Appendix G

Oak Woodlands in El Dorado County

Appendix G
Table of Contents

The term "oak woodland" refers to an oak stand with greater than 10 percent canopy cover or that may have historically supported greater than 10% canopy cover (Oak Woodlands Conservation Act, Fish and Game Code Section 1361). Oak tree species within the County will be discussed briefly before focusing on oak woodlands, their distribution within the County, and concerns about their future.

A. Oak Species

Several species of oak are native to El Dorado County. Table G-1 lists native oak tree species that occur within the planning area of the OWMP. Tanbark oak (*Lithocarpus densiflorus*), which occurs in the Georgetown area, produces acorns but is not considered a "true" oak (Pavlik et al., 1991; Oak Woodlands Conservation Act of 2001).

Table G-1. Native oak tree species that occur within the OWMP planning area of El Dorado County.

Oak Tree Species	Common Name
Quercus chrysolepis	Canyon live oak, maul oak
Quercus douglasii	Blue oak
Quercus garryana	Oregon oak, Oregon white oak
Quercus kelloggii	California black oak
Quercus lobata	Valley oak
Quercus wislizeni	Interior live oak
Quercus x morehus	Oracle oak (hybrid of California black and interior live oaks)

Shrub species of oak that occur in the planning area are scrub oak (*Quercus berberidifolia*), leather oak (*Quercus durata*), and Brewer oak (*Quercus garryana* var. *breweri*). Huckleberry oak (*Quercus vaccinifolia*) is widespread in El Dorado County above the planning area with limited distribution below 4000 feet.

The following tree species information is summarized from Stuart and Sawyer (2001), Pavlik et al. (1991), Bolsinger (1988), and Gaman and Firman (2006).

Canyon live oak (*Quercus chrysolepis*). Canyon live oak is an evergreen tree that ranges from 15 to 70 feet in height. Canyon live oak is shade and drought tolerant. It is found throughout much of California, except the Central Valley, Great Basin, and Sonoran Desert.

Canyon live oak grows on a variety of sites and with a variety of forms. Single-stemmed trees grow on better sites such as in moist forest canyons. Multi-stemmed trees grow on canyon walls, cliffs, and rocky sites; shrubby forms grow on the harshest sites. Repeated fires will convert canyon live oak to shrubs.

Wildlife use canyon live oak for roosting, nesting, foraging, and cover. Birds and mammals eat the acorns.

Blue oak (*Quercus douglasii)*. Blue oak grows as a single-stemmed tree 20 to 60 feet tall. This deciduous tree can live up to 400 years. The leaf surfaces are bluish green. Blue oak is drought tolerant and shade intolerant.

Blue oak occurs naturally only in California. It grows in woodlands and valleys of California's foothills, especially bordering the interior valley. Blue oak has several adaptations for growing on shallow soils in a hot, dry climate. Roots emerge from the acorns during the fall rains and grow rapidly. Leaves have a waxy, moisture-conserving coating. Blue oak drops its leaves in extremely hot and dry years. It is often associated with foothill pine (*Pinus sabiniana*), California buckeye (*Aesculus californicus*), interior live oak, Oregon white oak, and valley oak.

Blue oak provides critical winter range for deer and other wildlife. Its foliage is used for browse and many species consume its acorns.

Oregon white oak (*Quercus garryana*). Oregon white oak grows as a single-stemmed tree 25 to 90 feet tall. This deciduous tree is moderately shade tolerant but can be out-competed by conifers. It sprouts after being injured by fire or cutting.

Oregon white oak grows in the central and north Coast Range and in the foothills of the Sierra Nevada and Cascade Range. It is an uncommon species in El Dorado County; however, Stuart and Sawyer (2001) report that the largest Oregon white oak in California (over 120 feet in height and eight feet in diameter) grows in El Dorado County.

Wildlife and livestock browse its foliage. Many species of birds and mammals eat its acorns.

California black oak (*Quercus kelloggii*). California black oak grows as a single-stemmed tree 30 to 80 feet tall. On infertile sites, it can grow as a shrub.

California black oak is initially shade tolerant but becomes shade intolerant as it grows. It sprouts after being injured by fire or cutting. This deciduous tree can live 500 years. It is the primary commercial hardwood species in California.

California black oak is widely distributed within woodlands and coniferous forests. Stands dominated by California black oak occur infrequently within lower montane elevations. Oracle oak is a hybrid of California black oak and interior live oak that is found in El Dorado County.

Many wildlife species use California black oak for forage and cover and eat its acorns.

Valley oak (*Quercus lobata*). Valley oak is a single-stemmed, deciduous tree that grows 30 to 90 feet tall. It is the largest oak species in California and can live to be 400 to 600 years old. This deciduous tree is intermediate in its shade tolerance. It sprouts after being injured by fire or cutting.

Valley oak occurs only in California. It is found in valley and foothill woodlands in the Central Valley, Sierra Nevada foothills, and the Coast Ranges. Usually found on deep, alluvial soils, it can grow on shallow or stony soils if its roots can reach sufficient moisture. Its vertical root system taps into groundwater with some roots as deep as 80 feet. Although most common below 2,000 feet, it can range above 5,000 feet.

Valley oak provides important habitat for wildlife.

Interior live oak (*Quercus wislizeni*). Interior live oak is a single-stemmed tree that grows 30 to 75 feet tall. It is shade tolerant and drought sensitive. Its thick bark is resistant to fire. Trees sprout after fire. In areas with recurring fire, it forms shrubby thickets.

Interior live oak grows across the western half of California, including the Sierra Nevada foothills, usually where summers are hot and dry and winters cool and wet. In the Sierra Nevada, clumps of interior live oak may be concentrated around rock outcrops within blue oak woodland. With increasing elevation, particularly on north slopes, interior live oak becomes more prevalent and almost replaces blue oak.

Interior live oak provides important wildlife forage and habitat. Live oak leaves are less palatable to deer than are leaves of deciduous species such as blue oak.

B. Oak Woodland Habitats

Several vegetation classification systems or oak woodland habitat descriptions exist but most have not been mapped for El Dorado County. Existing mapping of California Wildlife Habitat Relationship (CWHR) types from the CWHR Habitat Classification Scheme (Mayer and Laudenslayer, 1988) is readily available. The CWHR types were adopted for the OWMP, which is consistent with the General Plan EIR. Online updates of CWHR types are available from the California Department of Fish and Game website (http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html).

Five CWHR woodland types that were identified in the General Plan EIR are described as oak woodland types for the intent of the OWMP. The CWHR types are Valley Oak Woodland (VOW), Blue Oak Woodland (BOW), Blue Oak-Foothill Pine (BOP), Montane Hardwood (MHW), and Montane Hardwood-Conifer (MHC). All types have at least 10 percent canopy cover of oak trees. A sixth type is Valley-Foothill Riparian (VRI), which may include Fremont cottonwood, willow, and valley oak as dominant tree species.

Both VOW and VRI were identified as sensitive habitats in the General Plan EIR based on a review of CNDDB and FRAP (EDAW, 2003). Valley oak forest and woodlands have been identified as high priority for CNDDB inventory (CDFG, 2003). VRI was not quantified from the FRAP mapping because it is difficult to distinguish using remote-sensing imagery (EDAW, 2003).

Other CWHR types that are not oak woodland types but occur within the planning area may contain greater than 10% oak tree canopy cover. These types include Ponderosa Pine (PPN), Douglas Fir (DFR), and Sierran Mixed Conifer (SMC). Because these types are dominated by conifers and not deemed oak woodland types, they are not considered in the OWMP. The following CWHR woodland types are addressed in the OWMP [descriptions follow the General Plan EIR (EDAW, 2003) and CDFG's California WHR System (http://www.dfg.ca.gov/whdab/html/wildlife_habitats.html) and are supplemented by the IHRMP website (http://danr.ucop.edu/ihrmp/wildhab.html)]:

Blue oak woodland (BOW) is usually associated with shallow, rocky, infertile, well-drained soils. Within the County, BOW usually occurs below 2,000 feet in elevation but can extend up to 3,000 feet. BOW commonly forms open savanna-like stands with little or no shrub understory on dry ridges and gentle slopes. The canopy becomes denser on better quality sites. The ground cover is comprised mainly of annual grasses. Shrubs are seldom extensive and often occur on rock outcrops. Shrub associates include California buckeye, poison-oak, hoary coffeeberry, and buckbrush. BOW usually intergrades with annual grasslands and valley oak woodlands at lower elevations and blue oak-foothill pine woodlands at higher elevations. In El Dorado County, BOW and blue oak-foothill pine woodlands tend to be intermixed.

Interior live oak, canyon live oak, California buckeye, and valley oak are common associates in blue oak woodland. Interior live oak and canyon live oak can be the dominant tree species where they may be considered as distinct habitats. Interior live oaks are often associated with river floodplains, low foothills, and upland slopes. In low-elevation foothill woodlands, interior live oaks occur as widely spaced trees or clumps that may be concentrated around rock outcrops. Interior live oak becomes a more significant part of the blue oak woodland canopy with increasing elevation, particularly on north-facing slopes. Canyon live oaks are found on low foothills, mountain canyons, upland slopes, and exposed ridges.

Blue oak-foothill pine (BOP) is typically found on well-drained soils rich in rock fragments, generally in hilly, dry terrain. Compared with BOW, BOP generally is found on steeper and dryer slopes with shallower soils. BOP merges with annual grasslands, blue oak woodlands, valley oak woodlands, and mixed chaparral (including the northern gabbroic chaparral). BOP is characterized by a mixture of hardwoods, conifers, and shrubs. Blue oak is usually most abundant with the taller foothill pine dominating the overstory. Foothill pine becomes more prevalent at higher elevations. Associated tree species include interior live oak and California buckeye. Interior live oak becomes more abundant on shallower soils, steeper slopes, and at higher elevations. Canyon live oaks are present on low foothills, mountain canyons, upland slopes, and exposed ridges.
The shrub component is typically composed of several species that tend to clump and are interspersed with annual grasses. Shrub species include buckbrush, whiteleaf manzanita, hoary coffeeberry, poison-oak, redbud, and yerba-santa. Shrubs are less prevalent at lower elevations.

Montane hardwood (MHW) has a relative overstory cover by hardwoods of at least 50% and a relative overstory cover by conifers of less than 25%. Canopy cover ranges from dense to open. The poorly developed shrub layer contains snowberry, wood rose, currant, manzanita, and poison-oak. The herbaceous layer is sparse. At lower elevations MHW merges with mixed chaparral. Tree associates are foothill pine, knobcone pine, tanoak, Pacific madrone, and California laurel. At middle elevations MHW merges with montane hardwood-conifer or Douglas-fir. Middle and higher elevation associates are canyon live oak, Douglas-fir, California black oak, and mixed conifer. Steep, rocky south slopes of major river canyons often support MHW, particularly canyon live oak and scattered Douglas-fir. MHW occurs on soils that are rocky, alluvial, coarse-textured, poorly developed, and well-drained.

Montane hardwood-conifer (MHC) has a relative overstory cover by hardwoods of at least 50% and a relative overstory cover by conifers of at least 25%. MHC is transitional between dense coniferous forests of upper elevations and montane hardwood, mixed chaparral, or open woodlands and savannahs. MHC often occurs as a closed forest. MHC typically supports relatively little understory except in ecotones or following a disturbance such as fire or logging. Common associates include California black oak, bigleaf maple, white alder, dogwood, Douglas-fir, incense-cedar, and ponderosa pine.

MHC includes vegetation associated with both coniferous and hardwood habitats. Habitat composition is generally defined as including a minimum of one-third coniferous trees and one-third broad-leaved trees. Typically, conifers dominate the upper canopy, and broad-leaved trees form a sub-canopy. In the northern Sierra Nevada, MHC is found between 1,000 and 4,000 feet elevation.

Valley oak woodland (VOW) is best developed on deep, well-drained alluvial soils and is usually found below 2,000 feet. VOW varies from savanna-like stands to forest-like stands with partially closed canopies. Denser stands typically grow in valley soils along natural drainages. Canopies in VOW are dominated almost exclusively by valley oak. In the foothills, VOW intergrades with blue oak or blue oak-foothill pine woodlands. Near major stream courses, VOW may intergrade with valley-foothill riparian woodland and be associated with Fremont cottonwood and willow. The shrub understory includes poison-oak, blue elderberry, California wild grape, toyon, coffeeberry, and California blackberry.

VOW provides food, cover, reproductive sites and corridors for numerous wildlife species. Wildlife commonly found in VOW includes gopher snake, acorn woodpecker, oak titmouse, white-breasted nuthatch, California quail, and western gray squirrel. Valley oak woodland is listed as a high-priority community for inventory by the CNDDB and a sensitive habitat by El Dorado County (EDAW, 2003).

Valley foothill riparian (VRI) is best developed on deep alluvial soils with a high water table. VRI is associated with low velocity flows, floodplains, gentle topography, and a substrate of coarse, gravelly or rocky soils. VRI is found in the lower foothills, below 2,000 feet. Valley oak or cottonwood can be the dominant species with white alder, box elder, and Oregon ash as subcanopy trees. Canopy cover ranges from 20 to 80 percent. Valley oak-dominated riparian systems may require more than 75 years to reach maturity. VRI was not mapped in El Dorado County because remote sensing imagery could not distinguish it (EDAW, 2003).

VRI provides food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for many wildlife species. As well as bird and mammal species, amphibians and reptiles utilize VRI.

1. Current Distribution

Table G-2 displays the acreage of each oak woodland type within the planning area. The majority of blue oak woodland, blue oak-foothill pine, and valley oak woodland within El Dorado County occurs below 2,000 feet (Figure IV-1). Valley oak woodland tends to be found on well-developed soils (Pavlik et al., 1991). Blue oak savanna with few or no shrubs occurs in the low foothills often on low hillocks and exposed, south-facing slopes. Blue oak savanna grades into blue oak woodland on sites with more rainfall or north-facing slopes. Blue oak woodland supports a more complex community (Pavlik et al., 1991). Montane hardwood is spread throughout the planning area, extending from the annual grasslands in the west to the forested types in the east. Montane hardwood-conifer is most prevalent east of Highway 49.

Table G-2. Acreage of oak woodland in El Dorado County based on 2002 FRAP mapping.

Oak Woodland CWHR Type	CWHR Type	Acreage
Blue oak woodland	BOW	42,400
Blue oak-foothill pine woodland	BOP	12,900
Montane hardwood	MHW	155,900
Montane hardwood-conifer	MHC	34,200
Valley oak woodland	VOW	3,400
Total		248,000

2. Historic Distribution

The historic distribution of oak woodland within El Dorado County is not known. Likely the distribution in 1848 is similar to the current distribution but the structure of oak woodland has been altered through mining, grazing, and development. In community centers such as occur along the Highway 50 corridor, oak woodland has been lost or greatly degraded due to urban development. The understory has been modified in

grazing lands and some oak woodland likely was converted to grassland. At the lower elevations of timberland, small areas of oak woodland were converted to conifer plantations.

Statewide the primary cause of woodland conversion between 1945 and the early 1970's was rangeland improvement; since the early 1970's, the primary cause has been urban and suburban expansion (Bolsinger, 1988). Valley oaks have been lost over the last 150 years to agricultural and residential development in prime lowland real estate (Pavlik et al., 1991).

3. Existing Threats

Several elements threaten oak woodlands statewide and in El Dorado County. The two main processes influencing oak woodlands are land clearing for subdivisions and intensive agriculture and the continued parcelization of large continuous woodland ownerships to exurban development (Giusti et al., 2004). Threats to oak woodlands in the Sierra Nevada foothills include development, fragmentation, agricultural development, livestock grazing, low regeneration, and wood cutting (WCB, http://www.wcb.ca.gov/Pages/oak_woodlands_RegionalThreats.htm). Additional threats identified for the Sierra Nevada above the foothills include high fire risk and water control. Residential development and intensive agricultural conversion, primarily to vineyards, are the primary threats to oak woodlands in the Sierra Nevada.

El Dorado County has more acres of oak woodlands at risk for development than any other county in California (Gaman and Firman, 2006). Forty percent of the County's oak woodlands have been developed and another 40 percent may be developed by 2040. Impacts vary from complete removal of oak woodland to degradation of the quality of remaining oak woodland.

Saving and Greenwood (2002) modeled projected development of El Dorado County under the proposed 1996 General Plan. They concluded that 4 percent of oak woodland land cover would be physically lost to development but 40 percent of "rural" oak woodland would be converted to marginal or urban habitat. "…areas that once functioned under a more natural state and presumably provided functional habitat for species are degraded, either due to proximity to urban land uses or by isolation from larger patches of contiguous natural vegetation." Clearing for fire protection that occurs with development also leads to the degradation of oak woodlands (Harris and Kocher, 2002). The thinning of trees and removal of understory shrubs and trees result in a loss of species and of structural diversity.

4. Status of Natural Regeneration and Growth Trends

Regeneration is the net effect of individuals added to a population through recruitment and individuals lost through mortality. Successful recruitment depends on several factors: acorn crop, conditions for germination, survival of seedlings, and survival of saplings to mature stages.

Bolsinger (1988) reported on regeneration in oak woodlands as indicated by seedlings and saplings in sample plots across California. Seedlings and saplings were in great abundance in canyon live oak stands and in moderate amounts in interior live oak, California black oak, and Oregon white oak stands. Regeneration was sparse in blue oak stands and almost nonexistent in valley oak stands (although valley oak regeneration was found in stands dominated by other species). The shortage of saplings for oak species (especially blue oak and valley oak), in the long-term, could lead to the gradual loss of oak stands as mature oaks are lost to natural mortality (Standiford and McCreary, 1996).

Specific to blue oak, Swiecki et al. (1997) support the concept of advance regeneration. Blue oak seedlings persist for extended periods (up to 15 years) in the understory. Sapling recruitment occurs under appropriate conditions such as an opening in the canopy. In their study, they found a positive correlation between gaps in the canopy and sapling recruitment.

Several factors have been implicated in poor oak regeneration (Giusti et al., 2005; Siegel and DeSante, 1999; McCreary, 2001; Pavlik et al., 1991). These factors include:

- grazing by livestock (depending on timing and intensity)
- browsing by deer
- fire suppression
- yearly burning
- conversion of native perennial understory to annual grasses that deplete soil moisture early before oak seedlings can compete and that compete for light and nutrients
- absence of appropriate climatic conditions
- global warming
- heavy vehicle use
- rodent herbivory (rodent populations have increased as their predators have declined)
- predation by turkey
- past management history

The factor or combination of factors affecting oak regeneration likely varies by geographic region and by local conditions.

Some writings indicate that poor regeneration dates back 100 to 150 years. Deciduous oak regeneration was locally abundant prior to 1900 (Standiford et al., 1996). Few areas are known where successful recruitment of blue oaks has occurred since the late 1800's (CWHR, http://www.dfg.ca.gov/whdab/cwhr/pdfs/BOW.pdf). Most surviving stands of valley oak woodland appear to be 100 to 300 years old (CWHR, http://www.dfg.ca.gov/whdab/cwhr/pdfs/VOW.pdf).

Growth Trends

In general, blue oak woodland and blue oak-foothill pine woodland grow at slower rates than valley oak woodland or montane hardwood (http://danr.ucop.edu/ihrmp/values.html). Low regeneration in the blue oak habitat types has created concern. The effectiveness of tree planting to mitigate habitat loss in blue oak woodlands was modeled from data derived from a 10-year-old blue oak plantation (Standiford, McCreary, and Frost, 2002).

Stand attributes for every 10-year interval was modeled using blue oak age and stand structure data. The model varied tree density and management intensity. With high intensity management and a planting density of 200 trees per acre, oak canopy cover could reach the minimum requirement for oak woodland (i.e., 10 percent canopy cover) after 10 years (depending on site conditions).

The study raised questions regarding the adequacy of planted stands for mitigating the loss of mature oak woodlands. After 50 years (a young age for oak woodland), the same stand would reach only 17 percent canopy cover. The wildlife species composition would shift from species that utilize acorns, cavities, and downed wood associated with mature oak woodlands to species associated with open grasslands.