIM 5
Lower Sacramento River (Colusa to Delta)	Verona	PROSIM 13
Feather River (Oroville Dam to mouth)	Mouth of Feather River	PROSIM 12
Lower American River (Folsom Dam to mouth)	Below Lake Natoma	PROSIM 14
Upper San Joaquin River (Friant Dam to mouth of Merced River)	San Joaquin River above the Merced River	SANJASM 37
Lower San Joaquin River (mouth of Merced River to Delta)	Vernalis	SANJASM 125

It should be noted that although river stages are reported to the nearest 0.1 foot, these values are based on average monthly flows simulated in the surface water models. Because of the nature of hydrologic input data and the use of average monthly operations in the simulations, the surface water model results may be accurate only within 10 to 20 percent depending on the watershed. Therefore, the values obtained from the surface water models and all dependent analyses should be used for comparisons only.

Whenever stages deviated more than 20 percent from the stages under the No-Action Alternative for a particular year type and in a direction that could be detrimental (e.g., flows that are too low in summer, during dry years), the impacts were considered noticeable. The effects of flows were assessed in the context of the floodplain morphology (e.g., distance between levees). Impacts on riparian communities in the Delta were assessed by an analysis of combined stage data from the lower Sacramento and lower San Joaquin rivers.

Effects on wetlands resulting from implementation of the CVPIA are expected mainly in river riparian zones, which could be affected by variations in river stage. The same simulated stage data used to assess impacts on riparian communities were used to assess wetland impacts. Drought (low summer stages) and inundation mortality (very high stages year-round) were considered to be the main impact mechanisms.

### **Long-Term Changes in Reservoir Levels**

Changes in the operations of CVP reservoirs to meet Delta outflow requirements could result in long-term decreases in some reservoir levels. Riparian vegetation in areas of former riparian habitat along tributary streams could recover naturally and persist for long periods. Minimal

recovery of upland vegetation would be expected elsewhere in the drawdown zones because loss of topsoil to erosion would inhibit the establishment of new vegetation.

Data on the distribution and abundance of riparian vegetation at all reservoirs in the project area were not available. However, unpublished file data were available on the distribution and abundance of willow scrub vegetation at Folsom Lake, and these data were used to evaluate impacts on riparian vegetation. It was assumed that all other reservoirs would respond in a similar manner and that riparian vegetation recovery resulting from reservoir operations could be significant locally but less than significant on a valleywide basis.

### **Delta Salinity Levels**

The effects of changes in river flows on Delta salinity were also assessed. Instream salinity levels in the western Delta and the eastern San Francisco Bay estuary were compared with species tolerance levels to determine whether shifts from salt marsh to brackish marsh or freshwater marsh could occur. The methods for salinity calculation are described in the Fish Habitat Water Quality Methodology/ Modeling Technical Appendix.

## **IMPACT MECHANISMS RELATED TO RIVER AND RESERVOIR AQUATIC HABITATS**

### **River Habitat Condition**

Many aquatic vertebrates that inhabit rivers and streams (i.e., river otter, belted kingfisher, and osprey) rely on fish as an important prey species. Changes in the operations of CVP reservoirs could affect fish populations in these rivers and, therefore, these predators. Impacts on these predators are described qualitatively based on changes described in the Fisheries Technical Appendix. It was assumed that these predator populations would respond in proportion to changes in fish habitat conditions.

### **Reservoir Habitat Condition**

Changes in reservoir operations can affect the availability of vegetation, prey (such as fish), and open and shallow water habitat. Changes in the amount of shallow, deep, and open water habitat in CVP reservoirs were used to evaluate changes in reservoir habitat quality. Models developed for the analysis of fish production in reservoirs were used to estimate the changes in the number of acres of water surface at three different depths. Shallow water habitat is the surface area where water is less than 1 foot deep. Deep water habitat is the surface area where water is more than 1 but less than 15 feet deep. Open water habitat is the surface area where water is greater than 15 feet deep.

Data from the Fisheries Technical Appendix were used to qualitatively describe changes in fish availability to predators.

The hydrologic modeling for this analysis did not include data on non-CVP or non-SWP reservoirs. The analysis of these reservoirs and the rivers they control is described qualitatively. The purchase of water from reservoirs by willing sellers could lead to changes in the timing of

water releases from those reservoirs and thus to changes in reservoir water levels compared with the levels under the No-Action Alternative. It was assumed that impacts resulting from changes in water levels at these reservoirs would be mitigated using funds included in the sale price of the water.

### **IMPACT MECHANISMS RELATED TO WATERFOWL AND SHOREBIRDS**

The following assumptions were made in evaluating the potential effects on waterfowl, shorebirds, and other wetland-dependent wildlife of implementing the CVPIA in the Central Valley.

- Increases in wetland acreage and longer durations of wetland flooding at refuges and other managed wetlands would promote the survival and reproductive success of migratory and breeding waterfowl, shorebirds, and other wetland-dependent wildlife.
- The health and reproductive success of northern pintails (and probably other migratory waterfowl) on their northern breeding grounds correlate with the number of acres of wetland habitats in the Central Valley in late winter and early spring.
- Central Valley wetlands are critical to both migratory and breeding waterfowl and shorebirds, especially in drought years.
- Established, private duck clubs have a strong commitment to the preservation and enhancement of waterfowl habitats; therefore, wetlands receiving water from non-CVP sources would remain in operation with implementation of the CVPIA.
- The wildlife habitat values of rice fields to migratory waterfowl and shorebirds depend on the timing, depth, and duration of flooding and on their proximity to state or federal refuges and other managed wetlands (e.g., GRCD, District 10).
- Incentive programs to flood agricultural fields for waterfowl habitat and enhance CVP water supplies could result in a maximum of 200,000 acres of flooded fields (probably 99 percent on rice fields); however, it was assumed that no more than 80,000 acres would be evaluated in the PEIS (Miller, pers. comm.). On average, fields would be flooded to depths of 4 to 12 inches, and 90 percent of the flooding would occur between mid-September and early March. Two-thirds of the acreage would be in the Sacramento River Region, one-sixth would be in the Delta Region, and one-sixth would be in the San Joaquin River Region. These programs were assumed to continue through 2020.

### **Public Refuges, the GRCD, Reservoirs, and Bypasses**

State and federal refuge managers and managers of the GRCD were contacted to determine changes in wetland management with implementation of the CVPIA. Preliminary information describing the projected refuge water supply deliveries; wetland acreages; and use by ducks, geese, and other waterbirds was summarized in an interim report (Reclamation, 1992). Although these data are incomplete, they constitute the best current source of information available for comparing the effects of Level 2 and Level 4 refuge water management with the No-Action

Alternative (Miller, pers. comm.). Level 2 refuge water supplies are defined in the 1989 and 1992 Refuge Water Supply Studies as the average amount of water the refuges received between 1974 and 1983. A large portion of this water was from tailwater return flows on upstream agricultural areas. Therefore, under Alternative 1, the CVP would provide firm Level 2 water supplies to the refuge borders. Level 4 refuge water supplies are defined in the above-mentioned reports as the amount of water for full development of the refuges based on management goals developed in the 1980s.

Refuge managers are currently preparing water management strategies for the next 10 years that incorporate Service resource objectives, the types of wetlands that would be created with this extra water, and water source information. Because these plans are in preparation (Forrest and Miller, pers. comms.), site-specific information on how new water supplies would be used on individual refuges, especially those in the Sacramento River Region, were not available for this analysis.

Percentage changes in deliveries compared with deliveries under the No-Action Alternative were calculated for Alternative 1 (Level 2) and Alternatives 2 through 4 (Level 4). Data for the No-Action Alternative were estimated using percentages of water supplies delivered to the refuge boundaries for each region. Because most values calculated for this analysis incorporated estimated data, values are considered relative indices used to describe changes among alternatives rather than measured quantities for individual refuges (Miller, pers. comm.).

### **Private Duck Clubs and Other Managed Wetlands**

The analysis assumes that under all alternatives, private duck clubs and other managed wetlands that were not specifically identified in the CVPIA (i.e., duck clubs in the GRCD) would continue to receive their historical water deliveries.

Evaporation ponds attract waterfowl and shorebirds, and the toxic substances in these ponds have resulted in birth defects. It was assumed that pond acreages would increase even with the planned retirement of some farmland (Reclamation, 1990c). For this analysis, it was assumed that new evaporation ponds would be placed on existing agricultural habitat.

### **IMPACT MECHANISMS RELATED TO SPECIAL-STATUS SPECIES**

Special-status species were evaluated using the same impact mechanisms and habitat-based approach described above for other resources. The habitat requirements of each species, as defined in the literature, were used to evaluate changes in the status of special-status species. It was assumed that the distribution and abundance of special-status species is proportional to the amount of habitat available. No data are available to determine habitat quality.

Impacts on threatened or endangered species were evaluated for individual species or for small groups of species when the impact mechanisms and habitat requirements were similar. Impacts on species that are not proposed for listing or listed as threatened or endangered were evaluated for guilds.

**Central Valley Project Conservation Program**

The CVP Conservation Program (Conservation Program), a long-term management program to address the biological needs of special-status species in the areas affected by the CVP. This program is currently being implemented by Reclamation and the Service. The special-status species include federally listed species; in addition, species that are candidates or are proposed species for Federal listing as well as other species of concern may benefit from the Conservation Program if they have high-priority biological needs. The Conservation Program will implement an aggressive, adaptive management program to protect, restore, and enhance these species and the ecosystems which support them throughout the Central Valley of California and other areas where CVP water is delivered. Reclamation and the Service expect the long-term implementation of the Conservation Program to be accomplished through partnerships with other programs that can contribute to and share goals of the Conservation Program. Considerable public involvement in refining, developing, and implementing the program is envisioned. The objectives of the Conservation Program are listed below:

- address the needs of special-status species in an ecosystem-based manner;
- assist in the conservation of biological diversity; and
- improve overall conditions for these species.

Meeting these objectives would enhance the overall quantity and quality of habitat and populations of special-status species throughout the Central Valley and help ensure that current and future operations of the CVP will not jeopardize the existence of any species.

Initially, the Conservation Program will address the high-priority needs of special-status species identified during recent consultations under Section 7 of the Endangered Species Act for CVP short-term interim contract renewals. The initial list includes actions presented in Attachment H of the PEIS, such as the establishment of additional wild populations of the riparian bush rabbit in the San Joaquin Valley by protection of habitat; increasing areas of flood refuges; establishing a working fire management plan; and management of wetland, riparian, and grassland mosaic ecosystem habitats. A preliminary list of species and actions is included in Attachment H of the PEIS; it will be modified as new scientific information becomes available, specific actions are completed, and the public has an opportunity to provide input.

The Conservation Program will benefit special-status species in the areas affected by the CVP through the following actions:

- addressing the biological needs of priority special-status species through land acquisition, management, restoration, and monitoring; and
- conducting studies to determine critical life requisites, habitat needs, and other relevant information (such as minimum viable population analysis).

**b(1) "other" Program (Section 3406(b)(1))**

In addition to the needs of specific fish and migratory waterfowl addressed in other portions of the CVPIA, Reclamation and the Service also would address the needs of other species that may

have been adversely affected by construction and operation of the CVP. The (b)(1) "other" Program would make all reasonable efforts to mitigate for past impacts of the CVP on fish, wildlife, and habitat resources not specifically identified in other portions of the CVPIA. The following items are the initial objectives of the (b)(1) "other" Program:

- Protect and restore native habitats impacted by the CVP that are not specifically addressed in the Fish and Wildlife Restoration Activities section of the CVPIA. Initial focus will be on habitats known to have experienced the greatest percentage decline in habitat quantity and quality since construction of the CVP, where such decline could be attributed to the CVP (based upon direct and indirect loss of habitat from CVP facilities and use of CVP water).
- Stabilize and improve populations of native species impacted by the CVP that are not specifically addressed under the Fish and Wildlife Restoration Activities section of the CVPIA. The initial focus would be given to federally-listed, proposed or candidate species, other non-listed State and Federal species of special concern including resident fish and migratory birds, and other native wildlife species associated with habitats which have declined in quantity and quality as a result of the CVP.
- Coordinate with and participate in other efforts contributing to the alleviation of the CVP impacts, including related provisions of the CVPIA.
- Develop partnerships with others to achieve the greatest possible benefit for species and habitats, and the most efficient use of program funds.

The initial actions to be coordinated with the ongoing actions developed under the Conservation Program, as described under the No-Action Alternative, would be the actions summarized in Attachment H of this PEIS. This list would be supplemented periodically.

As implementation proceeds, the emphasis of this program would focus more on ecosystem-level actions, regardless of federal or state listing programs for special status species.

The benefits of the (b)(1) "other" Program would be to mitigate, as feasible, the past impacts of the CVP to fish, wildlife, and habitats; and to improve biological status of species and habitats for special status species and native non-special status species and habitats.

The (b)(1) "other" Program would expend approximately \$1 million to \$2 million (1992 dollars) annually from the Restoration Fund. As opportunity permits, these funds would be combined with funding from other programs with similar goals, ensuring priority projects are coordinated and receive the greatest possible benefit.

## NO-ACTION ALTERNATIVE

Table III-2 lists the acreages of important habitats in the Central Valley under the No-Action Alternative.

**TABLE III-2**  
**SUMMARY OF HABITAT TYPES IN THE CENTRAL VALLEY**  
**UNDER THE NO-ACTION ALTERNATIVE**

Habitat Type	Sacramento River Region (acres x 1,000)	Sacramento-San Joaquin Delta Region (acres x 1,000)	San Joaquin River Region (acres x 1,000)	Tulare Lake Region (acres x 1,000)
Rice	472.0	2.0	13.0	0.1
Pasture and grains	630.0	272.0	714.0	450.0
Potential habitat from land fallowing	0.0	0.0	0.0	0.0
Potential habitat from retirement of drainage lands	0.0	0.0	21.6	23.4
Wetlands on refuges	19.0	NA	40.0	3.6
Field flooding	0.0	0.0	0.0	0.0
LEGEND: NA = Not applicable.				

## NATURAL AND AGRICULTURAL COMMUNITIES

## Natural Terrestrial and Agricultural Habitats

**Common Species.** Under the No-Action Alternative, approximately 1.75 million acres of land would be in agricultural production, 2.07 million acres would be nonirrigated land, and 498,300 acres would be developed for urban uses in the Sacramento River Region. Nonirrigated land includes dry pastures, naturalized and native grasslands, and valley foothill hardwood habitats. Grains, rice, and orchards account for approximately 72 percent of the agricultural habitat available to wildlife.

In the Delta Region, approximately 422,600 acres of land would be in agricultural production, 301,100 acres would be nonirrigated lands, and 70,500 acres would be developed for urban uses. Row crops and grain account for approximately 75 percent of the agricultural habitat available to wildlife.

In the San Joaquin River Region, approximately 2.4 million acres of land would be in agricultural production, 1.60 million acres would be nonirrigated lands, and 477,000 acres would be developed for urban uses. Orchards, row crops, and cotton account for approximately 70 percent of the agricultural habitat available to wildlife.

In the Tulare Lake Region, approximately 2.01 million acres of land would be in agricultural production, 1.56 million acres would be nonirrigated lands, and 244,000 acres of urban development would occur. Orchards and cotton account for approximately 64 percent of the agricultural habitat available to wildlife.

Changes in cropping patterns could adversely affect common wildlife, particularly those associated with rice. The conversion of lands from rice production to cotton production would reduce habitat for many waterbirds and raptors. These impacts are described in more detail under the discussion of impacts on waterfowl and shorebirds. Urban development would reduce natural terrestrial, agricultural, and nonirrigated habitats, resulting in habitat loss for common wildlife such as the yellow-billed magpie, savannah sparrow, red-tailed hawk, California vole, deer mouse, and western fence lizard.

**Special-Status Species.** Urban development in agricultural habitats and grassland (including vernal pools) and valley foothill hardwood habitats in the Sacramento River Region could affect populations of as many as 23 plant species that are federally listed or proposed for listing as threatened or endangered and as many as 28 special-status plant species. In the Delta Region, as many as 11 special-status plant species, including nine species that are federally listed or proposed for listing as threatened or endangered. Urban development in these regions could also affect two federal wildlife candidate species (mountain plover and California tiger salamander) and seven state- and federally listed species (San Joaquin kit fox, Swainson's hawk, giant garter snake, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, and conservancy fairy shrimp).

The conversion of lands from production of rice or small grain crops to cotton in these regions could reduce habitat for the giant garter snake, Aleutian Canada goose, and Swainson's hawk and also could reduce waterfowl abundance, indirectly affecting potential prey for peregrine falcons and bald eagles.

Under the No-Action Alternative, urban development in agricultural habitat and grassland, alkali desert scrub, and valley foothill hardwood habitats of the San Joaquin River Region could affect populations of as many as 18 special-status plant species, including 14 species of plants that are federally listed or proposed for listing as threatened or endangered and, in the Tulare Lake Region, as many as 16 special-status plant species, including 14 species that are federally listed or proposed for listing as threatened or endangered. Urban development in the San Joaquin River and Tulare Lake regions could affect five federal candidate wildlife species (California tiger salamander, mountain plover, Buena Vista Lake shrew, riparian brush rabbit, and San Joaquin Valley woodrat) and 13 state- and federally listed wildlife species (giant garter snake, blunt-nosed leopard lizard, Aleutian Canada goose, giant kangaroo rat, Fresno kangaroo rat, Tipton kangaroo rat, San Joaquin antelope squirrel, San Joaquin kit fox, vernal pool fairy shrimp, vernal pool tadpole shrimp, conservancy fairy shrimp, longhorn fairy shrimp, and valley elderberry longhorn beetle).

Effects of urban development on special-status species could be reduced by compliance with requirements in the federal and state ESAs and local ordinances designed to conserve special-status species. Additionally, in areas serviced by the CVP, the Conservation Program will identify actions that meet the needs of the species and improve the status of those species.

## Pesticide Use

Pesticides are used to manage crop production, manage utility rights-of-ways, and meet health and safety standards near dwellings. This analysis focuses on herbicides, which could adversely affect native or naturalized vegetation; insecticides, which reduce prey for insect-eating wildlife; and rodenticides, which directly affect rodents and indirectly affect predators that prey on rodents.

**Common Species.** Under the No-Action Alternative for the Sacramento River, Delta, San Joaquin River, and Tulare Lake regions, herbicides would remove native or naturalized vegetation in grasslands, valley foothill hardwood habitats, and emergent wetlands. Insecticides would reduce prey for various common species of bats, lizards, and birds. Rodenticides would be used to control California ground squirrels and other burrowing rodents in orchards and along canals.

Effects on common vegetation and wildlife would be minimized because many of the pesticides would be used in areas that do not provide high-quality habitat for these species, and the use and application of these chemicals would continue to be regulated by federal and state laws.

**Special-Status Species.** The continued use of herbicides could adversely affect special-status plants throughout the Central Valley, and aquatic herbicides might affect the giant garter snake. Insecticides could adversely affect the valley elderberry longhorn beetle. Rodenticides could adversely affect giant kangaroo rat, Tipton kangaroo rat, Fresno kangaroo rat, and San Joaquin antelope squirrel. Swainson's hawk, blunt-nosed leopard lizard and San Joaquin kit fox could be affected through secondary poisoning.

Effects on special-status species would be minimized because many of the pesticides would be used in areas that do not provide high-quality habitat for these species, and the use and application of these chemicals would continue to be regulated by federal and state laws. Additionally, in areas serviced by the CVP, the Conservation Program will identify actions that meet the needs and improve the status of those species.

## RIPARIAN COMMUNITIES

### Effects of Changes in Hydrology on Riparian Communities

**Common Species.** Under the No-Action Alternative for the upper reach of the Sacramento River (Keswick to Colusa), the average monthly stage (depth) of the Sacramento River below Red Bluff for an average year would range from 4.6 feet in September and October to 9.1 feet in February. The average monthly stage for wet years would range from 4.6 feet to 13.7 feet, and for dry years from 4.0 to 5.8 feet (Figure III-1). The upper and middle reaches of the Sacramento River support 14,800 acres of riparian habitat. The abundance and distribution of common riparian plant species (e.g., willows, Fremont cottonwood, western sycamore, and white alder) and common wildlife species that use riparian habitats (e.g., California newt, canyon wren, and ornate shrew) are expected to be similar to existing conditions for these species.

On the lower reach of the Sacramento River (Colusa to the Delta), the average monthly river stage at Verona for an average year would range from 8.1 feet in October to 18.1 feet in February. The average monthly depth for wet years would range from 8.9 to 21.8 feet, and for dry years from 6.6 to 12.1 feet (Figure III-1). The acreage of riparian vegetation and abundance of common wildlife species are not expected to change by 2020 because levees have replaced most of the riparian habitat.

The average monthly river stage at the mouth of the Feather River for an average year is projected to range from 3.0 feet in October to 6.9 feet in February and March. The average monthly stage for wet years is projected to range from 2.9 to 10.2 feet, and for dry years from 2.3 to 4.8 feet (Figure III-1). Stages in spring and early summer may be higher than existing conditions, while average stages in August and September may be slightly lower. The higher spring stages would have a beneficial effect on establishment of riparian vegetation, while the adverse effect of somewhat lower late summer stages would be relatively small. The extent and density of riparian communities along the Feather River may increase slightly by 2020.

The average monthly stage for an average year for the lower American River below Lake Natoma would range from 3.5 feet in October to 5.0 feet in February and March. The average monthly stage for wet years would range from 3.5 to 7.0 feet, and for dry years from 3.1 to 4.5 feet (Figure III-1). The average stages in July and August are projected to be slightly lower by 2020 than currently. This lower water level in summer might reduce the extent of riparian vegetation, which could have a minimal effect on common riparian plant species and wildlife species using riparian habitats.

In the Delta Region, the extent of riparian vegetation is expected to remain approximately 7,000 acres. The distribution and abundance of common riparian plant species (e.g., willows and cottonwoods) and wildlife species using riparian habitats are not expected to change by 2020.

Under the No-Action Alternative, the monthly river stage of the San Joaquin River above Merced for an average year is projected to range from 4.3 feet in September and October to 6.9 feet in February. The average monthly depth for wet years would range from 4.4 to 9.5 feet, and for dry years from 3.8 to 5.2 feet (Figure III-1). The stages for an average year are not expected

to differ substantially from the existing condition. The extent of the riparian vegetation along the upper San Joaquin River is expected to be similar to or somewhat below the extent under existing conditions. Minimal changes in the abundance of common riparian plants and wildlife that use riparian habitats are expected.

The monthly river stage of the San Joaquin River at Vernalis for an average year is projected to range from 5.5 in September to 9.7 feet in March. The average monthly stage for wet years would range from 6.1 to 12.0 feet, and for dry years from 4.2 to 6.7 feet (Figure III-1). The stages for an average year are expected to differ only slightly from existing conditions and the extent of riparian vegetation is not expected to change. The abundance of common riparian plants and wildlife that use riparian habitats is not expected to change.

The estimated 14,000 acres of riparian vegetation in the Tulare Lake Region along the Kings, Kaweah, Tule, and Kern rivers are not directly affected by CVP or SWP dam operations;

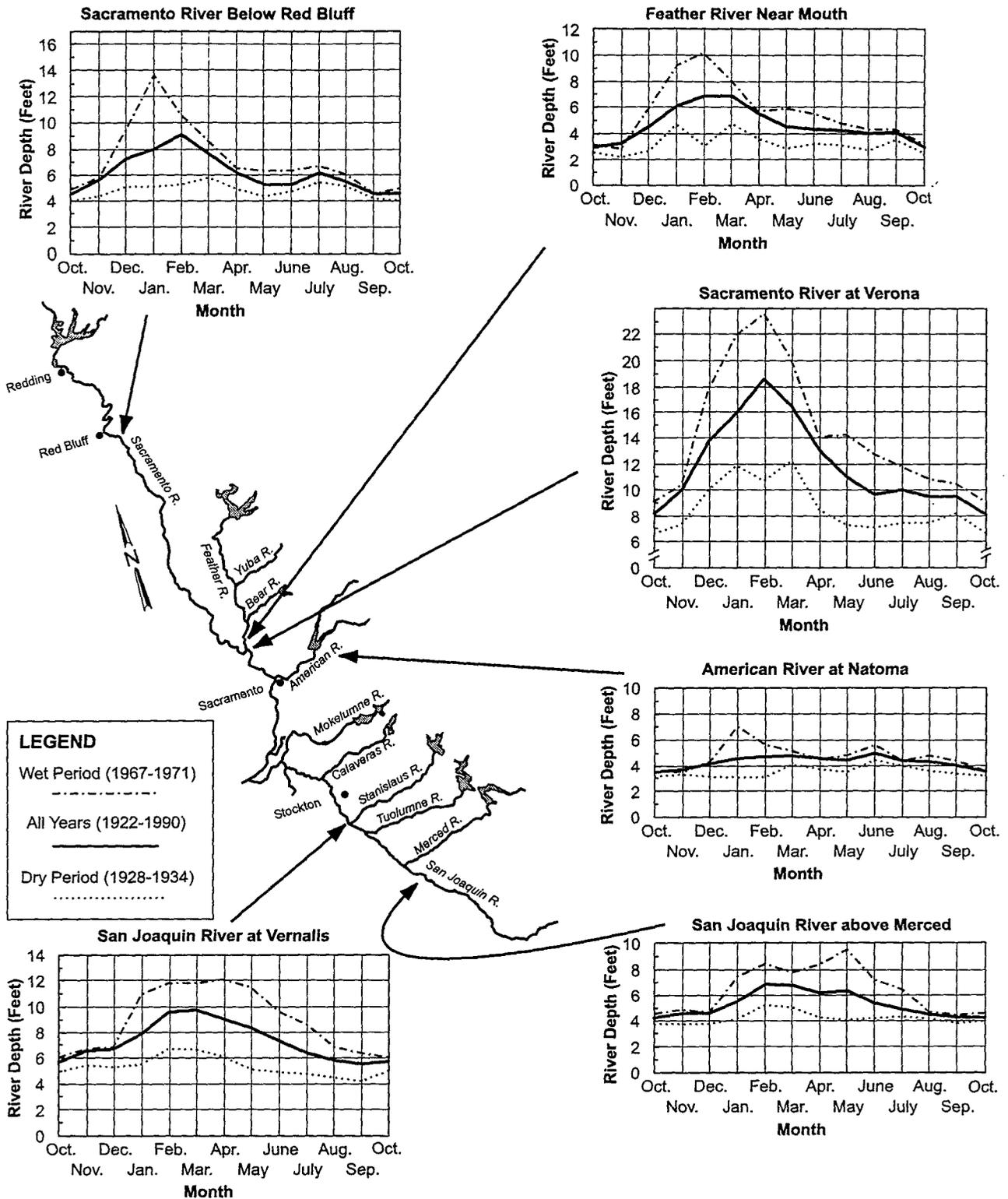


FIGURE III-1

RIVER STAGE VARIATIONS IN THE CENTRAL VALLEY:  
NO-ACTION ALTERNATIVE

therefore, the acreage of riparian communities under the No-Action Alternative would be similar to existing conditions.

**Special-Status Species.** Under the No-Action Alternative, riparian habitat in the Sacramento River Region is expected to increase on the Feather River and decrease on the American River compared with existing conditions. Two federal candidate species (California tiger salamander and mountain plover) and the valley elderberry longhorn beetle, which also occur in this region, would not be affected.

In the Delta Region, species that occur in riparian habitats include one federal candidate species and the federally listed valley elderberry longhorn beetle and a state-listed plant species (Mason's lilaopsis). No changes in hydrology are projected to occur in this region under the No-Action Alternative, and these species would not be affected.

In the San Joaquin River Region, species that occur in riparian habitats include two federal candidate (riparian brush rabbit and San Joaquin Valley woodrat) and the valley elderberry longhorn beetle. Effects on these species are not expected.

No federal candidate species occur in riparian habitats in the Tulare Lake Region.

### **Effects of Changes in Reservoir Drawdown Zones on Riparian Communities**

The drawdown zone of Folsom Lake supports willow scrub in the 400- to 470-foot elevation range (65 acres in 1995) (Reclamation, 1995). Under the No-Action Alternative, water levels are projected to vary from approximately 418 feet to 448 feet during March through August (lowest in March and August, highest in April). Water levels are projected to exceed 400 feet (low in the riparian zone) for more than three months in approximately 94 percent of years and 440 feet (high in the riparian zone) for more than three months in approximately 39 percent of years (Figure III-2). The extent of riparian vegetation is not expected to be reduced as a result of inundation-induced mortality, so minimal effects on common riparian plant species and wildlife species using riparian habitats would be expected.

## **WETLAND COMMUNITIES**

### **Effects of Changes in Hydrology on Wetland Communities**

**Common Species.** Wetland communities in the Sacramento River, Delta, and San Joaquin River regions are in areas generally associated with riparian habitats that have hydrologic conditions identical to those of riparian communities. Under the No-Action Alternative, acreages of wetland communities are expected to be approximately the same as under existing conditions. The distribution and abundance of common wetland plant species (e.g., tules, cattails, smartweed, and rushes) and common wildlife species using wetlands (e.g., egrets, American coots, muskrats, and beavers) are not expected to change.

Wetland communities in the Tulare Lake Region would not be directly affected by the CVP or SWP dam operations; therefore, the acreages of wetlands under the No-Action Alternative are expected to be similar to acreages under existing conditions.

Bar charts indicate the percent of years (1922-1990 simulation) in which water stands above each elevation for more than three months during the willow growing season (March-August) under each alternative.

Willows that are fully inundated at a given elevation for more than three months during the willow growing season are likely to drown.

Differences between the No-Action Alternative and the other alternatives appear to be too small to substantially affect the overall extent and condition of willow scrub habitat.

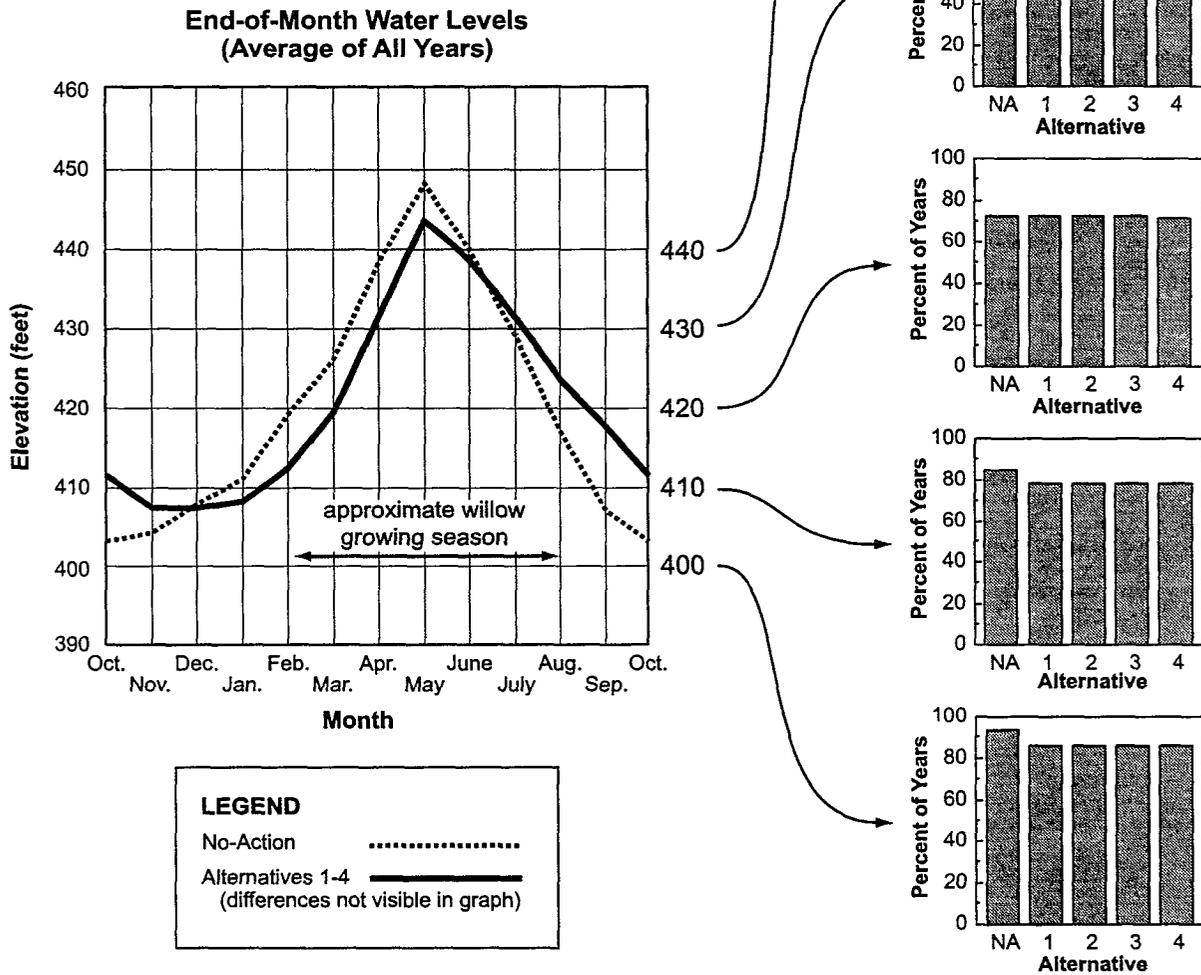


FIGURE III-2

VEGETATION INUNDATION ASSESSMENT: FOLSOM LAKE

**Special-Status Species.** Under the No-Action Alternative, populations of special-status plants and wildlife, including the giant garter snake, occurring in wetlands in the Sacramento River and San Joaquin River regions are not expected to change from existing conditions. Also, special-status plant and wildlife populations supported by wetland habitats in the Delta Region are not expected to change. These species include two federal candidate wildlife species (California tiger salamander and mountain plover) and three wildlife species that are listed as threatened or endangered (giant garter snake, black rail, and salt marsh harvest mouse).

Wetland habitats in the Tulare Lake Region support three federal candidate wildlife species (California tiger salamander, mountain plover, and Buena Vista Lake shrew) and special-status plants that are not expected to be affected by CVP operations.

### **Effects of Changes in Salinity on Wetland Communities**

Under the No-Action Alternative, salinity values on the southwestern end of the Delta at Chipps Island are projected to fall within an approximate annual range of 0.5 to 6 parts per thousand (ppt), which is the range for freshwater marsh habitat (Figure III-3). West of Chipps Island in the vicinity of Port Chicago, and farther west at Benicia, the salinity would range from 3 ppt to 13 ppt and from 5 ppt to 16 ppt, respectively (Figure III-3). At those two locations, brackish and salt marsh habitats are more prevalent.

The distribution and abundance of common freshwater marsh plants, including cattails and common tule, are not expected to change compared with existing conditions. Also, no change is expected in the abundance and distribution of common plants occurring in brackish marshes (e.g., Pacific alkali bulrush) or species occurring in salt marshes (e.g., saltgrass and pickleweed). The abundance of wildlife species that use these wetland habitats would remain unchanged by 2020.

## **RIVER AND RESERVOIR AQUATIC HABITATS**

### **Common Species**

The availability of fish as prey for belted kingfishers, river otter, and other wildlife associated with riverine habitats is not expected to change in any of the study regions.

Under the No-Action Alternative, Lake Oroville and Shasta, Folsom, and Whiskeytown lakes in the Sacramento River Region are projected to fill slowly with water between October and March (Figure III-4). In the San Joaquin River Region, little change is expected to occur in the surface areas of New Melones Reservoir and Millerton Lake between October and March. The surface area of San Luis Reservoir is projected to increase substantially during this same period (Figure III-5).

The amount of winter habitat available to waterbirds in reservoirs during wet and dry years is very similar to the amount available for the 69-year average, so only the amount of habitat available during the 69-year period of record was evaluated. The proportion of shallow water habitat (less than 1 foot deep) used by mallard, cinnamon teal, and other dabbling ducks to deep water habitat (from 1 to 15 feet deep) used by lesser scaup, ring-necked duck, and other diving

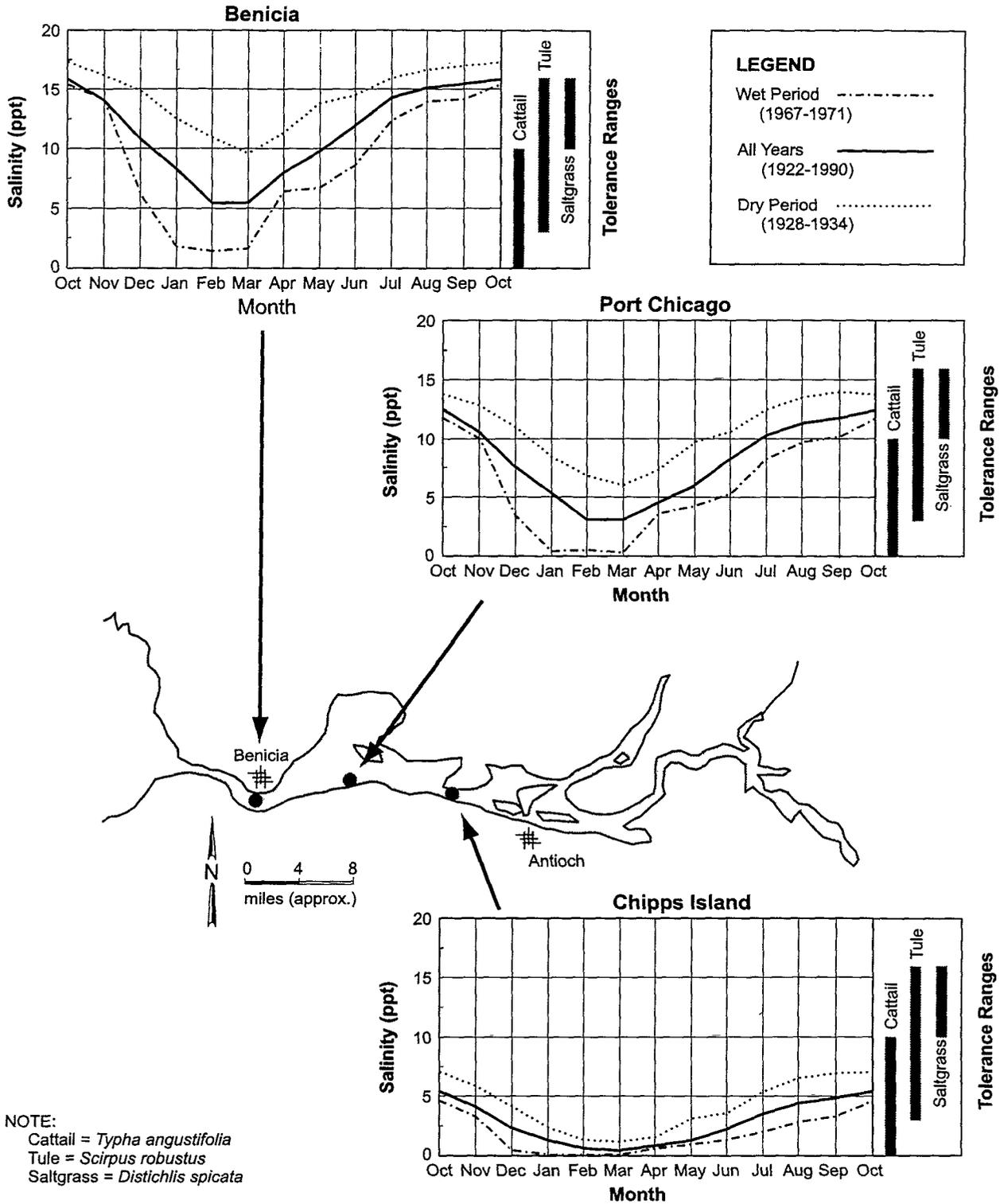
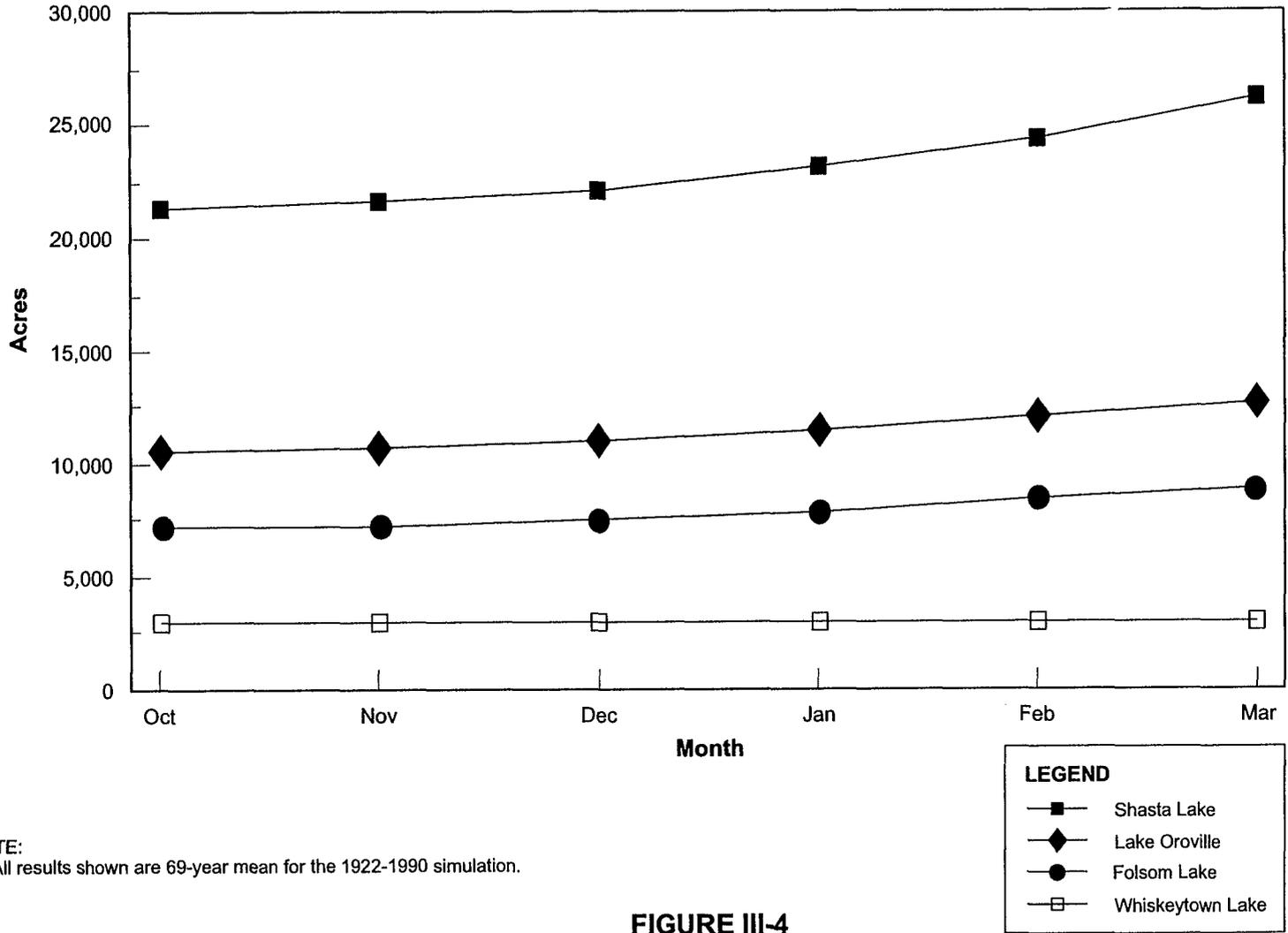


FIGURE III-3

SALINITY VARIATIONS IN THE WESTERN DELTA: NO-ACTION ALTERNATIVE



NOTE:  
All results shown are 69-year mean for the 1922-1990 simulation.

**FIGURE III-4**

**MEAN END-OF-MONTH SURFACE AREAS OF RESERVOIRS IN THE SACRAMENTO RIVER REGION FOR THE NO-ACTION ALTERNATIVE**

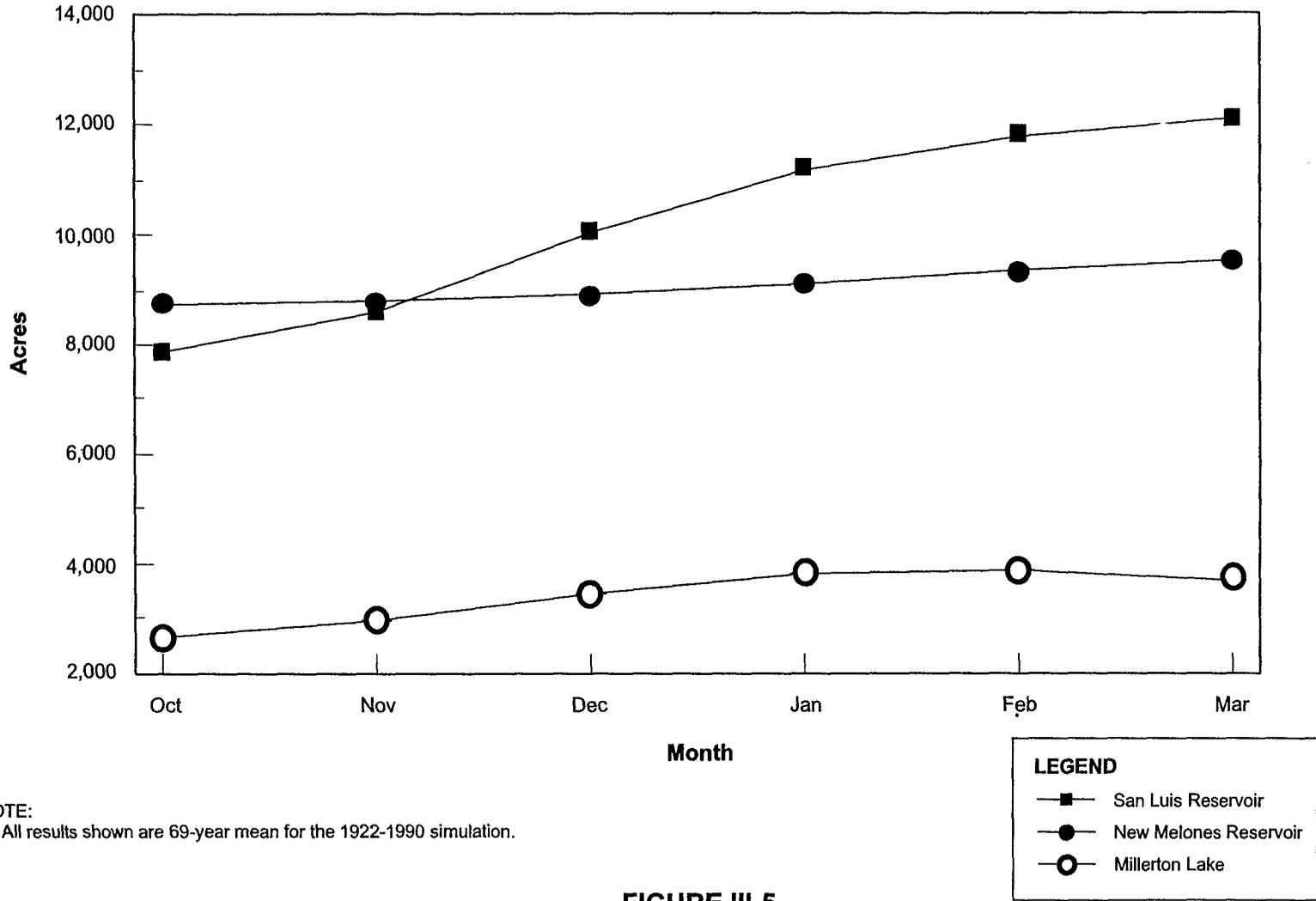


FIGURE III-5

MEAN END-OF-MONTH RESERVOIR SURFACE AREAS IN THE SAN JOAQUIN RIVER REGION UNDER THE NO-ACTION ALTERNATIVE

ducks and the proportion of shallow water habitat to open water habitat (more than 15 feet deep) used by gulls and western grebe are projected to be similar among all reservoirs (Figures III-6 and III-7). Shallow water provides the least habitat, while open water provides the most habitat. No changes are projected to occur in the smaller and shallower regulating reservoirs associated with each large reservoir that generally receives more use by waterbirds.

Under the No-Action Alternative, implementation of the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) is expected to provide more water and increase the availability of fish in the Delta Region. This would benefit belted kingfisher, river otter, and other wildlife that prey on fish.

### **Special-Status Species**

Riverine habitat quality is not expected to change for the Sacramento River and San Joaquin River regions; therefore, no effects on special-status species are expected. Reservoir habitat quality is also not expected to change; therefore, nesting or wintering bald eagles are not expected to be affected.

Implementation of the 1995 Water Quality Control Plan for the Bay-Delta would provide additional water and increase the availability of fish in the Delta Region; however, this is not expected to affect special-status species in this region. Salinity in the Delta is not projected to change; therefore, no impact on freshwater, brackish water, and salt marshes and the special-status species associated with these habitats is expected.

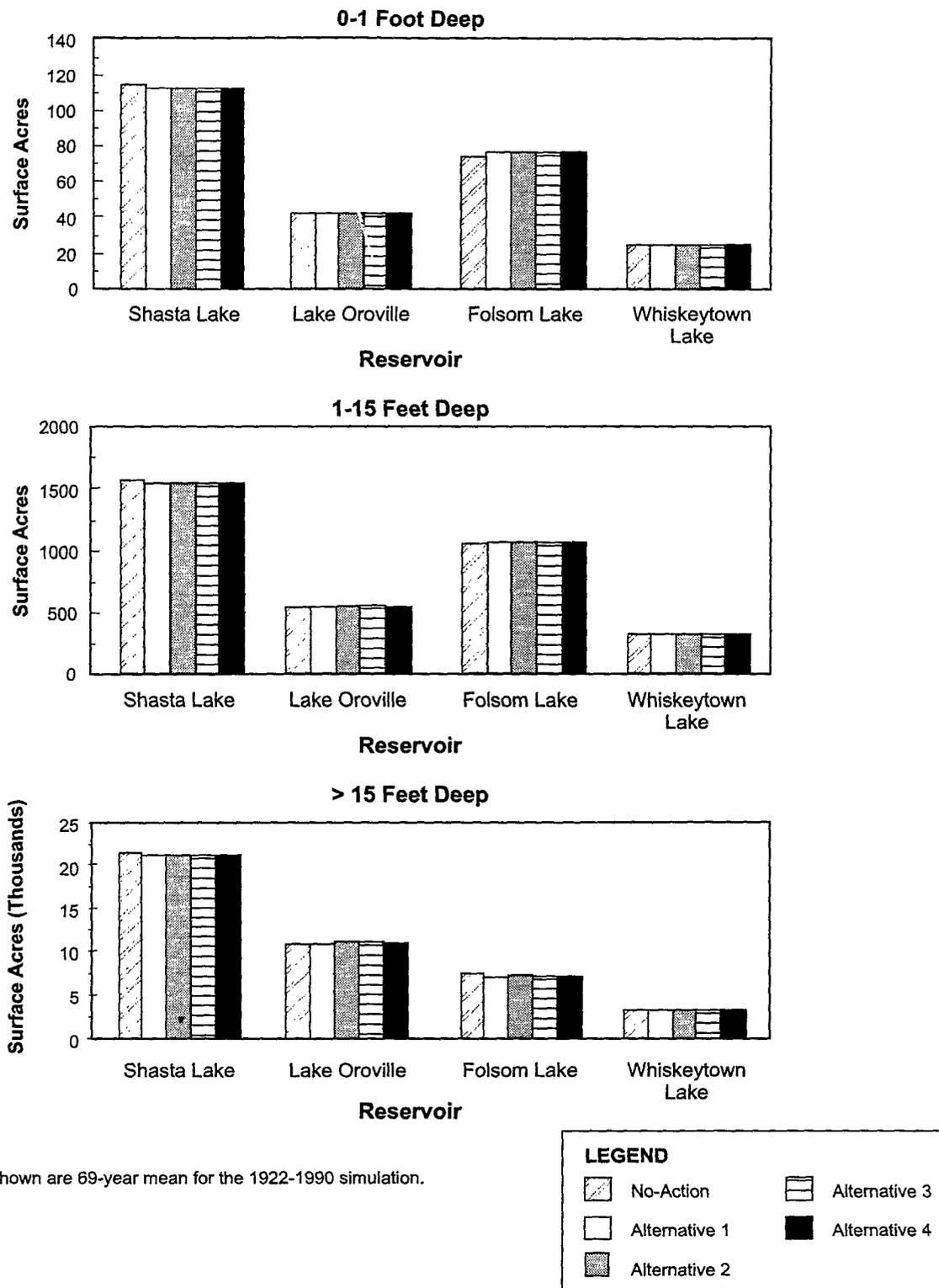
## **WATERFOWL AND SHOREBIRDS**

### **Refuges - Common Species**

Under the No-Action Alternative, water deliveries to the boundaries of refuges in the Sacramento River Region, including the Sacramento, Delevan, and Colusa NWRs, would total approximately 69,263 acre-feet of CVP water in normal and wet years (Table III-3). Approximately 58,900 acre-feet of non-CVP water would be delivered to Sutter NWR and Gray Lodge WMA. This level of water deliveries reflects the general conditions on the refuges prior to the implementation of the CVPIA in 1992. In 1992, approximately 2,450 acres of permanent ponds, 14,650 acres of seasonal marshes, and 1,900 acres of watergrass (millet) habitats were managed for migratory and breeding waterfowl and other wetland-dependent wildlife at refuges in the Sacramento River Region (Table III-4).

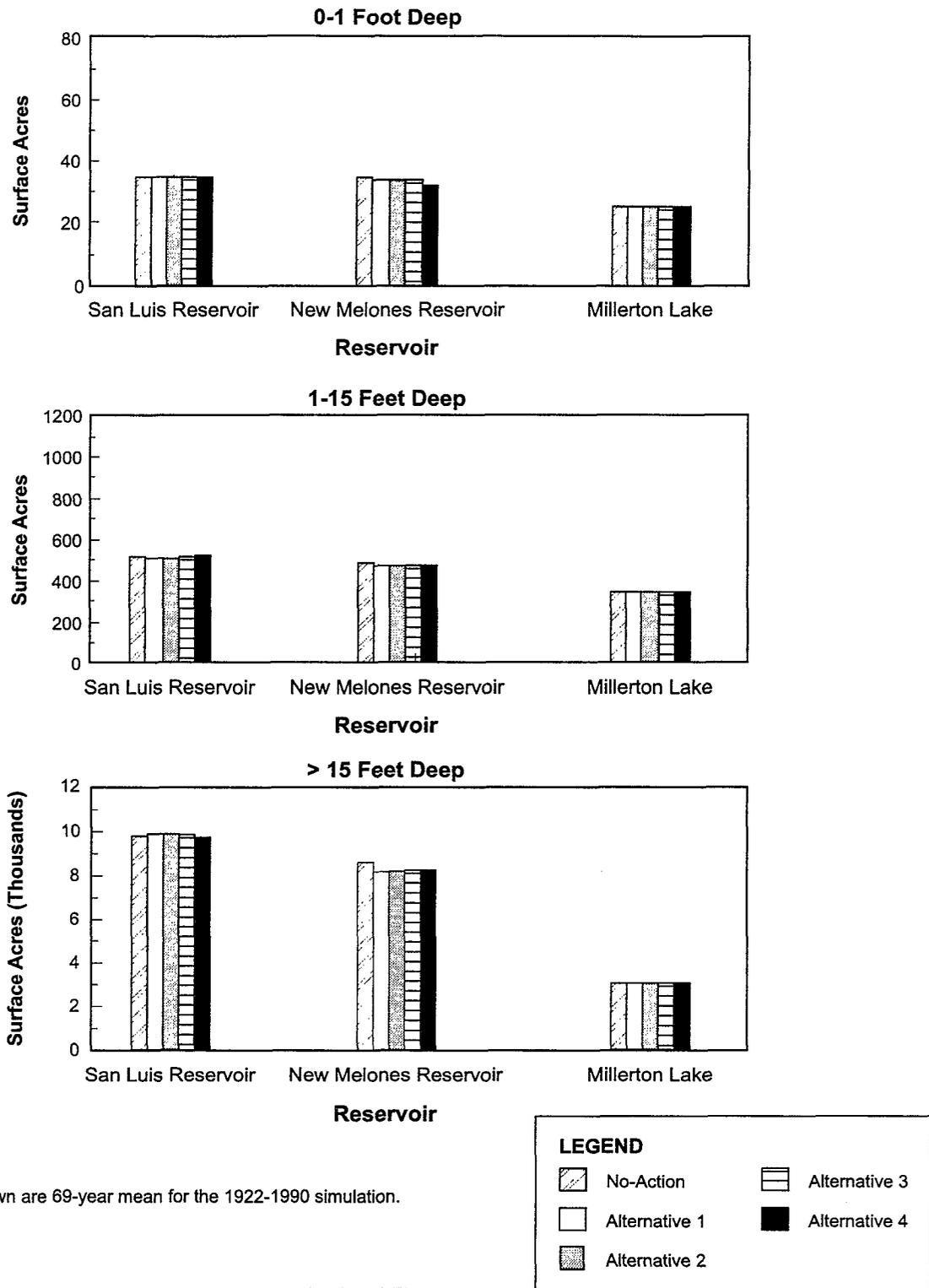
Water supplies available to refuges under the No-Action Alternative would limit the flexibility of refuge managers to use adaptive management techniques in adjusting the timing and locations of wetland habitats to maximize their benefits to wildlife (Forrest and Miller, pers. comms.).

Large numbers of ducks, geese, and other waterbirds would continue to use the refuges in the Sacramento River Region under the No-Action Alternative, but limited wetland acreages and short flooding cycles could reduce their use of refuge wetlands. The relative numbers of waterfowl and other waterbirds on the refuges, expressed in use-day indices (one use-day equals one bird present at a refuge for one day), reflect the potential use of Sacramento River Region



NOTE:  
All results shown are 69-year mean for the 1922-1990 simulation.

**FIGURE III-6**  
**MEAN SURFACE AREA OF WATERBIRD HABITAT**  
**AT RESERVOIRS IN THE SACRAMENTO RIVER REGION**  
**FOR WINTER MONTHS (OCTOBER-MARCH)**



NOTE:  
All results shown are 69-year mean for the 1922-1990 simulation.

**FIGURE III-7**  
**MEAN SURFACE AREA OF WATERBIRD HABITAT AT RESERVOIRS IN THE SAN JOAQUIN RIVER REGION FOR WINTER MONTHS (OCTOBER-MARCH)**

TABLE III-3

**WATER SUPPLIES DELIVERED TO THE BOUNDARIES OF CENTRAL VALLEY REFUGES UNDER THE ALTERNATIVES (ACRE-FEET)**

Region/Refuge	No-Action	Alternative 1 (Level 2)	Alternatives 2-5 (Level 4)
<b>Sacramento River</b>			
Sacramento NWR	34,800	46,400	50,000
Delevan NWR	15,713	20,951	30,000
Colusa NWR	18,750	25,000	25,000
Sutter NWR	23,500	23,500	30,000
Gray Lodge WMA	35,400	35,400	44,000
<b>Subtotal</b>	<b>128,163</b>	<b>151,251</b>	<b>179,000</b>
Change from No-Action Alternative		18%	40%
<b>San Joaquin River</b>			
San Luis NWR	19,000	19,000	19,000
Kesterson NWR	10,000	10,000	10,000
Merced NWR	15,000	15,000	16,000
Volta WMA	13,000	13,000	16,000
Los Banos WMA	16,670	16,670	25,496
<b>San Joaquin Basin Action Plan Lands</b>			
Freitas	5,290	5,290	5,290
West Gallo	10,810	10,810	10,810
Salt Slough	6,000	6,680	10,020
China Island	0	6,967	10,450
Grasslands RCD	47,800	125,000	180,000
East Gallo	0	8,863	13,295
<b>Subtotal</b>	<b>143,570</b>	<b>237,280</b>	<b>316,361</b>
Change from No-Action Alternative		65%	120%
<b>Tulare Lake</b>			
Mendota WMA	18,500	27,594	29,650
Kern NWR	9,950	9,950	25,000
Pixley NWR	0	1,280	6,000
<b>Subtotal</b>	<b>28,450</b>	<b>38,824</b>	<b>60,650</b>
Change from No-Action Alternative		36%	113%
<b>Total</b>	<b>300,183</b>	<b>427,355</b>	<b>556,011</b>
Change from No-Action Alternative		42%	85%
<b>LEGEND:</b>			
NWR = National Wildlife Refuge.			
RCD = Resource Conservation District.			
WMA = Wildlife Management Area.			

**TABLE III-4  
APPROXIMATE WETLAND ACREAGES AT CENTRAL VALLEY REFUGES IN THE  
STUDY AREA REGIONS UNDER THE ALTERNATIVES**

Region	No-Action (1)			Alternative 1 (Level 2)			Alternatives 2-5 (Level 4)		
	Permanent Ponds	Seasonal Marsh	Watergrass	Permanent Ponds	Seasonal Marsh	Watergrass	Permanent Ponds	Seasonal Marsh	Watergrass
Sacramento River	2,454	14,652	1,933	2,896	17,290	2,281	2,991	18,565	2,685
Change from No-Action Alternative				18%	18%	18%	22%	27%	39%
San Joaquin River (2)	2,040	35,821	2,152	3,366	59,105	3,550	6,240	57,683	7,700
Change from No-Action Alternative				65%	65%	65%	205%	61%	259%
Tulare Lake	--	3,582	--	--	4,872	--	--	11,976	4,024
Change from No-Action Alternative					36%			234%	
<b>Total</b>	<b>4,494</b>	<b>54,055</b>	<b>4,085</b>	<b>6,262</b>	<b>81,267</b>	<b>5,831</b>	<b>9,231</b>	<b>88,224</b>	<b>14,409</b>
Change from No-Action Alternative				39%	50%	43%	105%	63%	252%
NOTES:									
(1) Acreages under the No-Action Alternative were estimated from the Level 2 values of wetland acreages on the refuges (Reclamation, 1992) and the percent changes from the No-Action Alternative to Level 2 water supplies (Table III-3).									
(2) No data were available for wetland acreages at the San Joaquin Basin Action Plan lands or at the East Gallo property.									
LEGEND:									
-- = No data were available.									

refuge wetlands under the No-Action Alternative (Table III-5). Use-day indices for the No-Action Alternative were extrapolated from Level 2 estimates provided by Reclamation (1992). These values are included to provide an approximate basis for comparison with the other alternatives. Actual numbers of ducks and geese visiting the Sacramento River Region each year would vary with population trends in the Pacific Flyway and with the regional availability of suitable wetland habitats.

**TABLE III-5**

**APPROXIMATE USE-DAYS BY DUCKS, GEESE, AND OTHER WATERBIRDS  
IN THE STUDY AREA REGIONS UNDER THE ALTERNATIVES**

Region	No-Action Alternative (1)		Alternative 1 (Level 2)		Alternatives 2-4 (Level 4)	
	Ducks and Geese	Other Waterbirds	Ducks and Geese	Other Waterbirds	Ducks and Geese	Other Waterbirds
Sacramento River	157,986,440	6,186,440	186,424,000	7,300,000	213,780,000	8,115,000
Change from No-Action Alternative			18%	18%	35%	31%
San Joaquin River (2)	76,002,420	46,220,600	125,404,000	76,264,000	161,504,000	119,337,000
Change from No-Action Alternative			65%	65%	113%	158%
Tulare Lake	6,583,820	986,030	8,954,000	1,341,000	27,237,000	4,200,000
Change from No-Action Alternative			36%	36%	314%	326%
<b>Total</b>	<b>240,572,680</b>	<b>53,393,070</b>	<b>320,782,000</b>	<b>84,905,000</b>	<b>402,521,000</b>	<b>131,652,000</b>
Change from No- Action Alternative			33%	59%	67%	147%
NOTES:						
(1) Use-days under the No-Action Alternative were estimated from the Level 2 values of regional waterfowl use (Reclamation, 1992) and the percent changes from the No-Action Alternative to Level 2 water supplies (Table III-3).						
(2) No data were available for waterfowl use-days at the San Joaquin Basin Action Plan lands or at the East Gallo property.						

In dry winters, private wetland and flooded rice field acreages are reduced compared with acreages in normal and wet years. Under these conditions, managed refuge wetland habitats are especially important to waterfowl. Limited wetland resting areas and inadequate food supplies could result in migratory waterfowl departing from the Sacramento River Region with inadequate

energy reserves to fuel their long-distance migrations and subsequent reproductive activities. For example, Miller (1986) attributed the body weight losses and reduced fat reserves of northern pintails he observed to reduced availability of wetland habitats and rice field foraging areas in the Central Valley during a dry winter. He also suggested that such weight losses could adversely affect or delay the reproduction of this species in its northern breeding grounds.

Water supplies for refuges in the Sacramento River Region under the No-Action Alternative could limit late-season wetland acreages and nesting opportunities for ducks, shorebirds, and wading birds that nest in the Central Valley. Lack of suitable late-season water supplies also could increase stagnation of waters in permanent ponds and seasonal marshes, and could increase the potential for outbreaks of waterfowl diseases such as botulism and avian cholera (Miller, pers. comm.). Similarly, the limited summer and early fall water available to refuges under the

No-Action Alternative would not permit refuge managers to adapt their water use to prevent or eliminate waterfowl disease outbreaks in wetland habitats.

Under the No-Action Alternative, the deliveries to Delta Region refuges would be the same as described for existing conditions.

Under the No-Action Alternative, refuges in the San Joaquin River Region and private wetlands would receive approximately 143,570 acre-feet of CVP water in normal and wet years (Table III-3). Federal refuges in the San Joaquin River Region, including San Luis, Kesterson, and Merced NWRs, have been managed at optimal water levels for many years (Zahm, pers. comm.). Similarly, two federally managed San Joaquin Basin Action Plan (BAP) lands (i.e., Freitas and West Gallo [Reclamation, 1995]) would receive optimal water deliveries for wetland management under the No-Action Alternative (Table III-3).

In contrast, state refuges, including Volta WMA, Los Banos WMA, two state-managed BAP lands (Salt Slough and China Island [Reclamation, 1995]), GRCD lands, and the East Gallo property would not receive adequate water supplies for optimal wetland management under the No-Action Alternative (Table III-3). GRCD lands were included with refuge lands in this analysis because they are adjacent to each other and are managed as a large, contiguous wetland complex (Zahm, pers. comm.).

Under the No-Action Alternative, wetlands available for breeding and migratory waterfowl on refuges in the San Joaquin River Region (excluding the BAP lands and the East Gallo property) and the GRCD lands could include an estimated 2,000 acres of permanent ponds, 36,000 acres of seasonal marshes, and 2,000 acres dedicated to growing waterfowl food plants such as watergrass and smartweed (Table III-4). The water supplies available to state refuges, the East Gallo property, and the GRCD under the No-Action Alternative (Table III-3) would limit the flexibility of refuge managers to use adaptive management techniques to adjust the timing and locations of wetland habitats to maximize their benefits to wildlife (Miller and Zahm, pers. comms.).

Large numbers of ducks, geese, and other waterbirds would continue to use refuges in the San Joaquin River Region under the No-Action Alternative, but limited wetland acreages and short flooding cycles could limit the potential waterfowl use of refuge wetlands. Use-day indices indicate that refuges in the San Joaquin River Region would support about half as many

waterfowl but more than seven times as many shorebirds, wading birds, and other waterbirds as refuges in the Sacramento River Region under the No-Action Alternative (Table III-5). The actual number of water-dependent species using all these refuges and private wetlands each year would vary with population trends in the Pacific Flyway and with regional availability of suitable wetland habitats in the San Joaquin River Region.

Under the No-Action Alternative, refuges in the Tulare Lake Region (including Mendota WMA, Kern NWR, and Pixley NWR) would receive approximately 28,450 acre-feet of CVP water in normal and wet years (Table III-3). Water supplies available to these refuges under the No-Action Alternative would limit the flexibility of refuge managers to use adaptive management techniques to adjust the timing and locations of wetland habitats to maximize their benefits to wildlife (Miller, pers. comm.). With supplies available under the No-Action Alternative, approximately 3,600 acres of seasonal wetlands could be managed at Mendota WMA and at Kern NWR; no permanent ponds or seasonal wetlands would be managed at Pixley NWR under this alternative.

The number of ducks, geese, and other waterbirds using seasonal marshes at refuges in the Tulare Lake Region probably would represent less than 10 percent of the birds using refuges in the San Joaquin River Region or Sacramento River Region under the No-Action Alternative (Table III-5). Limited wetland acreages and short flooding cycles could limit waterbird use of refuge wetlands. The actual number of water-dependent species using refuges in the Tulare Lake Region each year would vary with population trends in the Pacific Flyway and the regional availability of suitable wetland habitats.

### **Field Flooding - Common Species**

Under the No-Action Alternative, the incentives identified in the CVPIA for fall flooding of agricultural fields in the Central Valley to aid wintering waterfowl would not be available. Lack of these potential wetland habitats would continue the reliance of migratory waterfowl on refuge wetlands and the GRCD.

### **Special-Status Species**

Under the No-Action Alternative, special-status species would not be affected at federal or state refuges in the Sacramento River, Delta, San Joaquin River, and Tulare Lake regions because water deliveries would not change, and no additional field flooding would occur.

### **Duck Clubs and Other Private Lands**

Duck clubs and other private wetlands in the Sacramento River Region receive their water supplies from a variety of sources, including pumped groundwater, and through direct purchases of CVP and non-CVP water from local water districts and agencies. Aside from duck clubs and other managed wetlands in the GRCD area of the San Joaquin River Region, the PEIS alternatives do not consider water deliveries to privately managed wetlands in the Central Valley. Therefore, duck clubs and other private wetlands in the Sacramento River Region should continue to receive their historical water deliveries in dry, normal, and wet years under the No-Action Alternative.

Under the No-Action Alternative, the deliveries to duck clubs and other private wetlands in the Delta Region would be the same as described for existing conditions.

Duck clubs and other privately managed wetlands in the GRCD are discussed earlier under "Refuges - Common Species." The CVPIA does not mention water deliveries to privately managed wetlands other than the GRCD in the San Joaquin River Region. Therefore, duck clubs and other private wetlands in the region should continue to receive their historical water deliveries in dry, normal, and wet years under the No-Action Alternative.

Duck clubs and other private wetlands in the Tulare Lake Region should continue to receive their historical water deliveries in dry, normal, and wet years under the No-Action Alternative.

### Evaporation Ponds

The area of evaporation ponds in the San Joaquin River and Tulare Lake regions is projected to remain at current levels under the No-Action Alternative even with the retirement of some farmland. Effects on waterfowl and shorebirds would continue to occur. The magnitude of the effects would depend on the design of individual evaporation ponds and the availability of alternative wetlands that would provide suitable waterfowl and shorebird habitat.

## SAN FRANCISCO BAY AREA AND CENTRAL COAST REGIONS

Water deliveries to the San Francisco Bay Area and Central Coast regions would continue. No data are available at this time to determine potential changes in land uses.

### ALTERNATIVE 1

Table III-6 summarizes the changes in acreages of important habitats in the Central Valley under Alternative 1.

## NATURAL AND AGRICULTURAL COMMUNITIES

### Natural Terrestrial and Agricultural Habitats

**Common Species.** Under Alternative 1, it was assumed that no new agricultural lands would be put into production, so no impacts on natural and terrestrial habitats would occur as a result of this mechanism. Similarly, no additional urban development would occur under Alternative 1 compared with the No-Action Alternative, so no impacts on vegetation and wildlife would result from urban development.

Cropping patterns in the Sacramento River Region would change slightly compared with cropping patterns under the No-Action Alternative (Figure III-8), resulting in the reduction of 1,600 acres planted in pasture, grain, and rice. No increase in the amount of cotton grown in the Sacramento River Region compared with the amount grown under the No-Action Alternative was assumed. This amount of habitat change is too small (0.1 percent) to substantially affect the distribution or number of common wildlife in the Sacramento River Region.

**TABLE III-6**  
**CHANGES IN ACREAGES OF HABITAT TYPES**  
**UNDER ALTERNATIVE 1**

Habitat Type	Sacramento River Region (acres x 1,000)	Sacramento- San Joaquin Delta Region (acres x 1,000)	San Joaquin River Region (acres x 1,000)	Tulare Lake Region (acres x 1,000)
Rice	-1.0	0.0	0.0	+0.9
Pasture and grains	-1.0	-1.0	-8.0	-7.0
Potential habitat from land fallowing	+1.6	0.0	+10.0	+6.4
Potential habitat from retirement of drainage lands	0.0	0.0	+14.4	+15.6
Wetlands on refuges	+3.5	0.0	+26.0	+1.2
Field flooding	+54.0	13.0	13.0	0.0
<b>NOTE:</b> The values shown represent the differences between acreages under the No-Action Alternative and under Alternative 1 (e.g., -1 represents a loss of 1,000 acres under Alternative 1 compared with the acreage under the No-Action Alternative).				

Cropping patterns would not change in the Delta Region compared with cropping patterns under the No-Action Alternative (Figure III-9). There would be a reduction in the number of acres of pasture, row crops, grain, and cotton in the San Joaquin River and Tulare Lake regions compared with acreages under the No-Action Alternative (Figures III-10 and III-11). These changes would result from the fallowing of land for water acquisition. This amount of change is too small to substantially affect the distribution or number of common wildlife in these regions.

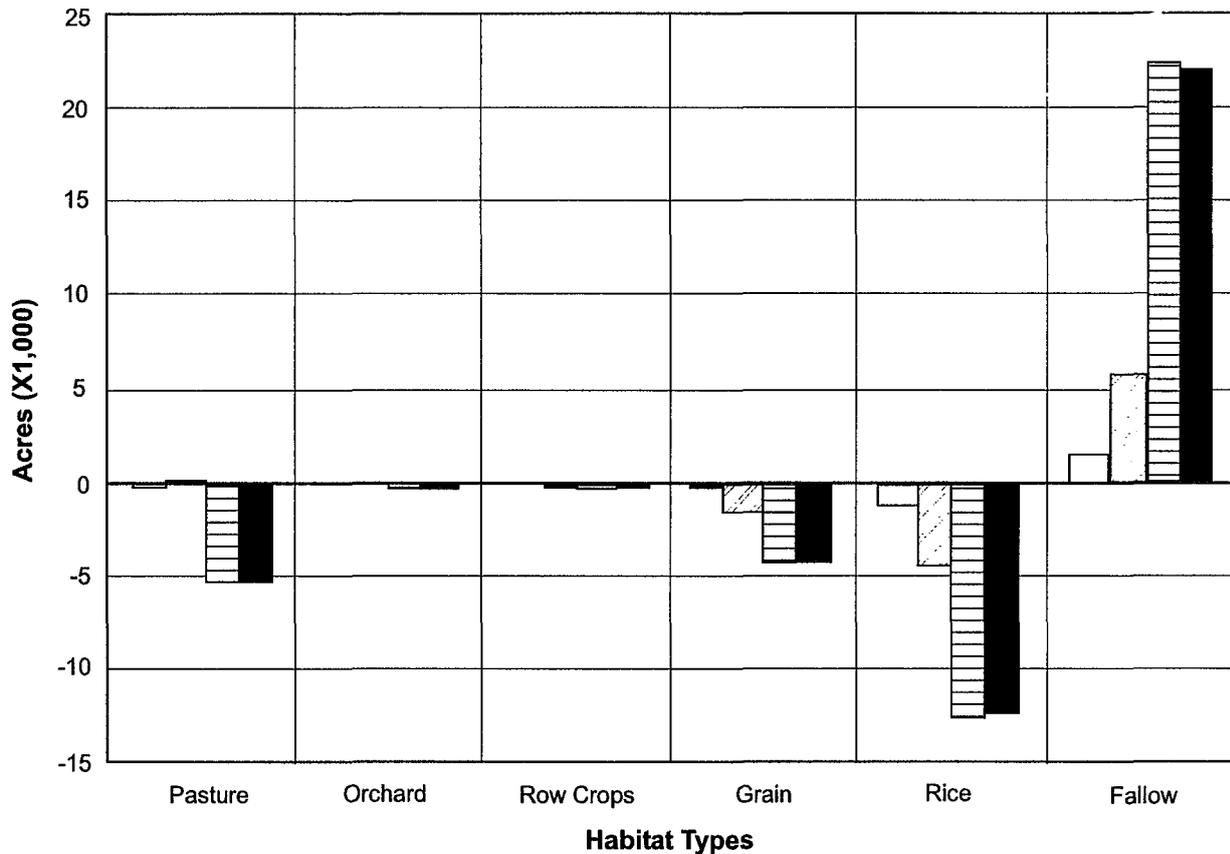
**Special-Status Species.** Changes in cropping patterns would have little effect on special-status species because the amount of agricultural land affected would be small compared with the extent of the available habitat and the amount of land that would be fallowed. The effects of fallowing are described below.

Implementation of the b(1) "other" program would benefit special-status species.

The following types of activities will be emphasized under the b(1) "other" Program:

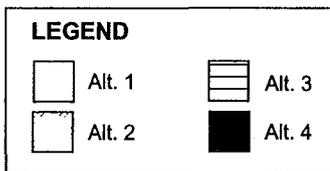
- implement habitat restoration, maintenance, enhancement, and protection in partnership with willing landowners of agricultural and municipal areas;
- coordinate and participate with ongoing state and federal habitat restoration activities such as CALFED, Department of Fish and Game operations, and other CVPIA provisions;

### Sacramento River Region



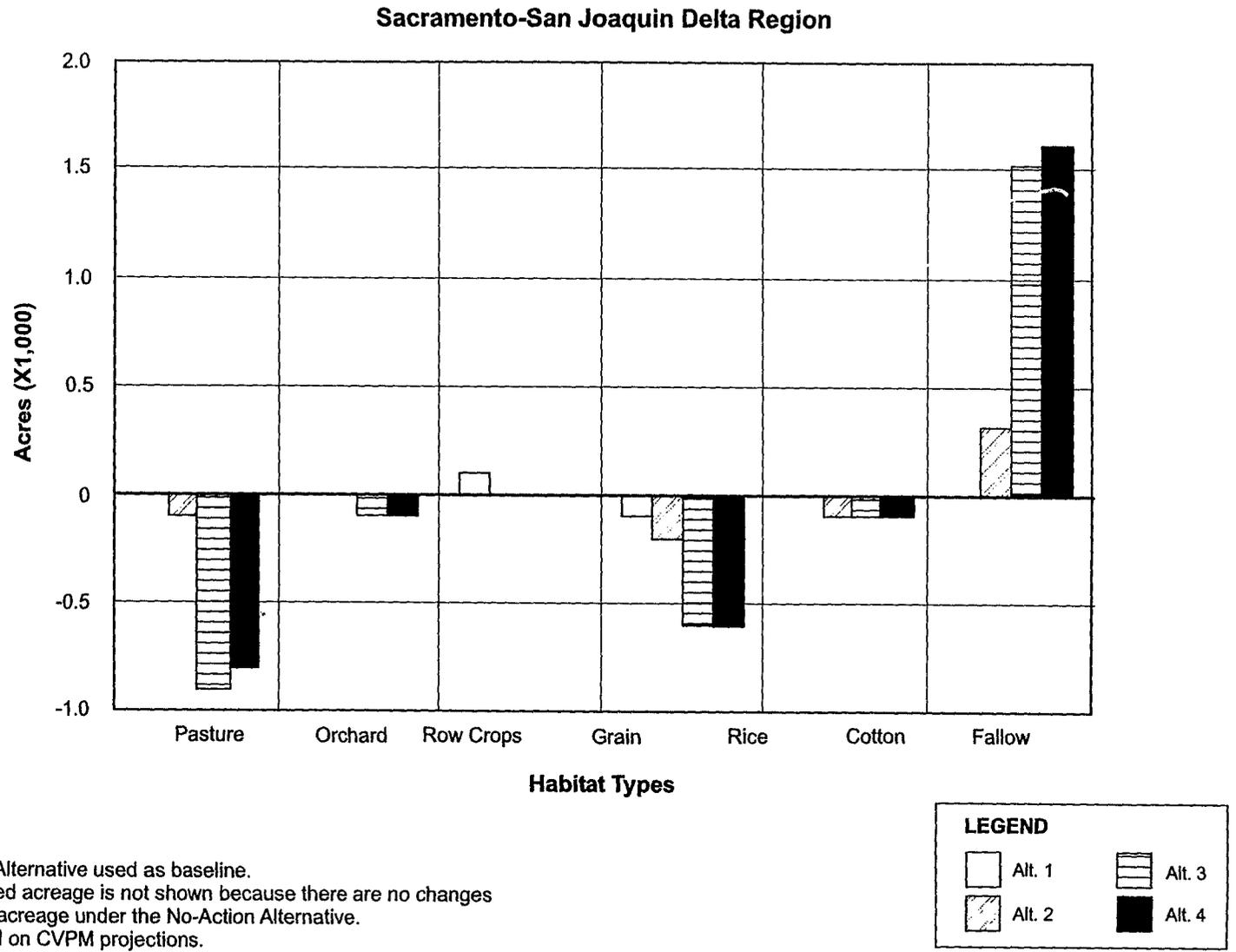
**NOTES:**

No-Action Alternative used as baseline.  
 Non-irrigated acreage is not shown because there are no changes from the acreage under the No-Action Alternative.  
 Cotton was not included in the modeling because data were unavailable.  
 Data based on CVPM projections.



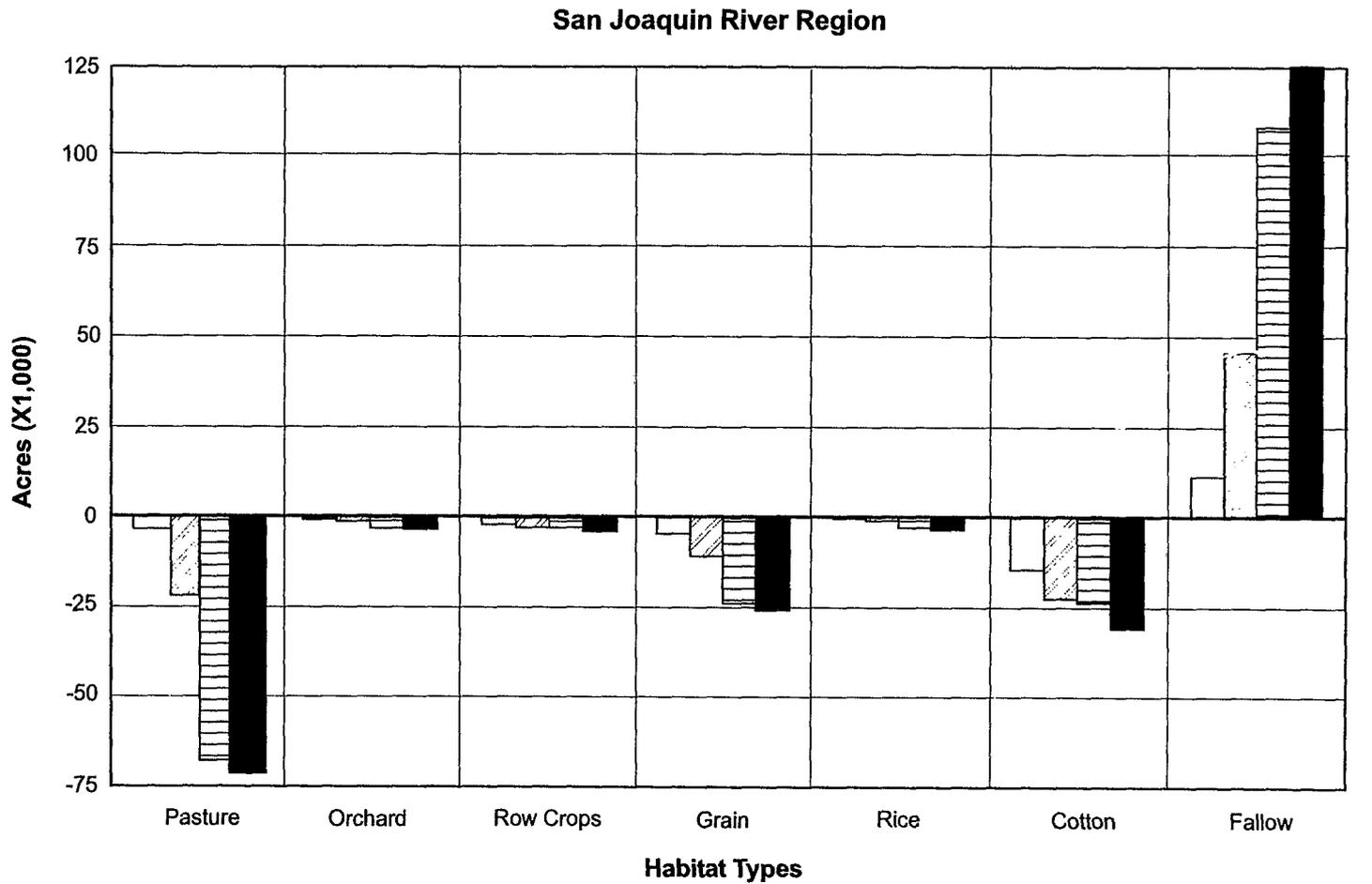
**FIGURE III-8**

**CHANGES IN MEAN AREA OF NATURAL TERRESTRIAL AND AGRICULTURAL HABITAT TYPES IN THE SACRAMENTO RIVER REGION UNDER EACH ALTERNATIVE**



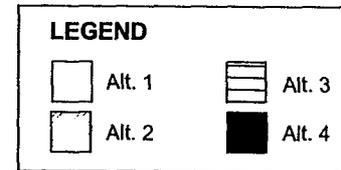
**NOTES:**  
 No-Action Alternative used as baseline.  
 Non-irrigated acreage is not shown because there are no changes from the acreage under the No-Action Alternative.  
 Data based on CVPM projections.

**FIGURE III-9**  
**CHANGES IN MEAN AREA OF NATURAL TERRESTRIAL AND AGRICULTURAL HABITAT TYPES IN THE SACRAMENTO-SAN JOAQUIN DELTA REGION**



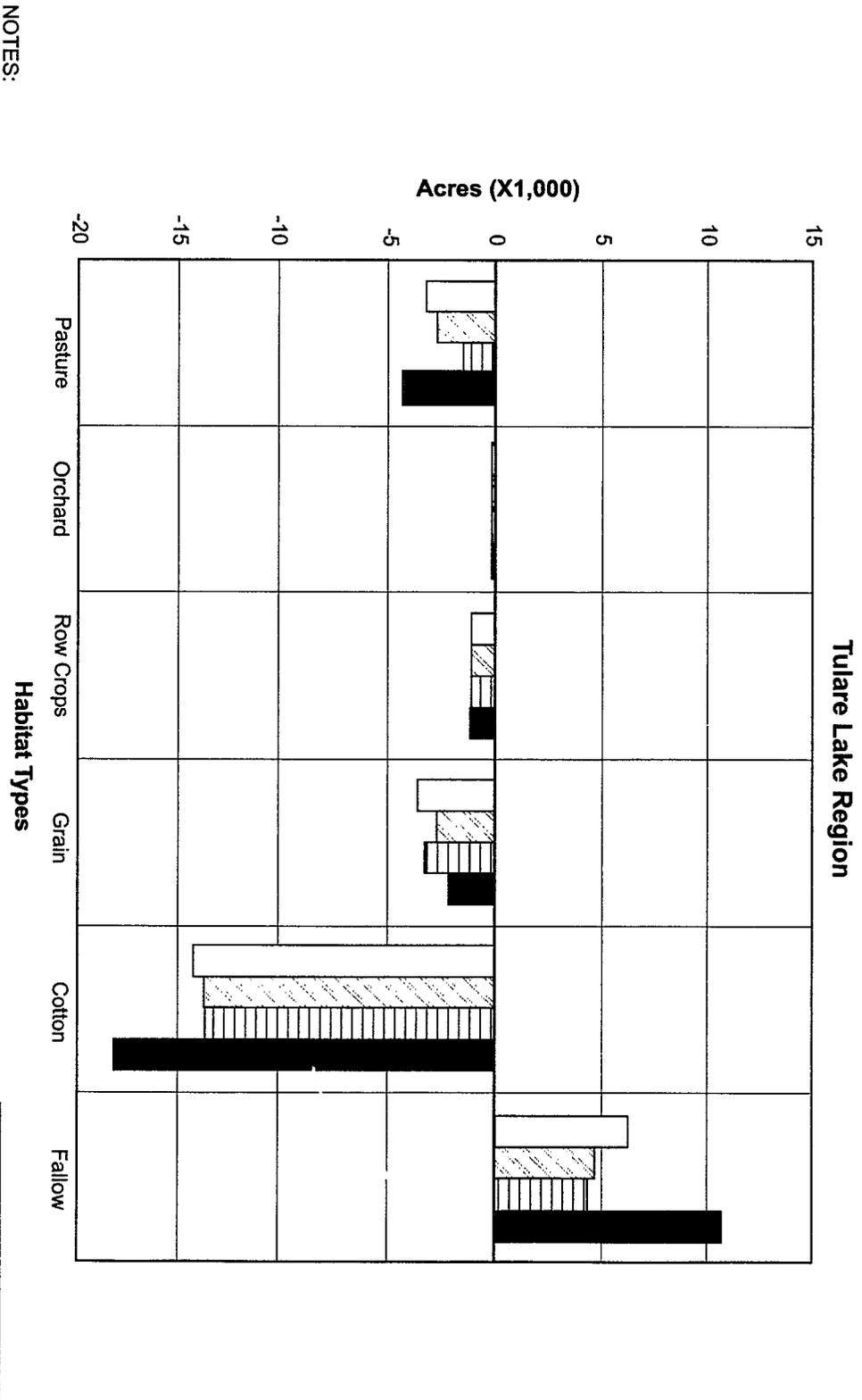
**NOTES:**

No-Action Alternative used as baseline.  
 Non-irrigated acreage is not shown because there are no changes from the acreage under the No-Action Alternative.  
 Data based on CVPM projections.



**FIGURE III-10**

**CHANGES IN MEAN AREA OF NATURAL TERRESTRIAL AND AGRICULTURAL HABITAT TYPES IN THE SAN JOAQUIN RIVER REGION**



**FIGURE III-11**  
**CHANGES IN MEAN AREA OF NATURAL TERRESTRIAL AND AGRICULTURAL HABITAT TYPES IN THE TULARE LAKE REGION**

- partnership with other agencies and the public including watershed conservancies, conservation groups, water districts, non-profit entities, and private landowners to assure the greatest overall program benefit; and
- studies will be performed where appropriate; however, they will generally receive a lower priority than implementation actions unless the study is a necessary precursor to an implementation action.

Initial focus would be given to funding the following types of projects (specific actions listed in Attachment K):

- acquiring areas of existing habitat through purchase, lease, or easements for special-status species impacted by the CVP;
- maintaining, restoring, and enhancing priority habitats and habitat for priority species; and
- performing studies necessary to determine appropriate species and habitat-specific actions.

Priority habitats are those known or believed to have experienced the greatest percentage decline in quantity and quality since construction of the CVP that can be attributed to the CVP (based upon direct and indirect loss of habitat from CVP facilities and expansion of irrigation water use). Priority species include federally listed, proposed, or candidate species; other non-listed state and federal species of special concern, including resident fish and migratory birds; and other native wildlife species associated with habitats that have declined in quantity and quality as a result of the CVP.

As implementation proceeds, the emphasis of the program would focus more on ecosystem-level actions, regardless of federal or state listing programs for special-status species.

These activities, singly and in combination with each other, should assist in the maintenance and/or restoration of ecological functions and biodiversity within the service area. It is expected that the program would have a net positive effect on habitats of interest that have been adversely affected by the CVP and would provide increases in fish and wildlife populations dependent on these habitats.

Specific actions that are expected to benefit species would include expansion of available habitat through acquisition of land, either directly or through easements; management of habitat to meet species critical life requisites; creation of travel corridors to allow movement between and among habitat parcels; restoration of habitat to provide missing structural or functional components required by various species or populations, and conducting studies to determine species critical needs, minimum viable population, and other related habitat needs.

The following types of actions are expected to have the following effects:

- The acquisition of land areas would potentially protect or limit impacts to habitat of special-status and other native species from agriculture, municipal, or industrial development, including the future potential conversion of native habitats. For example, acquisition of

riparian and wetland habitat in the east Sacramento River and east San Joaquin River regions will benefit the giant garter snake, neotropical migrants, migratory waterfowl, and valley elderberry longhorn beetle. Acquisition of alkali sink habitat in Alameda County will benefit the intact hydrology of the area and the endangered palmate-bracted bird's-beak.

- Restoration activities would potentially provide additional habitat for special-status and other native species by improving the quality and quantity of existing and acquired habitat areas. Establishing a control burn program in San Joaquin County grasslands will help restore the native perennial bunch grass community and assist in the recovery of the endangered large-flowered fiddleneck.
- Studies to evaluate species and habitats would not adversely impact natural resources in the study area. Study results would potentially provide valuable information for adaptive management of the program and designing and implementation of future management actions, including acquisition or restoration which may benefit special-status and native species and their habitats they depend on.

### Potential Habitat Resulting from Land Fallowing

**Common Species.** Under Alternative 1, approximately 1,600 acres of agricultural land in the Sacramento River Region, 10,000 acres in the San Joaquin River Region, and 6,400 acres in the Tulare Lake Region would be fallowed. For this analysis, it was assumed that these fallowed lands would be in small, isolated parcels distributed throughout each region. These parcels would be planted with any annual grass cover crop to reduce erosion and air quality effects and would be invaded by a wide variety of ruderal species, including bindweed, ripgut brome, Mediterranean barley, amaranth, yellow star-thistle, and Russian thistle. Areas previously planted with cotton in the San Joaquin River and Tulare Lake regions would be revegetated more slowly than other former crop areas because of residual levels of herbicides in the soil. These scattered, small patches of ruderal vegetation would provide habitat for common wildlife, such as the house mouse, deer mouse, savannah sparrow, and western fence lizard.

**Special-Status Species.** Fallowed land would not provide high-quality habitat for special-status plant species. Where special-status plant species occur near fallowed land they could colonize the parcels; however, population densities would be low because special-status plant species do not compete well with the types of grasses used as cover crops or with the types of grasses used as cover crops or with ruderal species. The scattered, isolated patches of ruderal vegetation could provide low-quality habitat for Swainson's hawk in the Sacramento and San Joaquin River regions and habitat for San Joaquin kit fox, San Joaquin antelope squirrel, giant kangaroo rat, and blunt-nosed leopard lizard in the San Joaquin River and Tulare Lake regions.

### Potential Habitat Resulting from Retirement of Drainage Lands

**Common Species.** Under Alternative 1, 14,400 acres of irrigated agricultural land in the San Joaquin River Region would be retired. About 15,600 acres of irrigated land would be retired in the Tulare Lake Region.

The retired land would be reseeded with grasses to prevent soil erosion. These reseeded annual grasslands would provide potential habitat for common wildlife, such as savannah sparrow, red-tailed hawk, California vole, deer mouse, western fence lizard, and western toad.

**Special-Status Species.** Under Alternative 1, retired land in the San Joaquin River Region could provide potential habitat for the Swainson's hawk, Aleutian Canada goose, blunt-nosed leopard lizard, giant kangaroo rat, Fresno kangaroo rat, San Joaquin antelope squirrel, and San Joaquin kit fox. In the Tulare Lake Region, the land would provide potential habitat for the blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, San Joaquin antelope squirrel, and San Joaquin kit fox. The additional habitat could benefit special-status wildlife species.

### **Pesticide Use**

**Common Species.** Under Alternative 1, the fallowing and retirement of agricultural land would reduce the use of herbicides and insecticides, providing a minor benefit to common wildlife. The use of rodenticides would not change compared with use under the No-Action Alternative because there would be no change in the acreage cultivated as orchards, so the effects on rodents and their predators would remain the same.

**Special-Status Species.** The small reduction in annual use of herbicides and insecticides could provide a small benefit to the valley elderberry longhorn beetle.

The potential adverse effects of rodenticides on giant kangaroo rat, Fresno kangaroo rat, Tipton kangaroo rat, San Joaquin antelope squirrel, Swainson's hawk, San Joaquin kit fox, and blunt-nosed leopard lizard would be similar to those described for the No-Action Alternative. The b(1) "other" program will benefit the status of these species and reduce adverse effects.

### **b(1) "Other" Program**

Under Alternative 1, the b(1) "other" program will benefit species not specifically identified in the Act. Initially, the program will emphasize special-status species; however, as implementation proceeds, the emphasis of the program will focus more on ecosystem-level actions. The acquisition of land, development rights, and conservation easements may be used to protect important habitat occupied by special-status species; habitat restoration may be used to increase the amount or quality of habitat required by special-status species; and studies may be conducted to assist with developing or adapting ecosystem-level management plans.

Examples of beneficial impacts on vegetation and wildlife resources include acquisition of a gabbro soil preserve in the Sacramento Region to protect special-status plants or acquisition and restoration of riparian habitat for yellow-billed cuckoo and valley elderberry longhorn beetle. Additional examples of actions under the b(1) "other" program are described in Attachment K.

## RIPARIAN COMMUNITIES

### Effects of Changes in Hydrology on Riparian Communities

**Common Species.** Under Alternative 1, stages on the Sacramento River below Red Bluff and at Verona, and on the Feather River and lower American River would be slightly below those under the No-Action Alternative (Figure III-12). These small differences in hydrology would have only a minor effect on the extent or condition of riparian communities.

Mean monthly flows and river stages in the Delta Region would show only small differences from stages under the No-Action Alternative. San Joaquin River stages at Merced and Vernalis would be similar to the stages under the No-Action Alternative (Figure III-12). The effects of these differences in hydrology on the extent and condition of riparian communities would be minor.

Under Alternative 1, the extent and condition of riparian communities in the Tulare Lake Region would not differ from those under the No-Action Alternative.

**Special-Status Species.** Alternative 1 changes in river flows would have little effect on riparian habitat and would not adversely affect habitat used by special-status species, including valley elderberry longhorn beetle, giant garter snake, or bank swallow.

### Effects of Restoration on Riparian Communities

**Common Species.** Under Alternative 1, the restoration of a meander belt along the 57 river miles of the upper Sacramento River between Keswick and Chico Landing would have a beneficial effect on the extent, diversity, and density of riparian habitat in this area.

Common riparian plants that would benefit include black and red willows, Fremont cottonwood, California grape, blue elderberry, Oregon ash, and western sycamore. Common wildlife, including the deer mouse, gopher snake, black phoebe, and orange-crowned warbler, would benefit also.

Restoration of riparian habitat along Clear, Cow, Cottonwood, Mill, Deer, and Big Chico creeks and the Yuba, lower American, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin rivers would have locally beneficial effects on the extent and condition of riparian habitat. Common riparian plant species, including willows, Fremont cottonwood, and Oregon ash, would benefit, as would common wildlife species, including the deer mouse, gopher snake, black phoebe, and orange-crowned warbler. The magnitude of the beneficial impact would depend on the restoration actions taken.

**Special-Status Species.** Under Alternative 1, restoration of riparian habitat could benefit the San Joaquin Valley woodrat, riparian brush rabbit, western yellow-billed cuckoo, and valley elderberry longhorn beetle.

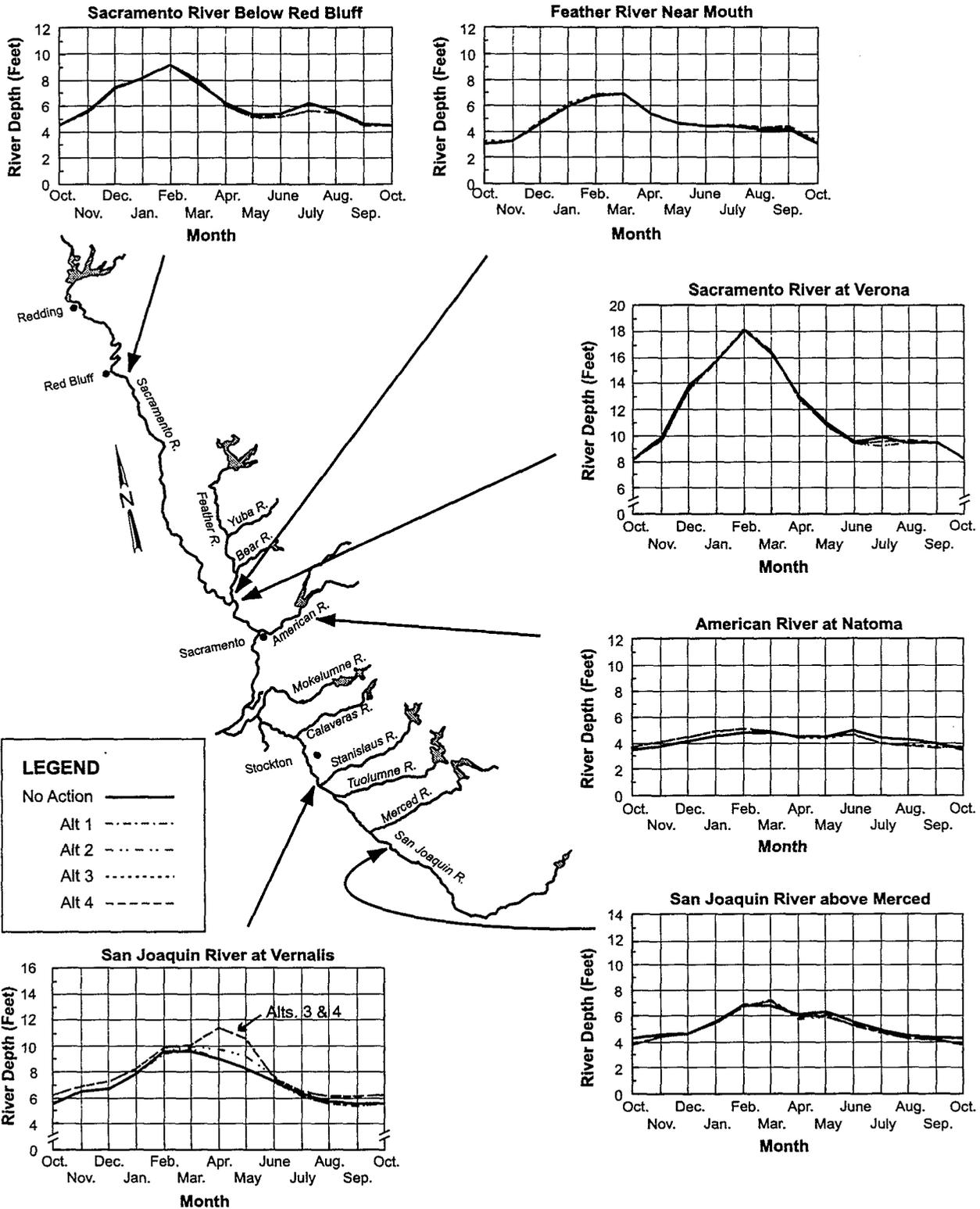


FIGURE III-12

**RIVER STAGE VARIATIONS IN THE CENTRAL VALLEY:  
COMPARISON OF ALL ALTERNATIVES**

## Effects of Changes in Reservoir Drawdown Zones on Riparian Vegetation

**Common Species.** Under Alternative 1, average monthly water levels at Folsom Lake would be approximately 3 to 6 feet lower than under the No-Action Alternative between March and June, and up to 8 feet higher during August. Water-level exceedance frequencies during the willow-growing season would be within a few percent of the frequencies under the No-Action Alternative. No substantial changes in riparian vegetation extent or condition would occur under Alternative 1 (Figure III-2). Similar conclusions are anticipated for other reservoirs.

**Special-Status Species.** Special-status species that use riparian habitats in reservoir drawdown zones would not be affected under Alternative 1.

## WETLAND COMMUNITIES

### Effects of Changes in Hydrology on Wetland Communities

**Common Species.** Under Alternative 1, hydrologic conditions in wetlands associated with riparian habitats would not differ from those described for riparian communities. Changes in the extent and condition of wetland communities as a result of the changes in hydrology between Alternative 1 and the No-Action Alternative would be minor. Common wetland plant species, including tules, cattails, sedges, and rushes, would not be affected. Common wildlife species that use these wetland habitats, including bitterns, coots, rails, Pacific treefrogs, and bullfrogs, also would not be affected.

Under Alternative 1, the extent and condition of wetland communities in the Tulare Lake Region would not differ from those under the No-Action Alternative.

**Special-Status Species.** Changes in the extent and condition of wetland communities as a result of changes in hydrology would be minor under Alternative 1 and would not adversely affect habitat used by special-status species.

### Effects of Changes in Salinity on Wetland Communities

**Common Species.** Under Alternative 1, salinity changes at Chipps Island in the Delta and at Port Chicago and Benicia west of the Delta boundary would be minor and would have no impact on the wetland communities there (Figure III-13). Common wetland plant species and wildlife species and special-status species using wetland habitats would not be affected.

**Special-Status Species.** Freshwater, brackish water, and salt marshes would not be affected by salinity changes and no effects on special-status species associated with these habitats would occur.

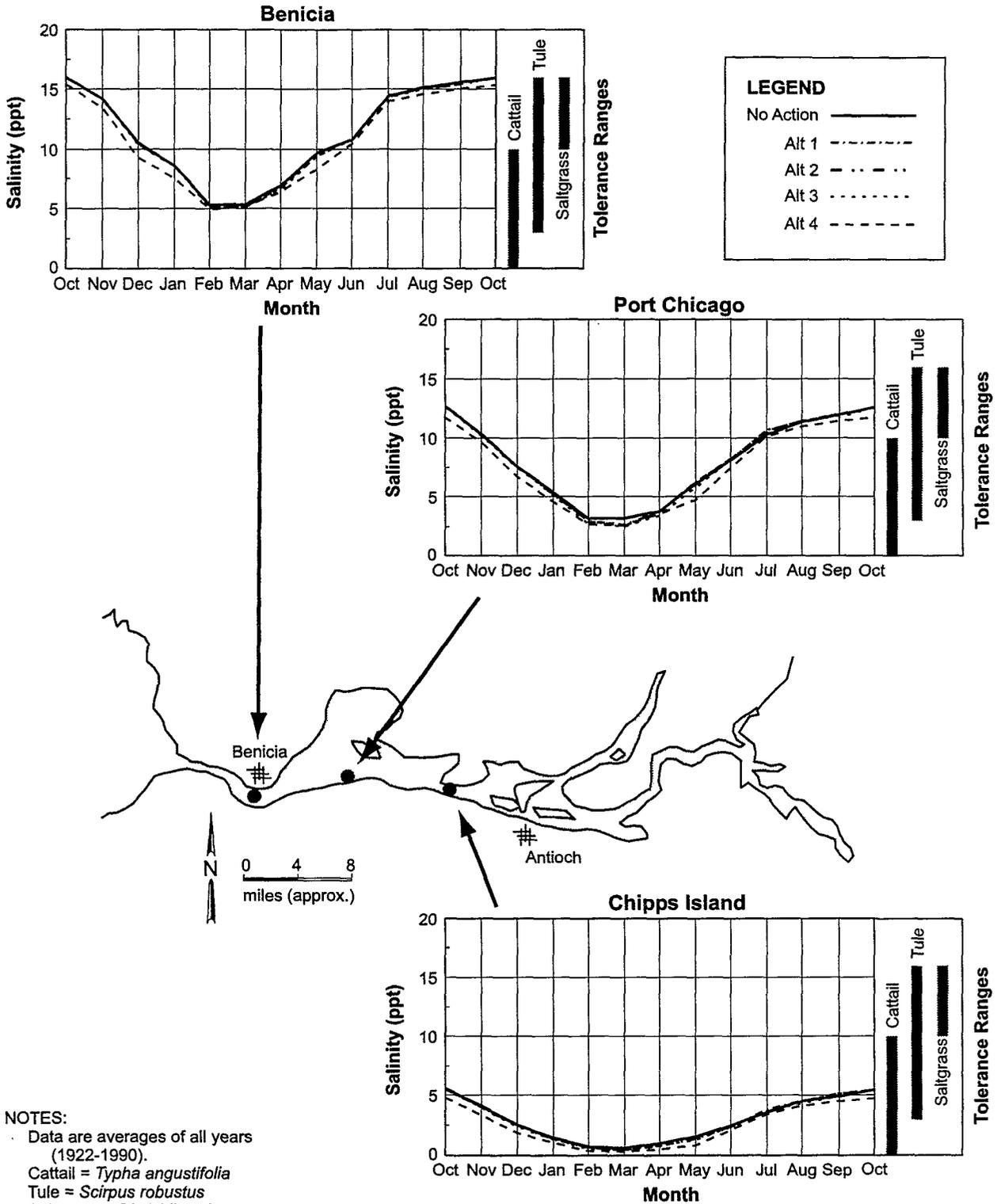


FIGURE III-13

**SALINITY VARIATIONS IN THE WESTERN DELTA:  
COMPARISON OF ALL ALTERNATIVES**

## RIVER AND RESERVOIR AQUATIC HABITATS

### Common Species

Under Alternative 1, restoration of riparian habitat and spawning gravel in the Sacramento and San Joaquin rivers and many of their tributaries would increase salmonid fish in these rivers and streams. The availability of additional fish would benefit wildlife that feed on fish.

The amounts of shallow water, deep water, or open water habitat available at reservoirs in the Sacramento River and San Joaquin River regions would not change compared with the amounts under the No-Action Alternative (Figures III-6 and III-7). Additionally, the availability of fish in reservoirs would not change. Therefore, fall and winter waterbird use would not change compared with use under the No-Action Alternative.

### Special-Status Species

Reservoir habitat quality would not change in the Sacramento River or San Joaquin River regions; therefore, nesting or wintering bald eagles would not be affected. Increases in the availability of fish in the Sacramento and San Joaquin rivers and many of their tributaries would improve riverine habitat quality and benefit bald eagles.

## WATERFOWL AND SHOREBIRDS

### Refuges - Common Species

Alternative 1 would result in approximately 151,251 acre-feet of water being delivered to refuges in the Sacramento River Region, representing an 18 percent increase in normal and wet years compared with deliveries under the No-Action Alternative (Table III-3). Increased water deliveries (Level 2) to refuges in the Sacramento River Region would allow more effective management of existing wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife. Under Alternative 1, approximately 2,900 acres of permanent ponds, 17,300 acres of seasonal marshes, and 2,300 acres of watergrass habitats would be managed on refuges in the Sacramento River Region, an increase of 3,500 acres over the No-Action Alternative acreage (Table III-4). Although these acreages would represent a substantial benefit to migratory waterfowl and other waterbirds, water supplies would be inadequate for optimal wetland management (Forrest and Miller, pers. comms.).

Alternative 1 would result in approximately 237,280 acre-feet of water being delivered to refuges in the San Joaquin River Region, representing a 65 percent increase in normal and wet years compared with deliveries under the No-Action Alternative (Table III-3). As discussed under the No-Action Alternative, federal refuges and BAP lands already have optimal wetlands management and this management would not change under Alternative 1. Thus, the major increases in water deliveries to refuges in the San Joaquin River Region would be received by GRCD, the East Gallo property, and the state refuges and BAP lands. With increased water deliveries to these lands, refuges in the San Joaquin River Region (excluding the BAP lands and the East Gallo property) could support approximately 3,400 acres of permanent ponds; 59,100 acres of seasonal wetlands; and 3,550 acres of waterfowl food plant habitat, such as watergrass

and smartweed (Table III-4). This is an increase of 26,000 acres over the No-Action Alternative acreage. Increased water deliveries to refuges in the San Joaquin River Region would enable refuge managers to more effectively manage existing wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife. However, although these acreages would substantially benefit migratory waterfowl and other waterbirds compared with acreages under the No-Action Alternative, water supplies would be inadequate for optimal wetland management (Miller, pers. comm.).

Alternative 1 would result in approximately 38,824 acre-feet of water delivered to refuges in the Tulare Lake Region, representing a 36 percent increase in normal and wet years compared with deliveries under the No-Action Alternative (Table III-4). Eventually, Kern and Pixley NWRs would reduce their reliance on groundwater and obtain water through the Friant-Kern Canal. Increased water deliveries (Level 2) to refuges in the Tulare Lake Region would enable more effective management of existing wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife. Under Alternative 1, approximately 4,800 acres of seasonal marshes would be managed on refuges in the Tulare Lake Region, an increase of 1,200 acres over the No-Action Alternative acreage (Table III-4). Although these acreages would represent a substantial benefit to migratory waterfowl and other waterbirds, water supplies under this alternative would be inadequate for optimal wetland management (Miller, pers. comm.).

Relative indices indicate that the number of use-days for ducks, geese, and other waterbirds could be 18 percent higher in the Sacramento River Region, 65 percent higher in the San Joaquin River Region, and 36 percent higher in the Tulare Lake Region under Alternative 1 than under the No-Action Alternative (Table III-5). Under Alternative 1, higher levels of bird use and less than optimal wetland availability could result in increased crowding of waterfowl into smaller areas and could promote outbreaks of botulism, avian cholera, and other diseases on these managed wetland areas. Problems associated with waterfowl crowding and disease outbreaks are expected to be less severe than under the No-Action Alternative, however, and the overall effects of Alternative 1 should be beneficial.

Water deliveries to refuges would be reduced by 25 percent during drought years, approximately 8.7 percent of the period of record. The reduction in water deliveries to individual refuges would be based on the reductions being imposed on the sources of water. During droughts, the acreage of wetlands available would not change; however, the period of their availability would be reduced, resulting in less habitat being available to wintering waterfowl in state and federal refuges.

### **Field Flooding - Common Species**

Alternative 1 would result in approximately 54,000 additional acres of flooded agricultural fields in the Sacramento River Region, approximately 13,000 additional acres in the Delta Region, and approximately 13,000 additional acres in the San Joaquin River Region compared with acreages under the No-Action Alternative. These new seasonal wetlands would offer major benefits for migratory waterfowl, shorebirds, and wading birds because they would provide important alternative foraging and resting habitat to existing state and federal wildlife refuges, duck clubs, and other private wetlands in the Sacramento River Region. Additional flooded fields would

alleviate problems associated with crowding of birds on the refuges, such as depletion of food supplies and outbreaks of waterfowl disease.

No additional flooding of fields in the Tulare Lake Region is anticipated, and no impacts on dependent wildlife would occur.

### **Special-Status Species**

Additional water deliveries to federal refuges, state refuges, and the GRCD and field flooding would improve potential habitat for the giant garter snake and Aleutian Canada goose.

### **Duck Clubs and Other Private Lands**

No impacts on duck clubs and other private lands were identified because Alternative 1 would not affect water deliveries from the CVP or other water sources for these private waterfowl habitat areas. Therefore, duck clubs and other private wetlands in the Central Valley should continue to receive their historical water deliveries in dry, normal, and wet years under this alternative.

### **Evaporation Ponds**

The area of evaporation ponds in the San Joaquin River and Tulare Lake regions is projected to remain the same under Alternative 1. Impacts on waterfowl and shorebirds would continue to occur. The magnitude of the impacts would depend on the design of individual evaporation ponds and the availability of alternative wetlands that would provide suitable waterfowl and shorebird habitat.

## **SUPPLEMENTAL ANALYSIS 1d**

Under Alternative 1d, federal and state refuges and the GRCD would receive full water deliveries during drought years. This would result in the same amount of wetlands and period of wetland availability as described under Alternative 1 for the entire period of record. This would be beneficial to waterbirds because it would provide additional habitat during drought years and reduce the probability of disease outbreaks.

## **SUPPLEMENTAL ANALYSIS 1h**

### **COMMON SPECIES**

Under Supplemental Analysis 1h, natural habitats would be restored on retired lands. Restoration efforts would focus on grassland and alkali desert scrub habitats. Grassland restoration could involve seeding with native grasses and forbs, such as needlegrasses, fescues, poppies, and brodiaeas. Alkali desert scrub restoration could involve seeding and planting of native shrubs and herbs, such as allscale saltbush, fourwing saltbush, Torrey blazing star, and

kidney-leaved buckwheat. These areas also could provide potential habitat for the common species identified in Alternative 1.

## **SPECIAL-STATUS SPECIES**

Under Supplemental Analysis 1h, natural habitats would be restored as previously described. Introduction of populations and enhancement of habitat of special-status plants dependent on grassland and alkali desert scrub habitats would be part of the restoration efforts. These areas might be used to implement conservation objectives for regional habitat conservation plans. Population introductions and habitat restoration would result in beneficial impacts on up to 19 special-status plant species in the San Joaquin River Region, including 16 species that are federally listed or proposed for listing as threatened and endangered. Population introductions and habitat restoration would result in beneficial impacts on as many as 14 plant species either federally listed or proposed for listing as threatened and endangered, and one federal candidate and one state-listed plant species in the Tulare Lake Region.

Restoration efforts in these two regions would provide high-quality habitat for eight state- and federally listed wildlife species (Swainson's hawk, Aleutian Canada goose, blunt-nosed leopard lizard, giant kangaroo rat, Fresno kangaroo rat, Tipton kangaroo rat, San Joaquin antelope squirrel, and San Joaquin kit fox).

## **ALTERNATIVE 2**

Table III-7 summarizes the changes in acreages of important habitats in the Central Valley under Alternative 2.

## **NATURAL AND AGRICULTURAL COMMUNITIES**

### **Natural Terrestrial and Agricultural Habitats**

**Common Species.** Under Alternative 2, it was assumed that no new agricultural lands would be put into production, so no impacts on natural terrestrial habitats would occur as a result of this mechanism. Similarly, no additional urban development would occur under Alternative 1 compared with development under the No-Action Alternative, so there would be no impacts on vegetation and wildlife. The acreage of rice in the Sacramento River Region would be reduced by less than 1 percent compared with acreage under the No-Action Alternative (Figure III-8) as a result of the fallowing of land to acquire water. It was assumed that the amount of cotton grown in the Sacramento River Region would not increase from the amount grown under the No-Action Alternative. These reductions in agricultural habitats would not substantially change the distribution or number of common wildlife in the region.

A minor reduction (less than 1 percent) in acres planted in the Delta Region compared with acres under the No-Action Alternative (Figure III-9) would occur under Alternative 2. The number of acres of all crops in the San Joaquin River Region and the Tulare Lake Region would be reduced by 1.0 percent and 0.2 percent, respectively, compared with acres of crops under the No-Action Alternative (Figures III-10 and III-11). These changes would result from the fallowing of land

TABLE III-7

**CHANGES IN ACREAGES OF HABITAT TYPES  
UNDER ALTERNATIVE 2**

Habitat Type	Sacramento River Region (acres x 1,000)	Sacramento- San Joaquin Delta Region (acres x 1,000)	San Joaquin River Region (acres x 1,000)	Tulare Lake Region (acres x 1,000)
Rice	-4.0	0.0	0.0	0.1
Pasture and grains	-2.0	-1.0	-32.6	+0.4
Potential habitat from land fallowing	+6.1	+0.3	+43.8	+4.8
Potential habitat from retirement of drainage lands	0.0	0.0	+14.4	+15.6
Wetlands on refuges	+5.3	NA	+31.6	+12.4
Field flooding	+54.0	+13.0	+13.0	0.0

**NOTE:**  
The values shown represent the differences between acreages under the No-Action Alternative and under Alternative 2 (e.g., -1 represents a loss of 1,000 acres under Alternative 2 compared with the acreage under the No-Action Alternative).

**LEGEND:**  
NA = Not applicable.

for water acquisition. These reductions in agricultural habitats would not substantially change the distribution or number of common wildlife in the region.

**Special-Status Species.** Under Alternative 2, urban development would be the same as under the No-Action Alternative; therefore, no additional impacts on special-status species would occur as a result of this mechanism.

The minor loss of rice acreage in the Sacramento River Region under Alternative 2 would have little effect on the giant garter snake. Approximately 3 percent of the pasture and grain acreage in the San Joaquin River and Tulare Lake regions would be fallowed. This could result in a loss of habitat for the Aleutian Canada goose; however, the b(1) "other" program would improve the status of this species. Swainson's hawk would continue to use these areas as foraging habitat.

### Potential Habitat Resulting from Land Fallowing

**Common Species.** Under Alternative 2, approximately 6,100 acres of agricultural land in the Sacramento River Region, approximately 300 acres in the Delta Region, approximately 43,800 acres in the San Joaquin River Region, and approximately 4,800 acres in the Tulare Lake Region would be fallowed. It was assumed that this land would be in small, isolated parcels distributed throughout the region. These parcels would be planted with a cover crop and invaded by a wide variety of ruderal species and associated wildlife, as described for Alternative 1.

**Special-Status Species.** Impacts on special-status species would be minor and similar to those described for Alternative 1. Because the fallowed land would be scattered in small patches throughout the study area, there would be no opportunity for increases in special-status plant populations or habitat. The fallowed lands would provide low-quality potential habitat for the Swainson's hawk in the Sacramento River, Delta, and San Joaquin River regions, and low-quality habitat for San Joaquin kit fox, San Joaquin antelope ground squirrel, giant kangaroo rat, and blunt-nosed leopard lizard in the San Joaquin River and Tulare Lake regions.

### **Potential Habitat Resulting from Retirement of Drainage Lands**

**Common Species.** Effects of retirement of drainage lands on common wildlife species under Alternative 2 would be similar to those described under Alternative 1.

**Special-Status Species.** The potential beneficial impact associated with long-term colonization of retired lands by special-status plants and potential habitat for special-status wildlife in the San Joaquin River and Tulare Lake regions would be similar to the potential beneficial impact described under Alternative 1.

### **Pesticide Use**

Under Alternative 2, the fallowing of agricultural land would reduce the use of herbicides and insecticides and provide a minor benefit to common wildlife. There would be no change in rodenticide use because there would be no change in the acreage cultivated as orchards. Potential impacts would be similar to those described under Alternative 1.

## **RIPARIAN COMMUNITIES**

### **Effects of Changes in Hydrology on Riparian Communities**

**Common Species.** Under Alternative 2, stages on the Sacramento, Feather, and lower American rivers and in the Delta Region would be similar to those under Alternative 1 (Figure III-12). Changes in the extent and condition of riparian communities as a result of these small changes in hydrology would be minor compared with those under the No-Action Alternative. Common wetland plants and common wildlife using wetland habitats would not be affected. Flows would not change in the Tulare Lake Region.

Under Alternative 2, average monthly stages for an average year on the San Joaquin River above Merced would deviate less than 0.3 foot (less than 10 percent) from the stages under the No-Action Alternative, (Figure III-12). During dry or wet years, the monthly average river stage would be within 0.3 feet (10 percent) of the stage for the No-Action Alternative.

Under Alternative 2, average monthly river stages at Vernalis (lower San Joaquin River) during an average year would be within 1.0 foot (within 12 percent) of the stages under the No-Action Alternative (Figure III-12). During dry years, the average river stages in April and May would be 0.8 foot (13 percent) and 1.5 feet (28 percent) higher, respectively, than the stages under the No-Action Alternative. During wet years, the average monthly stages would be within 0.5 foot (within 5 percent) of the stages under the No-Action Alternative.

Higher spring flows under Alternative 2 than under the No-Action Alternative would result in a higher level of reproduction of riparian species, especially during dry years on the lower San Joaquin River and some tributaries and would result in an increase in the extent and density of the riparian community. The magnitude of this effect cannot be determined; however, common plant and wildlife species would benefit.

**Special-Status Species.** The minor changes in riparian communities would have little effect on special-status species in the Sacramento River and Delta regions.

Under Alternative 2, increased spring stages would increase habitat for special-status species supported by riparian habitat and associated wetlands in the San Joaquin River and Delta regions. This increased habitat would beneficially affect three state-listed plant species. None of these species are federally listed or proposed for listing as threatened or endangered. Increased riparian habitat would benefit the valley elderberry longhorn beetle and giant garter snake.

### Effects of Restoration on Riparian Communities

**Common Species.** The potential beneficial impact under Alternative 2 associated with restoration of riparian habitat would be identical to the potential beneficial impact described for Alternative 1.

**Special-Status Species.** The potential beneficial impact under Alternative 2 associated with restoration of riparian habitat would be identical to the potential beneficial impact described for Alternative 1.

### Effects of Changes in Reservoir Drawdown Zones on Riparian Vegetation

Under Alternative 2, water-level conditions affecting riparian vegetation would be essentially the same as those described for Alternative 1 (Figure III-2). No substantial changes in riparian vegetation extent or condition would occur compared with extent and condition under the No-Action Alternative.

## WETLAND COMMUNITIES

### Effects of Changes in Hydrology on Wetland Communities

**Common Species.** Under Alternative 2, hydrologic conditions in the Sacramento River and Delta regions in wetlands associated with riparian communities would not differ from those described previously for riparian communities. Changes in the extent and condition of wetland communities would be minor as a result of these changes in hydrology. Changes in river flow in the San Joaquin River and some of its tributaries would improve wetland habitat in the riparian zone and benefit common wetland species. The extent and condition of wetland communities in the Tulare Lake Region under Alternative 2 would not differ from those under the No-Action Alternative.

**Special-Status Species.** In the Sacramento River and Delta regions, changes in the extent and condition of wetland communities would be minor as a result of changes in hydrology

compared with extent and condition under the No-Action Alternative and would not adversely affect habitat used by special-status species.

Changes in flows on the lower San Joaquin River and some of its tributaries would improve wetland habitat in the riparian zone and benefit the giant garter snake.

### **Effects of Changes in Salinity on Wetland Communities**

**Common Species.** Under Alternative 2, salinity changes at Chipps Island in the Delta and at Port Chicago and Benicia west of the Delta boundary would be minor and would have no impact on the wetland communities. Common wetland plants and common wildlife using wetland habitats would not be affected (Figure III-13).

**Special-Status Species.** Freshwater, brackish water, and salt marshes would not be affected by the minor changes in salinity in the Delta, and special-status species associated with these habitats would not be affected.

## **RIVER AND RESERVOIR AQUATIC HABITATS**

### **Common Species**

The amounts of shallow water, deep water, and open water habitat available at reservoirs would not change under Alternative 2 compared with the amounts under the No-Action Alternative (Figures III-6 and III-7). In addition, there would be no change in the availability of fish in reservoirs. Therefore, fall and winter waterbird use would not change compared with use under the No-Action Alternative.

Under Alternative 2, restoration of riparian habitat and spawning gravel in rivers and streams in the Sacramento River, Delta, and San Joaquin River regions could increase populations of salmonid fish in these rivers and streams. The availability of additional fish would benefit wildlife that feed on fish.

### **Special-Status Species**

Reservoir habitat quality would not change under Alternative 2; therefore, nesting or wintering bald eagles would not be affected. Increases in the availability of fish would improve riverine habitat quality and benefit bald eagles to a small extent.

## **WATERFOWL AND SHOREBIRDS**

### **Refuges - Common Species**

Alternative 2 would result in delivery of about 179,000 acre-feet of water to refuges in the Sacramento River Region, a 40 percent increase in normal and wet years compared with deliveries under the No-Action Alternative (Table III-3). These increased water deliveries would permit optimal management (Level 4) of existing and new wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife. Under Alternative 2, approximately 3,000

acres of permanent ponds, 18,570 acres of seasonal marshes, and 2,700 acres of watergrass habitats would be managed on refuges in the Sacramento River Region (Table III-4). This is an increase of 5,300 acres over the No-Action Alternative acreage. Reclamation and DFG (1996) cite the following benefits of optimal (Level 4) water deliveries to refuges in the Sacramento River Region and the migratory waterfowl and other waterbirds that depend on them:

- earlier fall flood-up schedule for seasonal marshes to allow increased wildlife use, while easing water conveyance capacity constraints due to timing;
- maintenance of additional acres of both summer water and permanent pond habitat types for both wildlife use and vegetation improvement;
- increased acreage of watergrass habitat and increased frequency of irrigations, if necessary, to provide a high-quality carbohydrate food source for waterfowl and other waterbirds, while easing potential waterfowl crop depredation problems on nearby agricultural lands;
- increased “flow-through” of maintenance water levels in all wetland habitat units on the refuges to decrease the potential for disease outbreaks, especially botulism, among waterfowl and other waterbirds using these habitats;
- maintenance of water depths, using year-round water delivery, that provide optimum foraging conditions for the majority of avian species;
- control of undesirable vegetation species, such as cocklebur, using deep irrigation and maintenance for periods of two to four weeks during summer; and
- development of an additional 400 to 500 wetland acres throughout the Sacramento NWR complex during the next several years.

Each of these benefits is described in more detail in the specific master plans for individual refuges. As part of an ongoing analysis and adaptive management of refuges in the Sacramento River Region, managers are currently preparing water management strategies for the next 10 years. These plans will include detailed discussions of refuge-specific resource objectives, types of wetland habitats to be maintained or created, water supplies, and conveyance facilities (Forrest and Miller, pers. comms.).

Existing wetland and upland habitats would not be affected by the conveyance or application of Level 4 water supplies on the refuges because most of the water would be applied to existing wetlands and recreated wetlands would be in historical wetland areas, such as swales, basins, or farmed wetlands (Forrest and Miller, pers. comms.). The overall objectives of refuge water management strategies anticipated under Alternative 2 would enable refuge managers to implement their master plans to optimize the foraging, resting, and breeding habitats for wetland-dependent wildlife.

Projections indicate that the number of use-days for ducks, geese, and other waterbirds at refuges in the Sacramento River Region could be 35 percent higher under Alternative 2 than under the No-Action Alternative (Table III-5). The application of firm water supplies and, in some cases,

the delivery of incremental Level 4 supplies to Central Valley refuges in recent wet years has produced significant wildlife benefits. For example, Sacramento River Region refuges are currently recording the highest waterfowl populations since the drought of the late 1980s. Gray Lodge WMA recorded an increase of 18 million waterfowl use-days from previous years and an increase of 20 percent in brood water for nesting waterfowl and other water-associated birds (Reno, pers. comm.). The Sacramento NWR complex recorded an increase of approximately 5 million duck use-days and an increase of approximately 1,000 acres of wetland habitats at the four refuges over the 1990-1992 average (Forrest, pers. comm.). Higher levels of bird use and implementation of the optimal wetlands management possible under Alternative 2 also could result in fewer disease outbreaks than under the No-Action Alternative.

Water deliveries to refuges would be reduced 25 percent during drought years, approximately 8.7 percent of the period of record. These reduced deliveries would be based on the reductions being imposed on the sources of water. Wetlands would be available for less time during these periods; however, the impacts would be less than those described for Alternative 1.

Alternative 2 would result in delivery of approximately 316,360 acre-feet of water to refuges in the San Joaquin River Region, a 120-percent increase in normal and wet years compared with deliveries under the No-Action Alternative (Table III-3). These increased deliveries would permit optimal management (Level 4) of existing and new wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife. Under Alternative 2, approximately 6,240 acres of permanent ponds, 57,680 acres of seasonal marshes, and 7,700 acres of watergrass and smartweed habitats would be managed on refuges in the San Joaquin River Region, excluding the BAP lands and the East Gallo property (Table III-5). This is an increase of 31,600 acres over the No-Action Alternative acreage. Benefits of Level 4 water deliveries cited in Reclamation and DFG (1996) for the Sacramento River Region would also apply to refuges in the San Joaquin River Region.

Increased water deliveries to San Joaquin River Region refuges would enable refuge managers to more effectively manage existing wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife according to the goals of the BAP (Reclamation and DFG, 1995). Relative indices indicate that the number of use-days for ducks, geese, and other waterbirds could be more than 100 percent higher under Alternative 2 than under the No-Action Alternative (Table III-5).

Refuges and private wetlands in the San Joaquin River Region have benefited from firm water supplies during the past few years (Miller, pers. comm.). The GRCD has increased waterfowl and other waterbird production habitat by approximately 400 percent since 1992. The district also has increased wintering waterfowl food production by irrigating 14,600 acres in addition to those irrigated in 1994, resulting in an estimated 300 percent increase in food supplies (Poole, pers. comm.).

Five years of detailed research conducted by the Service, in cooperation with state and federal landowners, identified the importance of continuing to use high-quality, Level 4 CVP water supplies to reduce selenium concentrations at federal and state refuges and at the GRCD. Based on studies conducted in 1986, 1987, 1988, 1989, and 1994, selenium concentrations in waterfowl and other waterbirds wintering in that vicinity declined significantly. For example, selenium

concentrations in American coots from the North GRCD and northern pintails from the North and South GRCD had reached background concentrations by 1994 after nine years of freshwater management (Paveglio, pers. comm.). Prior to 1985, drainage water from agricultural operations south of the GRCD accounted for approximately two-thirds of the water supply delivered to the GRCD. Much of this water contained high concentrations of selenium and other trace minerals toxic to migratory birds and other wildlife (Reclamation, 1986a, 1986b).

Water deliveries to refuges would be reduced 25 percent during drought years, approximately 8.7 percent of the period of record. Wetlands would be available for less time during these periods; however, the impacts would be less than those described for Alternative 1.

Alternative 2 would result in deliveries of approximately 60,650 acre-feet of water to refuges in the Tulare Lake Region, an increase of 113 percent in normal and wet years compared with deliveries under the No-Action Alternative (Table III-3). These increased deliveries would permit optimal management (Level 4) of existing and new wetlands to benefit migratory and breeding waterfowl and other waterbirds and wildlife. Under Alternative 2, approximately 12,000 acres of seasonal marshes and 4,000 acres of watergrass and smartweed habitats would be managed on refuges in the Tulare Lake Region (Table III-4). This is an increase of 12,400 acres over the No-Action Alternative acreage. Benefits of Level 4 water deliveries cited in Reclamation and DFG (1996) for the Sacramento River Region also would apply to refuges in the Tulare Lake Region.

The increased water deliveries to Tulare Lake Region refuges would enable refuge managers to more effectively manage existing wetlands, to benefit migratory and breeding waterfowl and other waterbirds and wildlife. Relative indices indicate that the number of use-days for ducks, geese, and other waterbirds could be more than 65 percent higher under Alternative 2 than under the No-Action Alternative (Table III-5).

Refuges and private wetlands in the Tulare Lake Region have benefited from firm water supplies during the past few years (Miller, pers. comm.). For example, seasonal wetland habitats at the Kern NWR complex in 1994 peaked at 4,000 acres, compared with 1,900 in 1992, representing a 52 percent increase. An increase of 20 percent in waterfowl and 30 percent in other waterbird use was documented at the Kern NWR complex during this same period (Charmley, pers. comm.).

Water deliveries to refuges would be reduced by 25 percent during drought years, approximately 8.7 percent of the period of record. Wetlands would be available for less time during these periods; however, the impacts would be less than those described for Alternative 1.

### **Field Flooding - Common Species**

The potential beneficial impact under Alternative 2 of additional flooded agricultural fields in the Sacramento River, Delta, and San Joaquin River regions would be similar to the potential beneficial impact described under Alternative 1.

### **Special-Status Species**

Level 4 water deliveries to federal and state refuges and the GRCD would improve potential habitat for the giant garter snake, peregrine falcon, and Aleutian Canada goose. In the Tulare Lake Region, one federal candidate species, the Buena Vista Lake ornate shrew, would benefit from additional water deliveries.

Potential beneficial impacts would be similar to the potential beneficial impacts described under Alternative 1.

### **Duck Clubs and Other Private Lands**

No impacts on duck clubs and other private lands were identified because Alternative 2 would not affect water deliveries from the CVP or other water sources for this private waterfowl habitat.

### **Evaporation Ponds**

The number of acres of evaporation ponds and the effects of these ponds would be the same as under the No-Action Alternative.

## **ALTERNATIVE 3**

Table III-8 summarizes the changes in acreages of important habitats in the Central Valley under Alternative 3.

### **NATURAL AND AGRICULTURAL COMMUNITIES**

#### **Natural Terrestrial and Agricultural Habitats**

**Common Species.** Under Alternative 3, it was assumed that no new agricultural lands would be put into production, so no impacts on natural and terrestrial habitats would occur as a result of this mechanism. In the Sacramento River and Delta regions, the acreages planted in row crops, grain, and rice would be reduced compared with acreages under the No-Action Alternative, but this reduction would be less than 1 percent for these crops (Figure III-8). The number of acres of all crops in the San Joaquin River Region would be reduced compared with the number of acres under the No-Action Alternative (Figure III-10). The number of acres of most crops grown in the Tulare Lake Region would be reduced compared with the number of acres under the No-Action Alternative (Figure III-11). These areas would be fallowed for water acquisition. The amount of cotton grown in the Sacramento River Region would not increase from the amount grown under the No-Action Alternative. Changes in agricultural habitats would be small and would not affect the distribution or number of common wildlife in the Sacramento River and Delta regions. The reduction in agricultural habitats would improve the distribution and number of common wildlife in the San Joaquin River Region.

Cropping patterns in the Delta Region would change slightly, with a minor reduction (less than 1 percent) in the number of acres planted as a result of fallowing (Figure III-9). These changes would not affect the distribution or number of common wildlife in the region.

**TABLE III-8**  
**CHANGES IN ACREAGES OF HABITAT TYPES**  
**UNDER ALTERNATIVE 3**

Habitat Type	Sacramento River Region (acres x 1,000)	Sacramento-San Joaquin Delta Region (acres x 1,000)	San Joaquin River Region (acres x 1,000)	Tulare Lake Region (acres x 1,000)
Rice	-12.4	0.0	-2.5	0.0
Pasture and grains	-9.6	-1.8	-90.5	-4.8
Potential habitat from land fallowing	+23.1	+1.5	+108.1	+4.1
Potential habitat from retirement of drainage lands	0.0	0.0	+14.4	+15.6
Wetlands on refuges	+5.3	NA	+31.6	+12.4
Field flooding	55.0	+13.0	+13.0	0.0

NOTE:  
The values shown represent the differences between acreages under the No-Action Alternative and under Alternative 3 (e.g., -1 represents a loss of 1,000 acres under Alternative 3 compared with the acreage under the No-Action Alternative).

LEGEND:  
NA = Not applicable.

Urban development would be the same as under the No-Action Alternative.

**Special-Status Species.** Under Alternative 3, urban development would not change compared with the level of urban development the No-Action Alternative; therefore, no additional impacts on special-status plants would result from urban development.

The conversion of lands from production of rice or small grain crops to cotton and the urban development of grassland and valley foothill hardwoods in the Sacramento River Region would be similar to those described for the No-Action Alternative.

The reduction of agricultural habitat would not affect any special-status species in the Tulare Lake Region. Approximately 102,000 acres of pasture and grain would be fallowed in the Sacramento River, Delta, and San Joaquin River regions. The loss of approximately 6 percent of potential agricultural habitat would have little effect on the Aleutian Canada goose because the loss would be small in relation to the available habitat, and implementation of the b(1) "other" program would reduce this impact. Swainson's hawks would continue to use these areas because fallowing would not substantially affect common rodent species.

### Potential Habitat Resulting from Land Fallowing

**Common Species.** Under Alternative 3, approximately 23,100 acres of agricultural land in the Sacramento River Region, 1,500 acres in the Delta Region, and 4,100 acres in the Tulare Lake Region would be fallowed. It is assumed that this land would be in small, isolated parcels located throughout the region and that impacts would be similar to those described for Alternative 1.

Approximately 108,100 acres of agricultural land would be fallowed in the San Joaquin River Region under Alternative 3. Most of this land would be in small, isolated parcels located throughout the region. These parcels would be planted with a cover crop to reduce erosion and would be invaded by a wide variety of ruderal species and provide short-term habitat for common wildlife. It is assumed that approximately 15 percent of the land (18,375 acres) would be adjacent to wildlife refuges or SNAs, or that individual parcels would be large enough to provide potentially high-quality habitat. Conservation easements would be acquired, and management of these parcels would include vegetation and wildlife objectives. These changes would benefit common vegetation and wildlife species.

**Special-Status Species.** In the Sacramento River, Delta, and Tulare Lake regions, fallowed land would be in scattered, small patches planted with a cover crop and invaded by ruderal vegetation that would not provide an opportunity for increases in special-status plant populations. Effects on special-status wildlife would be similar to those described under Alternative 1.

Under Alternative 3, approximately 108,100 acres of agricultural land would be fallowed in the San Joaquin River Region. Most of this land would be in small, isolated parcels located throughout the region. These parcels would be planted with a cover crop and invaded by a wide variety of ruderal species, and impacts would be similar to those described for Alternative 1, providing low-quality potential habitat for the San Joaquin kit fox and blunt-nosed leopard lizard. It was assumed that approximately 15 percent of the land would be adjacent to wildlife refuges or SNAs, or that individual parcels would be large enough to provide high-quality habitat for special-status species.

Where these lands are near existing wildlife refuges and SNAs, federal conservation easements could be used to benefit special-status plants. Conservation easements could be acquired, and these parcels could be managed in ways that promote vegetation and wildlife objectives. As many as 18 special-status species could benefit from habitat enhancement, including 14 plant species in grassland, alkali desert scrub, and valley foothill hardwood habitats that are federally listed or proposed for listing. Three federal candidate wildlife species (mountain plover, riparian brush rabbit, and San Joaquin Valley woodrat) and seven state- and federally listed wildlife species (Swainson's hawk, blunt-nosed leopard lizard, Aleutian Canada goose, giant kangaroo rat, Fresno kangaroo rat, San Joaquin antelope squirrel, and San Joaquin kit fox) would also benefit.

### Potential Habitat Resulting from Retirement of Drainage Lands

**Common Species.** Effects under Alternative 3 of retirement of drainage lands on common wildlife species would be similar to those described under Alternative 1.

**Special-Status Species.** The potential beneficial impact under Alternative 3 associated with long-term colonization of retired lands by special-status plants and potential habitat for special-status wildlife in the San Joaquin River and Tulare Lake regions would be identical to the potential beneficial impact described under Alternative 1.

## Pesticide Use

**Common Species.** Under Alternative 3, the fallowing of agricultural land would reduce the use of herbicides and insecticides and provide a minor benefit to common wildlife. Reductions in the acreage of orchards (3,700) and use of rodenticides would be too small to have substantial beneficial effects on rodents.

**Special-Status Species.** The small reduction in pesticide use would provide a minor benefit to special-status plants and the valley elderberry longhorn beetle.

The potential adverse effects of rodenticides on Swainson's hawks would be similar to those described for the No-Action Alternative. As under the No-Action Alternative, rodenticides could affect special-status rodents and the San Joaquin kit fox and blunt-nosed leopard lizard through secondary poisoning. The b(1) "other" program will benefit the status of these species and reduce adverse effects.

## RIPARIAN COMMUNITIES

### Effects of Changes in Hydrology on Riparian Communities

**Common Species.** Under Alternative 3, the average stages of the Sacramento, Feather, and lower American rivers would be very similar to the stages under Alternative 1 (Figure III-12). Changes from the No-Action Alternative in the extent and condition of riparian communities resulting from these small changes in hydrology would be minor. The extent and condition of riparian communities in the Tulare Lake Region under Alternative 3 would not differ from those under the No-Action Alternative.

Average monthly stages in the upper San Joaquin River above Merced for an average year would differ relatively little from average monthly stages under the No-Action Alternative (less than 10 percent) (Figure III-12). During dry or wet years, the percentage difference in average monthly stage between Alternative 3 and the No-Action Alternative would be less than 11 percent.

At Vernalis, the San Joaquin River stages in an average year are projected to be 25 to 30 percent higher in April and May than under the No-Action Alternative (Figure III-12). During dry years, stages would be 40 to 50 percent higher in April and May and 10 to 18 percent higher from September to January than under the No-Action Alternative.

Mean monthly flows and river stages in the Delta Region under Alternative 3 are projected to be somewhat higher in spring than under the No-Action Alternative. Riparian reproduction would increase under this alternative, particularly in dry years. The extent and condition of riparian communities in the Tulare Lake Region under Alternative 3 would not differ from those under the No-Action Alternative.

The higher spring stages in the lower San Joaquin River and some tributaries would result in an increase in the reproduction of riparian species and, combined with higher stages throughout the year, would increase the extent and density of the riparian community along the San Joaquin River and in the Delta Region. Common riparian plants that would benefit include sandbar willow, Fremont cottonwood, and mule fat. Common wildlife, such as pocket gopher, Brewer's blackbird, and bushtit, also would benefit.

**Special-Status Species.** Under Alternative 3, changes in river stages in the Sacramento River and Tulare Lake regions compared with stages under the No-Action Alternative would be minor and would not affect habitat for special-status plant and wildlife species.

Under Alternative 3, increased spring stages would increase habitat for special-status species supported by riparian habitat and associated wetlands in the San Joaquin River and Delta regions. This increase would benefit up to two special-status plant species. None of these species are federally listed or proposed for listing as threatened or endangered. Increased riparian habitat would also benefit the valley elderberry longhorn beetle and giant garter snake.

### Effects of Restoration on Riparian Communities

**Common Species.** The potential beneficial impact under Alternative 3 associated with the increase in the extent and condition of riparian habitat as a result of restoration of the meander belt on the upper Sacramento River would be similar to the potential beneficial impact described under Alternative 1.

**Special-Status Species.** The potential beneficial impact under Alternative 3 associated with restoration of riparian habitat would be identical to the potential beneficial impact described under Alternative 1.

### Effects of Changes in Reservoir Drawdown Zones on Riparian Vegetation

**Common Species.** Under Alternative 3, water-level conditions affecting riparian vegetation would be essentially the same as those described for Alternative 1 (Figure III-2). No substantial changes in riparian vegetation extent or condition would occur compared with extent and conditions under the No-Action Alternative.

**Special-Status Species.** Special-status species that use riparian habitats in reservoir drawdown zones would not be affected under Alternative 3.

## WETLAND COMMUNITIES

### Effects of Changes in Hydrology on Wetland Communities

**Common Species.** Under Alternative 3, hydrologic conditions in wetlands associated with riparian communities in the Sacramento River Region would not differ from those described previously for riparian communities. Changes in the extent and condition of wetland communities in the riparian zone resulting from changes in hydrology would be minor. Common wetland plants and common wildlife using wetland habitats would not be affected.

The extent and condition of wetland communities in the Tulare Lake Region under Alternative 3 would not differ from those under the No-Action Alternative.

Under Alternative 3, changes in hydrology in wetlands associated with riparian habitats would be identical to those described above for riparian communities, with increased flows in the San Joaquin River and Delta regions and increases in the extent and quality of wetland communities. Common wetland plants and common wildlife using wetland habitats would benefit.

**Special-Status Species.** Special-status wetland species in the Sacramento River and Tulare Lake regions would not be affected under Alternative 3.

Changes in river flows in the San Joaquin River Region would improve wetland habitat and benefit up to two special-status plant species and the giant garter snake.

### Effects of Changes in Salinity on Wetland Communities

**Common Species.** Under Alternative 3, salinity changes at Chipps Island in the Delta and Port Chicago and Benicia west of the Delta boundary, compared with salinity under the No-Action Alternative, would be minor and would not affect wetland communities (Figure III-13).

**Special-Status Species.** Freshwater, brackish water, and salt marshes would not be affected by salinity changes under Alternative 3, and no effects on special-status species would be associated with these habitats.

## RIVER AND RESERVOIR AQUATIC HABITATS

### Common Species

Under Alternative 3, restoration of riparian habitat and spawning gravel in the Sacramento River and many of its tributaries would increase populations of salmonid fish in these rivers and streams. Restoration of riparian habitat and spawning gravel in rivers on the east side of the San Joaquin River would increase populations of salmonid fish in the San Joaquin River and its tributaries. Habitat restoration would increase the availability of fish that provide prey for wildlife in the Delta Region. The availability of additional fish would benefit wildlife that feed on fish.

There would be no change in the amounts of shallow water, deep water, or open water habitat available at reservoirs in the Sacramento River and San Joaquin River regions under Alternative 3, compared with amounts available under the No-Action Alternative (Figure III-6). Additionally, the availability of fish in reservoirs would not change. Therefore, fall and winter waterbird use would not change compared with use under the No-Action Alternative.

### Special-Status Species

Reservoir habitat quality would not change in the Sacramento River or San Joaquin River regions; therefore, nesting or wintering bald eagles would not be affected. Increases in the availability of fish would improve riverine habitat quality and benefit bald eagles.

## **WATERFOWL AND SHOREBIRDS**

### **Refuges - Common Species**

The potential beneficial impacts under Alternative 3 of increased water delivery to refuges and increased acreages of managed permanent ponds, seasonal marshes, and watergrass would be identical to the potential beneficial impacts described for Alternative 2.

### **Field Flooding - Common Species**

The potential beneficial impact under Alternative 3 of additional flooded agricultural fields in the Sacramento River, Delta, and San Joaquin River regions would be identical to the potential beneficial impact described for Alternative 1.

### **Special-Status Species**

The potential beneficial impacts under Alternative 3 on special-status species would be identical to the potential beneficial impacts described for Alternative 2.

### **Duck Clubs and Other Private Lands**

No impacts on duck clubs and other private lands were identified because Alternative 3 would not affect water deliveries from the CVP or other water sources for these private waterfowl habitats.

### **Evaporation Ponds**

The number of acres of evaporation ponds and the effects of these ponds would be the same as under the No-Action Alternative.

## **ALTERNATIVE 4**

Table III-9 summarizes the changes in acreages of important habitats in the Central Valley under Alternative 4.

## **NATURAL AND AGRICULTURAL COMMUNITIES**

### **Natural Terrestrial and Agricultural Habitats**

**Common Species.** Under Alternative 4, it was assumed that no new agricultural lands would be put into production, so no impacts on natural and terrestrial habitats would occur as a result of this mechanism. In the Sacramento River Region, the number of acres planted in pasture, grain, and rice would be reduced (less than 2 percent) compared with acres planted in these crops under the No-Action Alternative (Figure III-8). These lands would be fallowed for water acquisition.

TABLE III-9

## CHANGES IN ACREAGES OF HABITAT TYPES UNDER ALTERNATIVE 4

Habitat Type	Sacramento River Region (acres x 1,000)	Sacramento-San Joaquin Delta Region (acres x 1,000)	San Joaquin River Region (acres x 1,000)	Tulare Lake Region (acres x 1,000)
Rice	-12.3	0.0	-2.7	-0.1
Pasture and grains	-9.3	-1.7	-98.1	-6.5
Potential habitat from land fallowing	+22.6	+1.6	+125.6	+10.6
Potential habitat from retirement of drainage lands	0.0	0.0	+14.4	+15.6
Wetlands on refuges	+5.3	NA	+31.6	+12.4
Field flooding	+54.0	+13.0	+13.0	0.0
NOTE: The values shown represent the differences between acreages under the No-Action Alternative and under Alternative 4 (e.g., -1 represents a loss of 1,000 acres under Alternative 4 compared with the acreage under the No-Action Alternative).				
LEGEND: NA = Not applicable.				

It was assumed that the amount of cotton grown in the Sacramento Valley would not increase from the No-Action Alternative. Changes in agricultural habitats would be small but would improve the distribution or number of common wildlife in the Sacramento River Region.

Cropping patterns in the Delta Region would change less than 1 percent compared with patterns under the No-Action Alternative as a result of fallowing (Figure III-9). These changes would have little effect on the distribution or number of common wildlife in the Delta Region.

The number of acres of all crops in the San Joaquin River and Tulare Lake regions would be reduced by 136,200 compared with the number of acres under the No-Action Alternative as a result of land fallowing (Figures III-10 and III-11). This reduction in agricultural habitats would improve the distribution and number of common wildlife in the region.

It was assumed that urban development would not change compared with urban development under the No-Action Alternative.

**Special-Status Species.** Urban development under Alternative 4 would not change compared with urban development under the No-Action Alternative; therefore, no additional impacts on special-status plants would result from urban development.

The conversion of lands from production of rice or small grain crops to cotton and the urban development of grassland and valley foothill hardwoods in the Sacramento River Region would be similar to those described for the No-Action Alternative.

Approximately 110,000 acres of pasture and grain would be fallowed in the Sacramento River, Delta, and San Joaquin River regions. The loss of approximately 9 percent of potential

agricultural habitat would not affect the Aleutian Canada goose because implementation of the b(1) "other" program would reduce this impact. Effects on Swainson's hawks would be similar to those described for Alternative 3.

The potential impact would be identical to the potential impact described for Alternative 3.

### Potential Habitat Resulting from Land Fallowing

**Common Species.** Under Alternative 4, approximately 22,600 acres of agricultural land in the Sacramento River Region, 1,600 acres in the Delta Region, and 10,600 acres in the Tulare Lake Region would be fallowed. It is assumed that this land would be in small, isolated parcels located throughout the region, and that impacts would be similar to those described for Alternative 1.

Approximately 125,600 acres of agricultural land would be fallowed in the San Joaquin River Region under Alternative 4. It was assumed that approximately 15 percent (18,800 acres) would be adjacent to wildlife refuges or SNAs, or that individual parcels would be large enough to provide potentially high-quality habitat. These changes would benefit common vegetation and wildlife. This impact is similar to the one described for Alternative 3.

**Special-Status Species.** Effects on special-status species resulting from fallowing of agricultural land in the Sacramento River, Delta, and Tulare Lake regions would be similar to those described for Alternative 1.

### Potential Habitat Resulting from Retirement of Drainage Lands

**Common Species.** Impacts under Alternative 4 resulting from retirement of drainage lands would be similar to those described for Alternative 1.

**Special-Status Species.** The potential beneficial impact under Alternative 4 associated with long-term colonization of retired lands by special-status plants and potential habitat for special-status species in the San Joaquin River and Tulare Lake regions would be identical to the potential beneficial impact described for Alternative 1.

### Pesticide Use

**Common Species.** Under Alternative 4, the fallowing of agricultural land would reduce the use of herbicides and insecticides and provide a minor benefit to common wildlife. Reductions in the acreage of orchards (3,900) and use of rodenticides would be too small to have substantial beneficial effects on rodents.

**Special-Status Species.** The reduction in agricultural acreage under this alternative could provide a minor benefit to special-status plants, the valley elderberry longhorn beetle, special-status rodents, the blunt-nosed leopard lizard, and the San Joaquin kit fox. Potential impacts of pesticide use on special-status species could be reduced by implementation of the Conservation Program and the b(1) "other" program.

## RIPARIAN COMMUNITIES

### Effects of Changes in Hydrology on Riparian Communities

**Common Species.** River stages in the Sacramento River Region under Alternative 4 would be similar to the stages under Alternative 1 (Figure III-12). Changes from the No-Action Alternative in the extent and condition of riparian communities resulting from these small changes in hydrology would be minor.

The extent and condition of riparian communities in the Tulare Lake Region under Alternative 4 would not differ from those under the No-Action Alternative.

The potential beneficial impact in the San Joaquin River Region would be identical to the potential beneficial impact described under Alternative 3.

**Special-Status Species.** Under Alternative 4, changes in river stages in the Sacramento River and Tulare Lake regions would be minor compared with stages under the No-Action Alternative and would not affect habitat for special-status plant and wildlife species.

The potential beneficial impact would be identical to the potential beneficial impact described for Alternative 3.

### Effects of Restoration on Riparian Communities

**Common Species.** The potential beneficial impacts on common species under Alternative 4 associated with restoration of riparian habitat would be identical to the potential beneficial impacts described for Alternative 1.

**Special-Status Species.** The potential beneficial impacts on special-status species under Alternative 4 associated with restoration of riparian habitat would be identical to the potential beneficial impact described for Alternative 1.

### Effects of Changes in Reservoir Drawdown Zones on Riparian Vegetation

**Common Species.** Under Alternative 4, water-level conditions affecting riparian vegetation would be essentially the same as those described for Alternative 1 (Figure III-2). No substantial changes in riparian vegetation extent or condition would occur.

**Special-Status Species.** Special-status species that use riparian habitats in reservoir drawdown zones would not be affected under Alternative 4.

## WETLAND COMMUNITIES

### Effect of Changes in Hydrology on Wetland Communities

**Common Species.** Under Alternative 4, hydrologic conditions in wetlands associated with riparian communities in the Sacramento River Region would not differ from those described

previously for riparian communities. Changes in the extent and condition of wetland communities in the riparian zone resulting from changes in hydrology would be minor. Common wetland plants and common wildlife using wetland habitats would not be affected.

The extent and condition of wetland communities in the Tulare Lake Region under Alternative 4 would not differ from those under the No-Action Alternative.

The potential beneficial impact would be identical to the potential beneficial impact described for Alternative 3.

**Special-Status Species.** Special-status wetland species in the Sacramento River and Tulare Lake regions would not be affected under Alternative 4.

The potential beneficial impact would be identical to the potential beneficial impact described for Alternative 3.

### Effects of Changes in Salinity on Wetland Communities

**Common Species.** Under Alternative 4, salinity changes at Chipps Island in the Delta and at Port Chicago and Benicia west of the Delta boundary, compared with salinity under the No-Action Alternative, would be minor and would not affect wetland communities (Figure III-13).

**Special-Status Species.** Freshwater, brackish water, and salt marshes would not be affected by salinity changes under this alternative, and no effects on special-status species would be associated with these habitats.

## RIVER AND RESERVOIR AQUATIC HABITATS

### Common Species

Under Alternative 4, restoration of riparian habitat and spawning gravel in the Sacramento River and many of its tributaries, in the Delta, and in the San Joaquin River and its tributaries would increase salmonid fish in these rivers and streams. The availability of additional fish would benefit wildlife that feed on fish.

There would be no change in the amounts of shallow water, deep water, or open water habitat available at reservoirs in the Sacramento River and San Joaquin River regions under Alternative 4 compared with the amounts available under the No-Action Alternative (Figure III-6). Additionally, the availability of fish in reservoirs would not change. Therefore, fall and winter waterbird use would not change compared with use under the No-Action Alternative.

### Special-Status Species

Riverine habitat quality in the Sacramento River and the San Joaquin River regions under Alternative 4 would improve compared with riverine habitat quality under the No-Action Alternative and would benefit special-status species. Reservoir habitat quality would not change; therefore, nesting or wintering bald eagles would not be affected.

## **WATERFOWL AND SHOREBIRDS**

### **Refuges - Common Species**

The potential beneficial impacts under Alternative 4 of increases in water delivery to refuges and increased acreages of managed permanent ponds, seasonal marshes, and watergrass would be identical to the potential beneficial impacts described for Alternative 2.

### **Field Flooding**

The potential beneficial impact under Alternative 4 of additional flooded agricultural fields in the Sacramento River, Delta, and San Joaquin River regions would be identical to the potential beneficial impact described for Alternative 1.

### **Special-Status Species**

The potential beneficial impacts under Alternative 4 on special-status species would be identical to the potential beneficial impacts described for Alternative 2.

### **Duck Clubs and Other Private Lands**

The potential impacts on duck clubs and other private lands under Alternative 4 would be identical to the potential impacts described for Alternative 2.

### **Evaporation Ponds**

The number of acres of evaporation ponds would be the same as under the No-Action Alternative. Impacts on waterfowl and shorebirds would continue to occur.