

Environmental Baseline

Most of the Central Valley's threatened and endangered species depend on native habitats that are declining in area and quality. Because these sensitive habitats may host several threatened and endangered species, their loss or degradation can often adversely affect multiple species. Factors contributing to the environmental baseline are therefore grouped by habitat type in the analysis below. However, effects from environmental contaminants are typically less specific to particular habitats and are discussed separately. Population status for individual species is described in the species accounts found in Appendix E.

When the CVP began operations, approximately 30% of all natural habitats in the Central Valley had been converted already to urban and agricultural lands. This included loss of more than 80% of the riparian vegetation along the Sacramento River. By the time Shasta Reservoir (the first large CVP facility) began operation in 1944, many of California's natural habitats had been altered dramatically.

Habitat Analyses

Acreage trends in the analyses below are based primarily on Küchler (1977) and GAP (1996). Küchler's (1977) map of California's potential natural vegetation (*i.e.*, the potential climax vegetation which exists or has been estimated to exist and would occur if all alterations and disturbances to the respective environments, except reservoirs, were removed) was digitized into Geographic Information System format. GAP (1996) included digital information about extent and distribution of habitats from 1990 LANDSAT Thematic Mapper satellite imagery. The minimum mapping unit in GAP data is 100 hectares for upland habitats and 40 hectares for wetland habitats. Because comparisons of acreage figures between the two studies are complicated by slight differences in habitat classification, percentage changes are approximate. In particular, the areas delineated as potential wetlands by Küchler (1977) historically included habitats such as the large lakes of the Tulare Basin, which may be more comparable to the "open water" category of GAP data. Conversely, Küchler (1977) included artificial reservoirs in his map that did not exist prior to European settlement. Definitions of barren/alpine habitat also differ between the two studies. However, the two studies differ in estimation of total acreage by less than 0.1%. The estimated trends in habitat are identified in Table 3.A. The current (1990) acreage of native habitats and percent of land use is identified in Table 3.B.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Table 3.A. Habitat Trend Analysis for Conservation Program Focus Area.

Habitat Type	Potential Habitat Estimation (acres) (Küchler 1977)	1990 Habitat Estimation (acres) (GAP 1996)	Percentage Difference
Coniferous and Mixed Forest	5,660,803	5,525,528	-2%
Cismontane Woodlands	9,384,947	6,919,647	-27%
Riparian	1,192,605	134,840	-89%
Alkali Desert Scrub	1,385,948	444,188	-68%
Coastal Scrub	383,308	159,210	-58%
Sagebrush	88,558	67,203	-24%
Chaparral	1,474,527	1,353,140	-8%
Grassland	8,931,211	4,551,710	-49%
Wet Meadow	Category Not Used	13,295	NA
Tule Marsh	1,968,749	86,704	-96%
Salt Marsh	96,583	73,455	-24%
Water	70,482	299,409	+324%
Alpine or Barren	1,277	102,293	+7,910%
Agricultural	0	9,555,666	NA
Urban	0	1,379,243	NA
Total	30,637,721	30,665,716	+0.09%

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Table 3.B.: Distribution of habitat types by region in the Conservation Program Focus Area, as of 1990 (GAP 1996).

Habitat Acreage	Sacramento Basin	San Joaquin Basin	Tulare Basin	Delta	San Francisco Bay Area	San Benito/ Santa Cruz
Total Area	12,086,435	8,355,936	6,319,359	744,735	1,985,249	1,173,972
Coniferous & Mixed Forest	3,679,930	798,003	626,437	0	220,009	201,334
Cismontane Woodland	3,602,914	1,764,580	1,049,081	0	284,290	218,782
Riparian	67,128	25,498	36,777	2,587	696	2,154
Alkali Scrub	0	60,549	383,639	0	0	0
Coastal Scrub	5,864	35,925	24,103	0	78,860	14,458
Sagebrush	1,720	0	65,483	0	0	0
Chaparral	422,607	381,595	165,483	0	166,333	217,122
Grassland	1,027,935	1,579,938	1,098,498	22,209	485,308	337,822
Wet Meadow	11,472	644	1,179	0	0	0
Tule Marsh	57,208	16,357	4,099	8,904	136	0
Salt Marsh	†54,088	0	0	9,443	5,760	0
Water	142,831	67,596	21,114	53,040	14,828	0
Alpine or Barren	67,657	11,500	13,479	1,478	2,594	5,585
All Natural Communities	9,141,354 (75.6%)	4,746,319 (56.8%)	3,489,372 (55.2%)	97,661 (13.1%)	1,258,814 (63.4%)	997,257 (85.0%)
Agriculture	2,591,986 (21.4%)	3,378,816 (40.4%)	2,734,909 (43.3%)	597,624 (80.2%)	102,843 (5.2%)	149,488 (12.7%)
Urban	353,095 (2.9%)	230,801 (2.8%)	95,078 (1.5%)	49,450 (6.6%)	623,592 (31.4%)	27,227 (2.3%)

†Includes Suisun Marsh and San Pablo Bay

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Table 3.C.: Distribution of potential natural vegetation categories by region in the Conservation Program Focus Area (Küchler 1977).

Habitat Acreage	Sacramento Basin	San Joaquin Basin	Tulare Basin	Delta	San Francisco Bay Area	San Benito/ Santa Cruz
Total Area	12,061,234	8,358,500	6,333,602	722,696	1,987,737	1,173,952
Coniferous & Mixed Forest	4,077,008	777,063	574,887	0	71,903	159,942
Cismontane Woodland	3,462,430	2,335,602	1,491,951	50	1,285,115	809,799
Riparian	837,103	288,551	48,123	18,828	0	0
Alkali Scrub	0	208,852	1,177,096	0	0	0
Coastal Scrub	58,602	0	0	0	280,162	44,544
Sagebrush	88,558	0	0	0	0	0
Chaparral	810,130	197,392	379,178	0	45,682	42,145
Grassland	2,155,424	4,105,962	2,143,355	180,539	228,409	117,522
Tule Marsh	506,245	429,115	505,306	523,279	4,804	0
Salt Marsh	†24,921	0	0	0	71,662	0
Water	40,813	15,963	13,706	0	0	0
Alpine or Barren	1,277	0	0	0	0	0

† Includes Suisun Marsh and San Pablo Bay

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

General Habitats

Delta Aquatic

Habitat Description and Associated Species

The Delta is the uppermost part of the Sacramento-San Joaquin Estuary and is largely a tidally influenced freshwater system. During high flows of fresh water from the Sacramento and San Joaquin Rivers, the mixing zone between fresh and salt water is pushed downstream toward the Golden Gate. The position of the freshwater edge of the mixing zone (also known as X2), where the salt content (salinity) of the water is 2 parts per thousand, is determined by river flows and tides. Plankton (microscopic organisms floating in the water column) are most abundant in the mixing zone, so the vicinity of X2 is high-quality habitat for adult and larval fish that feed on plankton. Shallow aquatic habitats have been identified in the Delta Native Fishes Recovery Plan (Service 1996a) as essential to the long-term survival and recovery of delta smelt and other resident fish. When the mixing zone is below the Delta in Suisun Bay, a large area of suitable shallow water habitat is in the mixing zone and water temperatures are favorable for growth of plankton.

Listed species associated with Delta aquatic habitats include delta smelt and Sacramento splittail. Delta smelt and Sacramento splittail seek shallow, tidally-influenced, freshwater (< 2 ppt salinity) backwater sloughs and edge waters for spawning. To assure egg hatching and larval viability, spawning areas also must provide suitable water quality (*i.e.*, low concentrations of contaminants) and substrates for egg attachment (*e.g.*, submerged tree roots, branches, emergent vegetation).

Habitat Trends

Potential natural vegetation in the Delta included approximately 520,000 acres of tule marsh, covering 72% of the area of the Delta (Küchler 1977). Since the 1850's, there has been a cumulative loss of 94 percent of the Estuary's tidal marshes (Nichols *et al.* 1986, Monroe and Kelly 1992). In 1990, the Delta contained 597,624 acres of agricultural land and 49,450 acres of urban land, covering nearly 87% of the area of the Delta (GAP 1996). Tule marshes had been reduced to 8,904 acres, a decline of 98% from the estimate of Küchler (1977). All wetland and open water habitat combined covered only 71,387 acres, covering less than 10% of the Delta (GAP 1996). Most channels in the Delta have been dredged and shallow wetland habitats have been separated from the river by an extensive levee system.

Water flow and salinity in the Delta is strongly influenced by operations of the CVP and SWP including the Tracy Pumping Plant (CVP), the Banks Pumping Plant (DWR), and numerous smaller water diversions. The storage of runoff in reservoirs as well as diversions of fresh water move the mixing zone upstream, reducing habitat quality for Delta fishes. When river flows are low, and pumps are pulling in large amounts of water, the net flow of water is in the upstream direction in the channel, and young fish following the current can be sucked into the pumps and killed. In addition to direct mortality, upstream

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

movement of water can delay migration and increase fishes exposure to predation, poor water quality, and other factors.

Several aquatic exotic species have been introduced to the Delta system (see Nichols *et al.* 1986). These exotics have outcompeted many native species, replacing natural populations. For further information on alien species, see the Cumulative Effects Section of the Chapter on Effects of the Proposed Action (page 4-14)

Operations in the Delta are determined by: the Bay-Delta Accord, as implemented by the State Water Resources Control Board under order number WR 95-6; the Service's OCAP opinion on delta smelt; the NMFS's biological opinions on winter-run chinook for the operations of the CVP and SWP (National Marine Fisheries Service 1993, 1995); the delta smelt biological opinion on the Environmental Protection Agency's (EPA) Water Quality Standards for the San Francisco/Sacramento-San Joaquin Rivers and Delta (Service 1994d, 1994b, 1995); and implementation of the Anadromous Fish Restoration Program of the CVPIA. The water quality standards and operational constraints set forth in these documents include locating X2 at Chipps Island, export rate limits, and other operational standards.

Vernal Pool

Habitat Description and Associated Species

Vernal pools are seasonal wetlands that are unique to the Mediterranean climate region of California and northwestern Baja California and are most abundant in the Central Valley. Many of the endangered plants and invertebrates that inhabit vernal pools have sporadic and disjunct distributions (*i.e.*, they occur in relatively few pools at a given location and some of these locations are widely separated from each other).

Vernal pools are distinguished by their hydrology and their relationship to adjacent habitat. First, the Mediterranean climate of the region results in most rain falling during the winter. On locally flat land the water tends to pool after each rainfall in small depressions on the land surface. Over time the soils where the wetting and drying continue year after year develop a layer below the surface that becomes resistant to water. In some soils a hardpan of mostly lime develops. In others there is a layer where clay particles have built up. The pools gather water that falls as rain over a small area of relatively flat land and then hold it at the surface until it evaporates during the summer, providing a unique habitat type. Most of these vernal pools are found on sites where the soil has been in place for thousands of years. Over thousands of years a group of species has developed adaptations to the annual wetting and drying cycle and the mineral content of the water in the pools. Other species near pools (particularly co-adapted pollinators) interact with the plants and animals found in the pools themselves. The area comprising the pools, the areas of catchment where the water gathers as rain falls, and the associated species found in the habitat near the pools form a unit that is referred to as a "vernal pool complex".

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Conservation of vernal pool species depends on maintaining the ecosystem functions of the entire complex.

Listed, proposed, and candidate species associated with vernal pools are: Butte County meadowfoam, California tiger salamander, *Calistoga allocarya*, Colusa grass, Conservancy fairy shrimp, Contra Costa goldfields, delta green ground beetle, few-flowered navarretia, fleshy owl's-clover, Greene's tuctoria, hairy Orcutt grass, Hoover's spurge, Loch Lomond coyote thistle, longhorn fairy shrimp, Sacramento Orcutt grass, San Joaquin Valley Orcutt grass, slender Orcutt grass, Solano grass, vernal pool fairy shrimp, and vernal pool tadpole shrimp. Most of these species are patchily distributed within the Sacramento and/or San Joaquin Valleys in vernal pool complexes. *Calistoga allocarya*, few-flowered navarretia, and Loch Lomond coyote thistle are restricted to Napa County.

Habitat Trends

Holland (1998) mapped the distribution of vernal pool complexes in the Central Valley. Vernal pools are scattered throughout the grassland habitats mapped by Küchler (1977) and GAP (1996) but occur at too fine a resolution to have been adequately mapped as a distinct habitat type by those studies. Holland (1978) estimated that vernal pools occurred historically at varying densities over an estimated 31 percent (4.15 million acres) of the Central Valley, and the Service estimates that 60-85% of historical vernal pool habitat had been eliminated as of 1973 (59 FR 48136).

Freshwater Wetland

Habitat Description and Associated Species

Freshwater wetlands are characterized by a specialized community of aquatic dependent plant species such as the common tule (*Scirpus acutus*), cattail (*Typha latifolia*), sedges (*Carex* spp.), spike-rush (*Eleocharis* spp.) and rushes (*Juncus* spp.). Wetlands are usually defined by the types of plants, types of soils, and inundation duration. Wetland types in this category include deep and shallow freshwater marshes, wet meadows, seasonal wetlands, saturated freshwater flat, and vegetated shallows.

Listed, proposed, and candidate species associated with freshwater wetlands are: Aleutian Canada goose, bald eagle, Buena Vista Lake shrew, California red-legged frog, California tiger salamander, giant garter snake, marsh sandwort, San Francisco garter snake, and Santa Cruz long-toed salamander.

The bald eagle occurs widely throughout the study area. After severe declines due largely to pesticides such as DDT, its numbers have been increasing following new pesticide regulations. Ecosystem degradation in the Central Valley may limit the extent of their recovery in the Central Valley. Eagles use riparian and wetland habitats for resting and foraging. Recovery of bald eagles may be limited by availability of nest trees in riparian and woodland habitat and by declining wetland habitat. California red-legged frogs have been virtually extirpated from the floor of the Central Valley, despite their historic presence in the Central Valley in numbers large enough for commercial harvest. They currently remain

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

only in foothills of the Coast Range and isolated drainages in the Sierra Nevada. The giant garter snake occurs in scattered populations from Butte County south to the northern San Joaquin Valley. The Aleutian Canada goose winters in restricted areas of the Sacramento and San Joaquin Valleys. The Buena Vista Lake shrew is restricted to remnant wetland areas near the Kern Lake Preserve and Kern National Wildlife Refuge. The Santa Cruz long-toed salamander is found only in southern Santa Cruz County. The San Francisco garter snake has been reduced to 5 populations that are unprotected, unstable, or declining. Marsh sandwort populations in San Francisco and Santa Cruz Counties have been extirpated by urban development.

Habitat Trends

Potential natural vegetation within the Conservation Program Focus Area included an estimated 1,968,749 acres of tule marshes (Küchler 1977). These wetlands occurred primarily in the Sacramento Basin (506,245 acres), San Joaquin Basin (429,115 acres), Tulare Basin (505,306 acres), and the Delta (523,279 acres). Independent estimates of historic wetland acreages range from 1,500,000 acres (Warner and Hendrix 1985, cited in San Joaquin Valley Drainage Program 1990) to 4,000,000 acres in the Central Valley (Service 1978), and 1,093,000 acres in the San Joaquin and Tulare Basins (San Joaquin Valley Drainage Program 1990, adapted from Hall 1886 and Küchler 1977).

Freshwater emergent wetlands occupied about 554,000 acres of the Central Valley in the 1940s (Frayer *et al.* 1989, Central Valley Habitat Joint Venture 1990). By 1990, only 86,704 acres remained (GAP 1996), representing a reduction of 96% from the potential natural vegetation described by Küchler (1977). Regional reductions in freshwater emergent wetlands were estimated at 88.7% in the Sacramento Basin, 96.2% in the San Joaquin Basin, 99.2% in the Tulare Basin, 98.3% in the Delta, and 97.2% in the San Francisco Bay area.

The hydrology of many of the remaining wetlands has been altered from seasonal to permanent inundation. This change has altered plant communities and facilitated the invasion of introduced aquatic predators such as bullfrogs, bass, and sunfish. These species compete with or prey upon several listed species, including California red-legged frogs and giant garter snakes.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Riverine, Riparian, and Floodplain

Habitat Description and Associated Species

Riparian forests of the Central Valley are dominated by cottonwood (*Populus fremontii*) and willow (*Salix* spp.) near the rivers, with sycamore (*Platanus racemosa*), boxelder (*Acer negundo*), and valley oak (*Quercus lobata*) dominating the less frequently flooded higher terraces. Floodplain habitats above the riparian zone typically do not support wetland vegetation, but are hydrologically linked to rivers and riparian forests by periodic flooding and can be considered with them as an ecological unit. Streams historically flooded during the winter rainy season sometimes dry up partially or completely during summer droughts. Several fish species migrate from ocean or estuary habitats to spawn in sloughs, tributary streams, or inundated floodplain throughout the Central Valley.

Sacramento splittail, which migrate upstream to spawn in flooded riparian and floodplain vegetation, have also declined. Valley elderberry longhorn beetles occur in riparian habitats of the Sacramento Valley and San Joaquin Valleys and have declined with loss of habitat. Least Bell's vireos have not nested anywhere in the Central Valley for several decades, and southwestern willow flycatchers are restricted to the South Fork of the Kern River near Lake Isabella. The riparian woodrat and riparian brush rabbit are now largely or completely restricted to Caswell State Park on the Stanislaus River, which is the largest remaining tract of riparian forest in the northern San Joaquin Valley. The California red-legged frog has now been extirpated from 75% of its historic range, mostly in the Central Valley.

Habitat Trends

Potential natural vegetation within the Conservation Program Focus Area includes an estimated 1,192,605 acres of riparian habitat, including 837,103 acres in the Sacramento Basin, 288,551 acres in the San Joaquin Basin, 48,123 acres in the Tulare Basin, and 18,828 acres in the Delta (Küchler 1977). Historic acreages of riparian forest have been independently estimated at 1,600,000-2,000,000 acres in the Central Valley (Warner and Hendrix 1985) and 902,000 acres in the San Joaquin and Tulare Basins (San Joaquin Valley Drainage Program 1990, adapted from Hall 1886 and Küchler 1977).

In 1990, riparian habitat within the Conservation Program Focus Area covered an estimated 134,840 acres (GAP 1996), representing a reduction of 89% from the potential natural vegetation described in Küchler (1977). Regional reductions in riparian habitat were 92% in the Sacramento Basin, 91% in the San Joaquin Basin, 24% in the Tulare Basin, and 86% in the Delta. An estimated 2% of the historical riparian habitat remains on the Sacramento River (McGill 1979, McCarten and Patterson 1987). As a result, riparian-dependent species include several of the most critically endangered species in the Central Valley.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Coastal Beach, Lagoon, Inland Dune

Habitat Description and Associated Species

Coastal beach habitats within the Conservation Program Focus Area extend along approximately 200 miles of coastline from the Golden Gate to southern Santa Cruz County. Where coastal headlands are absent, dune habitats often occur behind the beaches. Coastal prairie and scrub habitats dominated by perennial grasses or shrubs develop behind the dunes or along terraces and headlands where salt spray, wind, and coastal fog incursions are common. Brackish lagoons sheltered from direct wave action are scattered along the coast.

Listed, proposed, and candidate species associated with these habitats are: bald eagle, beach layia, black legless lizard, California brown pelican, California least tern, Monterey spineflower, Myrtle's silverspot butterfly (extirpated), robust spineflower, San Francisco lessingia, Santa Cruz tarweed, tidewater goby, and western snowy plover. The coastal habitats used by each species are summarized in Table 3.D.

The **Antioch Dunes** are Pleistocene, wind-deposited sands adjacent to the San Joaquin River east of the City of Antioch in Contra Costa County. Exploitation of the dunes dates back to 1885, with the establishment of a pottery works. Subsequent activities that eliminated and degraded habitat included sand mining, agricultural conversion of sandy soils adjacent to the dunes, industrialization, urban expansion, power line right-of-way and fire break maintenance, and off-road vehicle recreation. Large numbers of black locust and other weedy, non-native plants have invaded the disturbed dunes, displacing endemic species from much of their habitat. Special-status species associated with Antioch Dunes are Contra Costa wallflower, Antioch Dunes evening primrose, and Lange's metalmark butterfly.

Habitat Trends

Coastal habitats such as dunes and coastal prairie are not classified separately by Küchler (1977) and GAP (1996), so trends in these habitats on a large scale cannot be quantified from these data. Extensive urbanization along the coast suggests declining trends in all native coastal habitats.

For the Antioch Dunes, a 1908 U.S. Geological Survey map shows approximately 190 acres of dune deposits along approximately 2 miles of river front, averaging about 0.17 mile in width (U.S. Fish and Wildlife Service 1984, Howard and Arnold 1980). Today approximately 70 acres of the original habitat remain, but most is severely degraded and lacks natural dune topography. Since 1980 the Service has owned and managed 60 acres of habitat and buffer as a satellite to the San Francisco Bay National Wildlife Refuge Complex and has negotiated agreements with adjacent landowners (including the Pacific Gas and Electric Company) to protect an additional 20 acres (U.S. Fish and Wildlife Service 1984, Howard and Arnold 1980). The Service has removed the locust trees within the refuge boundary and is actively restoring the dunes.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Salt Marsh

Habitat Description and Associated Species

The San Francisco Bay complex, including San Pablo Bay and Suisun Bay and Marsh, is the largest estuarine ecosystem in California. Tidal marshes consist of a low marsh dominated by cordgrass (*Spartina foliosa*) or tules (*Scirpus* spp.), a middle marsh of pickleweed (*Salicornia virginica*), alkali bulrush (*Scirpus robustus*), or cattails (*Typha* spp.), and a high marsh of peripheral halophytes (plants which grow in salty soils) with infrequent tidal coverage. Listed and proposed species associated with salt marsh habitats include: California clapper rail, California seablite (extirpated), salt marsh harvest mouse, soft bird's-beak, and Suisun thistle.

Habitat Trends

Originally the San Francisco Bay complex included an estimated 181,446 acres of tidal marsh, including 46,405 acres in San Francisco Bay, 63,678 acres in San Pablo Bay, and 71,363 acres in Suisun Bay and Marsh (Service 1984). Kuchler (1977) estimated that potential natural vegetation of the San Francisco Bay complex included 96,583 acres of salt marsh; this figure omits the brackish marshes in the Suisun Bay area, which are categorized as tule marsh in Kuchler's map.

In 1990, salt marsh and brackish marsh were estimated to cover 69,291 acres, including 54,088 acres in the Sacramento Basin (Suisun Bay and Marsh), 9443 acres in the Delta, and 4760 acres in the San Francisco Bay area (GAP 1996). This estimate probably includes large areas of diked marsh, particularly in Suisun Bay where non-tidal diked marshes are managed primarily for waterfowl. Dedrick (1993) estimated that about 30,100 acres of tidal marsh currently remain, representing 17 percent of historical marsh. Some salt marshes have been backfilled, eliminating the high marsh zones and adjacent upland habitat, others are narrow strips bordering dikes. Existing tidal marshes are fragments of the original marshes, and only a few large marshes remain.

Interior Grassland

Habitat Description and Associated Species

Grasslands in the Central Valley were originally dominated by native perennial grasses such as needlegrass (*Nassella pulchra*) and alkali sacaton (*Sporobolus airoides*). Currently most grasslands in the area are dominated by introduced annual grasses of Mediterranean origin and a mixture of native and introduced forbs. Please refer to the San Joaquin Valley Native Species Recovery Plan (Service 1998) for a complete description of this habitat.

Blunt-nosed leopard lizards, San Joaquin kit foxes, giant kangaroo rats, Tipton kangaroo rats, and Fresno kangaroo rats occur in arid grasslands in the San Joaquin and Tulare Basins. Bakersfield cactus, California jewelflower, Hartweg's golden sunburst, Hoover's woolly-star, and San Joaquin

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

wooly-threads occur in isolated populations within grassland habitat in the San Joaquin and Tulare Basins. The San Joaquin adobe sunburst is restricted to grasslands on adobe clay soils in the San Joaquin Valley. The Kern primrose sphinx moth occurs locally in agricultural fields and grasslands in the Walker Basin in Kern County. The large-flowered fiddleneck occurs in grasslands on a few sites in Alameda, San Joaquin, and Contra Costa Counties. The Alameda whipsnake is found in grasslands adjacent to chaparral and scrub in Alameda and Contra Costa Counties. Napa bluegrass occurs in grasslands in Napa County, in association with hot springs. Showy Indian clover originally occurred in grasslands from Mendocino to Santa Clara Counties, but is now extirpated from all but one site in Marin County. Reintroduced California Condors (in the southern San Joaquin Valley) range widely and may forage in grassland habitat.

Habitat Trends

Less than 1% of remaining grassland areas in the Central Valley contain enough native grass species to be labeled either valley sacaton or valley needlegrass grasslands (GAP 1996).

Alkali Desert Scrub

Habitat Description and Associated Species

Alkali desert scrub is dominated by low succulent chenopod shrubs including *Allenrolfea*, *Atriplex* (saltbush) and *Sueda* species. This habitat occurs most commonly on fine-textured, alkaline, or saline soils in areas of impeded drainage. Please refer to the San Joaquin Valley Native Species Recovery Plan (Service 1998) for a complete description of this habitat.

Blunt-nosed leopard lizards, San Joaquin kit foxes, giant kangaroo rats, Tipton kangaroo rats, and Fresno kangaroo rats occur in alkali desert scrub and other habitats in the San Joaquin and Tulare Basins. Bakersfield cactus, Hoover's woolly-star, Kern mallow, palmate-bracted bird's beak, and San Joaquin wooly-threads occur in isolated populations within alkali desert scrub habitat in the San Joaquin and Tulare Basins. Reintroduced California condors (in the southern San Joaquin Valley) range widely and may occur in alkali desert scrub habitat.

Habitat Trends

Regional declines in alkali scrub habitat range between 67 and 90 percent. Much of the remaining alkali scrub that is suitable habitat for wildlife exists in small, fragmented, and widely distributed patches in the San Joaquin and Tulare Basins.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Oak Woodland

Habitat Description and Associated Species

Several different types of oak woodland occur in the Central Valley and central coast regions of California. Oak woodlands in the Conservation Program Focus Area include stands dominated by: valley oak (*Quercus lobata*), mostly along rivers and streams on the valley floor and lower foothills; blue oak (*Q. douglasii*) and gray or digger pine (*Pinus sabiniana*), at low to middle elevations in foothills of the Sierra Nevada and Coast Ranges); coast live oak woodland (*Q. agrifolia*) in valleys and hills of the Coast Ranges; canyon live oak (*Q. chrysolepis*) and interior live oak (*Q. wislizenii*), near some CVP reservoirs; and Oregon white oak (*Q. garryana*) in and near service areas between Redding and Red Bluff. Transitional communities of mixed oaks, other hardwoods, pine, and chaparral occur among many of these woodland types (Forest and Rangelands Assessment Program 1988, Griffin 1977). These oak woodlands correspond to the valley oak savanna, Oregon oak forest, mixed hardwood forest, and blue oak-digger pine forest mapped by Küchler (1977), and can be considered to comprise a “cismontane woodland” category.

Listed, proposed, and candidate species associated with oak woodland include: California condor, California red-legged frog, and California tiger salamander. Reintroduced California Condors (in the southern San Joaquin Valley) range widely and may occur in oak woodland habitat. California red-legged frogs occur in oak woodland in foothills of the Coast Range and isolated drainages in the Sierra Nevada. California tiger salamanders occur in oak woodland at the fringes of the Central Valley and in the Coast Ranges. The frogs and salamanders live in burrows in these woodlands during dry parts of the year. Suitable habitat for these burrows is essential to their survival.

Habitat Trends

Potential natural vegetation within the Conservation Program Focus Area included an estimated 9,384,947 acres of cismontane woodland habitat (3,462,430 acres in the Sacramento Basin, 2,335,602 acres in the San Joaquin Basin, 1,491,951 acres in the Tulare Basin, 50 acres in the Delta, 1,285,115 acres in the San Francisco Bay area, and 809,799 acres in the San Benito/Santa Cruz area).

In the 1940s, woodland dominated by oaks and other hardwoods covered approximately 2,970,000 acres in the Sacramento Basin, 1,720,000 acres in the San Joaquin Basin, and 950,000 acres in the Tulare Basin (Weislander 1945). In 1990, cismontane woodland habitat within the Conservation Program Focus Area was estimated at 6,919,647 acres (GAP 1996), representing a 27% decline from potential natural vegetation (Küchler 1977). Regional declines in cismontane woodland habitat were 24% in the San Joaquin Basin, 30% in the Tulare Basin, 100% in the Delta, 78% in the San Francisco Bay area, and 73% in the San Benito/Santa Cruz area. Cismontane woodland increased by 4% in the Sacramento Basin.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Evergreen Hardwood and Coniferous Forests

Habitat Description and Associated Species

Coniferous and evergreen hardwood forests generally occur at higher elevations in the Sierra Nevada and Coast Ranges, on the margins of the Central Valley. This category comprises several forest types. Moist coastal forests in San Mateo and Santa Cruz Counties are dominated by redwood (*Sequoia sempervirens*) and Douglas-fir (*Pseudotsuga menziesii*). Montane forests in the Coast Ranges and Sierra Nevada are dominated by a variety of conifers including ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*P. jeffreyi*), Douglas-fir (*Pseudotsuga menziesii*), red fir (*Abies magnifica*), and white fir (*A. concolor*). In the Coast Ranges stands may be dominated by evergreen hardwoods such as madrone (*Arbutus menziesii*), tanoak (*Lithocarpus densiflorus*), and bay laurel (*Umbellularia californica*). Dry regions support woodlands and savannas dominated by pinyon pine (*P. monophylla*) and juniper (*Juniperus californica*). On drier sites, stands may be dominated by cypress (*Cupressus* spp.) and fire-dependent species such as Monterey pine (*P. radiata*) and knobcone pine (*P. attenuata*).

Listed species associated with coniferous and evergreen hardwood forests are California condor, bald eagle, marbled murrelet and northern spotted owl. The California condor and bald eagle may occur over wide areas and are not specifically limited to coniferous forest. The northern spotted owl and marbled murrelet require large tracts of old-growth coniferous forest as nesting habitat and are threatened by conversion to short-rotation forestry practices. Northern spotted owls occur in forests along the western and northern edges of the Sacramento Valley, and marbled murrelets can occur in Santa Cruz and San Mateo Counties.

Habitat Trends

Potential natural vegetation within the Conservation Program Focus Area included an estimated 5,660,803 acres of coniferous and mixed forest habitat, including 4,077,008 acres in the Sacramento Basin, 777,063 acres in the San Joaquin Basin, 574,887 acres in the Tulare Basin, 71,903 acres in the San Francisco Bay area, and 159,942 acres in the San Benito/Santa Cruz area (Küchler 1977).

In the 1940s, coniferous forest covered approximately 3,507,000 acres in the Sacramento Basin, 877,000 acres in the San Joaquin Basin, and 414,000 acres in the Tulare Basin (Weislander 1945). In 1990, coniferous and mixed forest habitat within the Conservation Program Focus Area was estimated at 5,525,713 acres (GAP 1996), representing a 2% decline from potential natural vegetation (Küchler 1977). Regional increases in coniferous forest habitat were 3% in the San Joaquin Basin, 9% in the Tulare Basin, 206% in the San Francisco Bay area, and 26% in the San Benito/Santa Cruz area. Coniferous forest declined by 10% in the Sacramento Basin.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Hidden within these totals is a shift from commercially valuable redwood and Douglas fir to juniper and other less merchantable conifers. This shift has contributed to declines of species that need habitat with large trees.

Chaparral

Habitat Description and Associated Species

Chaparral habitats in the **Coast Ranges** are characterized by dense thickets of chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp.), ceanothus (*Ceanothus* spp.), scrub oak (*Quercus berberidifolia*), and other shrubs. Chaparral occurs mostly on steep slopes and ridgetops that have thin soils and are hot and dry during the summer. Moister variants of chaparral habitat occur in gullies and on cooler, north-facing slopes (Hanes 1977). Presidio clarkia, Presidio manzanita. The Alameda whipsnake and pallid manzanita are found in chaparral habitats in Contra Costa and Alameda Counties.

Patches of serpentine, volcanic, and granitic soils occur sporadically along the western flanks of the **Sierra Nevada**. Special-status species associated with this habitat are: Chinese Camp brodiaea, Keck's checker-mallow, Mariposa pussypaws (granitic soils), Red Hills vervain, and Springville clarkia (granitic soils).

El Dorado County gabbro soils support the following listed chaparral species: Stebbins' morning-glory, Pine Hill ceanothus, Pine Hill flannelbush, El Dorado bedstraw, and Layne's butterweed. The five El Dorado County plant species occur primarily in the Pine Hill intrusive complex, a unique and localized geologic formation composed of gabbroic rocks. The Pine Hill intrusion occupies approximately 25,700 acres, and serpentine soils occupy an additional 10,000-15,000 acres in western El Dorado County. These species have a scattered distribution within chaparral and oak woodland habitats, which occupy 73% of the Pine Hill intrusion. Additional populations of a few of these species occur on soils derived from serpentine or metamorphic rocks at locations outside the Pine Hill intrusion. Both gabbro and serpentine soils strongly influence plant distributions because of nutrient imbalances and other characteristics that favor the growth of plants specifically adapted to these conditions (59 FR 18774; Kruckeberg 1984).

Outcrops of the **Ione Formation** are primarily restricted to an area of about 35 square miles in Amador County. These outcrops form barren, gravelly, kaolinic soils that are inhospitable for most plants. Kaolin clays are relatively poor at holding several important plant nutrients. The Ione buckwheat and Ione manzanita grow in openings within chaparral vegetation on lateritic soils crusts (cement-like crusts of yellow iron oxide) developed under a subtropical or tropical climate during the Eocene. Ione soils exhibit soil properties typical of those produced under tropical climates such as high acidity, high aluminum content, and low fertility (Singer 1978). These soils and the sedimentary deposits with which they are associated also contain large amounts of commercially valuable minerals including quartz sands, kaolinitic clays, lignite (low-grade coal), and possible gold-bearing gravels

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

(Chapman and Bishop 1975). Ione buckwheat and Ione manzanita can tolerate the acidic, nutrient-poor Ione soils and are essentially restricted to this soil type.

Habitat Trends

Fire suppression and reduced fire frequency have caused changes in the structure and species composition of large areas of chaparral. Longer intervals between fires has led to an increase in later successional species and slow-maturing species, greater standing biomass and dry fuels, and larger, more intense fires. Where fire is less frequent, many chaparral species decline. Also, roads, agriculture, and urban development have fragmented the habitat of some species. Changes in fire frequency and fragmentation and have contributed to the decline of several species.

Urban development increases local fire suppression efforts as well as directly removing chaparral habitat. Urban development in the foothills of the western Sierra Nevada, through expansion of residential neighborhoods and road construction and maintenance, has destroyed or degraded numerous populations of listed plants. Residential and commercial development around the communities of Cameron Park and Shingle Springs have caused the greatest losses in gabbro soils habitat. There are 15 active surface mines on private land near Ione, where the habitat of listed plants continues to be degraded. Mining for quartz sand, clay, lignite, laterite, and gravel have destroyed a large proportion of the original habitat.

Coastal Scrub and Coastal Grassland

Habitat Description and Associated Species

Coastal scrub is characterized by sagebrush (*Artemisia californica*) and coyote brush (*Baccharis pilularis consanguinea*), and the coastal grasslands are generally dense grasses in low lying areas or sparse grasses mixed with forbs on hilltops and ridges (balds). Coastal sagebrush occurs mostly on steep slopes and thin soils, and coyote brush is found in deeper soils with minimal slopes. The coastal grasslands are characterized by a mix of native and European grasses. Coastal scrub is typically found adjacent to and interspersed with coastal grasslands.

Callippe silverspot butterfly, Mission blue butterfly, and San Bruno elfin butterfly are largely restricted to coastal scrub and coastal grassland on mountains in San Mateo County, including San Bruno Mountain, Montara Mountain, Milagra Ridge, Sweeney Ridge and Skyline College. Isolated colonies also remain locally in San Francisco, Solano, Alameda, Contra Costa and Marin Counties.

The San Francisco garter snake is found in open canopy coastal scrub and grasslands adjacent to permanent water in San Mateo County. The habitat of this species continues to be lost to urbanization and agriculture, although agricultural ponds built after the drought in the 1970s may have provided for a

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

temporary increase in foraging habitat. The five remnant populations of San Francisco garter snake are unstable, unprotected, or seriously declining.

The Alameda whipsnake is found in coastal sage scrub and chaparral adjacent to grasslands in Contra Costa and Alameda counties. The habitat of this species has been subject to over 150 years of urbanization and over 100 years of fire suppression. The populations of this species are extremely disjunct and genetic exchange between the 5 remaining populations is extremely low or unlikely.

The following **serpentine** endemics, are found on serpentine outcrops in these habitats: Bay checkerspot butterfly, Clara Hunt's milkvetch, coyote ceanothus, fountain thistle, Hickmann's cinquefoil, Marin dwarf-flax, Metcalf Canyon jewelflower, Red Mountain campion, San Benito evening primrose, San Mateo thornmint, San Mateo wooly sunflower, Santa Clara Valley dudleya, showy Indian clover, Tiburon paintbrush, and white-rayed pentachaeta.

Zayante soils are endemic to Santa Cruz County and occur predominantly near the communities of Ben Lomond, Felton, Mount Hermon, Olympia, and Scotts Valley, as well as the Bonny Doon area. Zayante soils are deep, coarse-textured, poorly developed, and well drained (USDA Soil Conservation Service 1980). A unique habitat within the Zayante sand hills ecosystem is sand parkland characterized by sparsely vegetated, sandstone-dominated ridges and saddles that support a wide array of annual and perennial herbs and grasses. Scattered ponderosa pine trees are often present. Species occurring in this habitat are Ben Lomond spineflower, Ben Lomond wallflower, Mount Hermon June beetle, robust spineflower, Santa Cruz cypress (sandstone or granitic soils), Santa Cruz long-toed salamander (wetlands), and Zayante band-winged grasshopper.

Habitat Trends

Much of the coastal scrub and grassland in the San Francisco Bay Area is urbanized. The majority of the remaining natural habitat is largely restricted to ridges and mountains that are difficult to build on. Coastal scrub and its associated grasslands in San Mateo County have largely been destroyed or degraded by urbanization. The remaining isolated fragments are expected to be developed in the near future. In addition to urbanization, habitat modifications through changes in hydrology and fire frequency, as well as invasion of exotic species, are still affecting most habitats. The map developed by Küchler (1977) estimates that potential natural vegetation within the Conservation Program Focus Area included 383,308 acres of coastal scrub habitat. In 1990, coastal scrub habitat within the Conservation Program Focus Area had been reduced to 159,210 acres (GAP 1996), representing a decline of 58% from the potential natural vegetation estimated by Küchler (1977).

Although serpentine habitats are naturally fragmented and separated by areas of different geology and soils, serpentine habitats in the San Francisco Bay area have been severely reduced and fragmented by urban development and related activities in recent decades (Kruckeberg 1984; 57 **FR** 59053).

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

More than 40 percent of the Zayante sand hills and over 60 percent of the sand parkland habitat is estimated to have been lost or degraded (62 FR 3616). Portions of the Zayante sand hills ecosystem are protected under public ownership in only three locations: the Quail Hollow Ranch, owned by the County of Santa Cruz; Bonny Doon Ecological Preserve, managed by DFG; and Henry Cowell Redwoods State Park.

Role of Contaminants in the Decline of Species and Habitats

Drainage Water and Selenium Contamination

Soils on the west-side and southern end of the San Joaquin Valley are derived from marine sediments in the Coast Range and contain naturally high levels of arsenic, boron, chromium, molybdenum, and selenium, which are toxic or potentially-toxic trace elements. Evaporation has caused high concentration of these elements in near-surface soils and groundwater in those areas, and application of irrigation water increases these concentrations. Subsurface clay, underlying these contaminated soils, impedes vertical and lateral movement of irrigation water percolating below the root zone (Moore *et al.* 1990), causing a drainage problem.

To move contaminated water out of these saturated soils, deep ditches have been dug or subsurface drainage systems installed. The drainage systems take away harmful salts and excess moisture, thus lowering the water table to below the root zone for most crops. The effluent from these drains often contains salts, trace elements, and agricultural chemicals. Subsurface agricultural drainage water collected in such systems is pumped away or allowed to drain into surface ditches and canals, eventually discharged into ponds for evaporative disposal, or creeks or sloughs tributary to major streams and rivers. On average, approximately 0.7-0.8 acre-feet of subsurface drainage water is generated annually per acre of irrigated agricultural land on the west side and southern end of the San Joaquin Valley (San Joaquin Valley Drainage Program 1989). The historic and continuing discharge of subsurface drain water into surface waters of the San Joaquin Basin has resulted in degradation of surface- and groundwater quality through salinization and contamination by elevated concentrations of toxic or potentially toxic trace elements and agricultural chemicals.

In the drainage-impaired areas, evaporation ponds and agroforestry plantations are used for disposal of contaminated drain water. In 1990, 28 evaporation ponds (about 7,400 total acres) were utilized to dispose of drain water in Merced, Kings, Kern, and Tulare Counties. These ponds received approximately 30,000-40,000 acre-feet per year from a total of about 55,000 acres of irrigated lands (San Joaquin Valley Drainage Program 1990). Since 1990, the total acreage of evaporation ponds/basins has declined from about 7,000 acres to about 5,000 acres. The ponds are regulated by the Regional Board by means of Waste Discharge Requirements (*e.g.*, Order No. 93-136) that require creation of clean wetlands to mitigate unavoidable toxic impacts to breeding waterbirds.

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

Agroforestry disposal of drain water involves irrigation of various combinations of salt tolerant crops, shrubs, and trees with subsurface drainage wastewater. More than 40 agroforestry drainage water disposal sites were established between 1985 and 1990 (Moore et al. 1990). Given current trends in rising ground water elevations and the general lack of acceptable disposal options other than agroforestry sites, it is expected that the expansion of agroforestry sites will exponentially accelerate within a 5-10 year planning horizon. Although it has been established that agroforestry plantations (like evaporation basins) are wildlife magnets in the extensively cultivated landscape of the San Joaquin Valley (Moore et al. 1990), the potential for contaminant hazards remains poorly documented. A small set of waterbird eggs collected by the Service from just two agroforestry sites in 1996 yielded the highest rates of selenium-induced embryonic malformation ever reported in the scientific literature (Skorupa 1998) and established that the method of furrow irrigation being used was attracting breeding waterbirds.

The extent and severity of the drainage problem in the western and southern San Joaquin Valley continues to worsen. Between 1991 and 1997 the acreage of land in the southern San Joaquin Valley with shallow groundwater rising to within 5 feet of the soil surface—having a drainage problem—has increased from 159,000 acres to 359,000 acres (DWR 1997); therefore, in the past 6 years, an additional 200,000 acres of agricultural lands have been added to the inventory of parcels requiring a disposal option for drainage water to stay in production. Land retirement (retirement from irrigation) is being planned in this area (on a willing seller basis) to remove the lands with the greatest drainage problem from production.

Pesticides

Insecticides, herbicides, and rodenticides have been used for decades throughout the Central Valley, including the CVP service area. Farmers have used insecticides to eliminate crop damage caused by harmful insects and herbicides to reduce crop competition with weeds and other undesirable plants. Rodenticides have been used primarily to reduce or eliminate populations of ground squirrels and other burrowing rodents that can damage flood control levees and water delivery systems.

Beginning in the 1950's synthetic organochlorine (DDT, dieldrin, aldrin, endrin, toxaphene, lindane, chlordane, heptachlor, and Mirex) and organophosphate (*e.g.*, carbaryl and carbofuran) pesticides were extensively and increasingly used. Several organochlorine compounds persist in the soil for many years. In the Central Valley, the California brown pelican, American peregrine falcon, osprey, bald eagle, and California condor were seriously affected by DDT. Use of DDT was banned in the United States in 1972, and all of these species have increased their populations since that time. However, some birds may still be contaminated as a result of illegal or foreign application of DDT.

The quantity of pesticides used in the State—over 120 million pounds in 1980 alone (California Department of Food and Agriculture 1981)—is, in part, a result of the types of crops grown. For example, traditional cotton production uses more pesticides than production of any other crop (Service, undated). Acreage devoted to cotton production in the Tulare Basin increased by 330% between

1/27/00 Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA

1940 and 1980. During 1978, about 1.7 million acres in the Central Valley were devoted to cotton production, more acreage than for any other crop (~27% of the irrigated acreage in the Central Valley). The vast majority of the Central Valley's cotton production occurs within the San Joaquin Valley (Reclamation 1984). Of the almost 70 million pounds of pesticides applied in the Central Valley during 1980, a substantial proportion was used to produce cotton in the San Joaquin Valley (California Department of Food and Agriculture 1981).

CVP Environmental Programs

The CVP Conservation Program and the (b)(1)"other" program are currently carrying out a number of conservation actions for endangered species that form part of the baseline for this consultation. During 1996, 1997, and 1998, these programs have sponsored or obligated funds for a wide variety of projects including: purchase of Valensin Ranch (a large parcel of riparian, grassland, and vernal pool habitats along the Cosumnes River in southern Sacramento County); surveys for Keck's checker mallow; restoring habitat for the large-flowered fiddleneck; purchase of lands for Pine Hill Ecological Reserve in El Dorado County; purchase of property supporting California red-legged frogs on Weber Creek in El Dorado County; censusing, monitoring, and developing a restoration plan for riparian brush rabbits and riparian woodrats in Caswell State Park; acquisition of vernal pool and alkali sink habitat for the Allensworth Ecological Reserve in Tulare County; habitat protection and environmental education for Bakersfield cactus in Kern County; hydrological studies, conservation easements, and land purchase for the palmate-bracted bird's-beak at Springtown Alkali Sink; and surveying DFG property in Kern County for rare plant species. Additional planned projects include: protecting habitat for the Fresno kangaroo rat at Kerman and Alkali Sink Ecological Reserves in Fresno County; protection of riparian and vernal pool habitat at Howard Ranch in Sacramento County; planning riparian habitat restoration on the San Joaquin River; and acquisition of San Joaquin kit fox habitat owned by Wells Fargo in Stanislaus and Merced Counties.