

Appendix F

A GUIDE TO PLACER COUNTY ECOLOGICAL ZONES

A GUIDE TO AQUATIC AND WETLAND HABITATS - Peter F. Brussard (7/7/99)

INTRODUCTION

Aquatic and wetland habitats in Placer County include riverine (rivers or streams), lacustrine (lakes and ponds), and fresh emergent wetlands. Riverine, or lotic, habitats are characterized by intermittent or continually running water, while lacustrine (lentic) habitats are the water contained in inland depressions or dammed riverine channels. Riverine habitats range from small, headwater streams to major rivers; lacustrine habitats vary from small ponds to large lakes and reservoirs. Vernal pools are technically lacustrine habitats, but because of their conservation importance in Placer County they are treated separately. Fresh emergent wetlands (FEWs) may occur in association with various terrestrial habitats or with riverine or lacustrine habitats. FEWs range in size from small patches to areas covering several square miles. The boundary between wetland and upland habitats is generally considered to be the boundary between hydric and non-hydric soils. The boundary between wetlands and lacustrine or riverine habitats is the deep water edge of the emergent vegetation, about 6.6 feet in depth.

DISTRIBUTION

These habitats are found throughout California and Placer County. Lacustrine habitats can be found at virtually all elevations, but riverine and FEW habitats are more common below 7500-8000 feet. An enormous acreage of FEWs once occurred in the Sacramento Valley, but most of this was drained and converted to agriculture.

VEGETATION

Riverine habitats can be subdivided into an open water zone (depth greater than 6.6 feet), a submerged zone between open water and the shore, and the shore. Small streams may not have an open water zone. If the current is slow enough, rooted vegetation may occur in the submerged zone. If vegetation on the shore has a canopy cover of greater than 10% it is considered to be riparian habitat.

Lacustrine habitats also show zonation. The limnetic, or open water zone, extends from the deepest part to the depth of effective light penetration. The littoral zone is shallow enough to permit light penetration and occurs at the edges of lakes and throughout most ponds. Rooted aquatic plants can occur in this zone. The shoreline zone borders on the water; if it has more than 2% vegetative cover it is classified as riparian.

Fresh Emergent Wetlands are characterized by saturated or periodically flooded soils that support some combination of rushes, sedges, nutgrass, saltgrass, cattail, bulrush, and arrowhead. Vegetation may be distributed as concentric zones that follow basin contours and reflect the relative depth and duration of flooding, or if the bottom of the wetland is very uneven, the vegetation zones may be patchy rather than concentric.

FISHES AND WILDLIFE

Fresh Emergent Wetlands are among the most productive wildlife habitats in California. They provide food, cover, and water for more than 160 species of birds and numerous mammals, reptiles, and amphibians. Many species rely on this habitat type for their entire life cycle. Lacustrine habitats are used by 18 mammals, 101 birds, 9 reptiles, and 22 amphibians for reproduction, food, cover, and water. This represents about 23% of the terrestrial vertebrates in California. The open water zone of large rivers provides resting and escape cover for many species of waterfowl, and many fish-eating birds forage there. Near-shore waters and shoreline provide habitat for numerous fish-eating and insectivorous birds and mammals.

Several Placer County species of particular interest, the Central Valley steelhead, chinook salmon, Sacramento splittail, and foothill yellow-legged frog, are completely dependent on healthy riverine habitats. Tahoe yellow-cress is confined to the shoreline zone of Lake Tahoe. The giant garter snake and the California black rail use FEWs almost exclusively. Lahontan cutthroat trout, mountain yellow-legged frog, and bald eagle use both riverine and lacustrine habitats, and the California red-legged frog and the Peregrine falcon use those habitats plus fresh emergent wetlands.

CONSERVATION AND MANAGEMENT

In California, where a large and growing human population competes with aquatic organisms for limited supplies of fresh water, amphibian populations are declining precipitously, and 77 of the 115 native fish species are either extinct or in danger of extinction within the next 50 years. The situation with other aquatic organisms is presumably just as bad or worse, but their status is poorly known. The acreage of fresh emergent wetlands in California has decreased dramatically since the turn of the century due to drainage and conversion to other uses, primarily agriculture. Clearly, virtually all aquatic and wetland habitats in the state are in need of major conservation actions.

Necessary management actions for aquatic and wetland conservation include (1) organizing management by watershed boundaries, not by administrative units or political borders; (2) restoring natural hydrologic regimes, including low and high flow events; (3) reconnecting rivers to their floodplains by de-channelization and other means; (4) restoring and managing riparian areas properly; (5) reducing or eliminating populations of non-native fishes, amphibians, invertebrates, and plants; (6) controlling water quality by decreasing nutrient and toxin loading and sedimentation; and (7) and educating people on the economic, aesthetic, and other values of properly functioning ecosystems.

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A GUIDE TO VALLEY GRASSLAND HABITATS - Peter F. Brussard (7/7/99)**INTRODUCTION**

Prior to European settlement, the Valley Grassland ecosystem was most likely a bunchgrass prairie with native annual grasses and forbs filling the interspaces between the bunchgrasses. Unfortunately, no detailed descriptions of the original community, other than “excellent pasture,” exist. However, botanists are fairly certain that the dominant bunchgrass was *Stipa pulchra*, purple needlegrass.

Permanent alterations to the original ecosystem began when Europeans first reached the Americas. First, seeds of alien plant species, including scores of annual grasses, arrived in packing material, hay, and debris from Spain, and once these species became locally established, they were widely distributed throughout California by birds, mammals, and human activity. Second, domestic livestock shifted the timing and extent of grazing. Although the original bunchgrass prairie supported large numbers of native grazing ungulates, they tended to be seasonal residents. Livestock were maintained in the grasslands throughout the year and in increasingly large numbers during the gold rush period and afterward. Yearlong, heavy grazing favored the introduced annual grasses at the expense of the native perennial bunchgrasses. Third, large-scale cultivation which began in the Valley Grassland ecosystem during the latter half of the 19th century also has contributed to the replacement of the original prairie. Abandoned farmland came back as annual grassland rather than as the original community. Fourth, changes in the fire regime also may have favored annual grasses.

DISTRIBUTION

Valley Grassland occurs as a ring around the Central Valley from sea level to about 3900 feet. It also forms the understory for oak woodland communities. It borders on Valley Foothill Riparian, Fresh Emergent Wetland, Cropland, Orchard-Vineyard, and Pasture habitats at lower elevations and merges into woodland and chaparral habitats in the foothills.

VEGETATION

The Valley Grassland ecosystem now consists of a wide mixture of species, mostly introduced, annuals. Grasses include wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue, and forbs include filaree, mullein, clovers, and many others. The boundaries of this ecosystem are probably little different from the original perennial prairie. A few small remnants of the original ecosystem still exist, and most of the original perennial species can still be found as scattered individuals throughout the ecosystem.

The annual plants begin to germinate in the fall with the first good rains, grow slowly through the winter, grow rapidly in the spring, and mature between late April and June. A few warm-season annuals may reach their peak growth in summer. Since soil water deficits characterize this ecosystem for 4-8 months every year, most of the vegetation lives through the dry season in the seed stage.

WILDLIFE

The original Valley Grassland ecosystem supported large numbers of pronghorn, deer, tule elk, jackrabbits and rodents. As European man and his domestic animals rapidly increased in numbers in the 1850s, the larger wild animals diminished, but the smaller ones remained numerous. The Valley Grassland ecosystem is still habitat for numerous native reptiles, birds, and mammals. Placer County species of particular interest include the California tiger salamander, Swainson's hawk, the burrowing owl, and the mountain plover (if it occurs in the county at all).

CONSERVATION AND MANAGEMENT

Valley Grassland ecosystems continue to disappear under agricultural, residential, and industrial development, so their conservation should be an important goal for Placer Legacy. This dovetails well with open space conservation for agriculture, since these grasslands need to be managed as grazing systems. In the absence of livestock, annual grassland habitats often become dominated by tall, dense stands of grasses such as ripgut brome and wild oats that are not used by many wildlife species. In fact, annual grasslands can withstand fairly heavy livestock use with little soil erosion, high productivity, and little change in floristic composition. The introduced grasses are now permanent members of the ecosystem, and their elimination is inconceivable. Thus, they should be thought of as naturalized plant species rather than as invading species characteristic of rangeland in poor condition.

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A GUIDE TO OAK WOODLAND HABITATS - Peter F. Brussard (7/7/99)

INTRODUCTION

“Oak woodland” is a zone of oak-dominated communities growing between open grassland and montane forest or chaparral. The dominant trees are deciduous oaks, *Quercus lobata* (valley oak), and *Quercus douglasii* (blue oak). At higher elevations, foothill (digger) pine, *Pinus sabiniana*, becomes an important component in these communities. The lower elevational border of oak woodland is well defined by the absence of oak trees and the appearance of true grassland. The upper border, where an increasingly dense woodland becomes forest, is more difficult to define. Relict forest trees well within the present woodland zone and eroded forest soils that are now supporting woodland suggest that the upper border may have moved upward after destructive logging and severe burning of the lowest elevation forests occurred.

Ground cover in oak woodlands is now dominated by introduced annual grasses and forbs. Understory shrubs are few and concentrated on shallower soils.

Since European settlement, oak woodlands have been managed primarily for livestock production, and over 80% are in private ownership. Historically, losses of oak woodlands occurred because of clearing for range improvements and agriculture; the major losses now are from intensive residential and industrial development. Poor oak recruitment and regeneration is a major problem in many areas.

In addition to their value as rangeland, oak woodlands are important wildlife habitat, and they provide public recreation and aesthetics. Since virtually all of the state’s water flows through or is impounded in the oak woodland belt, these communities are also very important to water quantity and quality. .

DISTRIBUTION

Oak woodlands occur in the Great Valley and Sierra Nevada Foothills subregions as a 20 to 30 mile wide belt ranging from nearly sea level to about 4500 feet in elevation.

VEGETATION

Oak woodland is conventionally divided into three different community types, valley oak woodland, blue oak woodland, and blue oak-foothill pine woodland.

Valley oak woodland. On deep, well-drained alluvial soils, usually in valley bottoms, valley oak forms nearly pure, parklike stands of large trees (mature valley oaks range in height from 50-115 feet). A few live oaks (*Q. wislizenii*, interior live oak) may be mixed in. These stands blend into riparian forests (Valley Oak type of Valley Foothill Riparian) along stream courses and on active floodplains. The understory of valley oak woodland consists of a carpet of introduced annual grasses and forbs, and the shrub layer, if present, contains bird-dispersed species such as poison oak, toyon, and coffeeberry. At lower elevations, valley oak woodlands merge with annual grasslands or border on agricultural land. In the foothills they intergrade with blue oak woodland or blue oak-digger pine woodland.

Blue oak woodland. Blue oaks are relatively slow-growing, long-lived trees that can reach 80 feet in height. On shallower, well-drained upland soils, they form savanna-like stands on dry ridges and gentle slopes. Interior live oak and valley oak also may be present where the soils are deeper. The shrub layer in these communities is rarely extensive, often occurring only on rock outcrops. Shrubs include poison oak, coffeeberry, buckbrush, California buckeye, and several species of manzanita. The understory is typically composed of annual grassland species such as brome grass, wild oats, foxtail, and fiddleneck. Blue oak woodland intergrades with annual grasslands or valley oak woodland at lower elevations and blue oak-foothill pine woodlands at higher elevations. Blue oaks are well adapted to dry, hilly terrain where the water table is usually unavailable, and they have an unusual tolerance for severe drought, shedding their leaves under extreme moisture stress.

Blue oak-foothill pine woodland. This community differs from blue oak woodland in having conifer and shrub components. Blue oak and foothill pine typically comprise the overstory, with blue oak the most abundant species. Interior live oak and California buckeye are typical associates. The shrub layer is patchy and includes several species of manzanita, ceanothus, redberry, coffeeberry, poison oak, California yerba-santa, and California redbud. The understory consists of annual grasses and forbs. At lower elevations these woodlands merge with annual grassland, blue oak woodland, and valley oak woodland. At higher elevations, tree and shrub density and the number of evergreens increases until this community merges with mixed chaparral or forest types.

WILDLIFE

Oak woodlands are one of the richest wildlife habitats in California, with over 300 vertebrate species relying on them for feeding, cover, or nesting sites during all or some part of the year. The California tiger salamander, Swainson's hawk, and the Truckee barberry are Placer County species of particular interest that are found in oak woodlands.

CONSERVATION AND MANAGEMENT

Oak woodlands have decreased by over 1,000,000 acres during the last 50 years because of agricultural, residential, and industrial development. Moreover, in many places, blue and valley oaks have reproduced poorly during this time period. Even when germination occurs, seedling survival usually fails.

Valley oak regeneration. The failure of valley oak regeneration seems to be related to competition for soil nutrients and moisture between oak seedlings and introduced annuals, consumption of acorns and seedlings by wild and domestic animals, and flood control projects. Valley oaks are tolerant of flooding while other components of the community that are potential predators or competitors are not.

Blue oak regeneration. Poor blue oak regeneration also is related to competition for soil moisture from introduced annual grasses and the consumption of acorns and seedlings by insects, domestic livestock, and wildlife. Blue oak is somewhat shade-intolerant, and disturbances producing openings in the canopy may be necessary for seedling growth and survival.

Livestock and wildlife relationships. Some ecologists think that the lack of regeneration in oak woodlands can be explained by the consumption of acorns and seedlings by cattle. However, the cessation of livestock grazing does not generally result in oak regeneration because wildlife and

insects also cause heavy damage to acorns and seedlings. Populations of deer and many other species of mammals and birds that eat acorns and young oaks are probably more abundant now than in the past because of land use changes and predator control. However, some of these species have positive effects on oak regeneration; acorns buried by scrub jays, yellow-billed magpies, western gray squirrels, and California ground squirrels are more likely to germinate because they root better and are less likely to be eaten.

Fire. Frequent fires historically occurred in oak woodlands, and fire control has affected regeneration negatively in both valley and blue oaks. Young trees of both species will sprout when fire damaged, but older trees will not. Thus, frequent fires tend to maintain oak stands of younger age classes, but a century of fire control has resulted in the predominance of older trees. When these stands eventually burn, they do not regenerate themselves. Furthermore, the absence of frequent, non-catastrophic ground fires encourages the invasion of evergreen oaks, and their seedlings seem to be more browse resistant than those of deciduous oaks.

Conservation management. Active management of blue oak woodlands has increased regeneration in some areas. Recruitment enhancement techniques include reducing the intensity and duration of browsing pressure on woody vegetation, using fire to manipulate the understory, creating gaps in the canopy, and minimizing livestock use until regenerating blue oak saplings are taller than the browse level. For maintaining biodiversity in oak woodlands it is also necessary to conserve important habitat elements such as snags and downed wood.

Oak woodlands also present a substantial management challenge at the landscape scale; fragmentation and increasing interface with urban areas pose major threats to their biodiversity. The former results in the isolation of small, extinction-prone populations, and the latter brings household pets, humans, and fire suppression policies in contact with these habitats. Encouraging cluster development and conserving connecting corridors between oak woodlands can help reduce these threats.

Oak woodlands offer an excellent opportunity for adaptive management to (1) identify the appropriate combination of disturbance, acorn supply, spring precipitation, and predator pressure that leads to successful regeneration, (2) determine the types and densities of key habitat elements necessary to maintain biodiversity at the stand scale, and (3) establish the spatial arrangement of oak woodland patches and types of connectivity among them that best conserves their biodiversity at the landscape scale.

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A GUIDE TO VERNAL POOL HABITATS - Peter F. Brussard (7/7/99)**INTRODUCTION**

Vernal pools or “hogwallows” are seasonal wetlands that form in shallow depressions of various sizes at sites where soils contain an impermeable layer such as caliche, claypan, hardpan, or some other material that produces a perched water table. The depressions fill during winter rains and dry out completely by spring or summer. Vernal pools have been a part of the California landscape for at least ten thousand years judging from the number of endemic species restricted to this habitat.

There are two types of vernal pools in Placer County. Northern volcanic mudflow vernal pools occur on Tertiary volcanic mudflows called lahars. These are usually small pools, forming in irregular depressions in gently sloping surfaces. In the foothills of the Sierra Nevada this type of pool is found primarily on the Merhten Formation. A second type, northern hardpan vernal pools occur on acidic soils on old alluvial fans ringing the Central Valley.

DISTRIBUTION

In the western United States, vernal pools are found from southern Oregon into northern Baja California. In California they are found on lower coastal mountain terraces from Sonoma County south to San Diego County and in the Central Valley from Shasta County south to Kern County. In Placer County, vernal pools are most common in the Valley Grassland ecosystem, but they also occur in Blue Oak Woodland. Pools tend to be clustered in archipelagos in localities where the proper conditions for their formation occur.

VEGETATION

California vernal pool vegetation is characterized by a high proportion of plants that are endemic or regionally restricted to that habitat, and several genera show evidence of recent adaptive radiation. A recent study listed 101 plant species known to occur in vernal pools; more than 70% are native annuals; introduced species comprise less than 7% of this flora. Unlike the surrounding grassland, vernal pools have resisted invasions well.

The vegetation in vernal pools is arranged concentrically. The first zone corresponds to the pool bottom, the second occurs around the pool margin, and a third zone is on higher ground and supports typical annual grassland species. Because of winter flooding there is a sharp boundary between the grassland and the pool zones. Plant cover in the grassland zone may exceed 100%, while most pools have a characteristically low total cover, frequently less than 15-30%. Species richness is highest in the marginal zone, slightly lower in the grassland zone, and considerably lower in the pool.

The number of species within an individual pool (alpha diversity) is usually low and is related to pool area, pool depth, and the amount of bare ground. However, the number of species among pools in an archipelago (beta diversity) is quite high. Thus, typical vernal pool plants are characterized by highly subdivided populations with low genetically effective sizes and low dispersability.

WILDLIFE

A few vertebrates such as salamanders and spadefoot toads use vernal pools for breeding, but the vast majority of the pool fauna consists of invertebrates. Most are widespread species, but a few are endemic. The invertebrate fauna of vernal pools is not well studied, and it is likely that further work will result in the description of additional endemic species. Placer County species of particular interest that are found in vernal pools are two invertebrates, the vernal pool fairy shrimp and the vernal pool tadpole shrimp, one vertebrate, the California tiger salamander, and one plant, the Boggs Lake hedge-hyssop.

CONSERVATION AND MANAGEMENT

Prior to the 1950s the primary threats to vernal pools were grazing, water impoundments, and conversion to agriculture. More recently, urbanization, industrial development, and infrastructure construction have resulted in losses as high as 97 percent. The few remaining pools have been damaged or disturbed, and they continue to face a variety of threats including livestock grazing, off-highway vehicle use, watershed alteration, and trash dumping. Conservation efforts have been slow to develop because these small, ephemeral ecosystems are easily overlooked, especially during the dry season, and few people consider them important.

Conservation efforts must focus on archipelagos of vernal pools; fencing off a single pool surrounded by development is not an effective strategy. Furthermore, because of the complexity of vernal pool habitats and their associated watersheds, strategies for their conservation must include the surrounding environment. In particular, adequate habitat for the pollinators of the vernal pool flora must be included.

Conservation strategies include fencing for the protection of pool archipelagos, elimination of artificial drainages that alter pool hydrology, and creation of new pools using a variety of impervious substrates followed by inoculation with topsoil salvaged from other pools or with seeds of selected species. The results of vernal pool restoration are mixed, ranging from qualified successes to dismal failures. The lack of detailed knowledge of the physical and biological attributes of natural reference pools makes the evaluation of restoration success quite difficult.

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A GUIDE TO SIERRA NEVADA HABITATS - Peter F. Brussard

The final habitats that the Biodiversity Working Group will consider are those found in the middle and eastern parts of the county in the Sierra Nevada Foothills and Sierra Nevada ecological subregions. In many respects, these are the most important habitat types in the county. Most of them are forests, which are fundamental to sustainability. Not only do forests provide commercial timber, fuel, and many non-wood products, but they also provide invaluable environmental services. They protect watersheds and thus regulate the quantity and quality of water flows. They protect soils with their moisture and nutrients. They modulate climate at local and regional levels through regulation of precipitation and albedo, and they help to slow global warming by virtue of being carbon sinks. These forest habitats also are home to a number of species of particular interest, including the bald eagle, northern goshawk, California spotted owl, Sierra Nevada red fox, California wolverine, and Truckee barberry. Thus, the conservation of large, continuous blocks of these habitat types, especially late successional-old growth (LSOG) stands, is especially important for biodiversity conservation and sustainable development in Placer County.

The distribution of many of these Sierra Nevada habitat types is determined primarily by elevation and exposure. On a regional scale this results in a series of major habitat belts that run lengthwise along the Sierra. These are the foothill woodland-chaparral belt, the east-side and west-side yellow pine belts, the lodgepole pine-red fir belt, the subalpine belt, and the alpine belt. Most of these belts can be further subdivided into habitat types, the distribution of which within or among belts is determined by elevation and exposure, topography, soils, and past disturbance. *Zonal habitat types* develop within certain elevational boundaries on well-drained sites with moderate slope and well-developed soils. *Intrazonal habitat types* occur within or are interspersed with zonal habitats in places that have poor drainage, steep slopes, or peculiar soils. *Azonal habitat types*, such as riparian zones and wet meadows, develop wherever the right conditions occur at any elevation. Most of the habitat types that follow represent a so-called *climax* state--the vegetation that eventually appears at a site after recovery from a major disturbance such as fire or logging. The major exception is montane chaparral, which is often a seral, or intermediate, stage in the development of the climax vegetation at a site.

ZONAL AND INTRAZONAL HABITAT TYPES

Foothill woodland/chaparral belt (900'-5,600')

Foothill woodland/chaparral belt habitats include valley oak woodland, blue oak woodland, blue oak-digger pine woodland, chamise-redshank chaparral, and mixed chaparral habitat types. The first three have been covered previously.

Chamise-redshank chaparral. This habitat type consists of nearly pure stands of chamise or redshank or a mixture of both species. It generally occurs below and intergrades into mixed chaparral. Fire occurs regularly in this habitat type, and annuals, perennial herbs, and subshrubs dominate for several years after a fire. As the habitat matures, shrub cover increases and herbaceous cover declines. The primary land management consideration in this habitat type is fire; long-term fire suppression can lead to stand senescence and declines in deer, small mammals, birds, and reptiles.

Mixed chaparral. Mixed chaparral is a brushland habitat type dominated by shrubs with thick, stiff, heavily cutinized, evergreen leaves. It is floristically rich, supporting a high diversity of woody plants. Compared to chamise-redshank chaparral, mixed chaparral generally occupies more mesic (wetter) sites at higher elevations or on north-facing slopes. At upper elevations it grades

into ponderosa pine or mixed conifer types and frequently forms the understory of these habitats. Fire is a major factor in this habitat type, and many of its constituent species sprout from root crowns after fires. No wildlife species are confined to mixed chaparral, and, as in chamise-redshank chaparral, management usually focuses on selecting alternative fire management regimes.

Westside yellow pine belt (2,600'-7,900')

Ponderosa pine. In Placer County, ponderosa pine stands occur above oak woodland and montane hardwood habitats and below Sierran mixed conifer. Prior to European settlement, LSOG stands of ponderosa pine were parklike, with widely-spaced, large trees and very little understory. Periodic ground fires maintained this condition. Under fire suppression, shrubs and shade-tolerant conifers such as white fir grow to form a dense understory under the ponderosa pines. This understory usually ladders fire into the tree crowns, resulting in intense, stand-replacing burns that also threaten life and property.

Sierran mixed-conifer. This habitat type is an assemblage of conifer and hardwood species that forms a multilayered forest. Burning and logging have caused a wide variability in stand structure and composition. Dominant trees are ponderosa pine, sugar pine, Douglas fir, incense cedar, white fir, and California black oak. Because of fire control, white fir is almost ubiquitous in the understory. The mixed conifer forest supports a large number of wildlife species including several Placer County species of particular interest. A grove of giant sequoia is a striking associate of this habitat type in Placer County as well.

Montane hardwood-conifer. This habitat type is interspersed with ponderosa pine and Sierran mixed-conifer habitats and often occurs on coarse, well-drained soils as a mosaic of pure stands of conifers interspersed with pure stands of broad-leaved trees. The canopy is often dense and bi-layered with little understory. Common tree species include ponderosa pine, Douglas fir, California black oak, incense cedar, white alder, dogwood, and bigleaf maple. This habitat has high vegetational and floristic diversity with large numbers of endemic species. Mature montane hardwood-conifer forests are valuable to cavity-nesting birds, and many amphibians are found on the forest floor in more mesic areas.

Closed-cone pine. In Placer County this habitat type most often consists of patches of pure stands of knobcone pine within chaparral, montane hardwood-conifer, or mixed conifer habitats. These habitats are typically found on soils that are more rocky and infertile than those supporting the zonal habitat type. There is usually a well-developed shrubby understory. This habitat type is fire dependent; closed-cone pines have serotinous cones that are sealed tightly by resin and only open and spread their seeds when the resin is melted by a fire. Many wildlife species use this habitat, but none seems to be dependent on it.

Montane hardwood. In Placer County this habitat type usually consists of relatively pure stands of canyon live oak. There is a poorly developed shrub stratum and a sparse herbaceous layer. These habitats are characteristic of steep, rocky, south-facing slopes of major river canyons and interface with mixed hardwood-conifer, ponderosa pine, and Sierran mixed-conifer habitats. Many species of birds and mammals that feed on acorns, as well as a diversity of amphibians and reptiles that are found on the forest floor, utilize this habitat type.

White fir. In the Sierra Nevada white fir habitat occurs between mixed conifer and red fir habitats. It is characterized by a closed-canopy overstory of even-aged white fir trees with relatively few understory species. Fire influences this habitat by causing a mosaic of even-aged stands in different successional stages. The white fir habitat type is the coolest, most mesic nonriparian habitat within the yellow pine forest zone, and, as stands mature, many trees die,

resulting in many snags and downed wood. Thus, excellent habitat is provided for cavity nesting and insect gleaning bird species.

Eastside yellow pine belt (5,000'-6,500')

Bitterbrush. In Placer County bitterbrush habitats are found on low elevation flats and slopes with deep soils on the east side of the Sierra Nevada. While the dominant species in this habitat is antelope bitterbrush, it rarely occurs in pure stands. Rather, it is usually associated with big sagebrush, rubber rabbitbrush, Mormon tea, and desert peach. Sometimes there is a sparse overstory layer of ponderosa pine, Jeffrey pine, or curlleaf mountain mahogany. Bitterbrush is an important browse plant for mule deer, pronghorn, cattle, sheep, and horses, and many species of birds, rodents, and insects consume its seeds.

Eastside pine. A small amount of eastside pine habitat occurs in eastern Placer County. Ponderosa pine is the dominant tree species, with Jeffrey pine, lodgepole pine, white fir, incense cedar, and western juniper as associates. Undergrowth may include big sagebrush, antelope bitterbrush, greenleaf manzanita, ceanothus, mountain mahogany, mule ears, and arrowleaf balsamroot. Logging, bark beetles, and fire are the major disturbances in this habitat type. Disturbance usually increases the understory, particularly manzanita and ceanothus, and the brush may become so dense in the absence of fire that livestock and big game cannot use an area. On the other hand, brush also creates a high degree of structural diversity which favors many other species of wildlife.

Jeffrey pine. In Placer County, the Jeffrey pine habitat type occurs on the eastern slope of the Sierra Nevada above and intermingled with eastside pine. A single tree layer is characteristic, giving the impression of openness and light. A sclerophyllous shrub layer consisting of greenleaf manzanita, squaw carpet, and snowbush is usually present at higher elevations; at lower elevations the shrubs are usually antelope bitterbrush and sagebrush. Jeffrey pine habitats are self-perpetuating under a regime of periodic ground fires. This habitat is moderately species-rich, due in part to the value of its seeds as food for many birds and mammals.

Lodgepole pine-red fir belt (7,000'-10,000')

Lodgepole pine. Lodgepole pine habitats are typically found below or intermixed with red fir habitats. Lodgepole pine usually forms monospecific stands; occasional associates include aspen, red fir, and mountain hemlock. The understory is typically sparse except where lodgepole pine habitats are associated with meadow edges. There, grasses, sedges, and forbs are abundant. Many Sierran meadows have been invaded by lodgepole pine over the last few centuries; the reasons for the invasions are not at all clear. Lodgepole pines establish rapidly and reproduce at an early age. This continued recruitment within stands produces overcrowding which weakens the trees and makes them susceptible to insects, and dead and moribund trees create large quantities of fuel that increase the probability of wildfire. The lodgepole pine habitat type has low structural diversity and supports relatively few animal species. However, the wolverine, northern goshawk, and bald eagle, Placer County species of particular interest, use lodgepole pine habitat, particularly at meadow edges.

Red fir. In Placer County, red fir habitats occur on frigid soils in the higher elevations of the Sierra Nevada. These habitats are usually monospecific with very few plant species other than red fir in any layer. Heavy shade and a thick layer of duff tend to inhibit understory vegetation. Windthrows, lightning fires, insect outbreaks, and logging tend to create an even-aged stand structure. At lower elevations red fir habitats intergrade with mixed conifer habitats on drier sites and with lodgepole pine on wetter sites. At higher elevations, red fir habitats intergrade with subalpine

conifer habitats. Northern goshawk, Sierra Nevada red fox, and California wolverine, along with a number of other sensitive and rare species, utilize red fir habitats, particularly LSOG.

Aspen. Aspen habitats occur primarily at higher elevations near seeps, streams, and meadows, and they may consist of pure stands of quaking aspen or aspen in association with willows, alders, pines, and firs. In Placer County aspen habitats most often occur in the lodgepole pine-red fir zone, but they also can be found in mixed conifer, Jeffrey pine, and subalpine conifer habitats. All aspen stands spread by root suckering, resulting in a mosaic of clones of different ages. This is often evident in the fall when the leaves of each clone turn color at different times. Aspen habitats support a greater diversity and abundance of birds than adjacent forests and shrublands because of higher insect production and more nesting cavities. On the eastern slopes of the Sierra Nevada aspen habitats are important nesting sites for northern goshawks, a Placer County species of particular interest. Long-term fire suppression or excessive grazing and browsing by ungulates may result in the disappearance of aspen from an area.

Subalpine belt (9,000'-11,000')

Subalpine conifer. Typical subalpine conifer habitats are open forests of several species of conifers of low to medium stature. Placer County species include western white pine, lodgepole pine, and mountain hemlock. A sparse shrub understory may be present. Subalpine conifer habitats intergrade with red fir and lodgepole pine habitats at lower elevations and with alpine dwarf shrub habitats at timberline. Near timberline the trees are shaped by wind and snow into krummholtz--shrubby, mat-like forms only a few feet tall. Although fires and windstorms provide natural disturbance in this habitat, it has been little disturbed by human influence in California. Because of the severe climate and short growing season, this habitat supports fewer wildlife species than any other forested habitat in the state. However, the California wolverine, a Placer County species of particular interest, finds subalpine conifer habitat suitable.

Alpine belt (10,600'-up)

Alpine dwarf-shrub. The alpine dwarf-shrub habitat is found above timberline where it replaces subalpine conifer habitat. The environment is cold, dry, and windy, and the growing season is very short. The vegetation of this habitat consists of low growing grasses, sedges, and forbs with an admixture of dwarf shrubs, often cushion plants. Plant species diversity is surprisingly high, but only a handful of wildlife species use this habitat.

AZONAL HABITAT TYPES

These habitats are found throughout the Sierra, wherever the appropriate conditions occur, irrespective of belt or zone.

Montane chaparral. Montane chaparral habitats in Placer County are found in both the eastside and westside yellow pine forest belts and in the lodgepole pine-red fir belt. They are characterized by several species of shrubs including whitethorn ceanothus, snowbrush ceanothus, greenleaf manzanita, pinemat manzanita, bitter cherry, huckleberry oak, Sierra chinkapin, and California buckthorn. Most of these species are fire-adapted and sprout back from the root crown after a burn. One type of montane chaparral forms a permanent community on shallow soils overlying fractured granite bedrock. The more common type, found on deeper soils, is a transient community which follows a disturbance to a forested habitat. This type of montane chaparral is an important link in forest regrowth since the shrubs build up nutrient levels, especially nitrogen, to

the point where trees can survive. Many birds and mammals use montane chaparral habitat. Deer in particular depend on this habitat type for foraging, fawning, and escape cover.

Montane riparian. The montane riparian zone occurs as a narrow, often dense strip of broadleaved, winter deciduous trees associated with lakes, ponds, meadows, rivers, streams, and springs. Montane riparian can occur as stringers of shrubby willows or alders along creeks or seeps; in other situations an overstory of white alder, quaking aspen, black cottonwood, and willows may be present. Montane riparian provides important habitat and migration corridors for many species of amphibians, reptiles, birds, and mammals and modulates associated aquatic habitats for fish and invertebrates. Lahontan cutthroat trout, mountain yellow-legged frog, and willow flycatcher are Placer County species of particular interest that require healthy montane riparian habitats.

Wet meadow. Wet meadows can occur in virtually all of the habitat types in the Sierra Nevada wherever water is at or near the surface during most of the growing season. These habitat types have a simple structure consisting of mostly perennial herbaceous plants (grasses, sedges, rushes, and forbs). Shrub and tree layers are usually absent or sparse except near the meadow's edge. In the Sierra Nevada wet meadows provide important habitat for several species of amphibians and reptiles, including the mountain yellow-legged frog, a Placer County species of particular interest.

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