

SAN DIEGO COUNTY AS HABITAT FOR BIRDS

San Diego County's wondrously diverse biota is the product of diverse topography, climates, and soils, besides its position along the coast and astride a pathway for migration. Here I can offer only a brief overview. For information in greater depth, see Philip R. Pryde's book *San Diego: An Introduction to the Region* (Pryde 2004).

GEOGRAPHY

San Diego County's rugged and varied topography (Figure 5) is one of the main reasons for its biological diversity. The county may be divided into several regions useful for interpreting bird distribution. From west to east, the first is the open water of the Pacific Ocean. Since 1980, with oceanographic changes, numbers of many ocean birds off San Diego have plummeted, led by the Sooty Shearwater. Nevertheless, the species characteristic of the California Current can still be seen, even though a pelagic birder may spend hours of cruising the sea by boat with little return. Strong west winds, though, concentrate ocean birds nearer the coast, and on good days remarkable numbers can be

seen (with a spotting scope) from La Jolla. The distribution of birds over the ocean is strongly influenced by distance from shore. The continental shelf is only 2–10 miles wide off San Diego County. Ocean birds are usually most abundant within 10 miles of shore, and several species seldom or never venture farther out. Other species, such as the Black-footed Albatross, Leach's Storm-Petrel, and Xantus' Murrelet prefer to stay out of sight of land, however, so there is a substantial difference between the birdlife 5 or 50 miles offshore.

The coastline is a vital resource to a great number of birds. In many places, the littoral habitat is only a narrow sandy beach or sandstone bluff. Only small numbers of a few species frequent bare sandy beaches, but the clumps of giant kelp (*Macrocystis pyrifera* and *M. angustifolia*) that often wash up afford good foraging habitat for many shorebirds. With the rivers dammed and delivering little sediment to the beaches, though, erosion of sand is a continuing problem. Around La Jolla and Point Loma, the shoreline is bare rock, except for algae and sessile inver-

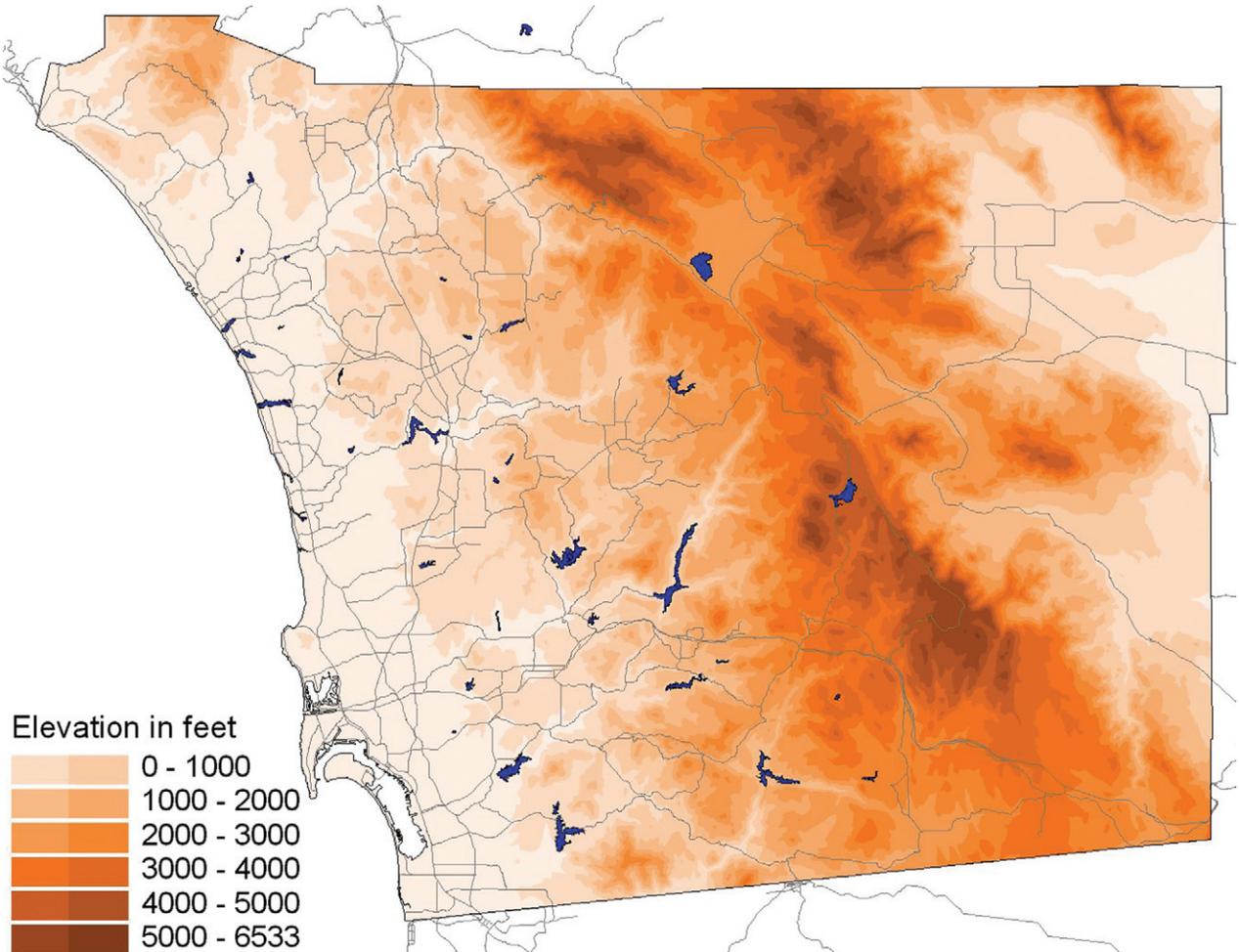


FIGURE 5. San Diego County topography.

tebrates. Birds like the Snowy Egret, Wandering Tattler, Surfbird, and Black Turnstone seek the tidepools here.

The outstanding features of San Diego's coastline are the 17 wetlands, the estuaries and lagoons, and bays. Each of these has its own unique features that result in a different combination of bird species frequenting each wetland. San Diego and Mission bays are fully open to the tides and offer large surfaces of water, a habitat sought by many ducks, loons, and grebes. Tidal mudflats are found in San Diego County primarily around San Diego and Mission bays and at the San Diego and Tijuana River mouths. As a result, species that prefer tidal mudflats, like wintering Red Knots and Short-billed Dowitchers, are restricted to those localities. The mouths of some lagoons are often blocked, so they may dry up or be flooded by high tides or winter rains only irregularly. Sedimentation of the lagoons, accelerated by the development of their watersheds, is a serious problem. Restoration is expensive, but without it these irreplaceable habitats will only degrade further. The Tijuana River estuary is of prime importance because it, of all the county's wetlands, remains most nearly in its natural condition.

The lowland region inland from the coast is characterized by a series of marine terraces or mesas. Through time, streams cut canyons and valleys through the mesas. The result is a mosaic of habitats: riparian woodland or sycamore groves in the valleys, coastal sage scrub on south-facing slopes, denser chaparral on north-facing slopes, and sparser chaparral with scattered vernal pools on the few mesa tops that remain undeveloped. In some places soil conditions favor grassland rather than scrub. Extensive urban and agricultural development has altered or replaced much of this pattern.

Above about 1200 feet elevation the marine terraces and clay-dominated soils of the coastal lowland give way to the rugged topography of the Peninsular Range geological province. Here the soil is composed primarily of decomposed granite, and in many areas large granite boulders or outcroppings form a conspicuous feature of the landscape. In some areas, though, the base rocks are a metamorphic gabbro, which weathers into a deep red soil with few large rocks. Both granite and gabbro soils support chaparral, but the plants composing it differ substantially. The effect of the soil type on birds is less evident from the species composition of plants than from the lower, more open growth of shrubs on the gabbro soils, a condition that favors the Sage Sparrow. The foothills are separated by canyons and valleys. The flatter valley bottoms are vegetated with grasses (now overwhelmingly nonnative) and low herbaceous plants, while the narrower canyon bottoms and the margins of the valleys usually support a woodland of coast live oaks. In some places, such as near Santa Ysabel, oaks are scattered in grassland to form an oak savanna. The largest grassland in San Diego County is that in Warner Valley, from Lake Henshaw to Warner Springs and east nearly to Ranchita.

In some places above about 4000 feet elevation, temperature and rainfall permit the growth of coniferous trees. So distinct a combination of bird species inhabits coniferous woodland that the mountains supporting it may be considered a separate montane zone. This zone is broken into five ranges. Hot Springs Mountain (6533 feet) and Palomar Mountain (6140 feet), in northern San Diego County, support "islands" of coniferous woodland, isolated from other tracts of this habitat by expanses of chaparral and grassland. In central San Diego County, the Volcan (5719 feet), Cuyamaca (6512 feet), and Laguna (6378 feet) mountains are more intimately connected with each other. The montane woodlands of San Diego County are isolated from similar habitats both to the north in the San Jacinto and Santa Rosa mountains and to the south in Mexico's Sierra Juárez. The highest mountains of the Anza-Borrego Desert, the Santa Rosa Mountains (up to 6000 feet at the Riverside County line) and the Vallecito Mountains (5349 feet) support small stands of pinyon pines but few birds characteristic of more heavily forested mountains.

The eastern slopes of the mountains are steep and rocky. As they descend into the Colorado Desert, they open into broad alluvial fans or bajadas. Farther into the desert there are broad sandy washes, rocky hills, sandy valley floors, and dry lake beds. Another desert landform is found in the Borrego and Carrizo badlands, where the sedimentary substrate has been deeply carved by the rare heavy rains, producing a contorted land surface. The ground here is almost devoid of vegetation and in dry years the area supports very few birds. A few oases are scattered along the east base of the mountains and at Carrizo Marsh along Carrizo Creek near the Imperial County line.

CLIMATE

The ocean temperature off San Diego varies only from about 55° to 72° F. The ocean constrains variation in air temperature along the coast from an average low of about 45° F in winter to an average high of about 78° F in summer. Rainfall distinguishes the seasons more sharply than does temperature (Figure 6). Almost all rain falls from November to April; the months from May to October may be completely dry. Within the rainy season, precipitation is quite irregular. Long dry spells may occur even in February, on average the rainiest month. Often two or three stormy periods account for the bulk of the year's precipitation at San Diego, which averages 9.91 inches. Along the coast, average rainfall decreases from north to south (12.70 inches at Laguna Beach in southern Orange County; 9.28 inches at Chula Vista).

There is also great variation in rainfall from year to year, from a high of 25.97 inches at San Diego in 1883-1884 to a low of 3.01 inches in 2001-2002 (as measured from 1 July to 30 June). The San Diego County Bird Atlas' five-year term thus captured a wide range of variation in rainfall. As measured at Lindbergh Field:

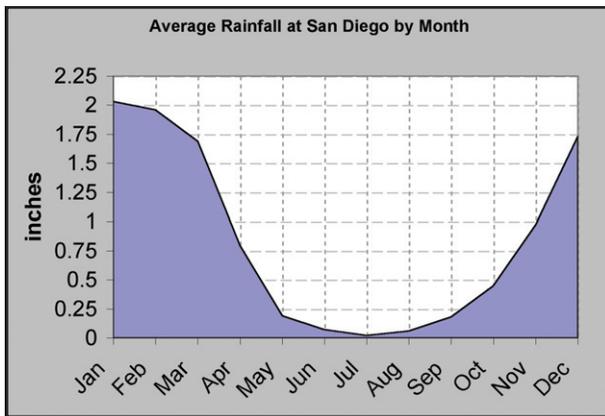


FIGURE 6. Average rainfall at San Diego by month, based on records maintained by the U.S. Weather Service.

1996-1997: 5.11 inches

1997-1998: 17.78 inches, eighth highest recorded since 1851

1998-1999: 6.72 inches

1999-2000: 5.78 inches

2000-2001: 8.61 inches

2001-2002: 3.01 inches, lowest since at least 1851

A relatively wet period that began in 1978 came to an abrupt end in 1998. These variations affect birds enormously. Breeding begins earlier and lasts later in wet years, and birds are able to spread into drier habitats than they can inhabit in dry years.

An outstanding feature of the dry season is the marine layer, the fog or low clouds that often cover the coast during the night and morning hours. This layer is caused by warm air being cooled over the colder ocean water, resulting in condensation. It has an appreciable local effect on bird migration since birds cannot use their celestial navigation when the sky is hidden, and the fog often obscures terrestrial landmarks as well. As a result, migrating land birds tend to concentrate along the coast if the fog is persistent. The fog may account for the absence or rarity of certain breeding birds like the Western Kingbird, Bullock's Oriole, and Lark Sparrow that are widespread and common except along the coastal strip.

Variation in temperature increases with distance from the coast. In the inland valleys summer highs average 88°

to 94° F. The rainfall regime in these areas is similar to that along the coast, but totals are higher, 12 to 20 inches annually, and summer thundershowers are possible.

The higher mountains are the coolest and most humid region of San Diego County. In winter freezing temperatures are the rule (lows average 28° to 32° F), and precipitation often falls as snow. Average annual precipitation is 20 to 34 inches. The severity of the dry season is relieved by occasional thundershowers.

The Anza-Borrego Desert lies in the rain shadow of the Peninsular Ranges, so precipitation is very sparse and irregular, with an annual average of only 6.09 inches at Borrego Springs and probably under 3 inches at the Imperial County line (average 2.6 inches in the Imperial Valley). Eastern San Diego County and western Imperial County make up one of the driest regions of the United States, second only to Death Valley.

VEGETATION

Plants and vegetation communities are so important to the distribution of so many birds that it is worthwhile to understand them in some detail (Figure 7). The following account is based primarily on the summary prepared for the earlier *Birds of San Diego County* by Thomas A. Oberbauer, one of the county's leading botanists.

Coastal strand vegetation grows on the beaches and sand dunes separating the bays, lagoons, and estuaries from the ocean. Its plants are small, herbaceous or succulent, often prostrate. They cover the ground sparsely, leaving wide areas of bare sand. The most common species are the exotic sea rocket (*Cakile maritima*) and the native beach evening primrose (*Camissonia cheiranthifolia*), beach bur (*Ambrosia chamissonis*), beach morning glory (*Calystegia soldanella*), and various rattleweeds (*Astragalus* sp.). The Snowy Plover, Least Tern, and Horned Lark are the only regular nesting birds, but the vegetation provides critical shade for the young chicks. The Killdeer, Black-bellied Plover, Least Sandpiper, American Pipit, Western Meadowlark, and House Finch visit to forage, and other shorebirds, gulls, and terns loaf on the strands.

Coastal wetlands that are at least occasionally flooded by the tides support salt marshes. The marshes' composition varies with how frequently they are inundated.

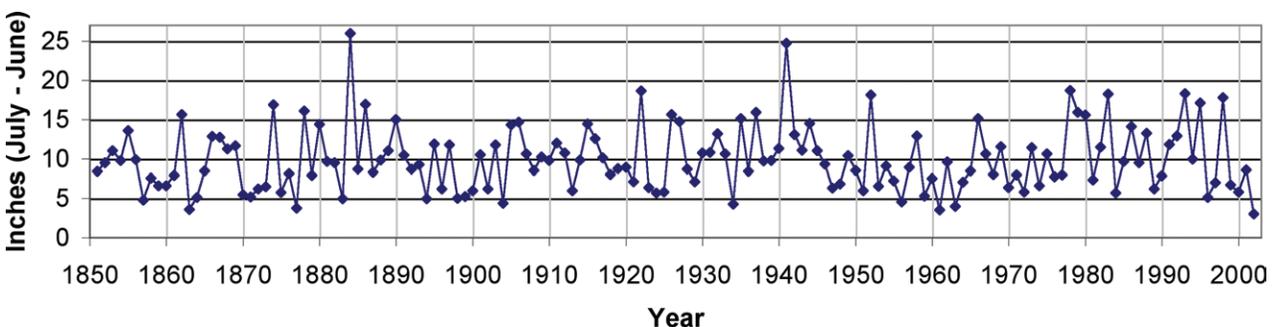


Figure 7. Annual rainfall at San Diego 1850-2002, based on records maintained by the U.S. Weather Service.

California cordgrass (*Spartina foliosa*) forms nearly pure stands in places covered by shallow water for long periods. On higher ground, flooded only by the highest tides or strong winter storms, the vegetation is dominated by low-growing succulents. Pickleweed (*Salicornia* spp.) is the most abundant plant; other common species are the alkali heath (*Frankenia salina*), fleshy jaumea (*Jaumea carnosa*), saltwort (*Batis maritima*), western marsh rosemary (*Limonium californicum*), saltgrass (*Distichlis spicata*), shoregrass (*Monanthochloe littoralis*), and dodder (*Cuscuta salina*). Among breeding birds, daily flooding of the habitat is challenged only by the Clapper Rail. In the higher zones of the marsh, the Mallard, Gadwall, Northern Harrier, Black-necked Stilt, American Avocet, Western Meadowlark, and Belding's Savannah Sparrow nest. The coastal salt marshes are essential to the Clapper Rail and Belding's Savannah Sparrow. They sustain the many herons, waterfowl, and shorebirds that forage in the coastal wetlands.

Freshwater marshes grow in shallow standing water or on perennially saturated ground. Their dominant plants are cattails (*Typha domingensis*, *T. latifolia*), bul-

rushes (*Scirpus* spp.), smartweed (*Polygonum* spp.), and dock (*Rumex* spp.). Their characteristic birds include the Least Bittern, Cinnamon Teal, Ruddy Duck, Virginia Rail, Common Gallinule or Moorhen, American Coot, Black Phoebe, Marsh Wren, Common Yellowthroat, Song Sparrow, and Red-winged and Tricolored Blackbirds. In an arid and rugged region like San Diego County, freshwater marshes are naturally small and scattered. Patches lie at the upper ends of Buena Vista, Agua Hedionda, Batiquitos, and San Elijo lagoons, where they are often mixed with saltmarsh plants. Small freshwater marshes grow around many lakes and ponds on the coastal slope. A surprising number lie on the Campo Plateau in arid southeastern San Diego County.

The upland vegetation community nearest the coast is the coastal sage scrub. It is found mainly on south-facing slopes below about 1500 feet elevation where the rainfall is under 15 inches per year. The plants of the coastal sage scrub are mostly shrubs 2 to 4 feet high. They cover most of the ground but leave enough openings that a person can walk through the scrub easily. Many of the shrubs are summer-deciduous in response to the long dry

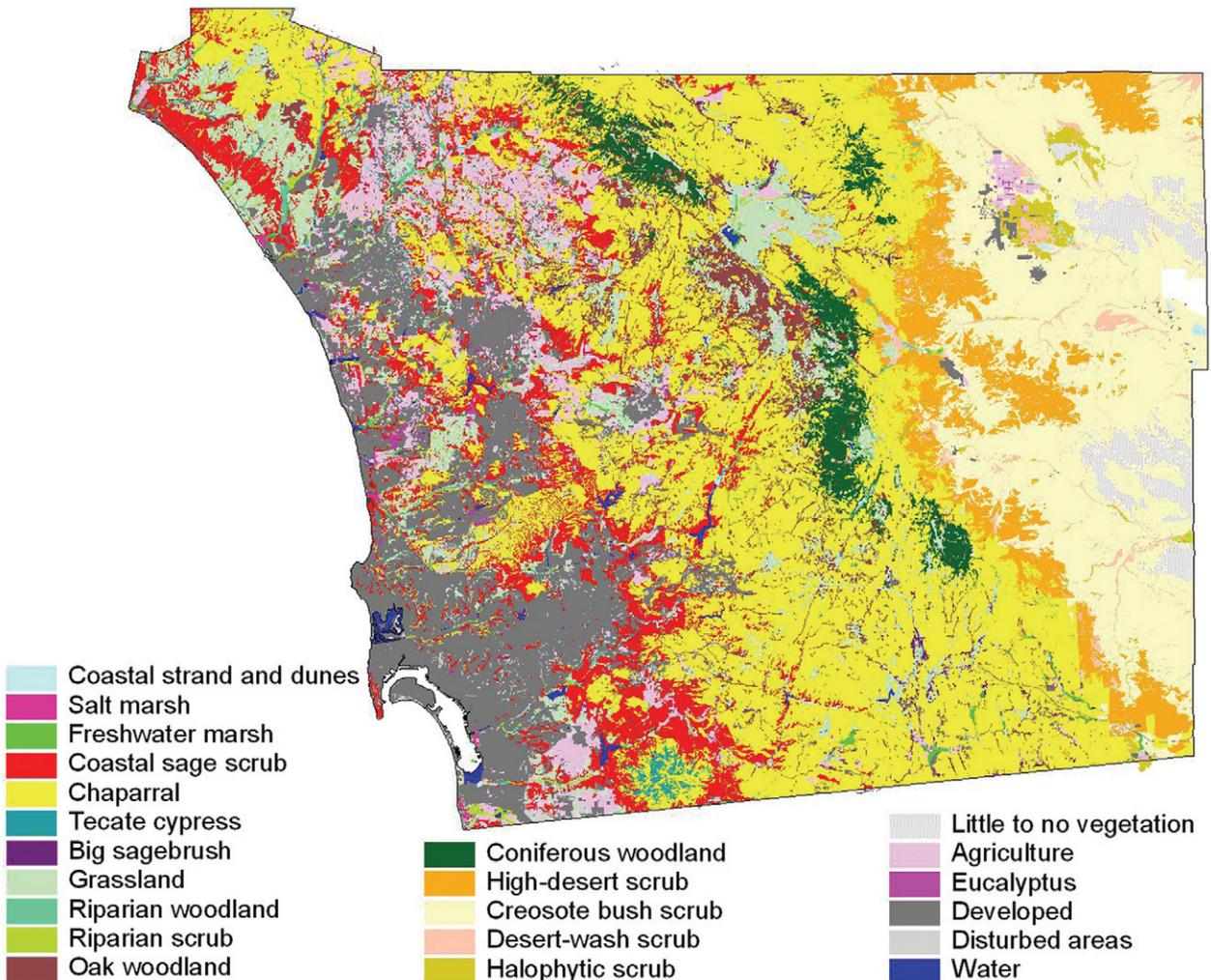


FIGURE 8. San Diego County vegetation, based on maps compiled by the U.S. Forest Service, Anza-Borrego Desert State Park, and the San Diego Association of Governments.

season. The dominant species are California sagebrush (*Artemisia californica*), flat-top buckwheat (*Eriogonum fasciculatum*), white sage (*Salvia apiana*), black sage (*S. mellifera*), lemonadeberry (*Rhus integrifolia*), and laurel sumac (*Malosma laurina*). The Greater Roadrunner, California Gnatcatcher, Rufous-crowned Sparrow, and subspecies *sandiegensis* of the Cactus Wren prefer this habitat, and some species of chaparral inhabit sage scrub as well. Most of San Diego County's original acreage of coastal sage scrub is now lost, converted to houses. Multiple-species conservation plans focus primarily on coastal sage scrub, but these still allow further loss, and the viability of the fragments that will remain is an open question.

Chaparral is the most widespread vegetation community in San Diego County, covering nearly 35% of the land surface. Chaparral is composed of shrubs with hard evergreen leaves and stiff woody stems. The shrubs grow generally 5 to 12 feet high and have such dense foliage that the habitat is almost impossible to walk through. Its composition varies greatly from region to region within the county, and the community can easily be subdivided into finer categories, but the birds are not much different among the various types of chaparral. The most abundant and widespread plant is chamise (*Adenostoma fasciculatum*). Among the many other chaparral components, manzanitas (*Xylococcus bicolor* and *Arctostaphylos* spp.), *Ceanothus* spp., toyon (*Heteromeles arbutifolia*), coast spicebush (*Cneoridium dumosum*), holly-leaf redberry (*Rhamnus ilicifolia*), *Yucca whipplei*, San Diego mountain mahogany (*Cercocarpus minutiflorus*), redshank (*Adenostoma sparsifolium*), and scrub oaks (*Quercus* spp.) are some of the important species. The California and Mountain Quail, Anna's Hummingbird, Western Scrub-Jay, Wrentit, Bewick's Wren, California Thrasher, Spotted and California Towhees, and Sage and Black-chinned Sparrows are prominent and characteristic breeding birds of chaparral. More reflected in the makeup of the birds of a tract of chaparral than the component plant species is the habitat's maturity—the time since it last burned. Chaparral and the animals inhabiting it are adapted to fire. Certain birds, like the Lazuli Bunting, Lawrence's Goldfinch, Lark Sparrow, and Costa's Hummingbird, move in the first year after a fire, when the habitat is dominated by herbaceous plants that proliferate while the ground is still largely bare. In the next couple of years, as the shrubs resprout, the semiopen chaparral is ideal for Rufous-crowned, Black-chinned, and Sage Sparrows. Within a few years of the fire, the shrubs crowd together, the species of the earlier seral stages drop out, and the birds differ little from those in old, dense chaparral.

Occurring largely as scattered patches in the chaparral, on flatter topography, are stands of the Great Basin or big sagebrush (*Artemisia tridentata*). Though this habitat resembles that in the Great Basin, in a different biogeographic region, in San Diego County the birds of these stands are basically a subset of those in chaparral.

Both the Sage and Black-chinned Sparrows use them. San Diego County's few breeding Brewer's Sparrows were found in this sagebrush.

Habitats dominated by low-growing herbaceous plants are grouped under the term grassland. In the lowlands and foothills, grasslands are composed largely of nonnative grasses such as wild oats (*Avena* spp.), red brome (*Bromus madritensis* ssp. *rubens*), soft chess (*B. hordeaceus*), ripgut grass (*B. diandrus*), hare barley (*Hordeum murinum* ssp. *leporinum*), and fescues (*Festuca* spp.), and herbaceous dicots such as filarees (*Erodium* spp.) and mustards (*Brassica* spp.). These species originating in the Mediterranean region had largely replaced the native grassland species before San Diego County was well explored ornithologically, so we have no way of knowing what effect this ecological calamity had on the native birds. Native perennial bunchgrasses (*Nassella* and *Achnatherum* spp.) are now uncommon and localized, persisting mainly where the soil is undisturbed. Patches of grassland habitat are scattered on rolling hillsides and valley floors. The largest tract in San Diego County lies in Warner Valley, the broad plain extending north and east of Lake Henshaw. In the higher mountains, moist meadows represent another grassland habitat. The plant species here, rushes (*Juncus* spp.) and sedges (*Carex* spp.), are different from those in grassland at lower elevations, but the birds are rather similar. Grassland has few breeding birds, principally the Horned Lark, Western Meadowlark, and Grasshopper Sparrow, but many other species that nest in trees or shrubs adjacent to or scattered in grassland depend on the grassland as foraging habitat. Quite a few nonbreeding visitors, especially birds of prey, seek grassland.

Riparian woodland covers barely one half of one percent of the county's area, yet is of major importance to birds. This vegetation community grows in strips along rivers in damp sandy soil. The dominant plants are willows (*Salix* spp.), cottonwoods (*Populus fremontii*, *P. trichocarpa*), western sycamore (*Platanus racemosa*), white alder (*Alnus rhombifolia*), and velvet ash (*Fraxinus velutina*). In addition to these canopy trees and large shrubs, dense undergrowth is an important part of the riparian community. Mulefat (*Baccharis salicifolia*), mugwort (*Artemisia douglasiana*), stinging nettle (*Urtica dioica* ssp. *holosericea*), California blackberry (*Rubus ursinus*), and wild grape (*Vitis girdiana*) are among the common riparian undergrowth plants. Riparian woodland is outstanding for its rich diversity of breeding birds. These include, among many others, the Green Heron, Downy and Nuttall's Woodpeckers, Willow and Western Flycatchers, Swainson's Thrush, Bell's Vireo, Orange-crowned and Yellow Warblers, Common Yellowthroat, Yellow-breasted Chat, Bullock's Oriole, Black-headed Grosbeak, American Goldfinch, and Song Sparrow. Much of the habitat has been destroyed for agriculture, residential and commercial developments, and flood-control, though the pace of this loss has been slowed

with regulations governing wetlands and the formal designation of the Least Bell's Vireo as an endangered species. Nevertheless, the damming of most streams has disrupted the cycle of flood and recovery that sustains riparian woodland. Exotic plants, especially the giant reed (*Arundo donax*), continue to proliferate in floodplains, displacing the native woodland.

Stream courses that do not have enough permanent water to support the full variety of riparian woodland often contain open groves of sycamore trees or riparian scrub. Riparian scrub is usually sparser than the jungles in riparian woodland, and mulefat is the most prominent plant. The blue elderberry (*Sambucus mexicana*) is also typical of riparian scrub and a food source for frugivorous birds like the Phainopepla. Most birds of riparian scrub, like the Lazuli Bunting, Lesser Goldfinch, and Lark Sparrow, are equally at home along the interface between riparian woodland and grassland. Sycamore trees are used heavily by large tree-nesting birds like the Red-tailed Hawk, Common Raven, and Great Horned Owl, by cavity-nesting species like the American Kestrel, Northern Flicker, and Ash-throated Flycatcher, and by the Black-chinned Hummingbird, which typically builds its nest with the fuzz from sycamore leaves.

In canyon bottoms, on north-facing slopes, and around the edges of valleys, groves of live oaks form another major habitat. Coast live oak (*Quercus agrifolia*) is the dominant species, but the Engelmann oak (*Q. engelmannii*) is widespread in the foothills, the canyon live oak (*Q. chrysolepis*) in the mountains. Undergrowth plants common in oak woodland are poison oak (*Toxicodendron diversilobum*), skunkbrush or pubescent basketbush (*Rhus trilobata*), currants and gooseberries (*Ribes* spp.), and creeping snowberry (*Symphoricarpos mollis*). In many places oak woodland is mixed with or adjacent to riparian woodland, but oaks do not grow along the coast. The Western Screech-Owl, Acorn and Nuttall's Woodpeckers, Western Wood-Pewee, Western Scrub-Jay, Oak Titmouse, House Wren, Western Bluebird, Hutton's Vireo, and Black-headed Grosbeak are some of the typical breeding birds of this vegetation community. Sparse woodland or savanna of the Engelmann oak grows in some parts of the foothill zone that have hot summers but receive over 17 inches of rain per year. Originally, the ground cover was white sage (*Salvia apiana*), but over two centuries of cattle grazing have resulted in its replacement in most places by the introduced grasses. Most of the birds that inhabit broken woodland or woodland edges show no special preference among deciduous trees, live oaks, or conifers.

In San Diego County, coniferous woodland is largely restricted to the higher mountains in places that receive over 18 inches of rain per year. Besides the conifers, the deciduous California black oak (*Quercus kelloggii*) and canyon live oak are also important members of this community. The composition of the coniferous woodland varies with humidity and exposure. In drier, flatter areas, the trees are more widely spaced, there is little ground

cover, and Jeffrey (*Pinus jeffreyi*) and Coulter (*P. coulteri*) pines dominate. In more humid, steeper areas, incense cedar (*Calocedrus decurrens*), white fir (*Abies concolor*), sugar pine (*P. lambertiana*; Cuyamaca and Hot Springs mountains only), and big-cone Douglas fir (*Pseudotsuga menziesii*; Palomar and Volcan mountains only) also grow. Characteristic breeding birds of this habitat include the Band-tailed Pigeon, Northern Saw-whet Owl, Hairy and White-headed Woodpeckers, Olive-sided Flycatcher, Violet-green Swallow, Steller's Jay, Mountain Chickadee, White-breasted and Pygmy Nuthatches, Brown Creeper, American Robin, Western Tanager, Purple Finch, and Dark-eyed Junco. Most of the species of oak woodland also occur in these coniferous woodlands.

On the east side of the mountain crests, the chamise-dominated chaparral abruptly gives way to a high-desert scrub. This varied habitat includes some components of the chaparral to the west and the creosote bush scrub to the east as well as several distinctive plants. The most prominent of these are the California juniper (*Juniperus californica*), the Mojave yucca (*Yucca schidigera*), and the yucca-like *Nolina bigelovii*; also common are the turpentine broom (*Thamnosma montana*), desert apricot (*Prunus fremontii*), lotebush (*Ziziphus parryi*), sugarbush (*Rhus ovata*), catclaw acacia (*Acacia greggii*), blackbush (*Coleogyne ramosissima*), and desert scrub oak (*Quercus cornelius-mulleri*). Also mapped as part of this community is the vegetation of the higher outlying mountains of the Anza-Borrego Desert, the Santa Rosa and Vallecito mountains. In those mountains grow stands of pinyon pines (*Pinus monophylla* and *P. quadrifolia*), but the stands are not large enough to support many birds different from those in high-desert scrub without the pinyons. The Mountain Quail, Ladder-backed Woodpecker, Western Scrub-Jay, Bushtit, Bewick's and Rock Wrens, California Towhee, Black-throated Sparrow, and Scott's Oriole are characteristic birds of this habitat.

Most of the Anza-Borrego Desert, in fact, about 16% of the entire area of San Diego County, is covered with a sparse scrub in which the creosote bush (*Larrea tridentata*) is the most common shrub. This creosote bush scrub community covers the most arid regions of San Diego County, and the density of plants is much lower than in other vegetation types. Other important desert plants include the ocotillo (*Fouquieria splendens*), brittlebush (*Encelia farinosa*), jumping or teddy-bear cholla (*Opuntia bigelovii*), barrel cactus (*Ferocactus acanthodes*), and burrobush or white bursage (*Ambrosia dumosa*), desert agave (*Agave deserti*), and desert lavender (*Hyptis emoryi*). The abundance of birds in this habitat varies greatly with rainfall; after several dry years it is very low. The Lesser Nighthawk, Costa's Hummingbird, Loggerhead Shrike, Cactus Wren, Black-tailed Gnatcatcher, House Finch, and Black-throated Sparrow are the most typical birds here.

Desert washes are able to support denser stands of shrubs and small trees up to 15 feet tall. The most common plants are the cheesebush (*Hymenoclea salsola*),

catclaw acacia (*Acacia greggii*), smoketree (*Psorothamnus spinosus*), ironwood (*Olneya tesota*), mesquite (*Prosopis glandulosa*, *P. pubescens*), blue paloverde (*Cercidium floridum*), and desert "willow" (*Chilopsis linearis*). The mesquite bosque in the floor of the Borrego Valley (G25/G26), a habitat unique in San Diego County, is also mapped as part of this desert-wash scrub. Characteristic birds of desert-wash scrub include those of the creosote bush scrub plus the California and Gambel's Quail, White-winged and Mourning Doves, Northern Mockingbird, Bewick's Wren, Verdin, and Phainopepla. The Borrego Valley's mesquite bosque is San Diego County's only site for the Crissal Thrasher and Lucy's Warbler. Native California fan palms (*Washingtonia filifera*) grow at oases in a few canyons draining into the desert; these appear on the vegetation map as riparian woodland.

On the desert floor where drainage is poor, mainly on the floors of Borrego and Clark valleys, a scrub of salt-tolerant shrubs grows. These are plants of the family Chenopodiaceae: the iodine bush (*Allenrolfea occidentalis*), bush seepweed (*Suaeda moquinii*), and various salt-bushes (*Atriplex* spp.). Bird diversity in this habitat is very low, especially in the breeding season. But this is prime habitat for LeConte's Thrasher. In winter, the Vesper, Brewer's, and pale migratory subspecies (*nevadensis*) of the Sage Sparrow invade.

Faced with land prices rocketing upward, agriculture is on the retreat in San Diego County. Nevertheless, it remains a billion-dollar business here, sustained mainly by avocados, citrus fruits, cut flowers, and nursery stock. Eggs, milk, and beef cattle remain important agricultural products, but pastures and rangeland are mapped here as grassland. Orchards are used by a limited variety of birds,

such as the Northern Mockingbird, House Finch, and Lark and Chipping Sparrows. The Dark-eyed Junco may be starting to colonize.

Urban development offers suitable, even preferred, habitats for some birds. Because of cultural attitudes, historical accidents, and climate, certain exotic plants useful to birds are a common feature of the urban environment. Eucalyptus trees offer nest sites to birds of prey, kingbirds, and the Western Flycatcher. Flowering eucalyptus trees as well as many others offer nectar to hummingbirds and passerines. Native birds are quickly learning to feed on the lerp psyllid (*Glycaspis brimblecombei*), an insect pest of eucalyptus trees that first appeared in southern California in the 1990s. Many horticultural plants bear berries that sustain frugivorous birds such as the Northern Mockingbird, American Robin, and Cedar Waxwing. The crevices among the leaf bases of the Canary Island date palm (*Phoenix canariensis*) are nest sites for birds that originally used cavities in trunks or branches. Fan palms (*Washingtonia* spp.), used for nest material and placement, are the main reason for the Hooded Oriole establishing itself as a common urban bird. The density of urban trees has reached the point where some woodland birds, the Cooper's Hawk, Nuttall's Woodpecker, House Wren, Western Bluebird, and above all the American Crow are moving into the cities. Other native birds that have adapted well to the suburban landscape include the Bushtit, Western Scrub-Jay, Mourning Dove, Lesser Goldfinch, Anna's Hummingbird, and House Finch. One study, based on a single 8-minute count per site, reported significantly greater numbers of the last three species, plus the mockingbird, along the urban fringe than in larger stands of native habitat (Bolger et al. 1997).