Ecoregions of California

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**Level III and IV Ecoregion Poster Descriptions for California**

**FRONT SIDE TEXT**

**Ecoregions of California**

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance (Bryce and others, 1999). These general purpose regions are critical for structuring and implementing ecosystem management strategies across Federal agencies, State agencies, and nongovernment organizations that are responsible for different types of resources in the same geographical areas (Omernik and others, 2000).

The approach used to compile this map is based on the premise that ecological regions are hierarchical and can be identified through the analysis of the spatial patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity (Wiken, 1986; Omernik, 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions. Level II divides the continent into 50 regions (Commission for Environmental Cooperation Working Group, 1997, map revised 2006). At level III, the continental United States contains 105 ecoregions and the conterminous United States has 85 ecoregions (U.S. Environmental Protection Agency, 2013). Level IV, depicted here for the State of California, is a further refinement of level III ecoregions. Explanations of the methods used to define these ecoregions are given in Omernik (1995), Omernik and others (2000), and Omernik and Griffith (2014).

California has great ecological and biological diversity. The State contains offshore islands and coastal lowlands, large alluvial valleys, forested mountain ranges, deserts, and various aquatic habitats. There are 13 level III ecoregions and 177 level IV ecoregions in California and most continue into ecologically similar parts of adjacent States of the United States or Mexico (Bryce and others, 2003; Thorson and others, 2003; Griffith and others, 2014).

The California ecoregion map was compiled at a scale of 1:250,000. It revises and subdivides an earlier national ecoregion map that was originally compiled at a smaller scale (Omernik, 1987; U.S. Environmental Protection Agency, 2013). This poster is the result of a collaborative project primarily between U.S. Environmental Protection Agency (USEPA) Region IX, USEPA National Health and Environmental Effects Research Laboratory (Corvallis, Oregon), California Department of Fish and Wildlife (DFW), U.S. Department of Agriculture (USDA)–Natural Resources Conservation Service (NRCS), U.S. Department of the Interior-Geological Survey (USGS), and other State of California agencies and universities.

The project is associated with interagency efforts to develop a common framework of ecological regions (McMahon and others, 2001). Reaching that objective requires recognition of the differences in the conceptual approaches and mapping methodologies applied to develop the most common ecoregion-type frameworks, including those developed by the USDA–Forest Service (Bailey and others, 1994; Miles and Goudy, 1997; Cleland and others, 2007), the USEPA (Omernik 1987, 1995), and the NRCS (U.S. Department of Agriculture–Soil Conservation Service, 1981; U.S. Department of Agriculture–Natural Resources Conservation Service, 2006). As each of these frameworks is further refined, their differences are becoming less discernible. Regional collaborative projects such as this one in California, where some agreement has been reached among multiple resource-management agencies, are a step toward attaining consensus and consistency in ecoregion frameworks for the entire nation.

#### Suggested Citation

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**1. COAST RANGE**

Ecoregion 1 covers the coastal mountains of western Washington, western Oregon, and northwestern California. These low mountains are covered by highly productive, rain-drenched evergreen forests. Sitka spruce forests originally dominated the fog-shrouded coast, and a mosaic of western redcedar, western hemlock, and seral Douglas-fir blanketed inland areas. Today, Douglas-fir plantations are prevalent on the intensively logged and managed landscape. In California, redwood forests are a dominant component of the region, along with some hardwoods, such as tanoak, madrone, bigleaf maple, California bay, and red alder. Beach pine and Bishop pine occur in many coastal sites. In Oregon and Washington, soils typically are Inceptisols and Andisols, whereas in California, Alfisols are common. Isomesic soil temperatures occur along the coast, and mesic soils occur inland in Oregon and Washington. Landslides and debris slides are common, and lithology influences land-management strategies. Coastal headlands, high and low marine terraces, sand dunes, and beaches also characterize the region.

**4. CASCADES**

This mountainous ecoregion stretches from the central part of western Washington, through the spine of Oregon, and includes a disjunct area in northern California. It is underlain by Cenozoic volcanics and much of the region has been affected by alpine glaciation. Some peaks are higher than 14,000 feet. Soils have mostly cryic and frigid temperature regimes, with some mesic soil temperatures at low elevations and in the south. Andisols and Inceptisols are common. The Cascades have a moist, temperate climate that supports an extensive and highly productive coniferous forest, with large areas intensively managed for logging. At low elevations in Oregon and Washington, Douglas-fir, western hemlock, western red cedar, big leaf maple, and red alder are typical. At higher elevations, Pacific silver fir, mountain hemlock, subalpine fir, noble fir, and lodgepole pine occur. In southern Oregon and California, more incense cedar, white fir, and Shasta red fir occur along with other Sierran species. Jeffrey and ponderosa pines are at many mid-elevation locations in the California Cascades. Subalpine meadows, conifers of whitebark pine and mountain hemlock, and rocky alpine zones occur at the highest elevations.

**5. SIERRA NEVADA**

Ecoregion 5 is a mountainous, deeply dissected, and westerly tilting fault block. The central and southern part of the region is largely composed of granitic rocks that are lithologically distinct from the mixed geology of Ecoregion 78 to the west and the volcanic rocks of the Cascades ecoregion (4) to the north. In the northern Sierra Nevada, however, the lithology has similarities to the Klamath Mountains. A high fault scarp divides the Sierra Nevada (5) from the Northern Basin and Range (80) and Central Basin and Range (13) ecoregions to the east. Near this eastern fault scarp, the Sierra Nevada reaches its highest elevations. Here, moraines, cirques, and small lakes are common, being products of Pleistocene alpine glaciation. Large areas are above timberline, including the Mount Whitney summit in California, the highest point in the conterminous United States at nearly 14,500 feet. The Sierra Nevada casts a rain shadow over Ecoregions 13 and 80 to the east. The ecoregion slopes more gently toward the Central California Valley (7) to the west. The vegetation grades from mostly ponderosa pine and Douglas-fir at low elevations on the western side, to pines and Sierra juniper on the eastern side, and to fir and other conifers at higher elevations. Alpine conditions exist at the highest elevations. Large areas are publicly owned Federal land, including several national parks.

**6. CENTRAL CALIFORNIA FOOTHILLS AND COASTAL MOUNTAINS**

The primary distinguishing characteristic of this ecoregion is its Mediterranean climate of hot dry summers and cool moist winters, and associated vegetative cover comprising primarily chaparral and oak woodlands; grasslands occur in some low elevations and patches of pine are found at high elevations. Surrounding the lower and flatter Central California Valley (7), most of the region consists of open low mountains or foothills, but there are some areas of irregular plains and some narrow valleys. Large areas are ranchland and are grazed by domestic livestock. Relatively little land has been cultivated, although some valleys are major agricultural centers such as the Salinas Valley or the wine vineyard centers of Napa and Sonoma Valleys. Natural vegetation includes coast live oak woodlands, Coulter pine, and unique native stands of Monterey pine in the west, and blue oak, black oak, and grey pine woodlands in the east.

**7. CENTRAL CALIFORNIA VALLEY**

Flat, intensively farmed plains with long, hot, dry summers and mild winters distinguish the Central California Valley ecoregion from its neighboring ecoregions that are either hilly or mountainous, covered with forest or shrub, and generally non-agricultural. Ecoregion 7 includes the flat valley basins of deep sediments adjacent to the Sacramento and San Joaquin Rivers, as well as the fans and terraces around the edge of the valley. The two major rivers flow from opposite ends of the Central California Valley, entering into the Sacramento–San Joaquin River Delta and San Pablo Bay. The region once contained extensive prairies, oak savannas, desert grasslands in the south, riparian woodlands, freshwater marshes, and vernal pools. More than one-half of the region is now in cropland, about three-fourths of which is irrigated. Environmental concerns in the region include salinity due to evaporation of irrigation water, groundwater contamination from heavy use of agricultural chemicals, loss of wildlife and flora habitats, and urban sprawl.

**8. SOUTHERN CALIFORNIA MOUNTAINS**

Like other ecoregions in central and southern California, the Southern California Mountains ecoregion has a Mediterranean climate of hot dry summers and moist cool winters. Although Mediterranean types of vegetation such as chaparral and oak woodlands predominate in this region, elevations are considerably higher, summers are slightly cooler, and precipitation is greater than in adjacent ecoregions, resulting in denser vegetation and some large areas of coniferous woodlands. In parts of the Transverse Range, a slope effect causes distinct ecological differences. The south-facing slope of the range receives more precipitation (30–40 inches) than the northern slope (15–20 inches), but high evaporation rates on the southern side contribute to a cover of chaparral. On the northern side of parts of the ecoregion, low evaporation, low annual temperatures, and slow snowmelt allows for a coniferous forest that blends into desert montane habitats as it approaches the Mojave Basin and Range ecoregion boundary. Conifer species, such as Jeffrey, Coulter, and ponderosa pines, occur along with sugar pine, white fir, bigcone Douglas-fir, and at the highest elevations, some lodgepole and limber pine. Severe erosion problems are common where the vegetation cover has been removed by fire, overgrazing, or land clearing. Large parts of the region are National Forest public land.

**9. EASTERN CASCADES SLOPES AND FOOTHILLS**

Ecoregion 9 is in the rain shadow of the Cascade Range. It has a more continental climate than ecoregions to the west, with greater temperature extremes, less precipitation, and frequent fires. Open forests of ponderosa pine, western juniper, and occasionally Jeffrey pine, are abundant at middle elevations. Lodgepole pine and western white pine often are present at the highest elevations and distinguish this region from the higher elevation ecoregions to the west where mountain hemlock and fir forests are common, and from the lower elevation, drier ecoregions to the east where xeric shrubs and grasslands are predominant. Historically, creeping ground fires consumed accumulated fuel and devastating crown fires were less common in dry forests. Volcanic cones, plateaus, and buttes are common in much of the region. A few areas of cropland and pastureland occur in the lake basins or larger river valleys, which also provide habitat for migrating waterfowl, such as sandhill cranes, ducks, and geese.

**13. CENTRAL BASIN AND RANGE**

Ecoregion 13 is composed of north-trending, fault-block ranges and intervening, drier basins. In the high-elevation mountains, woodland, mountain brush, and scattered open forest are found. Low-elevation basins, slopes, and alluvial fans are either shrub- and grass-covered, shrub-covered, or barren. The potential natural vegetation is, in order of decreasing elevation and ruggedness, scattered western spruce-fir forest, juniper woodland, Great Basin sagebrush, and saltbush-greasewood. The Central Basin and Range ecoregion (13) is internally drained by ephemeral streams and once contained ancient Lake Lahontan. Ecoregion 13 generally is warmer and drier than the Northern Basin and Range ecoregion (80) and has more shrubland and less grassland than the Snake River Plain ecoregion (12). Soils grade upslope from mesic Aridisols to frigid Mollisols. The land primarily is used for grazing. Additionally, some cropland is irrigated in valleys near mountain water sources. The region is not as hot as the Mojave Basin and Range (14) and Sonoran Basin and Range (81) ecoregions, and it has a greater percentage of land that is grazed.

**14. MOJAVE BASIN AND RANGE**

Stretching across southeastern California, southern Nevada, southwestern Utah, and northwestern Arizona, Ecoregion 14 is composed of broad basins and scattered mountains that generally are lower, warmer, and drier than those of the Central Basin and Range ecoregion (13). Its creosotebush-dominated shrub community is distinct from the saltbush–greasewood and sagebrush–grass communities to the north in the Central Basin and Range (13) and Northern Basin and Range (80) ecoregions; it also differs from the paloverde–cactus shrub and saguaro cactus in the Sonoran Basin and Range ecoregion (81) to the south. In the Mojave, creosotebush, white bursage, Joshua tree and other yuccas, and blackbrush are typical. On alkali flats, saltbush, saltgrass, alkali sacaton, and iodinebush are found. In the mountains, sagebrush, juniper, and singleleaf pinyon occur. At high elevations, some ponderosa pine, white fir, limber pine, and bristlecone pine can be found. The basin soils are mostly Entisols and Aridisols that typically have a thermic temperature regime; they are warmer than those of Ecoregion 13. Heavy use of off-road vehicles and motorcycles in some areas has made the soils susceptible to wind and water erosion. Most of Ecoregion 14 is federally owned and grazing is constrained by the lack of water and forage for livestock.

**78. KLAMATH MOUNTAINS AND CALIFORNIA HIGH NORTH COAST RANGE**

Ecoregion 78 encompasses the highly dissected ridges, foothills, and valleys of the Klamath and Siskiyou Mountains. It extends south into California to include the mixed conifer and montane hardwood forests that occur on mostly mesic soils in the North Coast Range mountains. The region’s mix of granitic, sedimentary, metamorphic, and extrusive rocks contrasts with the predominantly younger volcanic rocks of the Cascades ecoregion (4) to the east. It includes ultramafic substrates, such as serpentinite and mafic lithologies that directly affect vegetation. Most of the region was unglaciated during the Pleistocene epoch, when it likely served as a refuge for northern plant species. The region’s diverse flora, a mosaic of both northern Californian and Pacific Northwestern conifers and hardwoods, is rich in endemic and relic species. The mild, subhumid climate of Ecoregion 78 is characterized by a lengthy summer drought.

**80. NORTHERN BASIN AND RANGE**

The Northern Basin and Range ecoregion (80) consists of dissected lava plains, rocky uplands, valleys, alluvial fans, and scattered mountain ranges. Overall, it is cooler and has more available moisture than the Central Basin and Range ecoregion (13), and also is higher and cooler than the Snake River Plain ecoregion (12) to the northeast in Idaho. Valleys support sagebrush steppe or saltbush vegetation. Cool season grasses, such as Idaho fescue and bluebunch wheatgrass, are more common than in Ecoregion 13 to the south. Mollisols also are more common than in the hotter and drier basins of the Central Basin and Range ecoregion (13) where Aridisols support sagebrush, shadscale, and greasewood. Juniper woodlands occur on rugged, stony uplands. Ranges are covered by mountain brush, grasses (for example, Idaho fescue), aspen groves, and, at high elevations in Nevada, some forests with subalpine fir. Elevational banding of mountain vegetation is not as apparent as it is in Ecoregion 13. Most of Ecoregion 80 is used as rangeland. The western part of the ecoregion is internally drained; its eastern stream network drains to the Snake River system.

**81. SONORAN BASIN AND RANGE**

Similar in topography to the Mojave Basin and Range ecoregion (14) to the north, this ecoregion contains scattered low mountains and has large tracts of federally owned land, a large portion of which is used for military training. However, the Sonoran Basin and Range ecoregion is slightly hotter than the Mojave and contains large areas of paloverde-cactus shrub and giant saguaro cactus, whereas the potential natural vegetation in the Mojave is largely creosotebush. Other typical Sonoran plants include white bursage, ocotillo, brittlebrush, creosotebush, catclaw acacia, cholla, desert saltbush, pricklypear, and mesquite. Microphyll woodland trees and shrubs, such as ironwood, blue paloverde, smoketree, and desert willow, generally are unique to this desert, occupying desert washes with occasional moisture flow. In the region, winter rainfall decreases from west to east, whereas summer rainfall decreases from east to west. Aridisols and Entisols are dominant with hyperthermic soil temperatures and extremely aridic soil moisture regimes, creating some harsh environments for plant growth.

**85. SOUTHERN CALIFORNIA/NORTHERN BAJA COAST**

This ecoregion includes coastal and alluvial plains, marine terraces, and some low hills in the coastal area of Southern California, and it extends over 200 miles south into Baja California. Coastal sage scrub and chaparral vegetation communities with many endemic species once were widespread before overgrazing, clearance for agriculture, and massive urbanization occurred. Coastal sage scrub includes chamise, white sage, black sage, California buckwheat, golden yarrow, and coastal cholla. Small stands of the unique Torrey pine occur near San Diego and on one of the Channel Islands. The chaparral-covered hills include ceanothus, manzanita, scrub oak, and mountain-mahogany. Coast live oak, canyon live oak, poison oak, and California black walnut also occur.

**BACK SIDE TEXT**

**Descriptions of the Level IV Ecoregions of California**

**1. Coast Range**

**1a. Coastal Lowlands**

The **Coastal Lowlands** ecoregion contains beaches, dunes, and marine terraces below 400 feet in elevation. Wet forests, lakes, estuarine marshes, and tea-colored (tannic) streams are characteristic features of the landscape. Wetlands have been widely drained with many converted to dairy pastures. Residential, commercial, and recreational developments are expanding in the coastal corridor. In California, the region includes the Crescent City Plain, and Humboldt Bay Flats and Terraces. Soil moisture regimes are udic and aquic and soil temperatures are isomesic. Dune communities, grassland, coastal scrub, beach pine, bishop pine, and Sitka spruce are more typical than the redwoods in adjacent Ecoregion 1i. Riparian areas contain red alder, conifers, bigleaf maple, salmonberry, rhododendron, and willows.

**1i. Northern Franciscan Redwood Forest**

The low mountains of the **Northern Franciscan Redwood Forest** ecoregion lie entirely in the coastal fog zone and are characteristically covered by fog-dependent coast redwoods and Douglas-fir. Historically, unbroken redwood forests occurred and moderated local climate by trapping coastal fog and producing shade. The combination of shade, root competition, young soils with a deep organic debris layer on the soil surface, occasional fire, and silting by floods limits the number of plant species. The region extends north only about 10 miles into Oregon near Brookings. In some factors, this region has more similarities to the temperate rain forests of the Oregon and Washington Coast Ranges than to redwood forest regions to the south. Dominated by conifers, the region also includes western hemlock, western redcedar, Port Orford cedar, grand fir, and some Sitka spruce near the coast. Hardwoods such as red alder and tanoak occur. Fine and fine-loamy, isomesic, Ultisols and Alfisols are typical.

**1j. King Range/Mattole Basin**

In contrast to the redwood forests to the north and south, the vegetation of the **King Range/Mattole Basin** ecoregion includes a mixed evergreen forest of Douglas-fir, tanoak, and madrone, as well as areas of grassland. Prairies and coastal scrub cover many of the headlands. Although this is one of the wettest spots in California, the King Range rises above the coastal fog. In summer, warm, dry, offshore winds also help keep the fog away, making the King Range too dry to support the redwood forests that surround it on three sides. The King Range thrusts 4,000 feet above the Pacific, making this area one of the more spectacular and remote stretches of coastline in the continental United States. In the northern part of the region, the Bear and Mattole Rivers drain a hilly-to-steep landscape of mixed evergreen forest, with a land cover that includes a relatively greater amount of annual grasslands than in Ecoregions 1i to the north or 1k to the south. Timber production, livestock grazing, and recreation are primary land uses.

**1k. Coastal Franciscan** **Redwood Forest**

The main part of the **Coastal Franciscan Redwood Forest** ecoregion extends through Mendocino County from just south of the King Range to just south of the Russian River in Sonoma County. Unlike the conifer-dominated forests of Ecoregion 1i to the north, these central redwood forests typically are more a mixture of conifers and hardwoods. Vegetation includes a multi-story canopy of redwood, Douglas-fir, tanoak, bigleaf maple, evergreen shrubs, and various grasses. In the southern parts of the region, there are more coast live oaks and grassland savannas that are intermixed with denser areas of forest. The near-coastal part of the region that is influenced more by fog has more redwoods and similarities to Ecoregion 1i to the north. Soil temperature regimes are mostly isomesic and mesic. Soil moisture regimes are predominantly udic, ustic, and xeric. Runoff is rapid and many of the smaller streams are dry by the end of the summer. Natural lakes are absent. A small outlier of the region occurs in the south in Marin County that includes the coniferous and hardwood forests of Mount Tamalpais and Bolinas Ridge. This small area of redwoods and other forest types ranges in elevation from sea level to more than 2,500 feet. It has more relief and coniferous forest than the Marin Hills ecoregion (6o). Various types of coniferous and hardwood forests occur, composed mostly of Douglas-fir, redwoods, tanoak, madrone, California bay, and coastal live oak. Mount Tamalpais and the Bolinas Ridge force moisture out of the air as it cools and ascends the steep western mountain faces. These western parts are heavily forested with redwoods and Douglas-fir. A few areas of drier exposures or shallow soils contain grasslands, coastal scrub, or chaparral.

**1l. Fort Bragg/Fort Ross Terraces**

The **Fort Bragg/Fort Ross Terraces** ecoregion forms an elevated coastal plain that has less relief (200–800 feet) than the adjacent mountains of Ecoregion 1k. Quaternary and Tertiary sandstones and mudstones form the terraces, and some areas are deeply dissected, forming ravines that expose Cretaceous sedimentary rocks. Elevations range from sea level to about 1,300 feet. Soil moisture regimes are udic and some aquic, and soil temperatures are isomesic. Monthly and annual temperature variations are minimal and summer fog is common. Vegetation includes coastal grasslands and shrubs, stunted beach pine, Bishop pine, or pygmy cypress, along with areas of some grand fir and western hemlock. Terrace soils typically are unsuitable for redwoods, although they do occur in ravines and on some bluffs.

**1m. Point Reyes/Farallon Islands**

The **Point Reyes/Farallon Islands** ecoregion includes the Point Reyes Peninsula, Bodega Head and the sand spit at the north end of Bodega Bay, and the offshore Farallon Islands. The maritime climate is temperate and humid, with frequent fog. There are granitic rocks along with Pliocene and Miocene sandstone and mudstone, and Quaternary sands. Soil temperature regimes are mostly isomesic, with some mesic. Soil moisture regimes are mostly ustic. Common vegetation includes Douglas-fir, tanoak, Bishop pine, coast live oak, Pacific reedgrass, and coyote brush. A few redwoods occur. Most of the streams, which are small, are dry by the end of the summer. The rocky Farallon Islands, about 20 miles southwest of Point Reyes, are a group of small granitic islands providing important habitat for seabirds, seals, and sea lions.

**1n. Santa Cruz Mountains**

The **Santa Cruz Mountains** ecoregion covers the western and southwestern parts of the range where vegetation includes redwood, Douglas-fir, tanoak, coast live oak, and California bay, along with some chaparral and coastal scrub species. The shrub layer under forest canopy generally is sparse. Species of limited range in this area include the Santa Cruz cypress and Shreve oak. Forests of this region are ecologically and genetically distinct from those of the redwood ecoregions (1i, 1k) farther north. Clear-cut logging was typical from the late 1800s to about the 1960s. Most logging now uses smaller selective cuts. Climate varies from the west to the east, as the high mountain ridges reduce the penetration of maritime air. Winters are cool and wet. On the western side, summers are cool, and fog or low overcast is typical. Soil temperature regimes are mostly mesic and isomesic, with some thermic. Soil moisture regimes are mostly ustic and xeric. Streams on the northeastern side of the mountains generally are dry during the summer, but streams on the seaward side generally are perennial.

**1o. San Mateo Coastal Hills**

The **San Mateo Coastal Hills** ecoregion has lower relief and elevations than Ecoregion 1n, with more coastal scrub vegetation and a few small areas of cropland rather than the denser forest and woodland of the Santa Cruz Mountains ecoregion (1n). Marine terraces, coastal benches, and small valleys are the primary landforms. Elevations range from sea level to about 1,000 feet. Pliocene sandstone and siltstone are the main rock types compared to the mix of geology in Ecoregion 1n that includes older sedimentary and some igneous rocks. Mollisols are typical, with mostly thermic to isomesic temperature regimes. Soil moisture regimes are mostly xeric and ustic. Summer fog is common and winters are cool and moist.

**4. Cascades**

**4d. Cascade Subalpine/Alpine**

The **Cascade Subalpine/Alpine** ecoregion contains the prominent volcanic peaks of the high Cascades. Pleistocene glaciation reshaped the mountains, leaving moraines, glacial lakes, and U-shaped glacial canyons. Glaciers and permanent snowfields still occur on the highest peaks. The vegetation is adapted to high elevations, cold winter temperatures, short growing season, and deep winter snow pack. Herbaceous subalpine meadow vegetation and scattered patches of mountain hemlock and whitebark pine occur near timberline. In Oregon and Washington, some subalpine fir occurs. Elevations of the ecoregion in California typically are above 7,600 feet.

**4e. High Southern Cascades Montane Forest**

The **High Southern Cascades Montane Forest** ecoregion is an undulating, volcanic plateau containing isolated buttes, cones, and peaks. Some parts of the region are glaciated. The terrain often is less dissected than Ecoregion 4f. Elevations of Ecoregion 4e are generally intermediate to elevations in the Low Southern Cascades Mixed Conifer Forest(4f) and the Cascade Subalpine/Alpine (4d) ecoregions. In California, elevations of the ecoregion are mostly 5,500‒8,500 feet, but are lower in Oregon at 4,000‒8,200 feet. Cryic soils support mixed coniferous forests dominated by mountain hemlock, lodgepole pine, and, in Oregon, some Pacific silver fir; the soils are colder than the mesic and frigid soils of the Low Southern Cascades Mixed Conifer Forestecoregion(4f). White fir and Shasta red fir also occur in the ecoregion, with some grand fir in Oregon. This region has a longer summer drought and more intermittent streams than the Cascade Crest Montane Forest ecoregion (4c) to the north in Oregon and Washington.

**4f. Low Southern Cascades Mixed Conifer Forest**

The **Low Southern Cascades Mixed Conifer Forest** ecoregion generally is lower in elevation and less rugged than the more highly dissected Western Cascades Montane Highlands (4b) to the north in Oregon. Although still mostly a mesic mixed conifer region, the climate is drier than in the western Cascades of Oregon (Ecoregions 4a and 4b), and the vegetation reflects this. Western hemlock and western redcedar, indicator species of Ecoregions 4a and 4b, decrease in abundance southward in this region in Oregon and are replaced by Sierra Nevada species, such as incense cedar, white fir, Shasta red fir, and Jeffrey pine that tolerate prolonged summer drought. In California, shrubs such as manzanita and ceanothus are common. Curl-leaf mountain-mahogany, big sagebrush, and antelope bitterbrush occur as well, with their dispersion centers in the Great Basin regions farther east. River and stream discharge is significantly less than in systems to the north. Soil temperature regimes are mesic and frigid, and the soil moisture regime is xeric. Elevations in the California part of this ecoregion are about 3,000 to 7,600 feet.

**4g. California Cascades Eastside Conifer Forest**

The **California Cascades Eastside Conifer Forest** ecoregion is drier than the other California Cascades regions. It is dominated by ponderosa pine and, in some areas, Jeffrey pine where conditions are harsher. In lower, drier areas, the region blends into the western juniper and sagebrush fields more typical of adjacent Ecoregion 9. The region wraps around to the western side (that is, the Mount Shasta foothills), as similar dry conditions exist from the rain shadow cast by the Klamath Mountains to the west. Elevations range from 3,000 to 7,100 feet.

**4h. Southern Cascades Foothills**

The **Southern Cascades Foothills** ecoregion of volcanic hills and plateaus is mostly in the 2,000–4,000 foot elevation range, stretching from the town of Paradise in the south to the Pit River in the north. It contains dry-mesic mixed conifer forest and lower montane black oak-conifer forest and woodland. Ponderosa pine is abundant along with some Douglas-fir, and, at higher elevations, white fir. Hardwoods typically are black oak and canyon live oak. Soil temperature regimes are mostly mesic with some frigid, and soil moisture regimes are xeric.

**5. Sierra Nevada**

**5a. Sierran Alpine**

The **Sierran Alpine** ecoregion is above tree line and includes the highest elevations of the Sierra Nevada. Tree line generally occurs at about 10,500 feet in the southern and central areas and at about 9,600 feet in the north. On the eastern side, elevations of the alpine zone may start as high as 12,000 feet. Numerous peaks are higher than 14,000 feet. In the harsh climate of this region, summers are short and cool, and winters are long, cold, and snowy. Vegetation is limited or nonexistent on the exposed bedrock, boulder fields, and talus slopes. Cushion plants, tufted grasses, alpine willows, sedges, and various shrubs and herbaceous plants occur, as well as krummholz forms of high-elevation conifers in the lower alpine zone. Only a few animals are adapted this area, such as the American pika, Belding’s ground squirrel, and yellow-bellied marmot. Soil temperature regimes are mostly cryic.

**5b. Northern Sierra Subalpine Forests**

Above the upper montane forests of Ecoregion 5c, the **Northern Sierra Subalpine Forests** ecoregion is typified by lodgepole pine, whitebark pine, western white pine, and mountain hemlock. It mostly lacks the foxtail pine that is found in the Southern Sierra Subalpine Forests ecoregion (5k). Elevations generally range from 8,000 to 10,000 feet, although in some eastern areas, elevations can start and range higher. With heavy snowfall, high winds, cold climates, and shallow soils, trees at high elevations have slow growth rates and are not very large.

**5c. Northern Sierra Upper Montane Forests**

The **Northern Sierra Upper Montane Forests** ecoregion ranges in elevation mostly from 6,000 to 8,000 feet, and its forests have a mix of conifers, including red fir, white fir, Jeffrey pine, sugar pine, incense cedar, and some lodgepole pine. Intermixed are areas of quaking aspen groves. Some montane chaparral also occurs in areas of harsh exposure, repeated fires, and clear cuts. Geology types are mostly Mesozoic granitic rocks and Tertiary volcanics, although in the north these occur along with some areas of slate, sandstone, metavolcanics, and metasedimentary rocks. Soil temperature regimes are mostly frigid, with some cryic. Soil moisture regimes are mostly xeric, but are udic in areas where snow persists through spring.

**5d.** **Northern Sierra Mid-Montane Forests**

In contrast to the volcanic and granitic rocks of similarly zoned Ecoregion 5g to the south, in the **Northern Sierra Mid-Montane Forests** ecoregion, metamorphic rocks are abundant, with Paleozoic metasedimentary argillite, phyllite, and quartzite, and some metavolcanics, as well as Mesozoic peridotite and serpentine. Elevations range mostly from 3,000 to 6,000 feet, with some lower west-end canyon elevations. This higher elevation mixed conifer forest has more white fir and Douglas-fir and less ponderosa pine than in the lower elevation Ecoregion 5h to the south. Jeffrey pine occurs on ultramafic rocks and some drier areas to the east. Black oak and tanoaks are common hardwoods, along with canyon live oak. Soil temperature regimes are mostly mesic and soil moisture regimes are mostly xeric.

**5e. Northern Sierra Lower Montane Forests**

Generally lower in elevation than adjacent Ecoregion 5d, the **Northern Sierra Lower Montane Forests** ecoregion has a mix of montane hardwood, montane hardwood-conifer, and mixed conifer forests. Elevations range mostly from 2,000 to 4,000 feet, with a few higher areas. Ecoregion 5e has less ponderosa pine than Ecoregions 5h and 5n to the south. Douglas-fir is a more widespread conifer, and hardwoods include canyon live oak, interior live oak, black oak, and tanoak. Annual precipitation is somewhat higher than in Ecoregion 5h immediately to the south. Geology is a complex mix of Mesozoic granitic rocks, Jurassic to Triassic metavolcanics, and some Mesozoic to Paleozoic metasedimentary and ultramafic rocks.

**5f. Northeastern Sierra Mixed Conifer-Pine Forests**

The **Northeastern Sierra Mixed Conifer-Pine Forests** ecoregion includes many of the drier eastside forests of the northern Sierra Nevada that occur north of Bridgeport, in the Lake Tahoe area, and to the northern extent of the Sierra near Susanville. These are mid-elevation dry forests, typically between 5,000 and 8,000 feet, with a diverse mix of conifers, such as Jeffrey, ponderosa, and sugar pines; incense cedar; and California white fir. The understory can include sagebrush, antelope bitterbrush, and a fire-maintained chaparral component of snowbrush and manzanita. Soil temperature regimes are frigid and soil moisture regimes are mostly xeric.

**5g. Central Sierra Mid-Montane Forests**

The **Central Sierra Mid-Montane Forests** ecoregion, generally 4,000–6,000 feet in elevation, has a higher elevation, cooler climate, and a somewhat denser and different forest mix than Ecoregion 5h to the west. Although it is aspect-dependent, in general, a more mesic mixed conifer forest occurs in this region consisting of Douglas-fir; ponderosa pine; and canyon, live, and black oaks, compared to the abundance of pines, oaks, and chaparral more typical of Ecoregion 5h. Bedrock is volcanic (Tertiary andesite and ryholite) and granitic (Cretaceous granodiorite and quartz monzonite) in contrast to Ecoregion 5d to the north that has more metamorphic rock. Gently sloping Neogene-age lahars and lava flows cap some of the older plateau surfaces. Soil temperatures are mesic and some frigid and soil moisture regimes are xeric.

**5h.** **Central Sierra Lower Montane Forests**

Similar to the higher Ecoregion 5d, the **Central Sierra Lower Montane Forests** ecoregion has abundant metamorphic rocks, mostly Paleozoic metasedimentary argillite and quartzite, as well as some Jurassic slate and graywacke, and minor areas of Mesozoic peridotite and serpentine. Elevations here are mostly lower than Ecoregions 5d and 5g, generally 2,000–4,000 feet with a few higher elevation areas. Soil temperature regimes are mostly mesic and soil moisture regimes are xeric. Ponderosa pine and gray pine occur, with more mixed conifer forest at high elevations. Montane hardwood forests may include canyon live oak, interior live oak, black oak, or areas of shrubby tanoak. Lower montane mixed chaparral occurs in many areas, with manzanita, chamise, ceanothus, and other shrubs.

**5i. Eastern Sierra Great Basin Slopes**

The **Eastern Sierra Great Basin Slopes** ecoregion comprises the very steep eastern slope of the Sierra Nevada. It tends to have more conifers and sage, in contrast to the sparser Mojave Desert scrub typical of Ecoregion 5j to the south. Singleleaf pinyon pine and sagebrush are common, with some areas of bitterbrush and Utah juniper. Some Jeffrey and lodgepole pines occur at high elevations. Soil temperature regimes are mostly mesic and frigid. Soil moisture regimes are mostly xeric in the north to aridic in the south.

**5j. Eastern Sierra Mojavean Slopes**

The **Eastern Sierra Mojavean Slopes** ecoregion on the eastern low slopes of the Sierra Nevada is a transitional area to the Mojave Basin and Range ecoregion (14). Elevations range mostly from 4,000 to 6,000 feet. Many of the steep slopes are bare or have some desert scrub and can include blackbrush and some Joshua trees as well. There is less sagebrush and juniper than in the Eastern Sierra Great Basin Slopes ecoregion (5i) to the north. Soil temperatures are mesic, with thermic at lowest elevations, and soil moisture regimes are mostly xeric.

**5k Southern Sierra Subalpine Forests**

Located above the upper montane forests of Ecoregion 5l, and below the alpine zone of Ecoregion 5a, the **Southern Sierra Subalpine Forests** ecoregion is typified by lodgepole pine, whitebark pine, western white pine, mountain hemlock, foxtail pine, and, on the eastern side, limber pine. Elevations generally range from 9,000 to 11,000 feet, although in some eastern areas, elevations can range from about 10,000 to as high as 12,000 feet.

**5l. Southern Sierra Upper Montane Forests**

The **Southern Sierra Upper Montane Forests** ecoregion is typically found in the 7,000–9,000 foot elevation range on the western slope of the southern Sierra Nevada. Vegetation, from low to high elevations in this range, primarily is mixed conifer, white fir, and red fir forests. In some harsher or drier areas, especially to the east, Jeffrey pine and lodgepole pine occur. Some montane chaparral is found throughout the region. Soil temperature regimes are mostly frigid, but some high peaks may be cryic. Soil moisture regimes are mostly xeric. Soils have udic moisture regimes where snow persists through spring. Most of the runoff flows to the Tuolumne, Merced, San Joaquin, Kings, Kaweah, Tule, or Kern Rivers.

**5m. Southern Sierra Mid-Montane Forests**

The **Southern Sierra Mid-Montane Forests** ecoregion comprises the mid-elevations of the western slope of the southern Sierra Nevada. Elevations typically are in the 5,000–7,500 foot range, and slightly higher to the south. Soil temperature regimes are mostly mesic. Soil moisture regimes are xeric. Common vegetation includes ponderosa pine at low elevations and mixed conifer forest at high elevations. Some Jeffrey pine occurs in the eastern part of the region. Ecoregion 5m also contains most of the giant Sequoia groves in the Sierra Nevada. Sequoias are not drought-tolerant and are limited to mesic sites with sufficient moisture.

**5n. Southern Sierra Lower Montane Forest and Woodland**

The **Southern Sierra Lower Montane Forest and Woodland** ecoregion is lower in elevation, warmer, and drier than adjacent Ecoregion 5m. The oak woodlands and chaparral-covered hills of the low elevations transition to forest and woodlands dominated by ponderosa pine. Elevations typically are between 3,000 to 5,000 feet, but can range from near 2,500 to almost 6,000 feet. Geology is almost all Mesozoic granite, granodiorite, and quartz monzonite. Soil temperature regimes are mesic to some thermic and soil moisture regimes are xeric.

**5o. Tehachapi Mountains**

The **Tehachapi Mountains** form a connecting highland link from the core of the Sierra Nevada ecoregion (5) to the Transverse and Coast Ranges of Ecoregions 8 and 6. Although rugged topography and geology of the Tehachapi Mountains ecoregion have similarities to the southern Sierra Nevada, the diverse vegetation of this region reflects its biogeographic crossroads position and the influences from the Sierra, desert, oak woodlands, and grasslands that surround it. The vegetation includes large areas of oak savanna (with blue oak, gray pine, and some valley oak) that are intermixed with junipers, yuccas, and other species from adjacent ecoregions. Steep canyons and slopes contain canyon live oak and interior live oak, as well as chamise, ceanothus, and singleleaf pinyon. Some minor areas of ponderosa or Jeffrey pine also occur. Soil temperature regimes are thermic and mesic and soil moisture regimes are xeric and aridic.

**6. Central California Foothills and Coastal Mountains**

**6a.** **Tuscan Flows**

The **Tuscan Flows** ecoregion is a gently southwest-sloping plateau with some steep canyons and a few steep volcanic cones. Although the region is geologically related to the southwestern end of the Cascades ecoregion (4), it has ecosystem similarities to the Sierra Nevada foothills part of Ecoregion 6. Blue oak woodlands, annual grasslands, and foothill pine occur.

**6b.** **Northern Sierran Foothills**

The **Northern Sierran Foothills** ecoregion consists of moderately steep to steep mountains and hills at the western foot of the northern and central Sierra Nevada. The Melones Fault Zone is in this unit. Geology is a complex mix of mafic volcanics, granodiorite, slate and graywacke, argillite and quartzite, and some ultramafic bands of peridotite and serpentinite. The soil temperature regime is thermic and soil moisture regime is xeric. Common vegetation includes needlegrass and annual grasslands, chamise, manzanita, interior live oak, ceanothus, blue oak, and foothill pine. Runoff is rapid; streams drain to the Feather, Sacramento, and San Joaquin Rivers.

**6c.** **Southern Sierran Foothills**

The moderately steep hills and low mountains of the **Southern Sierran Foothills** ecoregion represent a transition from the Central California Valley (7) to the Sierra Nevada (5). Ecoregion 6c is somewhat warmer and drier than Ecoregion 6b to the north, but not as arid as Ecoregion 6ae to the south. The soil temperature regime is thermic and soil moisture regime is xeric. Vegetation includes blue oak, needlegrass and annual grasslands, chamise, ceanothus, mixed oaks, and foothill pine. Woodlands increase in the high elevation and eastern parts of the region.

**6d. Camanche Terraces**

The **Camanche Terraces** are on gently sloping to moderately steep hills and dissected terraces along the eastern edge of the Central California Valley (7) downslope from the central Sierra Nevada foothills. Sandstone, andesitic conglomerate, rhyolitic tuff, and some clay underlie the major terraces, in contrast to the metamorphic and igneous bedrock of Ecoregion 6b to the east and the younger alluvium of Ecoregion 7a to the west. The soil temperature regime is thermic and soil moisture regimes are xeric and aquic. Needlegrass and annual grasslands are common, along with some blue oak, vernal pool habitats, and cottonwood and willow near streams.

**6e Tehama Terraces**

The **Tehama Terraces** ecoregion forms a dissected plain between the coastal hills to the west and the western margin of the Sacramento Valley. Quaternary alluvial and colluvial materials overlie slightly consolidated Pliocene sandstone and conglomerate. The soil temperature regime is thermic and soil moisture regime is xeric. Common vegetation includes blue oak; needlegrass dominates on some fine-textured soils, and vernal pools are common.

**6f Foothill Ridges and Valleys**

The **Foothill Ridges and Valleys** ecoregion includes ridges, steep hills, and narrow valleys in the interior northern California Coast Ranges. It extends from the Vaca Mountains and Blue Ridge in the south, to the Bald Hills in the north near the Klamath Mountains (78). Ecoregion 6f is at a higher elevation and more hilly than Ecoregions 6e and 6h to the east, but lower elevation and drier than ecoregions to the west. Soil temperature regime is thermic and soil moisture regime is xeric. Vegetation includes purple needlegrass, blue oak, chamise, and foothill pine.

**6g. North Coast Range Eastern Slopes**

The **North Coast Range Eastern Slopes** ecoregion is located along the steep north-trending eastern edge of the Northern Coast Range mountains with sedimentary and ultramafic rocks. It has more relief and higher elevations than Ecoregion 6f to the east, with mostly chaparral vegetation compared to the grassland and blue oak to the east. It has few conifers compared to the higher elevation Ecoregion 78r to the west. The disjunct southern unit of the region between Clear Lake and Lake Berryessa has a complex pattern of Mesozoic sedimentary, metasedimentary, metavolcanic, and ultramafic rocks. Elevations range from about 450 feet near Lake Berryessa to the high point 3,196-foot Brushy Skyhigh, and relief is mostly 500–1,200 feet. Vegetation includes leather oak on serpentine soils, chamise on other shallow soils, and mixed conifer on deeper, mesic soils. Some hills contain McNab or Sargent cypress or some foothill and knobcone pine. Areas of blue oak woodland occur in low elevation, flatter areas. All but the larger streams are dry through most of the summer. Soil temperature regimes are mostly thermic, but are mesic on some north-facing slopes and at high elevations. Soil moisture regimes are xeric.

**6h. Western Valley Foothills/Dunnigan Hills**

The **Western Valley Foothills/Dunnigan Hills** ecoregion consists of the Dunnigan Hills, English Hills, Capay Valley, and other low hills or terraces adjacent to the western margin of the Central California Valley ecoregion (7). Elevations range from 150 feet in the south to nearly 1,000 feet in the northwest, and relief is mostly 200–300 feet. Soil temperature regimes are thermic and soil moisture regimes are xeric. Common vegetation series include needlegrass grasslands and some areas of blue oak. All but the larger streams are dry through most of the summer.

**6i. Clear Lake****Hills and Valleys**

The **Clear Lake****Hills and Valleys** ecoregion is a relatively low elevation area of the northern Coast Ranges, surrounded by ecoregions with higher elevation hills and mountains and greater relief. Elevations are 1,300–2,400 feet. Clear Lake, a large, shallow eutrophic lake, occupies a large part of the region. Much of the terrestrial part of the region, especially to the west, occurs on nearly level to gently sloping Quaternary sediments on terraces, alluvial fans, and basin fill. Some cropland, orchards, and vineyards occur in this ecoregion. Soil temperature regimes are mostly thermic. Soil moisture regimes are mostly xeric, with some aquic moisture regimes in alluvium around Clear Lake. Vegetation includes blue oak and needlegrass, with chamise and chaparral on hills to the east. The lake’s hydrology and nutrient balance have been greatly altered, and sediment volumes and mercury concentrations are high due to mining activities in the watershed.

**6j. Mayacmas Mountains**

The **Mayacmas Mountains** ecoregion is an interior coastal range that contrasts with the Ukiah/Russian River Valleys (6l) to the west and Clear Lake Hills and Valleys (6i) to the east. The mountains rise to more than 3,900 feet in elevation. The geology is a continuation of the Cretaceous and Jurassic Franciscan Complex sedimentary and metasedimentary rocks found in Ecoregion 78m to the north, along with some Mesozoic metavolcanics. Soil temperature regimes are thermic and soil moisture regimes are xeric. Annual grasslands and montane hardwoods are at low elevations, with mixed chaparral higher on the hills. Some blue oak woodland occurs, as well as patches of Sargent or McNab cypress. Scattered Douglas-fir grows in more mesic areas.

**6k. Napa-Sonoma-Lake Volcanic Highlands**

The **Napa-Sonoma-Lake Volcanic Highlands** ecoregion has two separate units. In the north, in Lake County, the region includes the volcanic terrain around Mount Konocti and the mostly volcanic terrain that extends to the southeast. Its Quaternary volcanic geology of rhyolite, andesite, and dacite differs from the Franciscan Complex geology of Ecoregion 6j to the west and from the abundance of ultramafic rocks of adjacent Ecoregion 6g. The unit in the south in Napa and Sonoma Counties has mostly Tertiary volcanic geology. Elevations in the ecoregion range from about 500 feet in the south to the high points of 4,286-foot Mount Konocti, 4,343-foot Mount St. Helena, and 4,722-foot Cobb Mountain. Soil temperature regimes are mostly thermic, but are mesic on some north-facing slopes and at high elevations. Soil moisture regimes are xeric. The vegetation mosaic includes mixed chaparral, mixed hardwoods (including coast live oak, madrone, and California bay), and some areas of Douglas-fir or pines and cypress.

**6l. Napa-Sonoma-Russian River Valleys**

The **Napa-Sonoma-Russian River Valleys** ecoregion is lower, flatter, more populated, and has more cropland, vineyards, and orchards than the surrounding more mountainous ecoregions (6j, 6k, and 6m). The Ukiah/Russian River valley in the north has less marine influence and fog than the valleys to the south. Quaternary alluvium covers large parts of the region, along with some other areas of older, loosely consolidated sedimentary material. The southern valleys of the North Coast Range include the Napa, Sonoma, Petaluma, and Cotati Valleys, and the Santa Rosa Plain. Elevations range from about 20 feet near the river deltas and bay flats of Ecoregion 6p to more than 500 feet in the northern hilly margins. Grape vineyards are extensive, as well as some areas of orchards or specialty crops. The southern low elevation parts of the valleys have more marine influence and fog than the high elevation northern parts, affecting grape varietals and production.

**6m. Sonoma-Mendocino Mixed Forest**

Located inland from the wetter, denser redwood and coniferous forests of Ecoregion 1k, the **Sonoma-Mendocino Mixed Forest** ecoregion is characterized primarily by a mixed hardwood forest. It includes tanoak, black oak, madrone, Oregon white oak, Douglas-fir, and only a few small areas of redwoods. Annual grasslands and chaparral also occur in the mosaic. The geology includes Tertiary sandstone and shale, as well as some Cretaceous and Jurassic Franciscan Complex metasedimentary rocks. Most streams in Ecoregion 6m drain east to the Russian River.

**6n.** **Bodega Coastal Hills**

The **Bodega Coastal Hills** ecoregion has less relief than Ecoregion 6o to the south, with Pliocene sandstone and mudstone compared to the Cretaceous and early Tertiary sedimentary material to the north and south, or to the younger Quaternary alluvium in Ecoregion 6l to the east. It is mostly all grassland and coastal scrub, compared to the hilly woodland of the Marin Hills ecoregion (6o) to the south or to the forest of Ecoregion 1k to the north.

**6o. Marin Hills**

The **Marin Hills** ecoregion consists of mountains and hills between San Francisco Bay and the San Andreas Fault. Soil temperature regimes are mostly mesic and thermic, with some isomesic. Soil moisture regimes are mostly xeric. Vegetation is mostly coast live oak, annual grasslands, coastal scrub, and some tanoak and Douglas-fir. Ecoregion 6o has less relief and coniferous forest than Ecoregion 1k. Most of the smaller streams are dry by the end of the summer.

**6p. Bay Flats**

The **Bay Flats** ecoregion includes the near-water flats around San Pablo Bay in the north and those at the southern end of San Francisco Bay. Elevations are sea level to about 10 feet on Quaternary bay fill of silt and clay. High tides inundate most of the area. Soil temperature regimes are isomesic and soil moisture regimes are aquic. Common vegetation includes pickleweed and saltgrass. The southern part of the ecoregion is somewhat warmer and drier than the northern part, and has less summer fog. The southern part receives 14–16 inches of annual precipitation, whereas the northern part receives 20–28 inches. Several salt evaporation ponds are found in the southern Bay Flats, where saltwater is impounded within levees in the former tidelands. As the water evaporates, microorganisms of several kinds change the color of the water. Restoration efforts are underway to return some salt ponds to a mix of tidal marsh, mudflat, and other wetland habitats.

**6q. Suisun Terraces and Low Hills**

The low-elevation **Suisun Terraces and Low Hills** ecoregion occurs on mostly Quaternary alluvium, surrounding Suisun Bay, upland from the lower part of the Delta (7j). A few low hills occur, such as the Portrero Hills and Montezuma Hills. Ecoregion 6q is mostly an urban or urbanizing region, and includes the cities of Fairfield, Concord, Pittsburg, and Antioch. The Montezuma Hills are mostly non-native grasslands, used for grazing and wind farms.

**6r. East Bay Hills/Western Diablo Range**

The **East Bay Hills/Western Diablo Range** ecoregion consists of the East Bay Hills to the east of the Berkeley-Oakland-Hayward urban area, Mount Diablo and the Black Hills area farther east, as well as the hills of the western Diablo Range. Soil temperature regimes are thermic, with some mesic on northern slopes. Soil moisture regimes are xeric. Common vegetation series include coast live oak, blue oak, valley oak, and chamise. All but the larger streams are dry through the summer. In the urban/suburban areas, eucalyptus and other flammable exotic vegetation present fire-management concerns.

**6s. San Francisco Peninsula**

The **San Francisco Peninsula** ecoregion occurs at the northern end of the peninsula, with a climate affected greatly by the marine influence. It is cooler than much of adjacent Ecoregion 6t, and fog is common. Soil temperature regimes are mostly isomesic, with some thermic on the bay side. Some metamorphosed sedimentary and volcanic rocks occur, but large areas are covered by Quaternary marine and sand dune deposits, with recent alluvium and large areas of fill on the bay side. There are some small serpentine outcrops and bluffs. Natural vegetation consisted of California oatgrass, purple needlegrass, coast live oak, California bay, dune communities, and some saltmarsh species. Some rare and endangered plant species persist. Like Ecoregion 6t, the San Francisco Peninsula ecoregion is nearly all urbanized.

**6t. Bay Terraces/Lower Santa Clara Valley**

The **Bay Terraces/Lower Santa Clara Valley** ecoregion is an urbanized area on alluvial plains that wrap around San Francisco Bay between the East Bay Hills ecoregion (6r) on the east and the Leeward Hills ecoregion (6x) to the west. Ecoregion 6t also includes the urbanized area around San Jose and the lower Santa Clara Valley. Soil temperature regimes are mostly thermic, with some isomesic. Soil moisture regimes are xeric with some aquic. Common vegetation historically included coast live oak, California oatgrass, and needlegrass grasslands, although land use now is nearly all urban and residential. All but the larger streams are dry through most of the summer.

**6u. Livermore Hills and Valleys**

The **Livermore Hills and Valleys** ecoregion consists of the Livermore, Amador, and San Ramon Valleys and the low hills that surround them. Large areas are relatively flat, now mostly urbanized, and occur on Quaternary alluvium. Ecoregion 6u includes the cities of Livermore, Pleasanton, Dublin, and part of Danville. The low hills occur on loosely consolidated Plio-Pleistocene deposits and are mostly grassland, with some scattered blue oak or coastal live oak. Elevations range mostly from 300 to 1,100 feet. Soil temperature regimes are thermic and soil moisture regimes are xeric. Streams are dry through most of the summer.

**6v. Upper Santa Clara Valley**

The **Upper Santa Clara Valley** ecoregion is a low-relief alluvial plain in the upper Santa Clara Valley, including the San Benito Valley. It retains more agricultural land and is not as urbanized as the Bay Terraces/Lower Santa Clara Valley ecoregion (6t). Late Quaternary alluvium is predominant. Soil temperature regimes are thermic and soil moisture regimes are xeric. Common vegetation series include valley oak, coast live oak, California oatgrass, and needlegrass grasslands, but most of the region is in cropland or urban and residential land. Runoff is slow across the alluvial plain. All but the larger streams are dry through most of the summer.

**6w. Monterey Bay Plains and Terraces**

The coastal **Monterey Bay Plains and Terraces** ecoregion occurs on alluvial plains and terraces that wrap around Monterey Bay. The marine-influenced climate of Ecoregion 6w makes it cooler than the Salinas Valley ecoregion (6af) that stretches inland to the southeast, and Ecoregion 6w has higher annual precipitation. Elevations range from sea level to about 400 feet. Quaternary marine and non-marine deposits and terraces occur. There are recent dunes along the western side of Monterey Bay, and stabilized dune sand is extensive on the southeastern side of the bay. Soil temperature regimes are isomesic near the ocean and thermic inland. Soil moisture regimes are mostly xeric but some are aquic on floodplains. Soluble salts accumulate in some soils near the ocean. Coast live oak and California oatgrass occur on the plains. Dunes support some herbaceous communities with coastal scrub and sage on stabilized dunes in the southeast. Pickleweed occurs in estuaries. Summer fog is common. There is a long frost-free period that helps support cropland agriculture including artichokes, strawberries, and lettuce.

**6x. Leeward Hills**

The **Leeward Hills** ecoregion is an area of mountains and hills with rounded ridges, steep and moderately steep sides, and narrow canyons. It occurs inland from the wetter Santa Cruz Mountains ecoregion (1n). Elevations range from about 200 feet to peaks greater than 3,700 feet. Metasedimentary and metavolcanics of the Franciscan Complex occur along with other Cretaceous sedimentary rocks, and some minor areas of ultramafics and Plio-Pleistocene non-marine sediments. Soil temperature regimes are thermic and soil moisture regimes are xeric. Common vegetation includes annual grassland, coast live oak, California bay, and a few areas of chaparral.

**6y. Gabilan Range**

The **Gabilan Range** ecoregion contains steep mountains between the San Andreas Fault on the northeast and the Salinas Valley on the southwest. These mountains are steeeper (with granitic, metamorphic, and volcanic rocks) and have more coastal oaks than the sedimentary-dominated hills of Ecoregion 6al to the southeast. Although Mesozoic granitic rocks are found in most of the region, Miocene rhyolite and pyroclastic rocks are exposed in the hills of Pinnacles National Park. Coast live oak is common on north-facing slopes in the northwestern part, with more blue oak to the south and east. Some black oak and mixed conifers occur on north-facing slopes at high elevations. Chamise is common on shallow soils.

**6z. Diablo Range**

The **Diablo Range** ecoregion includes mountains with rounded ridges and steep to moderately steep sides, along with narrow canyons and valleys. It is higher and wetter than Ecoregion 6aa to the east, and it has a different geology and vegetation mosaic compared to Ecoregions 6y and 6al to the west. The elevation ranges from about 600 feet near San Luis Reservoir to about 4,000–5,000 feet on the high elevation mountains, with a peak of 5,248 feet on San Benito Mountain. Ecoregion 6z is dominated by Cretaceous-Jurassic Franciscan sedimentary, minor volcanic, and metamorphic rocks that are intensely folded and faulted. Ultramafic rocks are widely scattered throughout the region. The hills along the San Andreas Fault also include some Paleocene marine, Miocene marine, Plio-Pleistocene nonmarine, and Quaternary stream terrace deposits. Soil temperature regimes are mostly thermic, but are mesic on north-facing slopes at high elevations. Soil moisture regimes are xeric. The natural plant communities include blue oak woodlands and savannas and, on shallow soils, chamise. Leather oak occurs on serpentine soils, as well as mixed chaparral shrublands. Sargent cypress occurs, but is sparse on serpentine soils. Some black oak and mixed conifers are on north-facing slopes at high elevations, and Jeffrey pine occurs on serpentine soils on San Benito Mountain. All but the larger streams are dry through most of the summer. Natural lakes are absent, but there are a few reservoirs in the area.

**6aa. Eastern Hills**

The **Eastern Hills** ecoregion includes the low, steep mountains and foothills on the eastern side of the Diablo Range, including the Panoche, Ciervo, and Kettleman Hills, and Avenal Ridge at the southern end. Elevations range from about 100 feet in the north to 2,000–3,000 feet on the highest hills. Ecoregion 6aa is drier, lower, and mostly grassland compared to Ecoregion 6z to the west. It is more hilly and lacks cropland compared to Ecoregions 7o and 7q to the east. The rocks are predominantly Cretaceous sandstone and shale, intensely folded and faulted. Eocene, Miocene, and Pliocene marine sediments, Plio-Pleistocene nonmarine sediments, and Quaternary alluvium also occur. The soils are well-drained; many are calcareous in their subsoils. Soil temperature regimes are thermic and soil moisture regimes are mostly xeric, with some aridic in the southeastern part of the region. The predominant vegetation is needlegrass and annual grasslands. There is some blue oak on north-facing slopes in wetter areas and some chamise on shallow soils. Valley oak occurs in valleys along the San Andreas Fault zone.

**6ab. Pleasant Valley/Kettleman Plain**

The **Pleasant Valley/Kettleman Plain** ecoregion contains disjunct small valleys and relatively flat plains of Quaternary alluvium that contrast with the steeper, adjacent hills of Ecoregions 6z and 6aa. Elevations in the southern areas are 600 to 1,000 feet. Ecoregion 6ab also includes the Panoche Valley in the north, with elevations mostly 1,000–1,800 feet. Some of the soils are similar to soils in the southern Central California Valley ecoregion (7), and cropland occurs here (typically dryland grain, such as barley and winter wheat). Other parts of the region are used as rangeland, especially following seasonal rains. Native grass and shrub communities have been replaced by cropland or species such as redstem filaree, soft chess, red brome, foxtail barley, and burclover. Soil temperature regimes are thermic and soil moisture regimes are xeric to aridic.

**6ac. Temblor Range/Elk Hills**

The **Temblor Range/Elk Hills** ecoregion contains steep mountains and moderately steep hills around the Temblor Range and the lower, gentler Elk Hills. Elevations range from 400 to greater than 4,300 feet. The soil temperature regime is thermic and soil moisture regimes are xeric and aridic. Soils generally are more saline than those in the Caliente Range ecoregion (6ao) farther west, and annual precipitation is only about 6–10 inches. Common vegetation series are purple needlegrass, annual grassland, blue oak, chamise, and California juniper.

**6ad. Grapevine Transition**

The **Grapevine Transition** ecoregion is an intermediate region between the Southern California Mountains (8) and Central California Valley (7). It consists of moderately steep to steep hills, dissected terraces, and some areas of sloping alluvial fans toward the valley, with elevations ranging from 600 to greater than 4,000 feet. The hills are mostly Miocene and Pliocene sandstone and conglomerate. Soil temperature regimes are thermic and soil moisture regimes are aridic and xeric. Vegetation includes allscale and needlegrass, with a few blue oaks or valley oaks.

**6ae. Tehachapi Foothills**

The **Tehachapi Foothills** ecoregion consists of moderately steep to steep mountains and hills on mostly granitic terrain. The ecoregion covers the lower slopes around the southern end of the Greenhorn Mountains and on the western sides of Breckenridge Mountain and the Tehachapi Mountains. As with Ecoregion 6c to the north, vegetation series include blue oak, needlegrass and annual grasslands, chamise, ceanothus, mixed oaks, and foothill pine, although this region tends to be more semi-arid than subhumid, and the mosaic of soil characteristics is different. The soil temperature regime is thermic and soil moisture regimes are xeric and aridic.

**6af. Salinas Valley**

The **Salinas Valley** ecoregion includes gently sloping alluvial plains, stream terraces, and nearly level floodplains of the Salinas Valley, inland from Salinas and Ecoregion 6w. Pleistocene, and some Plio-Pleistocene, nonmarine deposits and recent alluvium predominate. Soils are mostly well drained, with some poorly drained on floodplains. Soil temperature regimes are thermic and soil moisture regimes are xeric, with some aquic on floodplains. The climate in the lower, northwestern part has more coastal influence with cooler summer temperatures and milder winter temperatures compared to the greater climate extremes in the upper valley to the southeast. Valley oak and needlegrass grasslands occur, but cropland is the dominant land cover. Lettuce, broccoli, spinach, tomatoes, celery, peppers, flowers, and grapes are grown in the ecoregion.

**6ag. Northern Santa Lucia Range**

The **Northern Santa Lucia Range** ecoregion on the northern and coastal side of the Santa Lucia Range contains mountains with rounded ridges, steep sides, and narrow canyons. It has predominantly Mesozoic granitic and pre-Cretaceous metamorphic rocks, as well as Miocene marine sedimentary rocks. Soil temperature regimes are thermic and mesic at high elevations, and soil moisture regimes are xeric and ustic. Coast live oak occurs widely, especially on north-facing slopes, and California sagebrush-black sage is on south-facing slopes near the northwestern end of the Santa Lucia Range and inland. Canyon live oak is on steep canyon sideslopes, and chamise and live oak shrublands are on shallow soils inland and at higher elevations. There are less Douglas-fir, tanoak, and redwood compared to coastal Ecoregion 6ah.

**6ah. Santa Lucia Coastal Forest and Woodland**

The **Santa Lucia Coastal Forest and Woodland** ecoregion is a near-coastal zone that stretches from Carmel Bay in the north to near Salmon Creek in the south. It has more Douglas-fir, tanoak, redwoods, rain, and fog than the more interior parts of the Santa Lucia Range, and has a dense shrub understory. With steep relief (elevations range from sea level to about 4,000 feet), landslides are frequent, especially during heavy winter rains. Some of the high gradient streams support anadromous fish such as steelhead trout. Coastal tourism is economically important.

**6ai. Interior Santa Lucia Range**

The **Interior Santa Lucia Range** ecoregion is a steep, mountainous part of the Santa Lucia Range that is inland enough to diminish marine effects on climate compared to Ecoregions 6ag and 6aj to the west. It stretches southeast from near Greenfield in the Salinas Valley ecoregion (6af), to near the Sisquoc River, east of the Santa Maria Valley ecoregion (6aq). The geology is mostly Cretaceous sedimentary rocks and Miocene marine sediments. The Miocene-age Monterey Formation contains calcareous shales, sandstone, and mudstone. Vegetation is blue oak and coast live oak woodlands, chamise or mixed chaparral shrublands, and annual grasslands.

**6aj. Southern Santa Lucia Range**

The **Southern Santa Lucia Range** includes northwest-trending mountains and hills with rounded ridges, steep sides, and narrow canyons. Along the coast are narrow benches on marine terraces, and small areas of sand dunes. Mesozoic-age metamorphic rocks of the Franciscan Complex occur, with Miocene sandstone in the south. Elevations range from sea level to 3,408 feet on Pine Mountain. The soil temperature regime is thermic and soil moisture regime is xeric. Vegetation includes coast live oak woodlands, chaparral shrublands, and annual grasslands.

**6ak. Paso Robles Hills and Valleys**

The **Paso Robles Hills and Valleys** ecoregion is a dissected plain with low, rolling to moderately steep hills. It is lower, drier, and has less relief than the adjacent Ecoregions 6ai and 6al. The rolling hills are underlain by Plio-Pleistocene nonmarine sediments, with areas of Quaternary alluvium on the flatter plains. Some small areas of Miocene and Pliocene marine sediments occur. The soil temperature regime is thermic and soil moisture regime is xeric. Common vegetation includes blue oak savannas and annual grasslands. Some valley oak occurs on deep soils and a few small areas of chamise chaparral are found on shallow or dry soils. Ranching and livestock grazing is a dominant land use, with some pasture, hay, and cropland in the valleys. Grape vineyards have become more extensive in the ecoregion.

**6al. Salinas-Cholame Hills**

In contrast to the igneous and metamorphic rocks of the Gabilan Range ecoregion (6y) to the northwest, the **Salinas-Cholame Hills** ecoregion occurs on Pliocene and Miocene marine and nonmarine sediments, as well as Plio-Pleistocene unconsolidated sedimentary materials. These hills are less steep than Ecoregion 6y, the soils tend to be more calcareous, and there is more grassland and blue oak woodland and fewer coastal oaks. The soil temperature regime is thermic and soil moisture regime is xeric. Elevations range mostly from 600 to 2,600 feet.

**6am. Cuyama Valley**

Occupying an alluvial-filled synclinal basin, the **Cuyama Valley** ecoregion consists of alluvial fans, pediments, and terraces along the Cuyama River. The semi-arid climate has hot summers and cool winters, with only about 5 inches of annual precipitation. Land cover is mostly grassland, hay and pastureland, and some cropland. Some oil field activities occurred in the past. On the transitional slopes leading to Ecoregion 8, juniper, chaparral, and blue oak woodland occur. Elevations range from about 1,600 feet in the northwest to 3,400 feet on the southern boundary.

**6an. Carrizo Plain**

The **Carrizo Plain** ecoregion is a nearly level to very gently sloping alluvial plain with low hills on the margins. Although the ecoregion is in the Coastal Ranges, the climate is arid with long dry summers, similar to a desert basin. Average annual precipitation is only 7–9 inches per year. Runoff from the surrounding coastal mountains and hills flows in ephemeral drainage channels to Soda Lake, a terminal alkali lake. The inflow is lost to evaporation, leaving behind concentrated salts and minerals. The soil temperature regime is thermic and soil moisture regimes are aridic and xeric. Vegetation includes annual grassland, needlegrass, saltgrass, and emergent aquatics. Ecoregion 6an is one of the largest areas of native grassland remaining in the State. It is home to several endangered wildlife species, including the San Joaquin kit fox, San Joaquin antelope squirrel, and the blunt-nosed leopard lizard. Tule elk and pronghorn antelope have been reintroduced to the area. Some livestock grazing occurs, but remains a controversial issue.

**6ao. Caliente Range**

The **Caliente Range**, composed mostly of Miocene and Pliocene sandstone, siltstone, and conglomerate, is characterized by steep mountains with narrow canyons. It contrasts with the lower elevations and relief and the Quaternary alluvium of Ecoregion 6am to the south, and with the drier Carrizo Plain (6an) to the north. Soil temperatures are thermic and mesic and soil moisture regimes are xeric and aridic. Shrub and herbaceous cover dominates the ecoregion, with annual and perennial grasslands and forbs, mixed chaparral, blue oak woodland, and some coast live oak.

**6ap. Solomon-Purisima-Santa Ynez Hills**

The moderately steep to steep hills of the **Solomon-Purisima-Santa Ynez Hills** ecoregion have a mosaic of coastal sage scrub, chaparral, and oak woodland, interspersed with some grasslands used for cattle ranching. There are some transitional vegetation zones with a few species having either northern or southern range limits here. The hilly relief and marine sediments of Miocene and Pliocene sandstone and mudstone contrast with the flatter, more populated valleys of Quaternary alluvium in adjacent Ecoregion 6aq. Some oil and gas production occurs in the ecoregion, and wine grape production has expanded in the valleys and low hills.

**6aq. Santa Maria/Santa Ynez Valleys**

The **Santa Maria/Santa Ynez Valleys** ecoregion occurs on alluvial plains along the Santa Maria and Santa Ynez Rivers. With prevailing west-northwest winds, these east-west valleys have cool coastal temperatures and become progressively warmer inland. Coastal summer fogs occur. Soil temperature regimes are thermic, with some nearly mesic. Soil moisture regimes are mostly xeric. Runoff is slow across the alluvial plains. Natural vegetation historically was mostly valley oak, coast live oak, grasslands, and riparian willows and other shrubs. Some central maritime or sandhill chaparral occurs, with endemic plants such as sand mesa manzanita, Purisima manzanita, and coast ceanothus, although much of this habitat has been converted or fragmented. Some dunes and sand hills occur along the coast. Most of the valleys now are in agricultural, urban, residential, and military land uses. Wine grape production has expanded in many of these valleys and adjacent low hills. Flowers and vegetables are produced in the Lompoc area.

**6ar. Upper Sacramento River Alluvium**

The **Upper Sacramento River Alluvium** ecoregion includes the floodplains and terraces of the Sacramento River and lower Cottonwood Creek in the area between Redding and Red Bluff. It is flatter and has more cropland and irrigated hay and pastureland than the adjacent Tehama Terraces ecoregion (6e) that is mostly rolling and dissected woodlands and grasslands used for grazing. Although it has similarities to the northern parts of Ecoregions 7e and 7b in the Central California Valley, this narrow ecoregion is influenced by the surrounding oak woodlands. Natural vegetation consisted mostly of riparian woodlands of Fremont cottonwood, California sycamore, willow, box-elder, and valley oak, and at higher elevations, some blue oak woodland and savanna.

**7. Central California Valley**

**7a. Northern Terraces**

The **Northern Terraces** ecoregion occurs on gently sloping to sloping terraces and alluvial fans at the northern end and eastern side of the Sacramento Valley. It is mostly rolling grassland and has less agriculture than in the alluvium of adjacent Ecoregion 7b or in the floodplain soils of Ecoregion 7e. It also generally lacks the oaks that are upslope in Ecoregion 6. Soil temperature regimes are thermic and soil moisture regimes are xeric. Common soil series include Tuscan and Anita on the east and Corning, Redding, Hillgate, and Newville on the west. Although the terraces of the Tuscan Formation on the east have geological and soil differences from the Tehama Formation terraces on the west, the landforms, climate, vegetation, and land cover generally are similar. The vegetation of annual grasses and forbs is used mostly for dryland range and pasture. A few areas of blue oak woodlands occur, primarily at high elevations near the boundary with Ecoregion 6. Vernal pools are in some areas. Streams drain mostly to the Sacramento River, with a few in the south draining to the lower San Joaquin River.

**7b. North Valley Alluvium**

The **North Valley Alluvium** ecoregion covers the recent alluvial plain, very gently sloping recent alluvial fans, and some minor floodplains in the northern part of the Sacramento Valley. Elevations range from 100 to 300 feet. The soil temperature regime is thermic and soil moisture regime is xeric, with Tehama, Hillgate, and Arbuckle as common soil series. A mix of cropland, orchards, and pasture occurs here. Typical vegetation is annual grasslands, scattered blue oaks, and valley oaks on stream terraces and alluvial plains. Vernal pools are common.

**7c. Butte Sink/Sutter and Colusa Basins**

The **Butte Sink/Sutter and Colusa Basins** ecoregion occurs on nearly level to very gently sloping alluvial fans, floodplains, and basin floors that are split by the alluvium of the Sacramento River (Ecoregion 7e). Elevations range from about 20 to 150 feet. The Holocene basin deposits of silt and clay are covered by mostly fine-textured soils of low permeability, such as Vertisols. Winter and spring rains historically flooded wide areas, but these areas now are confined by artificial levees. There are no lakes in the ecoregion, but winter ponding occurs. Historical flood regimes likely contributed to seasonal wetlands and flat marshes. There is extensive agriculture of rice, and some orchards and pasture; however, the region also offers wildlife habitat for waterfowl and pheasant, and drainage canals support a warm-water fishery. Many of the rice fields are flooded and leased as private waterfowl hunting clubs in winter. In the western part of Ecoregion 7c, the Colusa Basin Drain is the single largest source of agricultural return flows to the Sacramento River. The natural vegetation historically consisted of perennial grasslands, but now is mostly annual grasslands, with some willows and cottonwoods along streams.

**7d. Southern Hardpan Terraces**

The **Southern Hardpan Terraces** ecoregion is on very gently sloping terraces, floodplains, and alluvial fans along the eastern edge of the San Joaquin Valley. Elevations range from 150 to 500 feet. Ecoregion 7d is warmer and drier than the Northern Terraces ecoregion (7a) to the north. Soil temperature regimes are thermic and soil moisture regimes are xeric, nearing aridic in the south. Common vegetation includes annual grasslands, ceanothus brushlands, blue oak savannas, and scattered foothill pines in the draws and protected slopes. Vernal pools are common. Streams drain to the San Joaquin River or the San Joaquin Valley closed basins.

**7e. Sacramento/Feather Riverine Alluvium**

The **Sacramento/Feather Riverine Alluvium** ecoregion consists of nearly level floodplains and levees associated with the Sacramento, Feather, and lower Yuba and Bear Rivers. Much of the unweathered gravel, sand, and silt deposits are in contact with present-day river systems and have constantly changing morphology. Flows of the major rivers are artificially controlled, and confined by built levees. Entisols, Mollisols, and Alfisols are more common compared to the Vertisols typical of the adjacent basins of Ecoregion 7c. Vina, Columbia, Riverwash, Sycamore, Shanghai, Gianella, and Parrott are representative soil series. The xeric soils are moderately well to somewhat poorly drained and support pasture, wheat, fruit and nut orchards, and woody wetlands. Cottonwoods and mixed willows are present, along with some grasslands. Affected in places by historical mining practices in the Sierra Nevada, the riverine region includes areas of gold field tailings on the Yuba and Feather Rivers.

**7f. Sutter Buttes**

The **Sutter Buttes** ecoregion is a small but distinctive circular area of volcanic hills that rise above the surrounding Sacramento Valley to an elevation of 2,117 feet. The region is only about 10 miles across, and the cluster of peaks, locally, is called "the world's smallest mountain range." In contrast to the surrounding regions that are mostly flat with cropland and orchards, this area is hilly grassland, with some areas of scattered blue oak woodland, similar to some foothill areas of Ecoregion 6. The Sutter Buttes are the remains of an extinct volcano that erupted between 1.6 and 1.3 million years ago. Rhyolite and andesite are the most common bedrock types. Soil temperatures are thermic and the soil moisture regime is xeric.

**7g. Yolo Alluvial Fans**

The **Yolo Alluvial Fans** ecoregion contains Pleistocene and recent alluvial fan material from the Coast Ranges and from hills on the lower western side of the Sacramento Valley. The soil temperature regime is thermic and soil moisture regime is xeric. Common vegetation includes grasslands and valley oak, with cottonwoods and willows along streams. Most of the region is in cropland, with some areas of pastureland. Alfalfa, winter wheat, sunflowers, corn, tomatoes, strawberries, and stonefruit, walnut, and almond orchards are typical crops.

**7h. Yolo/American Basin**

The **Yolo/American Basin** ecoregion includes nearly level to very gently sloping stream channels, levees, overflow basins, and alluvial fans of the main alluvial plain adjacent to the lower Sacramento River. The American Basin, just east of the river, is the northern unit, and the Yolo Basin, just west of the river, is the southern unit. Elevations range from about 10 to 40 feet. Some flooding and high water tables occur during wet winters, although much of the region is protected by artificial levees, dams, and diversions. The Yolo Bypass goes through the region, carrying Sacramento River water at overflow toward the Delta ecoregion (7j). Cropland, hay and pasture land, and herbaceous wetlands cover most of the region, with rice being the most extensive crop. The soil temperature regime is thermic and soil moisture regimes are aquic and xeric. Common vegetation includes annual grasslands and in riparian areas some cottonwood, willow, and sycamore. Emergent vegetation in the permanent wetlands includes cattails, tules, and sedges. The seasonal and permanent wetlands provide resting and feeding habitat for ducks, geese, rails, and songbirds; and foraging habitat for wading birds such as herons, egrets, pelicans and ibis.

**7j. Delta**

The **Delta** ecoregion is a low elevation area, near sea level, at the confluence of major rivers. It is characterized by numerous sloughs and channels formed where the Sacramento, San Joaquin, Cosumnes, Mokelumne, and Calaveras Rivers enter the ecoregion. Water from these rivers commingles in the Delta and is influenced by tidal action, streamflow, and water diversion as it flows toward San Francisco Bay. Brackish tidal water enters the area when river flow is low during the summer and autumn. In the main part of the region, former wetland islands have been reclaimed for intensive agriculture with a network of levees. Corn, alfalfa, hay, and wheat are the most extensive crops on these organic soils, although various crops were grown historically. Soil temperature regimes are thermic and soil moisture regimes are mostly aquic, with some xeric on levees. Land subsidence and salinity intrusion are two of many important resource issues here. The western part of the ecoregion includes large areas of brackish and seasonally freshwater marshes and wetlands that surround Grizzly Bay and Suisun Bay. The native vegetation historically consisted of aquatic plants such as tules, cattails, and rushes. Saltgrass was dominant in many areas. Many of the diked wetlands are managed for waterfowl hunting. The Delta plays a central role in the distribution of water from the State's wetter northern regions to its southern, arid, and populous cities and agricultural areas. These water diversions can have adverse effects on species such as delta smelt, Chinook salmon, Central Valley steelhead, and green sturgeon.

**7k. Lodi Alluvium**

The small **Lodi Alluvium** ecoregion is on nearly level to very gently sloping floodplains and alluvial fans of the Mokelumne and Calaveras Rivers and smaller streams between the Delta (7j) and the Northern Terraces (7a) along the eastern edge of the Central California Valley. Elevations range from about 20 to 100 feet. Nearly the entire ecoregion is in cropland, with some urban land around Lodi. Grapes are dominant in the northern part, whereas walnuts are typical in the south. The soil temperature regime is thermic and soil moisture regimes are xeric and aquic. The natural vegetation historically included perennial and annual grasslands, valley oak savannas, cottonwoods, and willows. Streams drain to the west to the Delta area or to the Stockton Basin (7l).

**7l. Stockton Basin**

The **Stockton Basin** ecoregion is a nearly level basin floor on the eastern edge of the Delta (7j). Nearly one-half of the ecoregion is urban and residential land of Stockton that covers most of the western part. To the east is cropland of corn, wheat, alfalfa, grapes, and walnuts. The soil temperature regime is thermic and soil moisture regimes are aquic and xeric. Vertisols are more common than in adjacent Ecoregion 7k. Winter ponding occurs. Natural vegetation historically included perennial and annual grasslands, valley oak savannas, cottonwoods, and willows.

**7m.** **San Joaquin Basin**

The **San Joaquin Basin** ecoregion, including the downstream Caswell Basin, is on nearly level floodplains and basin floors in the middle of the San Joaquin Valley. It is upstream of the Delta ecoregion (7j) and between alluvial fans from the Coast Ranges on the west and alluvial fans from the Sierra Nevada on the east. Elevations range from near sea level in the north to 130 feet in the south. The predominant soils are poorly drained, and much of the region is flooded periodically. The soil temperature regime is thermic and soil moisture regimes are aquic and xeric. Although cropland and hay/pasture land cover most of the region, large areas, particularly in the central part, are herbaceous wetlands. Alfalfa and corn are typical crops in the north, whereas cotton, alfalfa, corn, and tomatoes are grown in the south. Common vegetation includes emergent aquatics, cottonwood, willow, valley oak, saltgrass, alkali sacaton, creeping wildrye, and allscale.

**7n.** **Manteca/Merced Alluvium**

The **Manteca/Merced Alluvium** ecoregion is on very gently to gently sloping floodplains and alluvial fans that slope from the higher terraces and foothills in regions to the east toward the San Joaquin River to the west. The soil temperature regime is thermic and soil moisture regimes are xeric and aquic. Natural vegetation historically included perennial and annual grasslands, valley oak savannas, cottonwoods, and willow. Cropland, pasture, and urban uses now dominate.

**7o.** **Westside Alluvial Fans and Terraces**

The **Westside Alluvial Fans and Terraces** ecoregion is on very gently to gently sloping terraces and alluvial fans along the western edge of the San Joaquin Valley, adjacent to the Coast Ranges. Elevations range mostly from 5 to 300 feet, reaching 900 feet in the west. The soil temperature regime is thermic; soil moisture regimes are xeric, but aridic in the south. Vegetation includes needlegrass and annual grasslands and bladderpod and ephedra shrublands. Vernal pools and winter ponding occur. Agricultural land use is dominant, with grassland at the western margin.

**7p. Granitic Alluvial Fans and Terraces**

The **Granitic Alluvial Fans and Terraces** ecoregion is on nearly level to very gently sloping alluvial fans and basins that are below older fans or terraces on the eastern side of the San Joaquin Valley. Elevations range from 100 to 500 feet. The soil temperature regime is thermic and soil moisture regimes are xeric and aquic. Natural vegetation included grasslands and valley oak on the fans, cottonwood and willow along streams, and emergent wetland species in basins. Almost the entire region now is in cropland, hay and pastureland, and some urban and suburban uses.

**7q.** **Panoche and Cantua Fans and Basins**

The **Panoche and Cantua Fans and Basins** ecoregion is on nearly level to gently sloping alluvial fans of streams that drain from the Coast Ranges toward the San Joaquin Valley and partly on basin floors in the west-central part of the valley. Elevations range from 140 to 800 feet. The soil temperature regime is thermic and soil moisture regime is aridic. Annual precipitation is only 6–8 inches and streams often are dry. The grassland and shrubland vegetation has been replaced by cropland and orchards. Soil salinity is a concern in several areas.

**7r.** **Tulare Basin/Fresno Slough**

The **Tulare Basin/Fresno Slough** ecoregion contained historical Tulare Lake, which was once the largest freshwater lake west of the Mississippi River. The Tulare Basin was formed by the merging of alluvial fans from the Kings River to the east and Los Gatos Creek from the Coast Ranges to the west, generally blocking the basin’s outlet. When the seasonal lakes (Tulare, Buena Vista, Kern, and Goose Lakes) filled beyond capacity from winter and spring runoff, the overflow was sent down the Fresno Slough. In the dry season, subsurface flow from the Tulare Basin still helped to sustain flows in the San Joaquin River. Both areas once supported extensive freshwater marshes and interconnecting natural sloughs. Although the hydrology now is greatly modified by drainage canals, dams, and agricultural land uses, during major flood events, some water still collects in the lake basins and sloughs. Soils are mostly fine-textured and poorly drained. Their temperature regime is thermic and soil moisture regime is aquic. Ponding occurs.

**7s. Kern Terraces**

The **Kern Terraces** ecoregion consists of gently sloping terraces, dissected alluvial fans, and mostly small floodplains at the southeastern edge of the San Joaquin Valley. Elevations range from a low of 400 feet in the west to 2,100 feet near the eastern margin. Ecoregion 7s is warmer and more arid than the terraces of Ecoregion 7d to the north, with slightly more relief, and fewer hardpan soils or vernal pools. The soil temperature regime is thermic and soil moisture regime is aridic. Common vegetation includes needlegrass and annual grasslands, allscale scrub, and a few small areas of blue oak, especially near the transition to the Tehachapi Foothills ecoregion (6ae). Beavertail cactus is one indicator of the desert influence here. Streams drain westward to the canals and closed basins of the southern San Joaquin Valley. Streams are low gradient and intermittent, although the dam-controlled Kern River also cuts across the region. Some cropland occurs on the western margins, which are flatter and lower in elevation. Oil production occurs, especially near Bakersfield.

**7t.** **South Valley Alluvium**

The **South Valley Alluvium** ecoregion occurs on a level basin and on nearly level to gently sloping alluvial fans in the southern San Joaquin Valley. The soil temperature regime is thermic and soil moisture is aridic. Common vegetation includes needlegrass and annual grasslands, allscale, mesquite, and iodinebush. Basin ponding occurs. Cropland, pasture and grassland, and urban are dominant land uses. Numerous oil fields occur.

**7u. Antelope Plain**

The dry, hot **Antelope Plain** ecoregion occurs on nearly level to gently sloping alluvial fans along the southwestern edge of the San Joaquin Valley. Elevations range from 250 to 1,200 feet. Relief is slightly greater than in the flat Ecoregion 7v to the east. The soil temperature regime is thermic and soil moisture regime is aridic. Precipitation averages 6 inches annually. Allscale scrub, bush seepweed scrub, and annual and alkali sacaton grasslands are typical cover. About one-half of the ecoregion now is in cropland, and the western margin is mostly grazed. Some oil fields occur.

**7v Southern Clayey Basins**

The **Southern Clayey Basins** ecoregion consists of the low basin areas around the Buena Vista, Kern, and Goose Lake beds, and the area of fine-textured soils that extends into the Tulare Basin ecoregion (7r) to the north. The flat basins have elevations of about 200–300 feet. Cropland is the dominant land use, with some grassland and herbaceous wetlands in the north around the Kern National Wildlife Refuge and numerous private wetlands operated as hunting clubs. This area provides wintering habitat for migrating birds, shorebirds, and waterfowl in the southern San Joaquin Valley. The endangered Buena Vista Lake shrew, San Joaquin kit fox, and blunt-nosed leopard lizard also find remnant habitat here. Wetlands are maintained by a complex of canals, pipelines, deep wells, pump stations, and water control structures.

**8. Southern California Mountains**

**8a. Western Transverse Range Lower Montane Shrub and Woodland**

The **Western Transverse Range Lower Montane Shrub and Woodland** ecoregion provides a transition from the Coast Ranges to the west to the rest of the Transverse Range. The ecoregion has similarities to Ecoregion 8e, although the geology here primarily is Tertiary and Cretaceous marine sedimentary rock. The climate has somewhat more marine influence than Southern California Mountain regions farther inland. Elevations range from about 1,000 to more than 6,000 feet. Some coastal sage scrub occurs at low elevations. Scattered patches of coast live oak, canyon oak, Coulter pine, California bay, or bigcone Douglas-fir occur in a mostly chaparral-dominated landscape of chamise, ceanothus, manzanita, and scrub oaks, with smaller populations of other species such as cherry and birchleaf mountain-mahogany. The region provides habitat to the California condor and many other rare or endangered plant and animal species.

**8b. Western Transverse Range Montane Forest**

The **Western Transverse Range Montane Forest** ecoregion has two separate areas of high-elevation montane forest, with elevations ranging from 5,000 to more than 7,500 feet. The steep slopes are underlain mostly by Eocene and Cretaceous-age sandstone. Soil temperature regimes are mesic and soil moisture regimes are xeric. Annual precipitation is about 24–28 inches, with less snow in the winter than in Ecoregion 8f to the east. Along with some of the conifers at lower elevations, this high-elevation ecoregion contains a more continuous mixed coniferous forest with Jeffrey pine, sugar pine, white fir, incense cedar, hardwoods such as canyon live oak, and areas of montane chaparral. There is less ponderosa pine in this ecoregion than Ecoregion 8f to the east. In addition to the California condor, the ecoregion supports bird species such as the mountain chickadee, white-headed woodpecker, Cooper’s hawk, and golden eagle.

**8c. Arid Montane Slopes**

The **Arid Montane Slopes** ecoregion is diverse, has Mojave Desert influences, and has vegetation communities ranging from desert scrub to semi-desert montane chaparral to singleleaf pinyon-California juniper woodlands. It stretches along the northern side of the San Gabriel and San Bernardino Mountains, with elevations about 3,000 to 7,000 feet. The geology is mostly granitic and gneissic rocks. There also are areas of carbonate geology (limestone and dolomite) in the San Bernardino Mountains that provide unique habitat for several endangered endemic plants.

**8d.** **Southern California Subalpine/Alpine**

The **Southern California Subalpine/Alpine** ecoregion includes the highest elevation areas, generally 8,500 to greater than 11,000 feet, including peaks such as Mounts San Antonio (Baldy), San Gorgonio, and San Jacinto. Mount San Gorgonio in the San Bernardino Mountains at 11,502 feet is the southernmost point in California with evidence of glaciation. The large distances between these “islands” of high elevation habitat contribute to distinctive floras on each major peak. A few endemic alpine plant species occur. Scattered krummholz trees grow in some areas. The subalpine areas contain lodgepole pine, limber pine, and white fir. Some Sierra juniper occurs along with montane chaparral scrub. Gneiss, schist, and granitic rocks are dominant. Annual precipitation ranges from about 36 to 44 inches, and winter snowfall is typical.

**8e. Southern California Lower Montane Shrub and Woodland**

The **Southern California Lower Montane Shrub and Woodland** ecoregion occurs on the igneous-dominated mountains of the eastern Transverse Range and the Peninsular Ranges at elevations ranging from about 3,000 to 5,000 feet. The chaparral-dominated landscape also contains patches of mixed evergreen woodland consisting mostly of bigcone Douglas-fir and canyon live oak. These fragmented, compact groves typically occur in deep canyons and on steep north-facing slopes. Some minor areas of coastal sage scrub occur near the lower margins, although most of that scrub occurs at lower elevations in Ecoregions 85c and 85f. The mosaic of land cover and vegetation communities is complex in the Peninsular Ranges. Certain chaparral shrubs in the Peninsular Ranges, such as mission manzanita and red shank, have limited ranges in southern California and Baja California. Other shrubs, such as California buckwheat, are ubiquitous.

**8f. Southern California Montane Conifer Forest**

The **Southern California Montane Conifer Forest** ecoregion occurs on the igneous-dominated mountains of the eastern Transverse Range and the Peninsular Ranges, at elevations generally ranging from 5,000 to 8,500 feet. These high elevations contain a mixed coniferous forest with ponderosa pine, Jeffrey pine, sugar pine, white fir, incense cedar, hardwoods such as canyon live oak and black oak, and areas of montane chaparral. Ponderosa pine tends to be limited to moist areas with deeper soils, with extensive stands occurring in the western San Bernardino Mountains and on the western slope of San Jacinto Mountain. Fires are common in these forests, and in San Diego County in 2003, nearly all conifers in the Cuyamaca area were burned. Recovery of conifers in these southern areas remains uncertain.

**8g. Northern Transverse Range**

The **Northern Transverse Range** is a dry, montane ecoregion on the northern side of the Transverse Range with elevations ranging from about 3,000 to nearly 7,000 feet. It has some similarities to Ecoregion 8c to the east, although here there is more Mediterranean rather than Mojavean influence. Transitional areas are influenced more by Ecoregions 6 and 7 to the west and north, or by the Tehachapi Mountains ecoregion (5o) to the northeast. Diverse vegetation communities occur, including desert scrub, annual grasslands, semi-desert montane chaparral, Tucker oak shrubland, blue oak woodlands, and pinyon-juniper woodlands. The geology includes areas of sandstone and conglomerate, with some granitic and gneissic rocks to the east.

**9. Eastern Cascades Slopes and Foothills**

**9g. Klamath/Goose Lake Basins**

The **Klamath/Goose Lake Basins** ecoregion covers river floodplains, terraces, and lake basins. Various wildrye, bluegrass, hairgrass, sedge, and rush species once covered the basins, but most of the wet meadows and wetlands have been drained for agriculture. Sagebrush and bunchgrass occur on most of the upland areas. Several marshland wildlife refuges here are critical to preserving the regional biodiversity, particularly at-risk bird and fish species. In California, Butte Valley also is included in the ecoregion. Although the Butte Valley area differs somewhat from the Lower Klamath and Tule Lake Basins, it also has pasture and cropland.

**9h. Fremont Pine/Fir Forest**

The **Fremont Pine/Fir Forest** ecoregion occurs mostly in Oregon, with a small area west of Goose Lake in California. It contains mid-elevation mountains and high plateaus that rarely exceed timberline. Closed-canopy forests contrast with the savanna of the Klamath Juniper Woodland/Devils Garden ecoregion (9j). Ponderosa pine is widespread, but white fir, sugar pine, lodgepole pine, and incense cedar also grow at elevations greater than 6,500 feet and on northern slopes. Residual soils are common in contrast to ecoregions farther north in Oregon where residual soils have been buried by pumice and ash. Ecoregion 9h has a high density of lakes and reservoirs.

**9i. Southern Cascades Slope**

Only a small arm of the **Southern Cascades Slope** ecoregion occurs in California, with most of it extending to the Upper Klamath Lake in Oregon. It is a transitional zone between the Cascades (4) and the drier Eastern Cascade Slopes and Foothills (9). Ecoregion 9i is lower in elevation and moister than Ecoregion 9h, and it has a greater mix of forest types. Ponderosa pine woodland becomes mixed with white fir, incense cedar, Shasta red fir, and Douglas-fir at high elevations.

**9j. Klamath Juniper Woodland/Devils Garden**

The **Klamath Juniper Woodland/Devils Garden** ecoregion is composed of undulating hills, benches, and escarpments covered with a mosaic of rangeland and woodland. Western juniper grows on shallow, rocky soils with an understory of low sagebrush, big sagebrush, bitterbrush, and bunchgrasses. Other shrubland/grasslands include shrub species uncommon in eastern Oregon, such as woolly mule-ears, Klamath plum, and birchleaf mountain-mahogany. The diverse shrublands provide important wildlife habitat.Reservoirs dot the landscape and are important to lowland irrigation. Soil temperature regimes in the California part of Ecoregion 9j are mesic, whereas soil temperatures in the Oregon part are mesic and frigid. The Devils Garden place name appears on topographic maps in both States, 60 miles apart.

**9k. Shasta Valley**

The semi-arid **Shasta Valley** ecoregion is located in the rain shadow of the Klamath Mountains (78) to the west and the Cascades (4) to the east. Quaternary alluvium occurs along with small hills of Tertiary volcanic rocks protruding through the alluvium. Quaternary debris avalanche flow deposits and Quaternary basalt flows also occur. Nearly level to moderately sloping floodplains, terraces, and alluvial fans are found here along with undulating lava flows and many small, moderately sloping to moderately steep hills on the alluvial plain. Elevations range from about 2,500 to 3,700 feet on the highest hill. Soil temperature regimes are mesic and soil moisture regimes are aridic, xeric, and aquic. Big sagebrush, western juniper, annual grasslands, and sedge meadow communities are the main vegetation types. Most streams and rivers originate in adjacent mountain ecoregions. Lake Shastina is a large reservoir, and other small ponds occur in the region. Agriculture is affected by local springtime flooding and a short growing season, restricting crops to pasture, alfalfa, small grains, and some limited field crops. Cattle production is a prominent land use of the region.

**9l. Pit River Valleys**

The **Pit River Valleys** ecoregion consists of low areas along the Pit River with large areas of Quaternary alluvium. It includes Big, Round, and Fall River Valleys, and the smaller Ash Valley. Land cover is mostly pasture, hay, and cropland. Soil temperature regimes are mesic and soil moisture regimes are aridic, xeric, and aquic. Typical vegetation includes big sagebrush and sedge meadow communities. The Pit River is a tributary of the Sacramento River.

**9m.****Warner Mountains**

The **Warner Mountains** ecoregion comprises the low to mid-elevations of the Warner Mountains. In contrast to the mesic soils of the surrounding lower ecoregions, soil temperature regimes here are frigid. Soil moisture regimes are xeric. Vegetation includes big sagebrush, low sagebrush, perennial bunchgrasses, and western juniper at low elevations. At higher elevations, ponderosa pine, Jeffrey pine, Washoe pine, aspen, and white fir are common. Streams on the western side of this fault-block mountain drain to Goose Lake or the Pit River, and streams on the eastern side, which are much shorter, drain to Surprise Valley in Ecoregion 80*.*

**9n. High Elevation Warner Mountains**

The **High Elevation Warner Mountains** ecoregion is a subalpine/alpine area that ranges in elevation from about 7,800 to 9,892 feet at Eagle Peak. This high-elevation zone contains aspen and lodgepole pine, with whitebark pine as the primary subalpine and timberline tree above about 8,500 feet. Drought-tolerant alpine cushion plants also occur. Soil temperature regimes are cryic. Annual precipitation is about 28–32 inches with deep winter snow.

**9o. Likely Tableland**

The small **Likely Tableland** ecoregion is a gently sloping footslope west of the Warner Mountains (9m). Relief is only about 100–300 feet. Elevations range from 4,500 to 5,500 feet. The sagebrush and grassland of Ecoregion 9o contrast with the adjacent higher relief hills and mountains of Ecoregion 9p that have abundant pinyon-juniper woodland and some pine. Annual precipitation is only 12–15 inches. The Quaternary andesite and basalt are younger than the Tertiary volcanics of Ecoregion 9p. Some perennial streams cross the region from the Warner Mountains to the Pit River. Soil temperature regimes are mesic and moisture regimes are aridic and xeric.

**9p. Modoc/Lassen Juniper-Shrub Hills and Mountains**

The **Modoc/Lassen Juniper-Shrub Hills and Mountains** ecoregion is a faulted and eroded volcanic plateau with many volcanic hills and mountains. Soil temperature regimes are mesic and frigid. Soil moisture regimes are mostly xeric and aridic. Vegetation is mainly western juniper, big sagebrush, and perennial bunchgrasses. On the higher-elevation mountains, however, some small areas of Jeffrey pine, ponderosa pine, and white fir occur. There are few streams and most of those are dry during summer. Streams that flow from the ecoregion drain to either the Pit River, the Madeline Plains, or in the south, to the Honey Lake Valley.

**9q. Adin/Horsehead Mountains Forest and Woodland**

The **Adin/Horsehead Mountains Forest and Woodland** ecoregion consists of mountains to the north, east, and south of Big Valley. Elevations range from about 5,000 to 7,036 feet. Ecoregion 9q has more pine and mixed conifer forest than the drier Ecoregion 9p to the east or the adjacent lower Ecoregion 9r. Soil temperature regimes are frigid and mesic and soil moisture regimes are mostly xeric. Vegetation is a mix of Jeffrey pine, ponderosa pine, and some white fir, and at low elevations, western juniper, big sagebrush, birchleaf mountain-mahogany, and other deciduous shrubs. There are a few streams and springs, but almost no lakes.

**9r. Adin/Dixie Low Hills**

The **Adin/Dixie Low Hills** ecoregion consists of hills and lava plateaus to the west of Ecoregion 9q that are lower in elevation (4,000–6,000 feet) with less relief. The vegetation is mostly sagebrush and scattered juniper, and generally lacks the pine of the nearby mountain ecoregions (9q, 4g). Soil temperature regimes are mesic and soil moisture regimes are xeric. Some streams cross the ecoregion to the Pit River, and several small shallow reservoirs occur here. Ranching and livestock grazing are predominant land uses.

**9s. Modoc Lava Flows and Buttes**

The **Modoc Lava Flows and Buttes** ecoregion is a volcanic plateau surrounding the Medicine Lake Highlands that occur in the Cascades ecoregion (4). It is lower and drier than those highlands, with more juniper and pine. Soil temperature regimes are mesic and soil moisture regimes are aridic and xeric. Vegetation includes western juniper, big sagebrush, and native perennial grassland. Water drains down through joints in the basalt rock to the groundwater reservoir, limiting overland flow of water and development of stream channels on the volcanic plateau.

**9t. Old Cascades**

The **Old Cascades** ecoregion is composed of foothills and low mountains of middle Tertiary volcanic rocks north of Mount Shasta and extending up the Klamath River in Oregon. Soil temperature regimes are mesic and soil moisture regimes are xeric. Big sagebrush and other shrublands are widespread, with some Oregon white oak north of the Klamath River and on north-facing slopes. Some ponderosa pine and mixed conifers occur on north-facing slopes at high elevations. Wedgeleaf ceanothus and native grassland communities are common on south-facing slopes at low elevations. Water drains to the Klamath River.

**13. Central Basin and Range**

**13h. Lahontan and Tonapah Playas**

The nearly level and often barren **Lahontan and Tonopah Playas** ecoregion contains mud flats, alkali flats, and intermittent saline lakes, such as the Black Rock Desert, Carson Sink, and Sarcobatus Flat in Nevada, and the Honey Lake Basin in California. Marshes, remnant lakes, and playas are all that remain of Pleistocene Lake Lahontan, which was once the size of Lake Erie. Playas occur at the lowest elevations in the Lahontan Basin and are the terminus or “sink” of rivers flowing east from the Sierra Nevada. They fill with seasonal runoff from surrounding mountain ranges during winter, providing habitat for migratory birds. Black greasewood or four-winged saltbush grows around the perimeter in the transition to the salt shrub community, often stabilizing areas of low sand dunes. Ecoregion 13h has very limited grazing potential. Windblown salt dust from exposed playas may affect upland soils and vegetation. The Lahontan and Tonopah Playas are important as wildlife habitat and for some recreational and military uses.

**13u. Tonopah Basin**

The **Tonopah Basin** ecoregion lies in the transition between the Great Basin and the more southerly Mojave Desert. The Tonopah Basin shows varying degrees of Great Basin and Mojave Desert characteristics. The western side of the Tonopah Basin is a continuation of the Lahontan Basin, whereas the lower and hotter Pahranagat Valley on the eastern side is more like the Mojave Desert. Similar to basins farther north, shadscale and associated arid land shrubs cover broad rolling valleys, hills, and alluvial fans. However, unlike the Lahontan Salt Shrub Basin (13j) and Upper Lahontan Basin (13z) ecoregions, the shrubs often co-dominate in highly diverse mosaics. The shrub understory includes warm season grasses, such as Indian rice grass and galleta grass. Valleys with perennial water contain endemic fish species, including the Railroad Valley tui chub, Pahranagut roundtail chub, Railroad Valley springfish, and White River springfish.

**13v. Tonopah Sagebrush Foothills**

The **Tonopah Sagebrush Foothills** ecoregion includes the low mountains and hills rising from the floor of the flatter Tonopah Basin ecoregion (13u). The substrate is rocky and lacks the fine sediments found at lower elevations in Ecoregion 13u. Great Basin species are common in this ecoregion as they are farther north in the Lahontan Sagebrush Slopes ecoregion (13k). However, because Ecoregion 13v is in the rain shadow of the Sierra Nevada and is adjacent to the Mojave Desert, it is more arid than Ecoregion 13k. As a result, black sagebrush is more prevalent in the shrub overstory of Ecoregion 13v, and the more mesic understory species that are farther north and east are largely absent. Mojave Desert species, such as blackbrush, Joshua tree, and cholla cactus, become more common in the east and south, where summer moisture is more prevalent. Streams are ephemeral and flow during and immediately after storms. Storm events can be of sufficient magnitude to move large quantities of sediment in streambeds. Because of the droughty conditions, Ecoregion 13v has a low carrying capacity for cattle.

**13x. Sierra Nevada-Influenced Ranges**

The **Sierra Nevada-Influenced Ranges** ecoregion includes the wooded Great Basin mountains that have climatic and biotic affinities to the Sierra Nevada. Ecoregion 13x receives greater precipitation than the mountain ranges of Central Nevada; however, precipitation amounts vary from range to range in relation to the local strength of the Sierra Nevada rain shadow. Because of minimal summer rainfall, Ecoregion 13x contains pinyon–juniper woodland, but lacks oak and ceanothus species. The White, Sweetwater, Pine Nut, Wassuk, and Virginia Ranges of Nevada support varying amounts of Sierra Nevada flora, including small stands of ponderosa, lodgepole, Jeffrey, and western white pine. Scattered ephemeral pools perched over areas of flat, impermeable volcanic bedrock, similar to those in the High Lava Plains ecoregion (80g), support unique assemblages of flora and fauna. High ranges near the Sierra Nevada are more likely to have perennial streams. Bighorn sheep, deer, and black bear inhabit these mountains.

**13y. Sierra Nevada-Influenced High Elevation Mountains**

The **Sierra Nevada-Influenced High Elevation Mountains** occupy the elevational zone above the woodland-covered Sierra Nevada-Influenced Ranges (13x), and are affected in varying degrees by Sierra Nevada climate. Elevations range from 9,000 to greater than 14,000 feet. White Mountain Peak at 14,252 feet is the third highest peak in California. Ecoregion 13y is covered by shrubs (for example, mountain big sagebrush, low sagebrush, and mountain-mahogany), small aspen groves (on moist sites), scattered stands of high elevation conifers, and Sierra Nevada subalpine and alpine forbs. The alpine flora of the White Mountains shares more than 70 percent of its species with the Sierra Nevada. In the White Mountains, the bristlecone pines prefer the northern slopes and often are associated with the white, rocky soil derived from dolomite. In these nutrient-poor soils, few other plants grow, and the white rock color tends to reflect sunlight, possibly making a cooler and moister soil than on the areas of granite or quartzite. At high elevations, reproduction of limber pine is greater than bristlecone pine. Moisture amounts captured by the highest ranges in Ecoregion 13y result in substantial perennial streamflow in some areas.

**13aa. Sierra Nevada-Influenced Semiarid Hills and Basins**

The **Sierra Nevada-Influenced Semiarid Hills and Basins** ecoregion includes the basins and lower mountain slopes immediately east of the Sierra Nevada that are affected by its climate or that have its characteristic granitic substrate. Ecoregion 13aa differs from the Lahontan Sagebrush Slopes ecoregion (13k) to the east in Nevada in that plants with slightly higher moisture requirements, such as antelope bitterbrush and desert peach, may be associated with the semiarid shrub community, especially near the Sierra Nevada front. Three large river systems, the Truckee, Carson, and Walker Rivers, flow eastward through this region from the Sierra Nevada, providing water for agriculture and urban development. Their floodplains support some of the best remaining riparian cottonwood forest in Nevada, which has been degraded in many areas by grazing, agriculture, and invasive weeds. The Truckee and Walker Rivers and their tributaries also provide habitat for the threatened Lahontan cutthroat trout. In California, the Susan River flows through Ecoregion 13aa to Honey Lake, and to the south, the upper Owens River flows to Lake Crowley.

**13ab. Sierra Valley**

An intermontane valley with elevations ranging from 4,800 to 5,200 feet, the **Sierra Valley** ecoregion is surrounded by mountains with elevations mostly 6,000 to 8,000 feet. The valley is a down-faulted basin, and formerly was a Pleistocene lakebed. It now is filled with sediment up to 2,000 feet thick. The valley also has some thermal activity, such as Marble Hot Springs located in the western part. Annual precipitation averages 14–20 inches, falling mostly as snow. Soil temperatures are mesic with xeric, aquic, and aridic soil moisture regimes. The valley floor has a grassland and sagebrush ecosystem and contains extensive freshwater marshes filled with [cattails](http://en.wikipedia.org/wiki/Cattails), [bulrushes](http://en.wikipedia.org/wiki/Bulrush), and [alkaline flats](http://en.wikipedia.org/w/index.php?title=Alkaline_flats&action=edit&redlink=1) that drain into the Middle Fork [Feather River](http://en.wikipedia.org/wiki/Feather_River). Many species of wildlife use the valley, including migratory bird species and wintering waterfowl and raptors. More than 260 bird species have been observed in the valley, and 160 are known to breed here. Sandhill cranes usually nest in the valley. Pasture for cattle is extensive along with some hay and alfalfa fields.

**13ac. Upper Owens Valley**

The **Upper Owens Valley** ecoregion is a large north-to-south valley area with several segments, including Queen, Benton, Hammil, Chalfant, and Upper Owens Valleys on the western side of the White Mountains, and Round Valley near the Sierra Nevada. Gently to moderately sloping alluvial fans and mostly level basin floors, terraces, and floodplains are the primary landforms. The region also includes the distinct Alabama Hills in the far south. Elevations range from about 3,800 feet along the Owens River in the south to more than 6,000 feet where the higher fans descend from adjacent mountain regions. Quaternary alluvium covers the region, and the Upper Owens Valley has some small areas of lava flows. Soil temperature regimes are mesic to thermic and soil moisture regimes are aridic with some xeric. Shrub-covered rangeland is the dominant land cover, with some minor areas of hay and pastureland. Several small towns serve the local ranching and farming sector, as well as cater to mountain-related tourism. Vegetation includes big sagebrush, rabbitbrush, spiny hopsage, antelope bitterbrush, saltbush, ephedra, and several perennial grasses including desert needlegrass. Along the Owens River, some restoration of cottonwoods, willows, and wetlands has occurred, although water continues to be exported to Los Angeles.

**13ad. Mono/Adobe Valleys**

The **Mono/Adobe Valleys** ecoregion includes the nearly level to gently sloping lake plain around Mono Lake, at the base of the Sierra Nevada ecoregion (5), as well as the Adobe Valley to the southeast. Pleistocene and recent lacustrine deposits predominate. Ash layers occur from eruptions of the numerous volcanic domes that are mostly in adjacent Ecoregion 13x. Elevations range from 6,400 to 7,200 feet, with relief of 200–400 feet. Soil temperature regimes are mesic and soil moisture regimes are aridic. Big sagebrush, bitterbrush, and some singleleaf pinyon occur. Greasewood occurs in seep areas. Water from Sierra Nevada streams that flows to Mono Lake historically has been diverted for municipal use in Los Angeles, affecting lake levels and chemistry.

**13ae. Bishop Volcanic Tableland**

The **Bishop Volcanic Tableland** ecoregion occurs just north of the town of Bishop and Upper Owens Valley in Inyo and Mono Counties. The gently to moderately sloping tableland of volcanic rhyolite and tuff ranges in elevation from about 4,200 to 6,600 feet, with relief mostly 200–800 feet. The landscape was formed more than 700,000 years ago when volcanic materials spewed from the Long Valley Caldera to the northwest. The welded Bishop Tuff has a depth of more than 140 feet, and the nutrient-poor soils are very shallow and well-drained, with rocky and loamy soil textures. Soil temperature regimes are mostly thermic and soil moisture regimes are aridic. Vegetation is mostly shadscale and blackbrush, with some Indian ricegrass and desert needlegrass, and a variety of desert forbs. Annual precipitation is 6–7 inches. A few intermittent streams trend southwest across the region, with runoff draining to the Owens River. The Owens River Gorge traverses the southwestern part of the tableland. Recreation has become an important land use on the BLM public lands, including bouldering and rock-climbing.

**14. Mojave Basin and Range**

**14a. Eastern Mojave Basins**

The creosotebush-dominated **Eastern Mojave Basins** ecoregion includes the valleys lying between the scattered mountain ranges of the Mojave Desert at elevations ranging from 1,800 to 4,500 feet. Elevations are lower, soils are warmer, and evapotranspiration is higher than in the Central Basin and Range ecoregion (13) to the north. Limestone- and gypsum-influenced soils occur, but overall, precipitation amount has a greater ecological significance than geology. Toward the south and east, as summer rainfall increases, the Sonoran influence grows, and woody leguminous species, such as mesquite, acacia, and smoke tree, become more common. Creosotebush, white bursage, and galleta grass are typical in Ecoregion 14a. Pocket mice, kangaroo rats, and desert tortoise are faunal indicators of the desert environment. Desert willow, coyote willow, and mesquite grow in riparian areas, although the alien invasive tamarisk is rapidly replacing native desert riparian vegetation.

**14b. Eastern Mojave Low Ranges and Arid Footslopes**

The **Eastern Mojave Low Ranges and Arid Footslopes** ecoregion is composed of alluvial fans, basalt flows, hills, and low mountains that rise above the basin floors of the Mojave Desert to upper elevations of about 5,000–6,000 feet. Areas of sparsely vegetated soils, depending on slope, soil type, and grazing history, can be susceptible to erosion during storm events. In areas transitional to the Great Basin in the north, blackbrush dominates slopes just above the upper elevational limit for creosotebush. Elsewhere, a mixture of typical Mojave Desert forbs, shrubs, and succulent species occurs, including Joshua tree, other yucca species, and cacti on rocky, well-drained sites. Ecoregion 14b has a diverse array of reptiles including iguanas, chuckwallas, and desert tortoises, as well as leopard, collared, horned, and spiny lizards. Desert bighorn sheep also may be present on some remote rocky outcrops.

**14c. Eastern Mojave Mountain Woodland and Shrubland**

The **Eastern Mojave Mountain Woodland and Shrubland** ecoregion occurs in California, Nevada, Utah, and Arizona, at elevations from about 5,000 to greater than 7,000 feet, where mean annual precipitation increases to between 10 and 16 inches per year. Vegetation includes pinyon, juniper, curl-leaf mountain-mahogany, and cliffrose. In many areas, a denser and more diverse mixture of large interior chaparral shrubs occurs, including oaks, ceanothus, silktassel, and Apache plume. A sagebrush zone is largely absent, but some Wyoming big sagebrush may be found in the understory of the woodland along with blackbrush. Higher riparian zones along the few perennial streams have willow, mountain brush, and cottonwood, whereas other canyons have canyon live oak, or singleleaf pinyon and desert scrub oak. In California, the Kingston Range and New York, and Providence Mountains are areas of unique plant communities.

**14e. Arid Valleys and Canyonlands**

The **Arid Valleys and Canyonlands** ecoregion includes steep canyons and benchlands less than 2,000 feet in elevation near the Colorado River. This is a hot, dry ecoregion, receiving about 5 inches of rain per year in the California part. Rocky colluvial soils cover eroded slopes and deeper soils occur on benches. Vegetation is a sparse but diverse shrub cover that includes creosotebush, white brittlebush, white bursage, and occasional Sonoran desert elements, such as ocotillo. Along the rivers, exotic tamarisk is replacing native riparian vegetation such as Fremont cottonwood and willow. The presence of the Colorado River, Lake Mead, and Lake Mohave greatly influences the management and ecology of this ecoregion.

**14f. Mojave Playas**

The **Mojave Playas** generally are smaller than the Lahontan and Tonopah Playas (13h) and are not part of the broad Pleistocene pluvial basins found in the Central Basin and Range ecoregion (13) to the north. The high salt and clay content of playa surface mud, and the hot, dry conditions inhibit plant growth. Ecoregion 14f is largely barren and only sparse saltbush vegetation typically is found on the margins. Where moisture is sufficient, cold-intolerant trees and woody legumes such as velvet ash and mesquite occur, particularly in the southern Mojave. Playas are dynamic environments with surface channels, playa margins, alluvial materials, and biota changing with each flooding event. Physical and biological crusts on soil surfaces are important, stabilizing soil and reducing erosion from wind and water.

**14g. Amargosa Desert**

The **Amargosa Desert** ecoregion is an arid, internally drained basin. It has greater temperature extremes and less Sonoran influence than the Eastern Mojave Basins (14a). This is due in part to the Spring Mountains that border Ecoregion 14g on the east and block summer rainfall. In the Amargosa Desert, rainfall occurs mostly between October and April, with annual amounts of about 4–6 inches in California. Creosotebush and white bursage predominate in this ecoregion as they do in Ecoregion 14a, but there is less diversity of shrub species in Ecoregion 14g. The Amargosa Valley is a discharge point for an underground water system. Where the Amargosa River surfaces, it creates important wetland oases in the Mojave. A larger, but isolated, system of seeps and springs at Ash Meadows in Nevada is a wetland area of international importance, providing habitats for a large number of endemic plants and animals. In California, the ecoregion includes part of the Amargosa Valley, as well as the Stewart, Chicago, Pahrump, California, and Mesquite Valleys.

**14h. Death Valley/Mojave Central Trough**

The **Death Valley/Mojave Central Trough** ecoregion includes the alluvial plain of parts of Death Valley, the Silurian Valley, and the great depressions that contain Soda, Bristol, and Cadiz dry lakes of Ecoregion 14f. The line of basins in this trough is lower in elevation and warmer than adjacent basins to the east or west, with soil temperatures mostly hyperthermic rather than thermic. The far northern part of the ecoregion, where elevations are greater than 4,000 feet near the Nevada border, is slightly cooler than the lower-elevation central and southern parts. Some areas in the central part are at or below sea level. Creosotebush, white bursage, and mixed saltbush communities occur. Drainage is internal. Although some consider this trough as a convenient divide between the eastern and western Mojave, summer rainfall and certain plant species characteristic of the east occur slightly farther to the west of Ecoregion 14h.

**14i. Mesquite Flats/Badwater Basin**

The **Mesquite Flats/Badwater Basin** ecoregion encompasses one of the most extreme environments on the continent—the low elevations of Death Valley. With stark contrasts to nearby mountains, it is one of the driest and hottest ecoregions and contains the lowest elevation in North America at 282 feet below sea level. High elevations are near sea level. It is a mostly level lake plain and basin floor, internally drained, and with little relief. The Mesquite Flats part in the north surrounds some of the sand dunes and sand sheets of Ecoregion 14o. To the center and south, Badwater Basin contains one of the largest protected salt flats in the world, along with other playa deposits and the fluvial floodplain of the Amargosa River. Large parts of the region are barren or sparsely vegetated. A few areas have iodinebush, seepweed, saltbush, arrowweed, allscale, or saltgrass and, at the higher margins, some creosotebush and desert holly. Soil temperature regimes are hyperthermic and soil moisture regimes are aridic. Annual precipitation is 2–3 inches, although in some years no rain is recorded. Lake Manly was the pluvial lake that filled this ecoregion in the Pleistocene and into the Holocene. Recently, a large lake reappeared briefly in 2005 after a wet winter and a previous flood event in summer 2004.

**14j. Western Mojave Basins**

The **Western Mojave Basins** ecoregion includes the alluvial plains, fans, and bajadas of the major valleys lying between the scattered mountain ranges of Ecoregion 14k. There is some variation in climate and vegetation from north to south, but the basins typically are dominated by creosotebush and white bursage, with areas of shadscale, fourwing saltbush, and on some upper bajadas and fans, scattered Joshua trees. The Western Mojave Basins ecoregion has little summer rainfall compared to the Eastern Mojave Basins (14a), and typically lacks species such as Mojave yucca and big galleta found more to the east. Some annual plant species associated more with Mediterranean climates occur here, but not in the Eastern Mojave Basins. Soil temperature regimes are thermic and soil moisture regimes are aridic. Drainage is internal to closed basins in the Mojave.

**14k. Western Mojave Low Ranges and Arid Footslopes**

The **Western Mojave Low Ranges and Arid Footslopes** ecoregion consists of erosional highlands of exposed bedrock that rise above the alluvium of the basin floors. Granitic rocks are more typical in this western ecoregion compared to a mix of geology in the eastern Mojave ranges of Ecoregion 14b. Many of these western granitic outcrops have relatively low elevations and relief. Creosotebush shrubland occurs on hills along with areas of Joshua tree woodland on some footslopes. This ecoregion receives little summer rainfall compared to Ecoregion 14b, and lacks some of the shrubs, yuccas, and grasses in the eastern Mojave. The ranges in the north have some Great Basin desert scrub influence. Blackbrush shrubland and sagebrush occur more in the north in the transition to Ecoregion 13. The large highland area of Ecoregion 14k east of Owens Lake has a few small valleys or flats in it that are more similar to Ecoregion 14j, particularly between the Coso Range and Cottonwood Mountains.

**14l. Western Mojave Mountain Woodland and Shrubland**

The **Western Mojave Mountain Woodland and Shrubland** ecoregion occurs at elevations greater than about 6,000 feet on mountains in the northwestern part of Ecoregion 14. It includes parts of the Panamint, Argus, Coso, and Nelson Ranges. In contrast to the mostly creosotebush shrubland of the lower elevations in Ecoregion 14k, the vegetation of this higher, cooler, and wetter zone includes pinyon, juniper, and sagebrush. It is somewhat drier and less diverse than Ecoregion 14c in the eastern Mojave. Soil temperature regimes are mesic and frigid and soil moisture regimes are aridic and xeric aridic.

**14m. Western Mojave High Elevation Mountains**

The **Western Mojave High Elevation Mountains** ecoregion covers the highest elevations of the Panamint Range, from about 8,000 to over 11,000 feet on Telescope Peak. It differs from the high elevation Ecoregion 14d in the eastern Mojave because it receives less monsoonal precipitation in the summer, and lacks ponderosa pine, Rocky Mountain white fir, and other species found on the Spring Mountains of Nevada. Limber pine, mountain-mahogany, and big sagebrush occur, and at high elevations, bristlecone pines, some more than 3,000 years old. A distinctive bird fauna is found here in the breeding season, including the hairy woodpecker, mountain chickadee, red-shafted northern flicker, western bluebird, Audubon’s warbler, and Oregon junco.

**14n. Mojave Lava Fields**

The **Mojave Lava Fields** ecoregion includes the most recent volcanic features in the Mojave, and in many places these have changed little since the lava last erupted. The ecoregion includes Pliocene to Holocene rhyolitic and basaltic lava domes and flows. Seven different units of lava fields in California are mapped here, including the Coso volcanic field near the Sierra Nevada, the Lavic Lake volcanic fields east of Barstow, the Cinder Cone Lava Beds east of Baker, and Amboy Crater near Bristol Lake. These are the larger units of volcanic lava fields, and smaller areas of lava occur as part of the mosaic in other Mojave ecoregions. The lava flows have both ropy (*pahoehoe*) and blocky (*aa*) surfaces, and some areas have lava tubes and caves. Few if any plant communities have become established on these younger cinder cones and lava flows, except in a few pockets where shallow soils have developed.

**14o. Mojave Sand Dunes**

The **Mojave Sand Dunes** ecoregion includes migrating dunes, vegetation-stabilized dunes, and sand sheets. Although areas of eolian sand occur in many of the basins of the Mojave, only the largest areas have been mapped here. These include the Kelso dunes, Mesquite Flat dunes in Death Valley, Saline Valley dunes, Panamint dunes, Dumont dunes, Olancha dunes near Owens Lake, and Cadiz dunes. Plants and animals have adapted to the shifting sands and dry surfaces, and several of the dunes areas have endemic species. The Kelso Dune Field, about 30 miles southeast of Baker, is the largest field of eolian sand deposits in the Mojave Desert. The tallest dunes rise 650 feet above the surrounding terrain. The Kelso dunes have several endemic insect species, as well as several other rare native bees, wasps, and beetles. These dunes also provide habitat for the Mojave fringe-toed lizard.

**78. Klamath Mountains and California High North Coast Range**

**78a. Rogue/Illinois/Scott Valleys**

The **Rogue/Illinois/Scott Valleys** ecoregion supports Oregon white oak and California black oak woodland, ponderosa pine, and grassland. As in most developed valleys, vegetation is greatly altered, with only a few remnants of oak savanna, prairie vegetation, or seasonal ponds remaining. Land cover includes pastureland, cropland, orchards, grassland, and developed, with patches of woodland mostly near the margins. In California, the Scott Valley is a nearly level alluvial basin along the Scott River, with mesic soil temperatures and aridic soil moisture regimes.

**78d. Serpentine Siskiyous**

The **Serpentine Siskiyous** ecoregion is lithologically distinct from the rest of Ecoregion 78. Many plants have difficulty growing in its serpentine soils because of a shortage of calcium and high amounts of magnesium, nickel, and chromium. As a result, vegetation often is sparse and composed of specialist species. The dissected mountainous region covers diverse areas and plant communities. Jeffrey pine and endemic oak, ceanothus species, and many forbs have evolved to grow in the potentially toxic and nutrient-poor serpentine soils. Douglas-fir and western white pine also occur, especially coastward. Historical mining continues to cause some water-quality issues.

**78e. Inland Siskiyous**

The forested **Inland Siskiyous** ecoregion occurs in Oregon with only two small areas extending across the California border. It is higher and more mountainous than neighboring foothill and valley ecoregions (78a, 78b, and 78c). Ecoregion 78e has a higher fire frequency, less annual precipitation, and longer summer droughts than the Coastal Siskiyous ecoregion (78f) to the west. Forest cover in Ecoregion 78e is a diverse and multi-layered mix of conifers, broadleaf evergreens, and deciduous trees and shrubs in contrast to the predominantly coniferous forests in the Coast Range (1) or Cascades (4) ecoregions.

**78g. Klamath River Ridges**

The **Klamath River Ridges** ecoregion has a dry, continental climate and receives about 25–35 inches of precipitation annually. Higher altitudes and north-facing slopes have Douglas-fir and white fir; lower elevations and south-facing slopes are mostly ponderosa pine and western juniper, species that are more drought-resistant than other vegetation types found in Ecoregion 78. Some Oregon white oak occurs, and canyon live oak can grow on steep rocky slopes. Ecoregion 78g has less precipitation, more sunny days, and a greater number of cold, clear nights than the Inland Siskiyous ecoregion (78e) to the northwest in Oregon or the western Klamath Mountains in California. Mesic soil temperatures and xeric soil moisture regimes predominate.

**78h. Border High-Siskiyous**

The **Border High-Siskiyous** ecoregion consists of relatively high elevation mountains along the border area of Oregon and California. Elevations range from about 5,000 to greater than 7,000 feet, with a high point of 7,533 feet at Mount Ashland, Oregon. Soil temperature regimes are predominantly frigid, with some cryic at high elevations and soil moisture regimes are xeric. White fir and red fir forests occur, with some Jeffrey pine on ultramafic rocks, and a few areas of subalpine habitats. With a large western to eastern extent, conditions are slightly drier to the east.

**78i. Western Klamath Low Elevation Forests**

The **Western Klamath Low Elevation Forests** ecoregion is at elevations generally less than 3,500 feet. Douglas-fir and Port Orford cedar occur on lower slopes, grading into Douglas-fir and tanoak, or higher areas with canyon live oak. Red and white alder are typical along streams. Mixed oak stands occur on drier sites. The ecoregion generally is wetter and has a somewhat denser forest landscape than the drier Ecoregion 78k to the east.

**78j. Western Klamath Montane Forests**

The **Western Klamath Montane Forests** ecoregion generally is higher than Ecoregion 78i, with elevations typically ranging from 3,500 to 6,900 feet. Annual temperatures are cooler than in Ecoregion 78i, and precipitation is greater. Soil temperature regimes are mostly frigid, with some mesic at low elevations and soil moisture regimes are xeric. The vegetation consists mostly of Douglas-fir and white fir forests, with some red fir forests at high elevations. Ecoregion 78j lacks the serpentine geology of nearby Ecoregion 78d, and is composed mostly of Mesozoic quartz diorite, with areas of Jurassic slate, greywacke, shale, and sandstone.

**78k. Eastern Klamath Low Elevation Forests**

The **Eastern Klamath Low Elevation Forests** ecoregion is geologically and botanically diverse, and has some drier forests than the Western Klamath Low Elevation Forests (78i) to the west. Elevations generally are less than 3,500 feet. Forest and woodland types vary and can include areas of Douglas-fir, ponderosa pine, canyon live oak, and knobcone pine, along with chaparral of chamise, deer brush, and manzanita. Along streams, cottonwoods, white alder, and willows occur. Soil temperatures are mesic to near thermic and soil moisture regimes are mostly xeric.

**78l. Eastern Klamath Montane Forests**

Typically at elevations greater than 4,000 feet, the **Eastern Klamath Montane Forests** ecoregion includes a mosaic of forest and chaparral types. It often has more open tree canopies and understories than western Klamath regions. White fir, incense cedar, Douglas-fir, ponderosa pine, and sugar pine are dominant, with mountain dogwood in the understory. Some minor areas of Shasta fir or red fir occur at high elevations. Black and canyon live oaks mix with scattered conifers on drier sites, with understories of huckleberry oak and other chaparral species.

**78m. Marble/Salmon Mountains-Trinity Alps**

The **Marble/Salmon Mountains-Trinity Alps** ecoregion includes the Salmon Mountains, Marble Mountains, and Trinity Alps in the montane elevations mostly from 3,500 or 4,000 feet to about 7,000 feet. The rugged region has steep slopes and numerous canyons and narrow mountain valleys. Granitic, metavolcanic, and metasedimentary rocks occur, including some areas of serpentinized peridotite. Soil temperature regimes are predominantly frigid and soil moisture regimes are xeric. The climate is colder than surrounding lower elevation ecoregions 78g, 78i, and 78k. Forests include Douglas-fir, white fir, and at high elevations, red fir.

**78n. Scott Mountains**

The **Scott Mountains** ecoregion is dominated by ultramafic rocks with Mesozoic mafic intrusions, along with some granitic rocks near the Trinity Alps and at Castle Crags. Elevations generally range from 3,000 to 7,000 feet. Soil temperature regimes are mostly frigid, with some mesic at low elevations and soil moisture regimes are xeric. Ecoregion 78n has more ultramafic rocks and less precipitation than Ecoregion 78m to the west. Vegetation includes Jeffrey pine, mixed conifer, and white fir. The ecoregion drains to the Trinity, Sacramento, Scott, and Shasta Rivers.

**78o. Klamath Subalpine**

The **Klamath Subalpine** ecoregion is higher, wetter, and colder than surrounding areas, with elevations generally greater than 6,800 feet. Most of the region was glaciated, shown by the numerous cirques, moraines, and other glacial features. Shasta red fir, mountain hemlock, and some western white pine occur, as well as subalpine meadows with various mixes of shrubs, herbs, and grasses. Some foxtail pine occurs as well as small areas of Pacific silver fir to the north. Soils tend to be thin and rocky, across various bedrock types including granitics, gabbro, and ultramafic rocks. Soils deepen downslope and have cryic with some frigid soil temperature regimes.

**78p. Duzel Rock**

The **Duzel Rock** ecoregion is slightly lower in elevation with less relief than Klamath Mountain ecoregions immediately north or south and it has more juniper and big sagebrush, along with scattered woodland. Ponderosa pine, Oregon white oak, and areas of Jeffrey pine occur. Some Douglas-fir is found at higher elevations and on northern slopes. Curl-leaf mountain-mahogany is common in the western and southern parts. The geology is mostly Cambrian through Devonian metasedimentary and minor metavolcanic rocks including metamorphosed conglomerate, sandstone, shale, chert, limestone, and basalt. Soil temperature regimes are mesic with some frigid at high elevations and soil moisture is xeric. The region drains to the Scott and Shasta Rivers.

**78q.** **Outer North Coast Ranges**

Just inland from the redwood forests of Ecoregion 1, the **Outer North Coast Ranges** ecoregion occurs in the central part of the northern California Coast Ranges. It is characterized by high rainfall and mixed evergreen and mixed hardwood forests including Douglas-fir, tanoak, Oregon white oak, and some needlegrass grasslands. Some redwood occurs in areas closest to the coast. Mountain peaks are lower in elevation than those in the High North Coast Ranges ecoregion (78r) to the east. Soil temperature regimes are predominantly mesic, with some thermic in the southern part of the region and soil moisture regimes are xeric. Landslides occur frequently in this region, and high sediment loads occur in streams and rivers. All but the larger streams are dry by the end of the summer. Natural lakes are absent, but there are a few reservoirs.

**78r.****High North Coast Ranges**

The **High North Coast Ranges** ecoregion includes the high elevation part of the northern California Coast Ranges that are far enough inland that the Pacific Ocean has little influence on climate. The ecoregion has more winter snow and more montane and subalpine coniferous forest than Ecoregion 78q to the west. Cretaceous sandstone, mudstone, blueschist, and metasedimentary rocks are typical. Elevations range mostly from 3,000 to 7,000 feet, with a high point of 8,092 feet at Mount Linn. Common vegetation includes mixed conifer and Douglas-fir forests, along with tanoak. White fir forest and some red fir occur at high elevations. Soil temperature regimes are predominantly mesic, with some frigid and minor areas of cryic and soil moisture regimes are almost exclusively xeric. All but the larger streams are dry through much of the summer.

**80. Northern Basin and Range**

**80d. Pluvial Lake Basins**

The **Pluvial Lake Basins** ecoregion of northwestern Nevada, northeastern California, and south-central Oregon was last filled with water during the Pleistocene Epoch. Presently, some basin floor playas seasonally collect and evaporate water. Ecoregion 80d has cooler mean annual temperatures than the Lahontan Salt Shrub Basin ecoregion (13j) in Nevada. Greasewood, inland saltgrass, and seepweed grow in more alkaline soil, and Wyoming big sagebrush, basin big sagebrush, and associated grasses dominate better drained, less alkaline soils. The dry lakebeds near the Cascade Mountains have a significant ash layer. The land is used for rangeland, and alfalfa is grown on a limited basis in irrigated areas. The California part includes Surprise Valley in the north and the Madeline Plains and Grasshopper Valley to the south, with elevations mostly ranging from 4,500 to 5,500 feet.

**80g. High Lava Plains**

The **High Lava Plains** ecoregion of southeastern Oregon, northeastern California, and northwestern Nevada is part of a vast sagebrush steppe that extends northward to the Blue Mountains of Oregon. It contains scattered volcanic cones and buttes, and is internally drained. As a result of this internal drainage, the fish assemblage of Ecoregion 80g lacks an anadromous component. Bluebunch wheatgrass generally is associated with Wyoming big sagebrush, except where bunchgrasses have been depleted by grazing and replaced by cheatgrass. Scattered intermittent lakes and ephemeral pools are characteristic of Ecoregion 80g; they harbor unique flora and fauna as do those in the Sierra Nevada-Influenced Ranges ecoregion (13x) to the south.

**80j Semiarid Uplands**

The **Semiarid Uplands** ecoregion covers disjunct areas across southeastern Oregon, northern Nevada, and northeastern California. It includes hills, low mountains, volcanic cones, buttes, and the mid-elevation zones of mountain ranges that rise out of the drier Dissected High Lava Plateau (80a) and High Lava Plains (80g) ecoregions. Western juniper, mountain sagebrush, and grasses such as Idaho fescue grow on rocky substrates. Elevational banding is much less apparent on the mountains of Ecoregion 80j than in Ecoregion 13 to the south. The density and extent of juniper woodland varies with long-term climate fluctuations, grazing pressure, and fire frequency. Juniper woodland is absent in some of the mountains, but mountain brush and scattered aspen groves occupy the woodland zone. In California, the ecoregion includes the Skedaddle Mountains (and Shaffer Mountain northeast of Honey Lake, and the Cottonwood Mountains farther north, with elevations generally ranging from 5,000 to 7,600 feet. These mountains have some pinyon, juniper, mountain-mahogany, and aspen.

**81. Sonoran Basin and Range**

**81a. Western Sonoran Mountains**

The **Western Sonoran Mountains** ecoregion includes the erosional highlands of exposed bedrock that rise above the more gently sloping sediment-filled basins (Ecoregion 81c). The terrain is dissected by dry washes that can flash flood during the infrequent rainfall events. The mountains in this western ecoregion receive less summer precipitation than the ranges in Ecoregions 81i and 81k to the east. The vegetation of this mostly rocky terrain typically is Sonoran creosotebush scrub transitioning into succulent scrub with numerous ocotillo and cacti. There is some Mojavean as well as Peninsular Range influence compared to Sonoran mountain ranges to the east. Ocotillo, white bursage, teddy bear cholla, range ratany, barrel cactus, brittlebush, staghorn cholla, beavertail cactus, yucca, jojoba, Mormon tea, and a few juniper are present. Spring annual forbs include fiddleneck, popcorn flower, desertbells, and desert mariposa lily.

**81b. Western Sonoran Mountain Woodland and Shrubland**

The **Western Sonoran Mountain Woodland and Shrubland** ecoregion, at the western edge of the Sonoran Desert, is a montane transition region that occurs generally above 3,000 feet in elevation, as one ascends into the Peninsular Range toward Ecoregion 8. It includes parts of the Santa Rosa Mountains in the north, several mountainous parts of the Anza-Borrego area, and parts of the In-Ko-Pah and Jacumba Mountains in the south. Among the granitic boulders, desert chaparral as well as singleleaf pinyon and California juniper occur. A few canyon live oaks occur near the western margin. In some steep canyons, native fan palm oases are found. These mountainous slopes provide habitat for a population of Peninsular bighorn sheep.

**81c. Western Sonoran Basins**

The **Western Sonoran Basins** ecoregion includes the alluvial plains, fans, and bajadas that occur between the higher relief mountain ranges of Ecoregions 81a and 81b. The region of rolling terrain and some badlands of the Anza Borrego and Yuha Desert areas slopes to the east toward the Salton Sea and Imperial Valley. These basins have some similarities to Ecoregion 81j to the east, although this western ecoregion receives less summer precipitation. Much of this area is underlain by Late Miocene to Latest Pleistocene marine and non-marine sandstones and mudstones of the Palm Springs Formation. Alluvium, colluvium, and lacustrine deposits are thicker in the eastern, gently sloping part of the ecoregion and thinner in the western part where tectonic forces have uplifted Palm Springs Formation deposits to the surface where they form incised badland topography. Soils typically are sandy to gravelly loam in texture and highly permeable, with high potential for wind erosion. Sonoran creosotebush scrub covers large areas of the ecoregion. On alluvial fans and coarse soils, ocotillo, brittlebush, and cholla occur. Shrub density varies from low to moderate, with shrub spacing from several feet to tens of feet. Some desert saltbush scrub occurs on fine-textured, poorly drained soils with high alkalinity and salinity. In the washes and ephemeral streams, mesquite and nonnative tamarisk are mixed with creosotebush. Microphyll woodland habitat is found along some dry-wash channels. In these washes, blue paloverde, ironwood, smoke tree, or desert willow occur, and these additional vegetation species support a diversity of wildlife. Fauna of the ecoregion include reptiles such as the desert flat-tailed horned lizard, side-blotched lizard, desert iguana, zebra-tailed lizard, and Colorado Desert sidewinder, and mammals such as the black-tailed jackrabbit, desert cottontail, California ground squirrel, coyote, and desert kit fox.

**81d. Sand Hills/Sand Dunes**

The Sonoran **Sand Hills/Sand Dunes** ecoregion occurs in California, Arizona, and Baja California, and is one of the largest dune complexes in North America. In California, it includes lower elevation sandy areas of East Mesa as well as the higher elevation Algodones Dunes to the east. East Mesa has more stabilized aeolian deposits, possibly because of groundwater rises from human modifications of the hydrology. The wind-blown sand originated from the former beach deposits and lakebed of Pleistocene Lake Cahuilla to the west. This is one of the driest and hottest areas of the United States, with annual precipitation of only about 3 inches. The well-drained aridic soils are mostly Typic Torripsamments with hyperthermic temperature regimes. Although vegetation appears sparse on the dunes and sand hills, the ecoregion contains the largest number of dune-endemic plants in North America, as well as several specialized animal species. Psammophytic ("sand loving") scrub occurs in the interior part of the sand dune system, both in the active sand dunes and partially stabilized areas. Some microphyll woodland, Sonoran desert scrub, and canal-influenced vegetation also occurs. Peirson’s milk-vetch, a federally listed threatened plant, is found here, along with Wiggins’ croton and the Algodones Dunes sunflower. The flat-tailed horned lizard, desert tortoise, and Colorado Desert fringe-toed lizard occur in the ecoregion, and the dunes provide habitat for the Andrews’ dune scarab beetle. The ecoregion includes areas managed for wilderness as well as for off-road vehicle recreation.

**81e. Upper Coachella Valley and Hills**

The **Upper Coachella Valley and Hills** ecoregion is surrounded by mountains, except to the south where it descends toward the agricultural lands and Salton Sea of Ecoregion 81f. Alluvial deposits cover most of the ecoregion, mantled by sand deposits in some areas. On the northeastern side of the San Andreas Fault, some sandstone and conglomerate underlie the low, rolling Indio Hills and Mecca Hills. Elevations range from sea level in the southeast to about 1,800 feet in the Mecca Hills. Soil temperatures are hyperthermic and soil moisture regimes are aridic. In some of the canyons of the Indio Hills, native California fan palms occur. In sandy areas, the Coachella Valley fringe-toed lizard is one of several animal and plant species threatened or endangered because of habitat loss. The southwestern part of the ecoregion is mostly urbanized in the Palm Springs/Palm Desert area. It is a transitional desert region with some affinities to the Mojave Basin and Range ecoregion (14) to the north.

**81f. Imperial/Lower Coachella Valleys**

The **Imperial/Lower Coachella Valleys** ecoregion occurs in the basin of Pleistocene Lake Cahuilla. In the Quaternary period, the Colorado River meandered across its delta, sometimes flowing north and creating huge inland lakes in the Salton Basin. The deposited silt and sediments created rich agricultural soils and, with imported Colorado River water and an extensive canal system, cropland dominates the ecoregion’s land cover. The ecoregion mostly is below sea level. The Salton Sea is a terminal lake occupying the lowest parts of the Salton Trough. The elevation of the ecoregion ranges from about 50 feet above sea level to more than 225 feet below sea level at the surface of the Salton Sea. With annual precipitation of less than 3 inches, water levels of the Salton Sea are sustained mostly by agricultural runoff, with some municipal effluent and storm water that flows into the sea through rivers and creeks in the Imperial, Coachella, and Mexicali Valleys. The Salton Sea area is a complex ecosystem of both exotic and endemic species. It has great ecological importance to wintering, migratory, and breeding waterbirds in the Pacific Flyway; however, serious problems exist with effects of increasing salinity, contaminants, disease outbreaks, and large die-offs of birds.

**81g. Lower Colorado/Gila River Valleys**

The **Lower Colorado/Gila River Valleys** ecoregion includes the low elevation corridors along the Colorado and lower Gila Rivers. It is mostly an area of riverine alluvium and river- and fan-terraces, and large parts of the ecoregion are in agriculture. Elevations range from about 70 feet in the south where the Colorado River leaves Arizona and enters Mexico, to about 1,000 feet on slopes in the north. The riparian and wetland habitats of the ecoregion have been extensively altered. Exotic plants such as tamarisk now cover river banks that once were shaded by cottonwoods, willows, and mesquite. Only a few oxbows remain with some freshwater marshes and remnants of original riparian vegetation. Creosotebush and white bursage occupy most upland areas. Soil temperature regimes are hyperthermic and soil moisture regimes are aridic. The climate is almost frost-free and crops include wheat, barley, hay and alfalfa, cotton, lettuce, citrus, broccoli, and melons.

**81h. Sonoran Playas**

The **Sonoran Playas** ecoregion in California includes the Danby, Ford, and Palen dry lake areas in the low elevation basins of Ecoregion 81j. Danby Dry Lake is part of a large, northwest-trending structural trough that also includes Bristol and Cadiz Dry Lakes to the northwest in Ecoregion 14f. The elevation of Ecoregion 81h is about 600–620 feet. Danby Dry Lake is the sump of a large drainage basin that includes Ward Valley and adjacent upland areas. Playa lake sediments consist of silt and sand, tend to be orange or light yellowish-brown in color, and contain saline layers. The mostly barren cover has some sparse saltbush on the margins. Where moisture is sufficient, velvet ash and mesquite occur. Playas are dynamic environments with surface channels, playa margins, alluvial materials, and biota changing with each flooding event.

**81i. Central Sonoran/Colorado Desert Mountains**

Similar to Ecoregion 81a, the **Central Sonoran/Colorado Desert Mountains** ecoregion is the erosional highlands of exposed bedrock that rise above the more gently sloping sediment-filled basins (Ecoregion 81j). Unlike the Western Sonoran Mountains ecoregion (81a), these ranges receive more summer precipitation. The rugged terrain is dissected by dry washes that can flood during the infrequent rainfall events. The climate is hot, arid, and continental. Soil temperature regimes are hyperthermic with a typic aridic soil moisture regime. Soil moisture is driest from May to June and intermittently moist during the July–September and December–February periods. The vegetation of this mostly rocky terrain typically is Sonoran creosotebush scrub transitioning into succulent scrub with ocotillo and numerous cacti. Species include creosotebush, white bursage, brittlebush, ocotillo, teddy bear and staghorn cholla, range ratany, barrel cactus, and beavertail cactus, with some littleleaf paloverde in the Arizona part.

**81j. Central Sonoran/Colorado Desert Basins**

The **Central Sonoran/Colorado Desert Basins** ecoregion includes the broad alluvial plains, fans, and bajadas that occur between the higher relief mountain ranges of Ecoregion 81i. Large areas of the region are dominated by creosotebush and white bursage. On alluvial fans and coarse soils, ocotillo, brittlebush, and cholla occur. Shrub density varies from low to moderate, with shrub spacing from several feet to tens of feet. The Colorado Desert is more sparsely vegetated than eastern Sonoran ecoregions (81k, 81l) in Arizona, with a less diverse avifauna. Desert saltbush scrub occurs, often on finer textured, poorly drained soils with high alkalinity and salinity. Allscale is the dominant shrub along with some fourwing saltbush, mesquite, and bush seepweed. In the washes and ephemeral streams, mesquite and exotic tamarisk are mixed with creosotebush. Microphyll woodland habitat is found along some dry-wash channels, with blue paloverde, ironwood, smoke tree, or desert willow, and these plants support a diversity of wildlife.

**81k. Arizona Upland/Eastern Sonoran Mountains**

The **Arizona Upland/Eastern Sonoran Mountains** ecoregion includes highland areas that have more rainfall (7–20 inches annually) than Sonoran Desert mountains farther west (Ecoregions 81a, 81i) and have more rain in summer. Most of the ecoregion is in Arizona, and it is one of the highest and coldest parts of the Sonoran Desert. Vegetation includes saguaro, foothill paloverde, creosotebush, triangle bursage, pricklypear, cholla, limberbush, wolfberry, bush muhly, threeawns, ocotillo, and globe mallow. The soil temperature regime is thermic and soil moisture regime is typic aridic. In California, only the eastern part of the Whipple Mountains is in this ecoregion, with about 6–8 inches of annual rainfall. With cliffs, spires, natural bridges, and deep canyons, the Whipple Mountains are diverse in elevation and geology and contain plant species representative of both the Mojave and Sonoran Deserts. Ecoregion 81k is one of the few areas of California that has naturally occurring saguaro cactus.

**85. Southern California/Northern Baja Coast**

**85a. Santa Barbara Coastal Plain and Terraces**

The narrow, south-facing **Santa Barbara Coastal Plain and Terraces** ecoregion consists of beaches, terraces, and alluvial slopes that occur at the foot of the Santa Ynez Mountains of Ecoregion 8a. Elevations range from sea level to 1,000 feet. Many of the Tertiary and Quaternary terraces are uplifted, folded, and faulted, and the numerous active or potentially active faults pose an earthquake hazard. Large areas are in urban and residential land cover. The steep slopes and landslide deposits along the foothills of the Santa Ynez Mountains, along with chaparral and introduced vegetation, present wildfire and development issues. Ecoregion 85a has less cropland than Ecoregion 85b to the east, but a few small areas of citrus, avocados, or specialty crops occur. There are onshore and offshore oil and gas production activities.

**85b. Oxnard Plain and Valleys**

The **Oxnard Plain and Valleys** ecoregion occurs on nearly level floodplains and very gently to gently sloping alluvial fans and terraces in the valleys of the Santa Clara River and Calleguas Creek. Its landforms, alluvial geology, and land use contrast with the mountains of Ecoregion 8 to the north and the Venturan-Angeleno Coastal Hills ecoregion (85c) to the south and east. The hot, subhumid climate is modified greatly to moderately by marine air; early summer fog is common. The soil temperature regime is thermic and soil moisture regime is xeric. Vegetation historically included coastal sage scrub, coast live oak, and brome and needlegrass grasslands. Most of the natural vegetation has been replaced by cropland, citrus orchards, and urban and residential uses. The Santa Clara River drains much of the ecoregion and is perennial; Calleguas Creek is ephemeral.

**85c. Venturan-Angeleno Coastal Hills**

The **Venturan-Angeleno Coastal Hills** ecoregion includes the Santa Monica Mountains, Simi Hills, Oak Ridge and other hills of southern Ventura County, the Verdugo Mountains, San Rafael Hills, Chino Hills, Puente Hills, San Jose Hills, and the hills of the Palos Verdes Peninsula. These shrub-covered hills and mountains, with elevations ranging from sea level to more than 3,000 feet, contrast with the adjacent heavily urbanized flat plains and valleys. Mesozoic and Tertiary sedimentary rocks and some Miocene volcanics occur. In the Santa Monica Mountains, climate is modified greatly on the southern side by marine air, whereas climate on the northern side and on inland hills is affected more moderately by marine air. Annual precipitation ranges from 14 to 26 inches. Soil temperature regimes are thermic and soil moisture regimes are xeric. Vegetation includes annual grassland, California sagebrush, California buckwheat, mixed sage, chamise chaparral, mixed chaparral, and coast live oak. There are some differences in coastal sage communities and species compared to those found to the north in Ecoregion 6, as well as to those in the southern parts of Ecoregion 85 in San Diego and Baja California.

**85d. Los Angeles Plain**

The **Los Angeles Plain** ecoregion is on nearly level floodplains and terraces and very gently to gently sloping alluvial fans that include the San Fernando and San Gabriel valleys. Marine air influence is great on the Los Angeles Plain and moderate in the San Fernando Valley. Annual precipitation ranges from 10 to 17 inches. The soil temperature regime is thermic and soil moisture regime is xeric. Typical vegetation historically included California sagebrush, California buckwheat, coast live oak, chamise chaparral, and annual grasslands, although most all of the region has been converted to urban and residential land cover. Hydrology has been greatly modified and channelized. The Los Angeles River drains the San Fernando Valley and San Gabriel Mountains.

**85e. Diegan Coastal Terraces**

The **Diegan Coastal Terraces** ecoregion includes nearly level to gently sloping dissected marine terraces, and a narrow strip of beach and dune sand along the coast from Newport Beach south into Mexico’s Baja California. The ecoregion is modified greatly by oceanic influence. Soil temperatures are thermic and soil moisture regime is xeric. Vegetation is mostly coastal sage scrub, with maritime succulent, Diegan coastal sage scrub, and chaparral communities. California sagebrush, California buckwheat, black sage, ceanothus, coast live oak, and annual grasslands occur. A few vernal pools remain, as well as a small coastal stand of rare Torrey pines. Runoff is rapid except from undissected terraces with vernal pools. Urban and suburban land cover is widespread.

**85f. Diegan Coastal Hills and Valleys**

The **Diegan Coastal Hills and Valleys** ecoregion consists of coastal terraces and some moderately steep to steep foothills along the western side of the Peninsular Ranges from the Santa Ana River southeast to the Mexican border. It is cut by numerous canyons and a few wide valleys. It has more elevation and relief than Ecoregion 85e to the west, and less elevation and relief than Ecoregion 85g to the east. Tertiary and some Cretaceous sedimentary rocks occur, along with Mesozoic granitic rocks to the south and east. The climate is modified greatly by oceanic influence. The soil temperature regime is thermic and soil moisture regime is xeric. Vegetation includes coastal scrub and chaparral, annual and perennial grasslands, and some small pockets of coastal oak woodlands. Although not as urbanized as Ecoregions 85d and 85e to the west, some parts of the ecoregion have experienced rapid urban and suburban growth in recent decades.

**85g. Diegan Western Granitic Foothills**

The **Diegan Western Granitic Foothills**ecoregion consists of inland low hills at the intermediate elevations of central San Diego County, in the Escondido, Ramona, and Alpine areas. Part of the lower Peninsular Ranges, the mountains and hills are moderately steep to steep with narrow to rounded summits. A few narrow to broad valleys occur. Although there is some mild influence by marine air, it is much less than in Ecoregions 85e and 85f to the west. The soil temperature regime is thermic and soil moisture regime is xeric. Typical vegetation includes foothill needlegrass, coast live oak, chamise, mixed chaparral, and California sagebrush.

**85h. Morena/Boundary Mountain Chaparral**

The **Morena/Boundary Mountain Chaparral** ecoregion is a transitional area between Ecoregions 85 and 8, on the border with Mexico. Elevations and relief are less than in Ecoregion 8e to the north, and Ecoregion 85h lacks much of the hardwood and conifer woodland of Ecoregion 8. It is slightly higher than Ecoregion 85g to the west, except for that ecoregion’s high hills near the international border. Vegetation is predominantly mixed chaparral and some chamise.

**85i. Northern Channel Islands**

The **Northern Channel Islands** ecoregion consists of four east-west trending islands off of the Southern California coast: San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands. These islands are a seaward extension of the Santa Monica Mountains of Ecoregion 85c. The islands are mostly steep mountains and hills with some gently sloping plateaus and dissected marine terraces. Peak elevations are greater than 2,450 feet on Santa Cruz Island. The maritime climate is mostly frost-free, except at high elevations. Soil temperature regimes are isothermic and thermic, and soil moisture regimes are ustic and xeric. These northern islands have some climatic, soil, and vegetational differences from the Southern Channel Islands ecoregion (85m). Annual grassland, coastal sage scrub, and chaparral are typical, with some scattered mixed broadleaf woodland, island oak and coastal live oak woodlands, and a few Bishop or Torrey pine stands on sheltered slopes and canyons, or on ridges exposed to frequent fogs. Many unique plants and animals are endemic to the islands, as well as rich and globally significant marine ecosystems. These islands, plus Santa Barbara Island to the south, form Channel Islands National Park.

**85j Southern Channel Islands**

The **Southern Channel Islands** ecoregion consists of the San Nicolas, Santa Barbara, Santa Catalina, and San Clemente Islands. These northwest-trending islands have some similarities to the Northern Channel Islands ecoregion (85i), although there are some warmer ocean currents, higher average air temperatures, slightly less precipitation, less woodland, and more open xeric scrub vegetation. Ecoregion 85j has larger distances between islands and a more diverse flora than Ecoregion 85i, with more xeric components. Steep mountains and hills and dissected marine terraces occur, with a high elevation of 2,123 feet on Santa Catalina Island. The maritime climate is frost-free, soil temperature regimes are mostly thermic, and soil moisture regimes are ustic and xeric.

**85k. Inland Valleys**

The **Inland Valleys** ecoregion has less marine influence on climate compared to other valley regions to the west such as Ecoregions 85b and 85d. It consists of alluvial fans and basin floors immediately south of the San Gabriel and San Bernardino Mountains of Ecoregion 8, and includes the San Jacinto and Perris Valleys toward the south. Ecoregion 85k includes some floodplains along the Santa Ana River. The soil temperature regime is thermic and soil moisture regime is xeric. Vegetation historically included Riversidean coastal sage scrub, valley grasslands, and some riparian woodlands. The ecoregion now is heavily urbanized. A few areas of pasture or cropland persist.

**85l. Inland Hills**

The moderately steep to steep **Inland Hills** ecoregion is in a hotter and drier environment than the coastal hills of Ecoregion 85c to the west. Elevations generally are between 1,000 and 3,000 feet. Mesozoic granitic rocks are common along with some gabbro, diorite, and Jurassic argillite and graywacke. Diverse habitat mosaics occur with various types of sage scrub mixing with areas of grassland and chaparral. This contrasts with the mostly urbanized surrounding lowland of Ecoregion 85k. Interior or Riversidian sage scrub is more widespread than coastal sage scrub communities typical of ecoregions to the west. Annual precipitation is mostly 10–14 inches.

**85m Santa Ana Mountains**

The **Santa Ana Mountains** ecoregion is steep to very steep with narrow to rounded summits and narrow canyons. Elevations range from about 700 to 5,687 feet at Santiago Peak. Ecoregion 85m is modified moderately by marine air, and generally is hotter and drier on the inland side. Annual precipitation of 14–24 inches is greater than in the adjacent lower-elevation ecoregions. Soil temperature regimes are thermic and mesic and the soil moisture regime is xeric. Vegetation includes extensive areas of mixed and chamise chaparral, coastal sage scrub, coast live oak, and areas of annual grassland. Some canyon live oak occurs, bigcone Douglas-fir is found at the heads of some canyons, and areas of sparse Coulter pine are at high elevations. In the southeast, the Santa Rosa Plateau supports areas of vernal pools, native grasslands, and some Engelmann oak woodlands.