California
Wetland Resources

California has about 454,000 acres of nonagricultural wetlands; more than 90 percent of the State's wetlands have been drained, mostly for agricultural purposes. Before significant agricultural conversion began, about 5 million acres of wetlands supported lush aquatic vegetation and provided habitat for hundreds of species of fish and wildlife as well as food, clothing, protection from predators, and transportation for native Americans.

California's wetlands provide stopover, wintering, and breeding habitat for vast numbers of waterfowl (fig. 1). The Sacramento–San Joaquin River Delta is the largest remaining wetland area in the State. The delta's wetlands regularly harbor as much as 15 percent of the waterfowl on the Pacific Flyway, the bird-migration corridor extending from the southern tip of South America to Alaska. Although significantly reduced in size since predevelopment times, wetlands in the delta are a source of large amounts of plant and algal materials that are the basis of complex food systems in the wetlands themselves and downstream in the estuaries of San Francisco Bay.

California's wetlands have significant environmental and economic value for humans and wildlife. Wetlands provide temporary storage of floodwaters, reducing downstream damage, and serve as buffers against erosion. Marshes in the Sacramento–San Joaquin River Delta and many coastal marshes act as freshwater barriers to seawater intrusion of aquifers. Wetlands also trap sediment and absorb many waterborne pollutants and excess nutrients. Wetlands provide fish and wildlife habitat; inland wetlands are excellent habitat for bass, catfish, bluegill, sunfish, crappie, geese, ducks, wading birds, and many species of amphibians. Wetlands offer recreational and educational activities, as well as opportunities for scientific studies.

TYPES AND DISTRIBUTION

Wetlands are lands transitional between terrestrial and deepwater habitats where the water table usually is at or near the land surface or the land is covered by shallow water (Cowardin and others, 1979). The distribution of wetlands and deepwater habitats in California is shown in figure 2*A*; only wetlands are discussed herein.

Wetlands can be vegetated or nonvegetated and are classified on the basis of their hydrology, vegetation, and substrate. In this summary, wetlands are classified according to the system proposed by Cowardin and others (1979), which is used by the U.S. Fish and Wildlife Service (FWS) to map and inventory the Nation's wetlands. At the most general level of the classification system, wetlands are grouped into five ecological systems: Palustrine, Lacustrine, Riverine, Estuarine, and Marine. The Palustrine System includes only wetlands, whereas the other systems comprise wetlands and deepwater habitats. Wetlands of the systems that occur in California are described below.

System	Wetland description
Palustrine	Nontidal and tidal-freshwater wetlands in which vegetation is predominantly trees (forested wetlands); shrubs (scrub-shrub wetlands); persistent or nonpersistent emergent, erect, rooted herbaceous plants (persistent- and nonpersistent-emergent wetlands); or submersed and (or) floating plants (aquatic beds). Also, intermittently to permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet deep.
Lacustrine	Nontidal and tidal-freshwater wetlands within an intermittently to permanently flooded lake or reservoir larger than 20 acres and (or) deeper than 6.6 feet. Vegetation, when present, is predominantly nonpersistent emergent plants (nonpersistent-emergent wetlands), or submersed and (or) floating plants (aquatic beds), or both.
Riverine	Nontidal and tidal-freshwater wetlands within a channel. Vegetation, when present, is same as in the Lacustrine System.
Estuarine	Tidal wetlands in low-wave-energy environments where the salinity of the water is greater than 0.5 part per thousand (ppt) and is variable owing to evaporation and the mixing of seawater and freshwater.
Marine	Tidal wetlands that are exposed to waves and currents of the open ocean and to water having a salinity greater than 30 ppt.

Figure 1. Suisun Marsh provides habitat to many kinds of waterfowl. Agricultural and urban encroachment has reduced and continues to threaten valuable wetlands. *(Photograph courtesy of the Bureau of Reclamation.)*

The FWS National Wetland Inventory currently (1993) is mapping California's wetlands and compiling statewide acreage data. However, that inventory is not scheduled to be completed until the late 1990's, and there are no other systematically compiled data concerning statewide wetland acreage. Dahl (1990), on the basis of Central Valley (fig. 2*B*) acreage data in Frayer and others (1989) and approximations by the FWS, estimated that California had 454,000 acres of wetlands in the mid-1980's—0.4 percent of the State's area.

Frayer and others (1989) reported the results of a systematic survey of Central Valley and Sacramento–San Joaquin River Delta wetlands conducted in the mid-1980's. The study indicated that there were about 378,800 acres of freshwater and estuarine nonagricultural wetlands and 658,600 acres of flooded rice fields, most of which are converted wetlands. Field and others (1991) reported that the coastal counties of California had about 198,500 acres of palustrine, estuarine, and marine wetlands on the basis of interpretation of aerial photography done from the mid-1970's to the mid-1980's. Acreage data for the alluvial basins of northern California, montane wetlands in the Sierra Nevada and Cascade Range, and desert wetlands in southern California are not yet available.

The 378,800 acres of nonagricultural wetlands in the Central Valley and Sacramento–San Joaquin River Delta includes approximately 318,900 acres of palustrine wetlands and 59,900 acres of

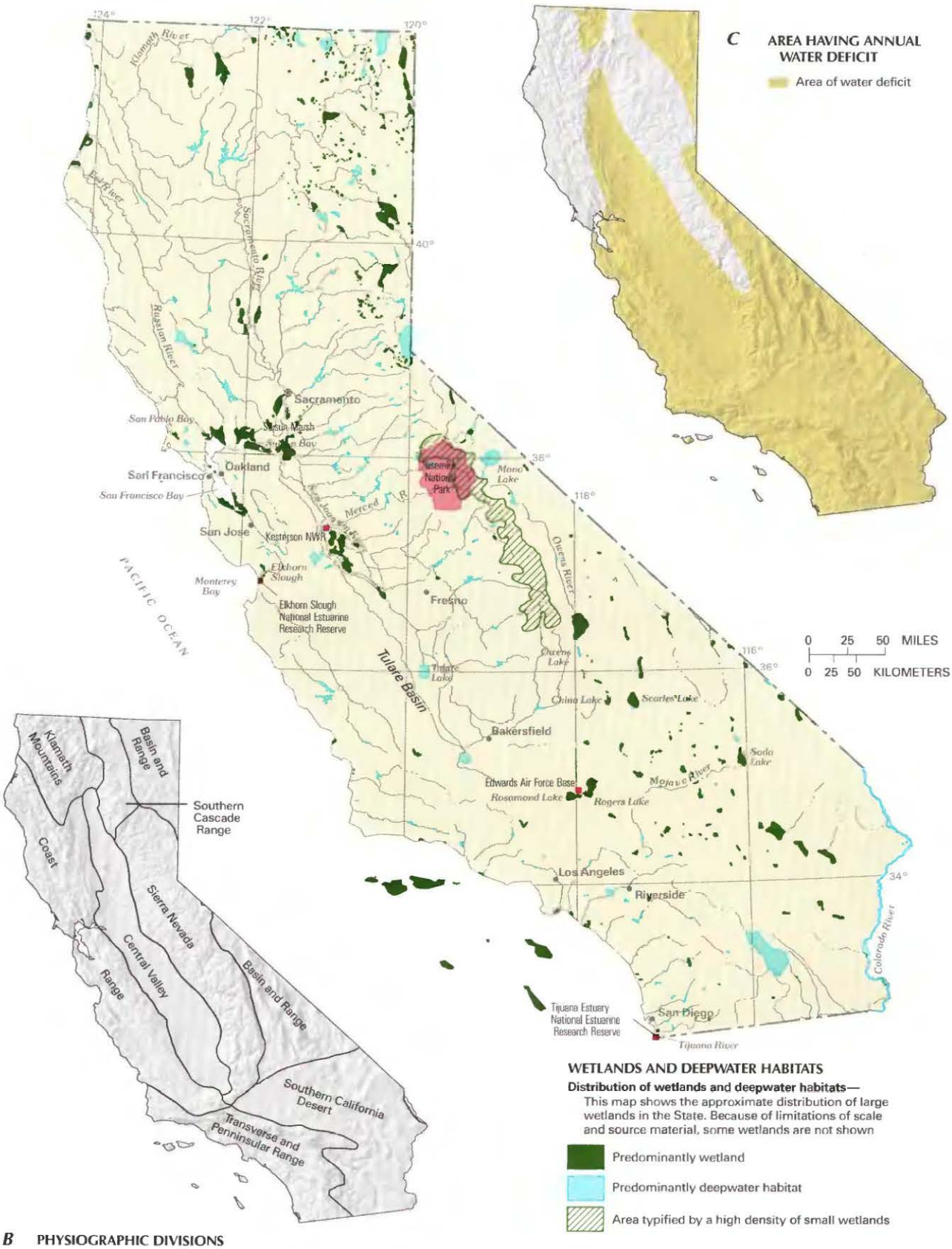

Figure 2. Wetland distribution in California and physical and climatological features that influence wetland distribution in the State. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Physiography. ***C***, Moisture balance. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions modified from Fenneman, 1946; landforms from EROS Data Center. C, Modified from Thomas and Phoenix, 1976.)*

estuarine wetlands (Frayer and others, 1989). The palustrine wetlands are of three types: (1) Those associated with or adjacent to rivers—primarily overflowed lands, sloughs, and bypasses; (2) those associated with grasslands—mainly on the alluvial fans of the eastern and western slopes of the valley, which contain numerous vernal pools during normal-precipitation years; and (3) marshes—mainly in the central lowlands of the Sacramento and San Joaquin River drainage basins and the Tulare Basin. The Central Valley's estuarine wetlands are in the Suisun Marsh in the westernmost part of the Sacramento–San Joaquin River Delta.

On the basis of data from Field and others (1991), most wetlands in California's coastal counties, which are primarily in the Coast Ranges, are classified as palustrine. Of the 198,500 coastal wetland acres, 46,700 acres are fresh marsh (palustrine emergent wetlands), 77,800 acres are palustrine forested or scrub-shrub wetlands, 21,700 acres are salt marsh (estuarine emergent wetlands), and 52,200 acres are tidal flats (estuarine unconsolidated-shore wetlands), which are mostly nonvegetated. (The acreages for individual wetland types do not total 198,500 because of rounding.)

The mountains of California contain palustrine, lacustrine, and riverine wetlands. These wetlands have not been inventoried to date (1993) because of their isolated and widely different topographic and ecological settings. Construction of reservoirs on the upland reaches of creeks and major rivers in the Sierra Nevada and Cascade Range has created additional wetland acreage. Palustrine wetlands of the Sierra, Cascades, and parts of the Coast Ranges are emergent wetlands commonly called bogs or meadows and forested or scrub-shrub wetlands called swamps. These wetlands are typically small, sometimes only a few thousand square feet, and exist randomly among coniferous forests at altitudes generally higher than 3,000 to 3,500 feet.

The desert basins of southeastern California contain lacustrine and palustrine wetlands referred to as playas, which are lakebeds that are intermittently flooded. Rogers, Soda, Searles, China, and Rosamond Lakes are large playas. The typical playa is nonvegetated except where fissures and sinklike depressions provide intermittent sources of water by pooling rainfall and overland flow. In unusually wet years and for periods following them, plants whose roots reach the water table, such as saltbrush, rabbitbrush, tamarisk, and mesquite, grow in areas of shallow ground water and around dry springs (C.J. Londquist, U.S. Geological Survey, written commun., 1993).

Mono Lake, a saline lake remnant of a much larger ice-age lake in the Basin and Range east of the central Sierra Nevada (fig. 2*B*), supports an abundance of brine shrimp and brine flies that are a significant food source for eared grebes, avocets, plovers, sandpipers, gulls, ducks, and phalaropes (Bakker, 1984). Because of the high salinity of the lake water, only salt-tolerant plants such as stinkweed, goosefoot, and salt or alkali grass grow around the lake.

In the Southern California Desert near the California–Mexico border is a type of palustrine desert wetland known popularly as an "oasis." These emergent, scrub-shrub, and forested wetlands support willow, catclaw, mesquite, cottonwood, tamarisk, reeds, arrowwood, and in some places, sedges, tules, and cattails. But the most distinctive plants of the oases are the native fan palms (Bakker, 1984).

HYDROLOGIC SETTING

To understand the existence of once vast natural wetlands in a State that has an average annual precipitation of about 20 inches and is commonly considered to be semiarid to arid, California's hydrography and topography must be examined. Most of the State has a natural annual water deficit (fig. 2*C*). However, in the areas having a natural water surplus, precipitation ranges from 40 to as much as 90 inches per year, most of that being snowfall in the Sierra Nevada, Cascade Range, and Klamath Mountains. Annual precipitation amounts can differ widely from year to year because of variability in the Pacific storm track.

Mountain ranges induce precipitation at the higher altitudes and create "rain shadows" (dry areas) in the leeward valleys and plains. In California, nearly continuous ranges of coastal mountains extend from the Oregon border to Mexico, and these ranges are paralleled by the southern Cascade Range and the Sierra Nevada about 150 miles farther inland (fig. 2*B*). Between the two ranges, in the rain shadow of the Coast Ranges, lies the Central Valley, nearly 400 miles long and 70 miles wide. In the rain shadow of the southern Cascade Range, the Sierra Nevada, and the coastal mountains of southern California are the Basin and Range and Southern California Desert physiographic provinces.

Central Valley wetlands.—Streams originating in the Sierra Nevada carry 95 percent of the runoff entering the Central Valley. Before hydrologic modification associated with agriculture, much of the southern Sierra Nevada runoff flowed into the internally drained Tulare Basin, creating several large freshwater lakes that existed for more than 2,000,000 years (Page, 1986). The largest, Tulare Lake, formed a large lacustrine wetland extending over 600 square miles. Streams flowing in the trough of the Central Valley typically have low gradients and almost imperceptible natural levees. Consequently, before the rivers were contained by irrigation and flood-control projects, flood plains were wide, and in many years the entire valley was inundated by floodwater. Overbank flooding created thousands of acres of marshland and tens of thousands of vernal pools. Despite flood-control projects since the mid-1850's, overbank flooding still can occur in wet years.

In the years before flood-control and irrigation projects, shallow water tables supported large areas of wetlands on the valley floor. However, as a result of agricultural drainage, ground-water withdrawal, building of upland diversion dams, and flood-control projects, the original flow paths of water into the Central Valley and most of California's other alluvial basins have been altered, and the valley's hydrology is now generally as shown in figure 3*A*. Floods no longer regularly cover the valley floors but are diverted to cropland, stored, or channeled. Ground-water levels under the valley floors have been drawn down to such an extent that recharge is primarily from irrigation, and discharge is mainly to large centers of ground-water pumping (Bertoldi and others, 1991). Most of the valley's wetlands are now sustained by controlled application of water (Frayer and others, 1989).

Many wildlife refuges in the Central Valley use irrigation drain water either as a part or as the total source of water. Until 1986, 1,200 acres of ponds in the Kesterson National Wildlife Refuge (fig. 2*A*) were partly sustained by agricultural drain water from the west side of the San Joaquin Valley. In 1983, the FWS discovered an unusually high incidence of deformed or dead birds in the refuge. Studies of the drain water entering the ponds and of the water in the ponds showed that the deformities were caused by high concentrations of selenium in the drain water. The Bureau of Reclamation (BOR) implemented a plan to mitigate the effects of the drain water at the refuge by stemming the flow of agricultural drain water into the refuge and eliminating all aquatic habitat in the areas of the contaminated ponds. Surface water is now imported into the refuge.

Estuarine wetlands.—California's estuaries have a high degree of variability in their physical and hydrologic environment. For most of the year, coastal estuaries, such as the Suisun Marsh below the confluence of the Sacramento and San Joaquin Rivers (and the Sacramento–San Joaquin Delta wetlands under natural conditions) are sustained by brackish to saline water. In the wet season during winter, they can become completely fresh. In addition, streamflow varies substantially, from none in many years to floods in wet years.

There is little emergent wetland acreage remaining in the Sacramento–San Joaquin River Delta. After World War I, nearly all

delta marshland had been transformed to the series of improved channels and leveed islands that exist to the present (fig. 3*B*). The delta soils are predominantly organic peat, and in agricultural use have oxidized extensively, causing land surfaces to subside to more than 15 feet below sea level within the leveed islands (California Department of Water Resources, 1993) so that emergent wetlands can exist only on the margins of the delta.

Three of California's estuarine wetlands have attracted national and international attention. The largest of these wetland areas is the complex system of over 1,000 miles of waterways in the Sacramento–San Joaquin River Delta and three bays within a 1,200-square-mile area of central California. The bays, beginning with the most landward, are Suisun, San Pablo, and the largest, San Francisco. About 70 percent of California's water supply originates in the Sierras, flows through the Central Valley into the bay-delta system, then discharges into the Pacific Ocean at San Francisco Bay.

Two other, smaller estuarine wetlands, Elkhorn Slough on Monterey Bay and the Tijuana River estuary at San Diego, have been included in the National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Research Reserves. Such reserves are defined as "classes of ecosystems worthy of research and education, yet different enough to warrant selection as a distinct regional type" (Zedler and others, 1992). The recent geologic factors that shape these estuaries are the forces of slowly rising sea level, which causes inland migrations of the estuaries, and tectonic uplift, which partly offsets the effects of a rising sea level. Deep submarine canyons and unusual shoreline configurations affect the size and condition of both estuaries. Longshore drifting and currents have not been measured, but the effects are well known. Beach erosion has caused landward movement of the estuarine shorelines and subsequent salinity changes. After decades of study at the Tijuana National Estuarine Research Reserve, restoration programs are underway.

Montane wetlands.—The most common types of montane wetlands in California are meadows, which are palustrine wetlands with persistent emergent vegetation (fig. 3*C* and 3*D*). Meadows in California have been best studied in the Sierras, where they are estimated to compose about 10 percent of the total area (Ratliff, 1985). At higher altitudes, glacial cirques commonly contain small pools or lakes known as tarns. Meadows can develop when tarns fill with sediment, peat, or both.

California's mountains are geomorphologically dynamic because of glaciation, tectonic uplift, and volcanic eruptions in the recent geologic past. Dynamic features include glacially scoured depressions, moraines, and till and outwash deposits resulting from landslides and mudflows and from volcanic debris and lava flows that impede the movement of water from precipitation and snowmelt, leading to the formation of wetlands. Impoundments can form

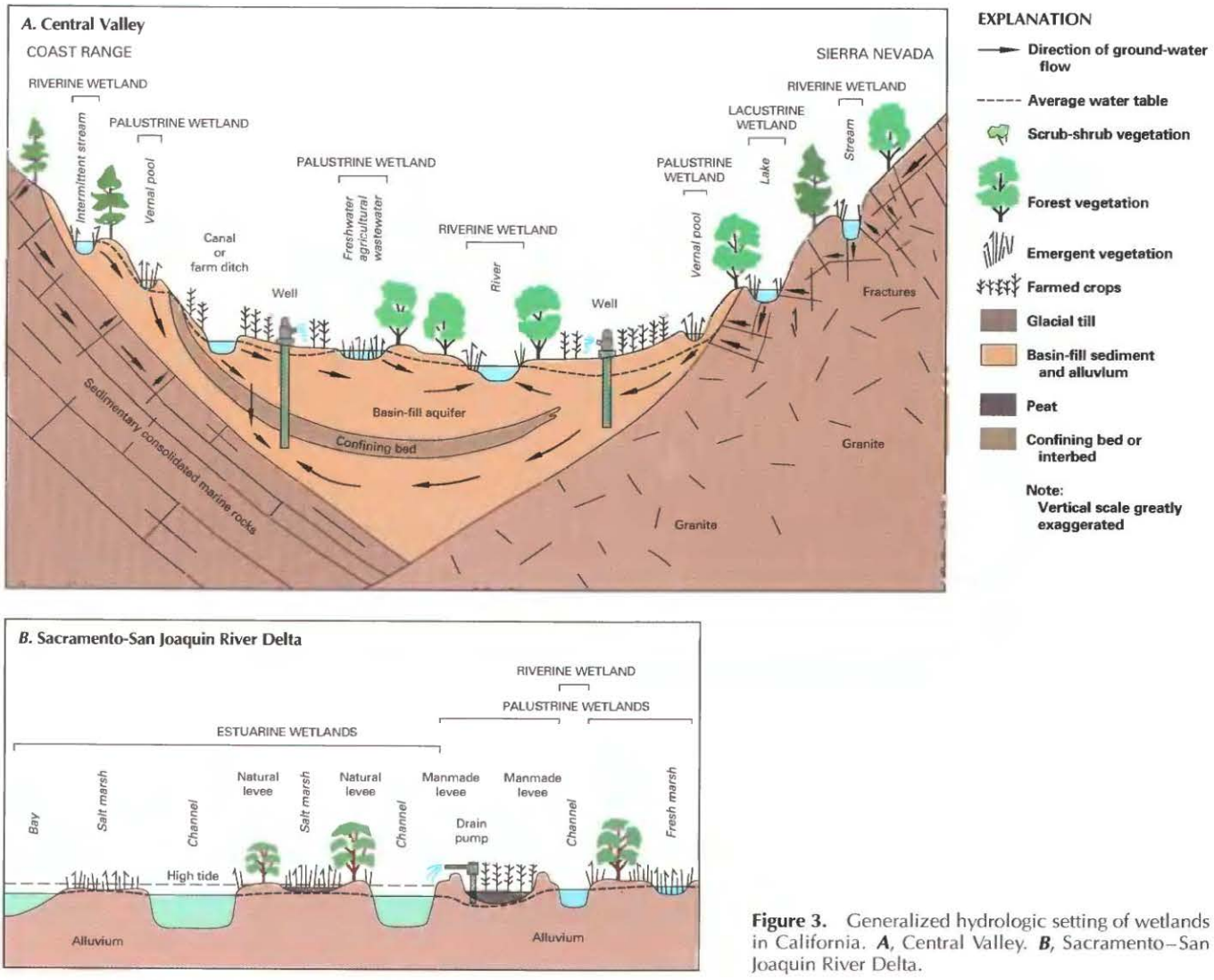

Figure 3. Generalized hydrologic setting of wetlands in California. ***A***, Central Valley. ***B***, Sacramento–San Joaquin River Delta.

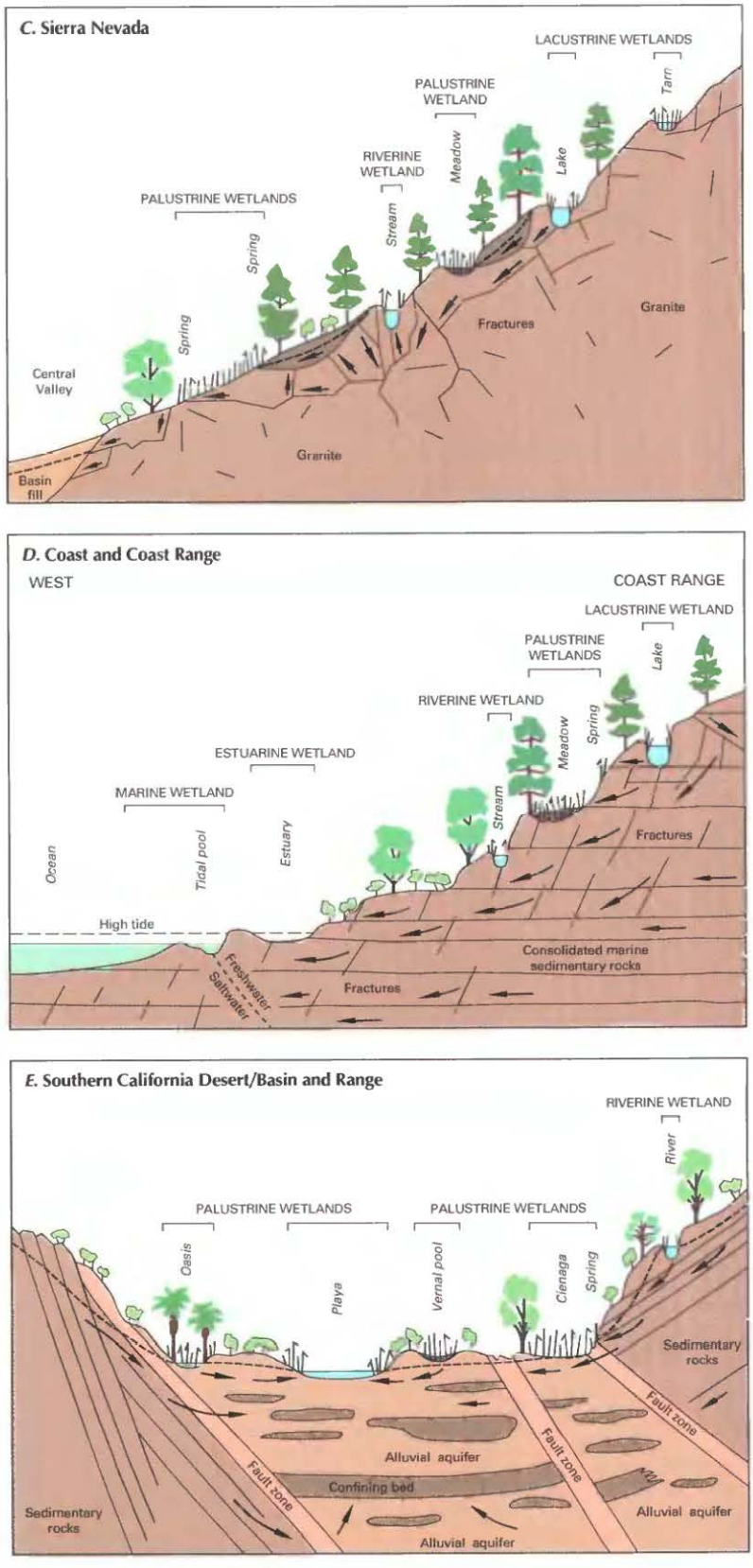

Figure 3. Continued. Generalized hydrologic setting of wetlands in California. *C*, Sierra Nevada. *D*, Coast and Coast Ranges. *E*, Southern California Desert and Basin and Range.

as a result of landslides or mining, road construction, and other human activities. Beavers create wetlands as a result of dam building. An example of a landslide-created wetland can be found in Mirror Lake at the base of Half Dome in Yosemite National Park. The lake is filling with sediment, and vegetation is becoming established.

Meadows form in several topographic positions: depressions in valley bottoms, on glacially gouged surfaces, in glacial moraines with surface depressions where water is held, and on slight to moderate slopes where ground water discharges into fine-textured soils (commonly glacial or landslide deposits) at a rate greater than it can be released to streams and the atmosphere.

Meadows can have a range of hydrologic characteristics, from seasonally wet from snowmelt to saturated throughout the year. A single meadow can have several different hydrologic regimes, each supporting different vegetative communities (Ratliff, 1985). Meadows can be hydrologically dependent on both surface and ground water. Recent studies indicate that ground water is more important to meadow wetlands than previously thought (Akers, 1986; Winter and Woo, 1990).

The present hydrologic condition of meadows in the Sierras, and likely elsewhere in California, ranges from slightly to highly altered; however, no systematic evaluation has been reported. Grazing of livestock since the mid-1850's disturbed many meadows enough to cause erosion, which in turn affected the hydrologic regime and the vegetative communities. More recently, intensive recreational use has contributed to degraded meadow conditions as well. Restoration of meadow vegetation to support grazing by livestock and wildlife requires that the hydrologic regime first be restored (Ratliff, 1985).

Southern California Desert/Basin and Range Wetlands.—Southeastern California from the Mexico border to the eastern flank of the Sierra Nevada lies in the rain shadow of the mountain ranges to the west. Precipitation is very low and temperatures are very high. Water for wetlands typically is supplied by mountain front creeks, springs, seeps, pools, and in more recent times, irrigation canals (fig. 3*E*). The largest wetlands in the region are playas, which typically are dry much of the year. Playas receive water from intermittent surface flows and from direct precipitation during infrequent storms. Water leaves playas through evaporation and transpiration because there is no surface drainage. Elsewhere, isolated springs and seeps support generally small marshes (cienagas) and other wetlands, such as oases. Where the water supply is relatively persistent but drainage is limited, saline wetlands can form.

California's population is concentrated and increasing in the southern part of the State. The growing demand for water and recreational activities (Bureau of Land Management, 1980) affects water resources and desert lands, especially wetland and riparian areas. Ground-water pumping in the western Mojave Desert has caused fissures in playas at Edwards Air Force Base, and riparian vegetation has been adversely affected by declining ground-water levels. Increased amounts of water diverted for urban uses decreases the amount supporting wetlands. Rec-

reational activities and grazing have damaged riparian vegetation, contributing to a general decline in the quantity and quality of riparian wetlands.

Owens Valley, a closed basin at the base of the Sierra Nevada's eastern escarpment, historically received runoff from the mountains that supported flow in the Owens River. This surface-water flow maintained Owens Lake and a ground-water level close to the ground surface of the valley floor. Diversions of surface water and ground water to Los Angeles since 1970 virtually eliminated wetlands dependent on surface water in the river and lake. However, ground-water-dependent vegetation on the valley floor has survived a lowering of the water table by several feet by extending the root systems (Sorenson and others, 1991). Its longer term survival and reproduction have not been studied.

TRENDS

The earliest estimates of wetland acreage in California are those documented by the California State Engineers Surveys dating between 1868 and 1886 (Hall, 1887). At that time, William H. Hall recorded nearly 5.2 million acres of land as swamps, lakes, bogs, and river overflow areas, most of which were located in the Central Valley. Dahl (1990) estimated that about 5 million acres of wetlands existed before large-scale agricultural conversions began. Of the original 5 million acres, nearly 4 million were palustrine, lacustrine, and riverine wetlands in the Central Valley, 700,000 were estuarine wetlands, 65,000 were palustrine and lacustrine wetlands of the Coast Ranges, 120,000 were palustrine, lacustrine, and riverine wetlands of the Cascade Range and Sierra Nevada, and 15,000 acres were riverine or palustrine wetlands of the interior basins and ranges.

Significant wetland loss in California began in about 1850. In that year, the National Swamp and Overflowed Land Act conveyed all swamp and overflowed land, including delta marshes, from Federal ownership to the State of California. In 1866, the California Legislature formed the Board of Swamp and Overflowed Land Commissioners to manage reclamation projects and proceeds from sales of swampland by the State. In 1869, the board relinquished its authority to individual county boards of supervisors. By about 1870, nearly all of California's wetlands were in private ownership, and subsidies were established to aid private developers in reclaiming swamplands (California Department of Water Resources, 1993).

Between 1850 and 1920, about 70 percent of California's wetland acreage was modified or converted to upland, largely by levee and drainage projects (Dennis and others, 1984). Nearly all of the reclaimed land was put into agriculture, helping to make California the leading agricultural State in the Nation by 1887. The diversion and redistribution of Sierran runoff water into the valley continued vigorously so that by 1939, 85 percent of the wetlands had been lost. By 1940, Tulare Lake, which had in post-European-settlement history covered as much as 1,000 square miles, had been completely drained. Between 1938 and the early 1970's, construction of large-scale irrigation systems had modified more than 90 percent of the original wetlands.

Although losses of wetlands have been large, some changes in land-use practices since about 1980 have caused increases or improvements in wetland habitats. Since 1939, a switch from pastureland and row-crop farming to flooded rice paddies in the Sacramento Valley and parts of the San Joaquin Valley has increased palustrine wetlands by 41,000 acres (Frayer, 1989). Rice farmers, in conjunction with university and State researchers and private organizations, are developing methods to flood rice paddies during critical periods of occupation by migratory waterfowl. If these methods are perfected, several hundred thousand acres could be returned to seasonal wetland-habitat status while continuing to be used as agricultural lands.

CONSERVATION

Many government agencies and private organizations participate in wetland conservation in California. The most active agencies and organizations and some of their activities are listed in table 1.

Federal wetland activities.—Development activities in California wetlands are regulated by several Federal statutory prohibitions and incentives that are intended to slow wetland losses. Some of the more important of these are contained in the 1899 Rivers and Harbors Act; the 1972 Clean Water Act and amendments; the 1985 Food Security Act; the 1990 Food, Agriculture, Conservation, and Trade Act; the 1986 Emergency Wetlands Resources Act; and the 1972 Coastal Zone Management Act.

Table 1. Selected wetland-related activities of government agencies and private organizations in California, 1993

[Source: Classification of activities is generalized from information provided by agencies and organizations. •, agency or organization participates in wetland-related activity; ..., agency or organization does not participate in wetland-related activity. MAN, management; REG, regulation; R&C, restoration and creation; LAN, land acquisition; R&D, research and data collection; D&I, delineation and inventory]

Agency or organization	MAN	REG	R&C	LAN	R&D	D&I
FEDERAL						
Department of Agriculture						
Consolidated Farm Service Agency	...	•	...	...	...	...
Forest Service	•	...	•	•	•	•
Natural Resources Conservation Service	...	•	•	...	•	•
Department of Commerce						
National Oceanic and Atmospheric Administration	•	•	...	...	•	...
Department of Defense						
Army Corps of Engineers	•	•	•	•	•	•
Military reservations	•	...	...	...	...	...
Department of the Interior						
Bureau of Land Management	•	...	•	•	•	•
Bureau of Reclamation	...	...	•	...	•	•
Fish and Wildlife Service	•	...	•	•	•	•
Geological Survey	...	...	...	...	•	...
National Biological Service	...	...	...	...	•	...
National Park Service	•	...	•	•	•	•
Environmental Protection Agency	...	•	...	...	•	•
STATE						
Environmental Protection Agency						
State Water Resources Control Board	...	•	...	...	...	...
Regional Water-Quality Control Board	...	•	...	...	•	•
Resources Agency						
California Coastal Commission	...	•	...	...	•	•
Department of Conservation	...	•	...	...	•	...
Department of Fish and Game	•	•	•	•	•	...
Department of Parks and Recreation	•	...	•	•	...	...
Department of Water Resources	•	•	...	...	•	...
San Francisco Bay Conservation and Development Commission	...	...	•	•	•	...
State Reclamation Board	...	•	...	...	•	...
State Lands Commission	•	•	...	•	...	•
State Coastal Conservancy	...	...	•	•	...	...
Wildlife Conservation Board	...	...	•	•	...	...
SDME COUNTY AND LOCAL GOVERNMENTS						
Local planning authorities	...	...	...	•	...	•
Reclamation districts	•	•	•	•	•	•
Resource conservation districts	•	•	•	•	•	•
Water districts	•	•	•	•	•	...
PRIVATE						
California Waterfowl Association	•	...	•	•	...	...
Ducks Unlimited	•	...	•	•	•	•
Farmlands and Dpen-Space Foundation	...	...	...	...	•	...
National Audubon Society	...	...	...	•	•	•
Pacific Flyway Project	•	...	...	•	•	•
Sierra Club	...	...	...	•	•	...
The Nature Conservancy	•	...	•	•	•	•
Trust for Public Land	•	...	...	•	•	•

Section 10 of the Rivers and Harbors Act gives the U.S. Army Corps of Engineers (Corps) authority to regulate certain activities in navigable waters. Regulated activities include diking, deepening, filling, excavating, and placing of structures. The related section 404 of the Clean Water Act is the most often-used Federal legislation protecting wetlands. Under section 404 provisions, the Corps issues permits regulating the discharge of dredged or fill material into wetlands. Permits are subject to review and possible veto by the U.S. Environmental Protection Agency (EPA), and the FWS has review and advisory roles. Section 401 of the Clean Water Act grants to States and eligible Indian Tribes the authority to approve, apply conditions to, or deny section 404 permit applications on the basis of a proposed activity's probable effects on the water quality of a wetland.

Most farming, ranching, and silviculture activities are not subject to section 404 regulation. However, the "Swampbuster" provision of the 1985 Food Security Act and amendments in the 1990 Food, Agriculture, Conservation, and Trade Act discourage (through financial disincentives) the draining, filling, or other alteration of wetlands for agricultural use. The law allows exemptions from penalties in some cases, especially if the farmer agrees to restore the altered wetland or other wetlands that have been converted to agricultural use. The Wetlands Reserve Program of the 1990 Food, Agriculture, Conservation, and Trade Act authorizes the Federal Government to purchase conservation easements from landowners who agree to protect or restore wetlands. The Consolidated Farm Service Agency (CFSA, formerly the Agricultural Stabilization and Conservation Service) administers the Swampbuster provisions and Wetlands Reserve Program. The Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) determines compliance with Swampbuster provisions and assists farmers in the identification of wetlands and in the development of wetland protection, restoration, or creation plans.

The 1986 Emergency Wetlands Resources Act and the 1972 Coastal Zone Management Act and amendments encourage wetland protection through funding incentives. The Emergency Wetlands Resources Act requires States to address wetland protection in their Statewide Comprehensive Outdoor Recreation Plans to qualify for Federal funding for State recreational land; the National Park Service provides guidance to States in developing the wetland component of their plans. Coastal States that adopt coastal-zone management programs and plans approved by NOAA are eligible for Federal funding and technical assistance through the Coastal Zone Management Act.

The EPA has authority, through the National Pollution Discharge System, National Pretreatment Program, Ocean Dumping/Dredging and Fill Program, and the Clean Water Act, to certify that permitted use of the State's waters is consistent with established water-quality objectives. Under the Clean Water Act, the EPA's San Francisco Bay-Estuary Project has a 5-year-program objective to develop a comprehensive management plan that would set operational standards for nearly 700,000 acres of estuarine and marine wetlands.

The U.S. Department of Agriculture, through local conservation districts and the NRCS, administers the Federal Water Bank program with assistance from the CFSA and the State of California. The major objective of this program is to restore, preserve, enhance, or improve wetland habitat in important migratory waterfowl nesting and breeding areas.

The NOAA administers the Coastal Zone Management Act, whose purpose is to increase awareness and understanding of the coastal environment and to increase the ability of States' coastal-zone-management programs to address problems. NOAA funding under the act assists California in coastal-plan development, including wetlands. Grants have been awarded to the California Coastal Plan and San Francisco Bay Plan. NOAA also administers the National Estuarine Research Reserve program, which provides site acquisition for preservation, research, and education.

The FWS manages approximately 225,000 acres of land on 34 National Wildlife Refuges, Wildlife Management Areas, National Fish Hatcheries, or other wildlife facilities. Wetlands on these holdings are among the most important habitat along the entire Pacific Flyway. Through the American Waterfowl Management Plan, the FWS administers the Central Valley Joint Habitat Venture, which comprises private organizations and other public agencies that have pooled their resources to help meet a target of restoring and maintaining the diversity, distribution, and abundance of waterfowl at 1970's levels.

State wetland activities.—California has no single agency that implements an integrated plan for management of wetland resources, nor does the State have a wetlands-management policy. The Governor's Office sets broad environmental goals for the State. The Governor's Office of Planning and Research has no regulatory authority but has substantial influence in guiding administration policy and is the clearinghouse for all documents promulgated under the California Environmental Quality Act of 1970. This act establishes the basic charter for protection of California's environment. A major policy under the act is the maintenance of fish and wildlife populations, and the protection of wetlands is identified as a significant goal.

The California Environmental Protection Agency administers four boards that set standards, control pollution, and improve the quality of the environment throughout the State. The State Water Quality Control Board administers the system of water rights and, through a series of nine Regional Water Quality Control Boards, is responsible for implementing section 108 of the Clean Water Act, which is a mandate to control nonpoint pollution. The boards also implement the provisions of the Porter-Cologne Act of 1969. These provisions provide for assessment reports identifying surface-water bodies that would not meet water-quality standards without nonpoint-source controls and allow for the development and implementation of best-management practices for control of nonpoint sources of pollution.

Several departments and commissions, operating within the overall administration of the Resources Agency of the State of California, have primary responsibility for the enhancement and protection of wetland habitats. The Fish and Game Commission sets policy for the Department of Fish and Game. The Department has legislative authority to preserve, protect, and manage California's fish, game, and native plants, without respect to their economic value, and administers provisions of the State Endangered Species Act. The Department is responsible for wildlife management, collecting and managing data for waterfowl and nongame wildlife, disease research, wetland enhancement, and habitat development and management on 76 State-owned designated wildlife areas, ecological reserves, and other public lands. The Department of Fish and Game Stream or Lake Alteration Agreements are required for activities that result in changes in natural conditions in streams, lakes, channels, or crossings.

The San Francisco Bay Conservation and Development Commission is authorized by the McAteer–Petris Act to analyze, plan, and regulate development activities in San Francisco Bay and along its shoreline. The Commission implements the San Francisco Bay Plan and the Suisun Marsh Protection Plan. The Commission also regulates dredging and filling in the bay, and in sloughs, marshes, certain creeks, and tributaries within 100 feet of the bay. The plan is subject to Coastal Zone Management Agency consistency review as a component of California's Coastal Plan, which is administered by the Commission. The Suisun Marsh Preservation Act was enacted in 1977 to establish policies and programs in the Suisun Marsh Protection Plan. Local governments and districts must prepare local protection programs to bring their policies and ordinances into conformity with the provisions of the act.

The Department of Water Resources is authorized by the Delta

Protection Act of 1988 to approve levee improvement in wetlands of the Sacramento–San Joaquin Delta. The Department is responsible for the State Water Project pumping facilities in the delta. The Department, as authorized by Delta Flood Protection Act of 1988, is involved in a levee-improvement program for flood protection that overlaps the North Delta Water Management Plans for widening channels, the South Delta Water Management Plans, and the Los Banos Grandes projects. The Department represents the State in Corps and BOR flood-control and water-development projects.

County and local wetland activities.—Resource Conservation Districts are authorized by Division 9 of the California Public Resources Code to assist the State in conserving soil and water resources, including wetlands. There are about 400 water, reclamation, and drainage districts in California, another 300 park and open-space districts, and 110 public-utility districts governed by Division 9 authority for conservation.

In addition to special districts, county and city governments are required to have a general plan that has mandated elements including open space/conservation, safety, land use, and water circulation (Government Code, Section 65000 et seq.). There are no regional requirements for plan consistency among the counties and cities. The conservation element of the general plan must address the conservation, development, and utilization of natural resources, including water and its hydraulic force, forests, soils, rivers, and other waters. harbors, fisheries, wildlife, minerals, and other natural resources. The open-space element defines provisions for open space for the preservation of natural resources, the managed production of resources, outdoor recreation, and public health and safety.

Private wetland activities.—Duck hunting clubs own most of the nonagricultural Central Valley and Suisun Bay wetlands and manage these areas for waterfowl. Ducks Unlimited is a major participant in the Joint Venture program of the FWS, in which public and private organizations cooperate to preserve wetlands. The Nature Conservancy, California Waterfowl Association, Pacific Flyway Project, Trust for Public Land, Solano County Farmlands and Open Space Foundation, Sierra Club, and National Audubon Society have acquired sensitive lands for preservation and restoration.

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