Yolo County
Oak Woodland
Conservation and Enhancement Plan

Parks and Natural Resources Management Division

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EXECUTIVE SUMMARY

The Yolo County Oak Woodland Conservation and Enhancement Plan promotes voluntary efforts to conserve and enhance the county's existing oak woodlands, which provide significant aesthetic, ecological, and economic benefits. Voluntary conservation and enhancement efforts will help to minimize the effects of land conversion and other factors that disturb the health and longevity of existing oak woodlands. Although partnerships with neighboring counties may be necessary to implement some conservation and enhancement activities, the plan covers only Yolo County. Furthermore, Yolo County will work with existing organizations involved with oak woodlands conservation and enhancement efforts to implement the plan, some of which already have valuable relationships with private landowners interested in oak woodland conservation.

GOALS

The plan will help coordinate voluntary oak woodland conservation and enhancement efforts, guide oak woodland mitigation, provide access to state funding, and assist with state efforts to conserve and enhance oak woodlands in California (See Appendix G for information on additional sources available for funding oak woodland conservation).

OAK WOODLAND RESOURCE VALUES

Oak woodlands are important to Yolo County because they provide a number of aesthetic, ecological, and economic benefits, including plant and wildlife habitat, erosion control, and water quality, flood, and air quality protection. They are enjoyed by regional residents simply for their beauty when viewed through a car window. They further are enjoyed through hiking, equestrian, hunting, or other recreational opportunities, thus supporting the county's economy. Finally, oak woodlands are valued for their historic and cultural significance. Native Americans once relied on oaks for food and shelter. The earliest European settlers sought refuge from the hot valley sun for themselves and their livestock under oaks and benefited economically from the use of oaks for building material and firewood.

EXISTING OAK WOODLANDS

Oak woodlands are one of most familiar landscapes in Yolo County, a prominent piece of a rural mosaic of agricultural land and open space dotted with small cities and towns. Oak woodlands spread over 107,000 acres of the county's 650,000 acres of land, primarily in the western portion of the county in the foothills of the Coast Range. Blue oak-foothill pine woodlands are the dominant community type, consisting of almost 78,000 acres or 74 percent of all oak woodland acreage. Approximately 87 percent of the county's oak woodlands are privately owned. Yolo County, the U.S. Bureau of Land Management, and other public entities own approximately 13 percent of the oak woodlands.

HISTORICAL EXTENT OF OAK WOODLANDS

Anecdotal evidence from local and state archives suggests that prior to the Gold Rush of 1849, oak woodlands stretched throughout Yolo County's foothills and valleys, including the Capay Valley and Yolo County's portion of the Sacramento Valley. Evidence also suggests that riparian forests, dominated by valley oaks, cottonwoods, and willows lined

Cache Creek, Putah Creek, and the Sacramento River as well as the Babel, Elk, Sutter, and Willow Sloughs. While a comprehensive evaluation of oak woodlands in the pre-settlement era is not a part of this planning effort, the plan includes some historical maps, aerial photos, anecdotal accounts, and other historical research to provide a glimpse of what Yolo County's oak woodlands may have looked like over 150 years ago.

FACTORS AFFECTING OAK WOODLANDS

While oak woodlands may seem abundant in Yolo County, conservation of existing oak woodlands is a challenge because of a number of factors that threaten their continued health and longevity. These factors include, but are not limited to, land conversion to intensive urban and rural uses and road or other infrastructure expansion; few young oak saplings to replace existing old oaks (also known as a lack of regeneration); increasingly limited access to groundwater in some areas that increases the mortality of both young and old oaks; and clearing for fire protection around developed areas.

SYSTEM FOR ESTABLISHING OAK WOODLANDS PRIORITIES

The plan presents a system to help identify high-priority, voluntary oak woodlands conservation and enhancement opportunities. Assuming that willing landowners are interested in participating in the program, the system can help identify areas with the highest oak woodlands resource values, as well as those that would benefit from enhancement efforts. The system uses criteria that reflect values such as stand size, composition and distribution, tree cover and density, plant and wildlife habitat (including special status species), invasive species presence and abundance, erosion control, contribution to air quality, water quality, and flood protection, historical and cultural significance, and recreational opportunities. In addition, the system factors in threat of loss and potential management constraints.

CONSERVATION AND ENHANCEMENT RECOMMENDATIONS

Implementation recommendations are included, based on the research and public outreach conducted during development of the plan. These recommendations include: proposed voluntary oak woodlands conservation goals and policies for inclusion in the Yolo County General Plan, provision of staff resources to help implement the plan, assistance with high-priority oak woodlands conservation and enhancement projects, development of landowner incentives to encourage conservation, establishment of a public outreach and education program, and working with the University of California, Davis and other institutions to encourage oak woodlands-related research in the county.

IMPLEMENTATION STRATEGY

The success of the plan is dependent on voluntary participation by landowners and public agencies that own oak woodlands. Plan implementation therefore relies heavily on a public outreach and education strategy to encourage willing landowners and public agencies to participate in the program. Yolo County will support the work of organizations and agencies currently involved with oak woodland conservation activities. Yolo County also can help solicit funding for oak woodland conservation efforts, since the state's oak woodland grant program requires Yolo County to certify that a project is consistent with the plan. The certification process is described in the plan.

INTRODUCTION

The Yolo County Oak Woodland Conservation and Enhancement Plan promotes voluntary efforts to conserve and enhance the county's existing oak woodlands. Oak woodlands provide significant aesthetic, ecological, and economic benefits. Voluntary conservation and enhancement efforts will help to minimize the impacts from land conversion and other factors that affect the health and longevity of existing oak woodlands. Although partnerships with neighboring counties (Colusa, Lake, Napa, Sacramento, Solano and Sutter) may be necessary to implement some conservation and enhancement activities, the plan covers only Yolo County. Furthermore, Yolo County will work with existing organizations involved with oak woodlands conservation and enhancement efforts to implement the plan, some of which already have valuable relationships with private landowners interested in oak woodland conservation.

Oak woodlands are one of most familiar landscapes to residents of Yolo County, completing a rural mosaic of agricultural land and open space dotted with small cities and towns. Defined by state law as "an oak stand with a greater than 10 percent canopy cover or that may have historically supported a greater than 10 percent canopy cover[1]," oak woodlands spread over 107,000 acres of Yolo County's 650,000 acres of land. These oak woodlands are found primarily in the foothills of the Coast Range located in the western portion of the county. While the plan emphasizes the conservation of existing oak woodland ecosystems, it also supports the enhancement of former oak woodlands that consist now of only a few remaining trees. These lone oaks are primarily valley oaks that were once a part of valley oak woodlands and savannahs.

Yolo County will focus on supporting the existing efforts of willing landowners, non-profit organizations, and government agencies to enhance and conserve oak woodlands. In addition, Yolo County will help these individuals and organizations access funds for voluntary oak woodlands conservation and enhancement activities (See Appendix G for information on additional sources available for funding oak woodland conservation). Voluntary conservation efforts may include oak woodlands conservation easements,[2] the

[1] California Fish and Game Code §1361(h). State law does not define "stand," but this plan focuses on existing and former oak woodlands that cover one acre or more. The resource values of contiguous, larger tracts of oak woodlands are typically greater than the resource values of isolated stands of oak trees. In addition, larger stands generally have more resource management options than smaller stands. Nonetheless, because some isolated stands of oak trees, especially those found on Yolo County's Sacramento River Valley floor, contain valley oaks or other oak species of limited distribution, these trees may be the focus of some voluntary conservation efforts covered under this plan. See Section on Conservation and Restoration Program and Policy Recommendations.

[2] An oak woodland conservation easement is a voluntary tool used to help landowners to protect their land while retaining ownership. A conservation easement is a legal restriction that a landowner places on his or her property to define and limit the type of development that may take place there. When land is protected by an easement, the landowner continues to own and use the land within the uses set forth in the easement. The entity that holds the easement ensures that the resource values are protected over time as specified in the easement. Generally, conservation easements are purchased by or donated to a nonprofit conservation organization, such as the Yolo Land Trust, which carries the responsibility to enforce the restrictions in perpetuity. See Appendix H for more information about the tax advantages of conservation easements.

development of landowner incentives to encourage conservation, and land use planning strategies that are consistent with the conservation of oak woodlands. Oak woodland enhancement efforts will focus on providing financial incentives and educational resources to encourage landowners to voluntarily enhance healthy oak woodlands through changes in management practices or oak woodlands restoration. Oak woodlands that provide the best available combination of ecological, aesthetic, cultural, and economic benefits will have the highest priority for available funding. Conservation activities to be funded through this plan include:

- Grants for oak woodlands enhancement activities, such as development of site-specific management plans, planting of oak seedlings and associated native species, control of competing native plants, and fencing and other rangeland improvements to better manage livestock.
- Cost-sharing incentive payments to private landowners who enter into long-term conservation agreements. These agreements could include management practices that benefit oak woodlands while promoting the economic sustainability of farming and ranching operations;
- Public education and outreach by non-profit organizations, local governments, and other qualified entities related to oak woodlands conservation and enhancement.

This document presents the following information:

- the goals of Yolo County's Oak Woodland Conservation and Enhancement program;
- descriptions of resource values that oak woodlands provide;
- information on the current and historical extent and types of oak woodlands in Yolo County;
- a system that will be used to establish priorities for voluntary oak woodlands conservation and enhancement[3];
- conservation and enhancement program recommendations; and
- an implementation strategy.

There are many public agencies and other organizations that are currently working to conserve and enhance oak woodlands in Yolo County. (See Appendix D and E for a description of these organizations and agencies and their oak woodlands-related efforts.) Yolo County will work with these organizations and agencies to further their efforts through implementation of the plan.

[3] This process is intended to complement, but not duplicate, conservation planning related to oak woodlands in the Yolo County Habitat Conservation Plan/Natural Communities Conservation Plan.

I. GOALS

The plan is designed to achieve the following goals:

1. Protect existing oak woodlands by creating a voluntary system, including landowner incentives, for conservation and enhancement of oak woodlands.

2. Encourage the development of land use and infrastructure planning strategies that are consistent with oak woodlands conservation efforts.

3. Direct conservation and enhancement funding and effort to areas that have the highest oak woodland resource values.

4. Direct mitigation for oak woodland impacts to areas that have the highest oak woodland resource values and are in need of protection.

5. Encourage the long-term stewardship of existing oak woodlands to maintain or improve oak woodland resource values.

6. Provide funding and technical assistance for oak woodland enhancement efforts that help achieve multiple benefits.

7. Increase the area covered by valley oak and other oak species that are now uncommon in Yolo County because they have been cleared from much of their historical range in the county.

8. Maximize the total amount of oak woodland canopy cover to achieve erosion, flood, and air quality protection benefits, while recognizing the importance of including a variety of canopy cover levels within conserved and restored woodlands to provide habitat diversity.

9. Coordinate oak woodland conservation and enhancement efforts with the Yolo County Habitat Conservation Plan/Natural Community Conservation Plan, the Yolo County General Plan, the Parks and Open Space Master Plan, the Cache Creek Resources Management Plan, and other local and state applicable conservation plans.

II. OAK WOODLAND RESOURCE VALUES

Oak woodlands are important to Yolo County because they provide a number of ecological, aesthetic, and economic benefits, including plant and wildlife habitat, erosion control, and water quality, flood, and air quality protection. They also are enjoyed by Yolo County residents simply for their beauty, as viewed through a car window or enjoyed through hiking, equestrian, hunting, or other recreational opportunities. Finally, oak woodlands are valued for their historic and cultural significance. Native Americans

once relied on oaks for food and shelter. The earliest European settlers sought refuge from the hot valley sun for themselves and their livestock under oaks and benefited economically from the use of oaks for building material and firewood. This section provides a brief description of these resource values.

Plant and Wildlife Habitat

Oak woodlands are the most diverse terrestrial ecosystems in California, supporting at least 300 vertebrate species (including at least 120 mammal, 147 bird, 60 reptile and amphibian species), 1,100 plant species, 370 fungal species, and 5,000 arthropods species (insects and mites). In Yolo County, oak woodlands provide habitats for a wide range of flora and fauna, many of which are threatened or endangered at the state and federal level. (See Appendix B and C for lists of species in the oak woodland communities found in Yolo County.) Each type of oak woodland found in Yolo County provides unique habitat structure for the plants, invertebrates, fish, and wildlife that inhabit them. Some oak woodland types provide a greater diversity of ecological benefits than other types, depending on the complexity of the vegetation structure, oak density (trees per acre), the level of canopy cover, the distribution of tree sizes and ages, and other factors. The habitat value of any oak woodland type may also vary according to its health, location in the landscape, extent, and current management strategies. Valley Foothill Riparian, for example, is an oak woodland-dominated plant community that provides one of the most diverse habitat types in California. It provides habitat for a broad range of plant and animal species, some of which are threatened or endangered.

Erosion Control

Oaks help control soil erosion in three ways: a) Tree canopies intercept raindrops and dissipate their energy, reducing their potential to erode soil; b) Dead leaves and twigs that accumulate on the soil surface under oaks provide further protection against the erosive action of rainfall; and c) Tree roots and their associated mycorrhizal fungi also help to reinforce and stabilize soil, reducing both the risk of landslides and erosion caused by running surface water (gully erosion and scour along creeks)[4]. Oak woodlands located in areas prone to erosion help prevent degradation in water quality and overall land resource value that are associated with erosion. Planting oaks in historically wooded areas showing accelerated erosion from lack of tree cover can help stabilize and prevent further erosion in these areas.

Water Quality Protection

Oak woodlands located on both slopes and level lands near streams play an important role in protecting water quality. By minimizing soil erosion as noted above, oak woodlands can help reduce the amount of sediment washing into local waterways. High levels of sediment in waterways can negatively impact the aquatic food supply by reducing habitat available for fish, aquatic invertebrates and other organisms important to the diets of fish and birds.[5] The contribution of oaks and other vegetation to erosion

[4] Both fine roots and soil fungi growing in association with roots promote the formation and stability of both fine and coarse soil aggregates. These aggregates resist erosive forces and promote soil cohesion.

[5] Sediment simplifies aquatic ecosystems by filling in and covering up productive rocky or gravelly habitats. The sediment reduces the growth of algae and other plants in these habitats that aquatic invertebrates rely on for food. Heavy sediment loads can also erode the gills of fish and aquatic

prevention near waterways is especially important if soils contain toxic material, such as mercury or other heavy metals. Cache Creek and Putah Creek, for example, both have elevated levels of mercury in the soil of the bed and banks and are the focus of regulatory efforts to reduce mercury levels.[6] Oaks and other vegetation also help reduce soil contamination by absorbing heavy metals, fertilizer nutrients, and pesticides from the soil and intercepting sediments containing these pollutants, thereby preventing these materials from reaching surface waters. Oaks and associated permanent vegetation along waterways also can reduce potential contamination of waterways from airborne pesticide drift, since oak foliage can intercept airborne pesticides.

Flood Protection

Oak and other trees provide protection equivalent to that provided by floodwater detention basins. Trees temporarily hold rainwater on their leaf and stem surfaces during a rainstorm, increasing the amount of time rain takes to reach the ground and contribute to runoff. By detaining peak flows for a period of time, oaks and other trees reduce the amount of water washing into waterways as a result of high rainfall events. Based on computer simulations of deciduous trees in California's Central Valley, researchers estimate that every 1000 trees reduces stormwater runoff by nearly 1 million gallons, about 3 acre ft.[7] The greatest flood protection benefits related to tree canopy cover are in watersheds that quickly concentrate flows and pose a risk of flash flooding and in areas where runoff conveyance is already near capacity. Trees also deplete moisture from the soil during the growing season. Compared to only annual vegetation, oaks can extract water from the soil profile to a greater depth. Consequently, soils under oak woodland canopy are able to absorb and hold greater amounts of rainfall in the soil than are equivalent soils with only annual grassland cover. This extra storage capacity further reduces the potential for flooding during the rainy season.

Air Quality Protection

In urban areas oak trees provide shade to houses and people, lowering the need for air conditioning and aiding in the maintenance of air quality. Shading of vehicles by trees also significantly reduces the amount of volatile organic compounds (VOCs) they release. Because VOCs are precursors to photochemical smog, lower VOC levels result in lower levels of ground-level ozone. Oaks and other plants directly reduce ozone pollution by absorbing and destroying ozone within leaves. Tree leaves also intercept airborne particulate pollutants, helping to lower ground level concentration of these pollutants. Large, long-lived trees such as oaks convert large quantities of carbon dioxide to various organic compounds that make up wood. Oak woodlands therefore provide a means for

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invertebrates, making it more difficult for them to breathe. See Waters, Thomas F. 1995. "Sediment in Streams." *American Fisheries Society Monograph.*

[6] The Central Valley Regional Water Quality Control Board (RWQCB) finalized the Cache Creek Mercury Total Maximum Daily Load (TMDL) in 2005. The RWQCB will enforce its provisions once the State Water Resources Control Board and the U.S. Environmental Protection Agency approve the TMDL, including provisions requiring private landowners to reduce erosion in areas with identified high levels of mercury. The RWQCB also has designated Putah Creek for development of a mercury TMDL, although the RWQCB has not yet started to develop it.

[7] Source: USDA Forest Service, Pacific Southwest Research Station, Center for Urban Forest Research, Davis CA. http://www.fs.fed.us/psw/programs/cufr/

helping to offset the increase in atmospheric carbon dioxide levels related to the use of fossil fuels, thereby helping to reduce the greenhouse effect which contributes to global warming.

Historic and Cultural Significance

Oak stands or individual trees may have historical significance due to past events or structures that were associated with the trees, historical accounts that mention the trees, the use of specific trees as landmarks or as boundary markers, or other factors. Oak woodlands and the acorns they provide also were important cultural resources for Native Americans that lived in what is now Yolo County, including the Rumsey Band of Wintun Indians. The earliest European settlers sought refuge from the hot valley sun for themselves and their livestock under oaks and benefited economically from the use of oaks for building material and firewood. Oak woodlands also created venues for recreation and public events in Yolo County. Nelson Grove near Woodland, for example, was used for a 14-county celebration of 18,000 people in 1919 and is still used today for Girl Scout and other events.

Aesthetics and Public Recreation

Oak woodlands are enjoyed by Yolo County residents simply for their beauty, whether through a car window on Highway 16 or Highway 128 or through hiking, bicycling, equestrian, hunting, or other recreational opportunities. Yolo County, cities, and other entities manage lands and operate parks in the Putah Creek, Cache Creek and Sacramento River watersheds that are located in the middle of some of Yolo County's most scenic oak woodlands landscapes. (See Appendixes D and E for more information about these parks and lands.) Thousands of residents living in Yolo County and visitors to the county enjoy swimming, fishing, hiking, and other activities at these sites every year. These activities contribute significantly to the quality of life in the county as well as providing economic benefits generated by visitors enjoying this important resource.

III. EXISTING OAK WOODLANDS IN YOLO COUNTY

Although Yolo County's oak woodlands have been significantly diminished over the last 150 years, oak woodlands still cover more than 100,000 acres of Yolo County's 650,000 acres. Oak woodlands are located primarily in the foothills of the Coast Range in the western portion of the county. At least six native oak species and five oak-dominated plant communities are found in Yolo County. Blue oak – foothill pine woodlands are the most common type of oak-dominated plant community.[8] The following section provides a brief description of individual oak species and oak-dominated plant communities found in Yolo County.

Individual Oak Species

Valley Oak *(Quercus lobata)* - Valley oaks are large, deciduous trees that may live as long as 500 years and reach a height of 100 feet of more. Open grown trees develop a round

[8] Yolo County Habitat Conservation Plan/Natural Community Conservation Plan Joint Powers Agency (HCP/NCCP JPA) data on existing oak woodlands. See Appendix A for a detailed description of the HCP/NCCP data.

spreading canopy with drooping younger branches that may touch the ground. Trees in dense riparian stands are commonly taller with more narrow crowns and may have few or no low branches. Valley oaks prefer deep, rich bottomland soils, but are also found on slopes and ridges in areas with deep soils, mostly at elevations below 2,000 feet. They are unique to California yet widely distributed throughout the Central Valley and inner Coast Range south of the Eel River in Mendocino County. The range of valley oaks extends to the Santa Monica Mountains in southern California.

Blue Oak *(Quercus douglasii)* - Blue oaks are typically small to medium sized trees that can reach 60 feet in height. Under excellent growing conditions blue oaks have been known to attain a stature comparable to valley oaks, although this size class is now uncommon. Their leaves are bluish green on the upper surface. They are commonly found on steep, poorly developed soils found on the foothills bordering hot interior valleys. Blue oaks are unique to California but occur in 39 of the 58 California Counties.

Interior Live Oak *(Quercus wislizeni)* – Interior live oak is a medium-sized evergreen oak that commonly has a full, rounded canopy that is often broader than it is tall. They are widespread on upland slopes below 5,000 feet but may also be found on valley floors and along riparian areas. Interior live oaks often grow in association with blue oak, but tend to be somewhat less drought tolerant. Interior live oak sometimes hybridizes with California black oak to produce a semi-deciduous tree with leaves that are intermediate in shape and size between the two species. This natural hybrid is known as oracle oak (*Quercus* X *morehus*).

California Black Oak *(Quercus kelloggii)* - Black oaks are a tall, deciduous tree with ascending limbs and an open rounded crown. They reach a height of 70 to 80 feet with trunks 2 to 4 feet in diameter. They are found predominately in mountainous areas away from the immediate coast at elevations between 2,000 and 6,000 feet on coarse, well-drained soils that common to mountain slopes and ridges. During the winter months the gray bark of these trees appears to be black from moisture. The name black oak was first given to this oak by Dr. Albert Kellogg because of this characteristic. They were extensively used for lumber in California.

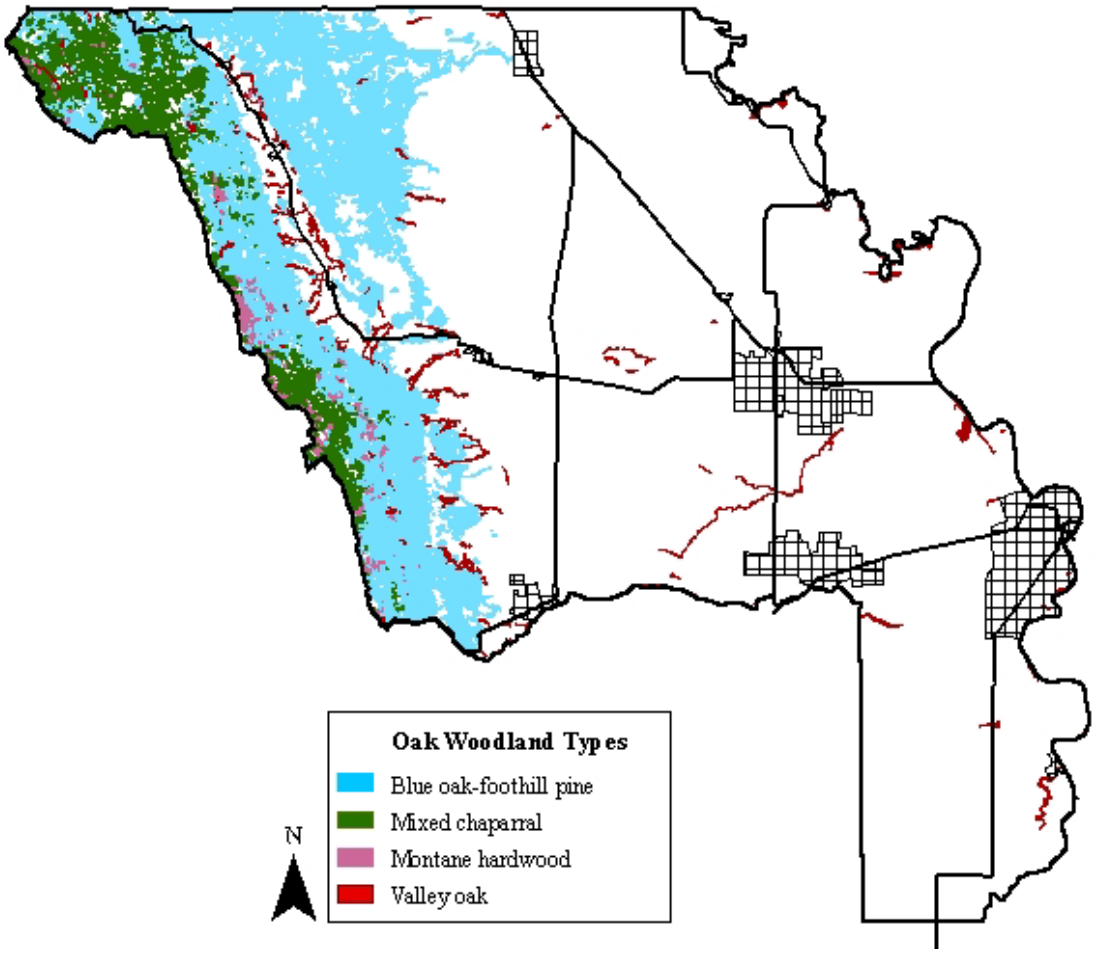
Scrub Oak *(Quercus berberidifolia)* – Scrub oaks are an important member of California's chaparral community. These small, shrubby oaks grow to between 6 and 15 feet in height. They often establish dense thickets that effectively exclude other understory plants. The leaves of the scrub oak are quite variable ranging from smooth to sharply toothed.

Leather Oak *(Quercus durata)* – Leather oaks are shrub like, densely branched and form an intricate rounded canopy usually between 3-5 feet above the ground. Leather oaks are typically confined to soils derived from serpentine substrate that are characteristically nutrient poor and somewhat toxic to many other plants. The leaves are convex, pale green and have smooth to sharply toothed leaf margins.

Oak-Dominated Plant Communities

Individual oak species are found either in relatively pure stands or in association with other tree and/or shrub species. The following oak-dominated plant communities are all found in Yolo County. (See Figure 1 for the distribution of these woodlands.) These oak woodland communities are organized according to the community types identified in the HCP/NCCP oak woodlands data in order to promote consistency between planning efforts (See Appendix A).

Figure 1. Oak woodland community types found in Yolo County



Blue Oak Woodlands – Foothill Pine

Throughout the Coast Range foothills in western Yolo County, oak woodlands are found in mixed species stands known as blue oak – foothill pine. This community type is by far the most extensive of the oak woodland types found in Yolo County, consisting of 79,712 acres or 12.2 percent of the county's land area (Table 1, Figure 1). Blue oak and foothill pine are the most common species in this community type. Blue oak is more common and exists in nearly pure stands in portions of this vegetation type. This woodland type also commonly includes interior live oak and may include valley oak on lower elevation sites characterized by well-drained soils. Tree density can range from open savanna with

scattered trees to a closed canopy forest. The understory consists primarily of annual grasses and forbs with a scattered shrub layer composed of buckbrush, whiteleaf manzanita, redberry, poison oak, silver bush lupine, blue elderberry, and California yerba santa.

Mixed Chaparral

Mixed chaparral is characterized by shrub or scrub oaks found growing in association with a diverse group of sclerophyllous (hard-leaved) shrubs on the dry exposed ridges of the Blue Ridge and Capay Hills. Mixed chaparral represents 14,557 acres, or 2.2 percent of the county's land area (Table 1, Figure 1). The most common type of mixed chaparral consists of an association of scrub oak, a scrub form of interior live oak (*Q. wislizeni* var. *frutescens*), toyon and birch-leaf mountain mahogany. Mixed chaparral is found scattered among purer stands of interior live oak near the crest of the Blue Ridge. Leather oak is also found in this community growing in patches on serpentine soils found along the western portion of the county in the Blue Ridge area.

Valley Foothill Riparian Forest

Valley foothill riparian forests occur in areas where relatively shallow water tables are accessible to tree roots, primarily along the principal watercourses of Yolo County. Valley oaks in these forests grow in relatively dense stands in direct association with sycamores, forming a dramatic overstory canopy. The valley foothill riparian forest occupies approximately 5,000 acres or 1 percent of the county. The valley oak riparian forest has one of the most complex forest structures of any forest type in California. Valley oaks grow in a complex association of deciduous trees such as box elder, Oregon ash, and black walnut. A dense shrub layer of California blackberry, willow, and wild rose forms the lowest canopy level. Lianas (climbing vines) of wild grape climb throughout the forest across all of the canopy layers. Where water tables are very shallow directly adjacent to surface water, cottonwoods and alders replace valley oaks and sycamores as the dominant canopy trees.

Valley Oak Woodlands

Valley oak woodlands are found in a few places just beyond the riparian forests, growing in pure stands of widely spaced trees on rich floodplains and foothill alluvial soils. Valley oaks are typically the sole canopy tree in these woodlands. Valley oak woodlands are much less common in Yolo County than they were 150 years ago, and currently cover approximately 5,208 acres or 1 percent of the county. In these woodlands, at least some valley oak roots may extend to the water table. With access to groundwater, valley oaks can grow fairly rapidly and may eventually attain enormous sizes, often reaching 6 to 7 feet in diameter. The understory is almost completely devoid of other woody vegetation and is composed primarily of a dense thicket of non-native annual grasses that have replaced the native grasses and forbs historically found in these woodlands.

Montane Hardwood Forest

This forest type is characterized by a mixture of different hardwoods that are dominated by distinct oak community types including mixed oak, black oak, and canyon live oak. Montane hardwood forests represent 3,060 acres or less than 1 percent of the county.

California bay laurel is also a dominant member of the overstory in this forest type. These forests exhibit a poorly developed shrub understory and little herbaceous cover.

Table 1. Oak Woodlands Community Types and Associated Acreage

Vegetation Name	Area (Acres)	% Total Land
Blue oak woodland – foothill pine	79,712	12.2
Mixed chaparral	14,557	2.2
Valley foothill riparian	5,029	1
Valley oak woodlands	5,208	1
Montane hardwood forest	3,060	>1
Total	**107,566**	

Oak Woodlands Ownership Patterns

Yolo County is a rural, agricultural county. The total area of the county is approximately 650,000 acres, of which 4 percent is the four incorporated cities Davis, Woodland, West Sacramento, and Winters. The current population is approximately 184,348 with a population density of 182 persons per square mile.[9] Much of the county's land is dedicated to farming and ranching. These farms and ranches produce renowned crops, including some fruits, nuts, and vegetables that are grown nowhere else in the United States. Cultivated agriculture accounts for approximately 346,400 acres or 54 percent of the county while ranching and livestock occupies 143,504 acres or 22 percent of the county.

Approximately 90,000 acres or 84 percent of the county's oak woodlands are found primarily along the western Blue Ridge and Capay Hills.[10] Approximately 77,000 acres of oak woodlands (72 percent of the total oak woodlands) in the western Blue Ridge and Capay Hills are found on private lands used primarily for cattle production. The remainder of the oak woodland is owned by public agencies such as the federal Bureau of Land Management and Yolo County.

The portion of the Sacramento Valley within Yolo County supports approximately 2,000 acres of valley oak riparian woodlands found in a patchy distribution along the major drainages: Cache Creek, Putah Creek, the Sacramento River, Willow Slough, the Tule Canal, the Yolo Bypass, and other small tributaries and waterways. These valley oaks are found almost entirely on private lands.

[9] Population statistics referenced here were found in the Yolo County General Plan Update Background Report, created by Jones and Stokes in 2005 to support Yolo County's General Plan Update.

[10] The Yolo County Parks and Resources Management Division estimated oak woodlands in private ownership using Geographic Information System parcel data and the oak woodlands data developed by HT Harvey and Associates for the HCP/NCCP (See Appendix A).

IV. HISTORICAL EXTENT OF OAK WOODLANDS

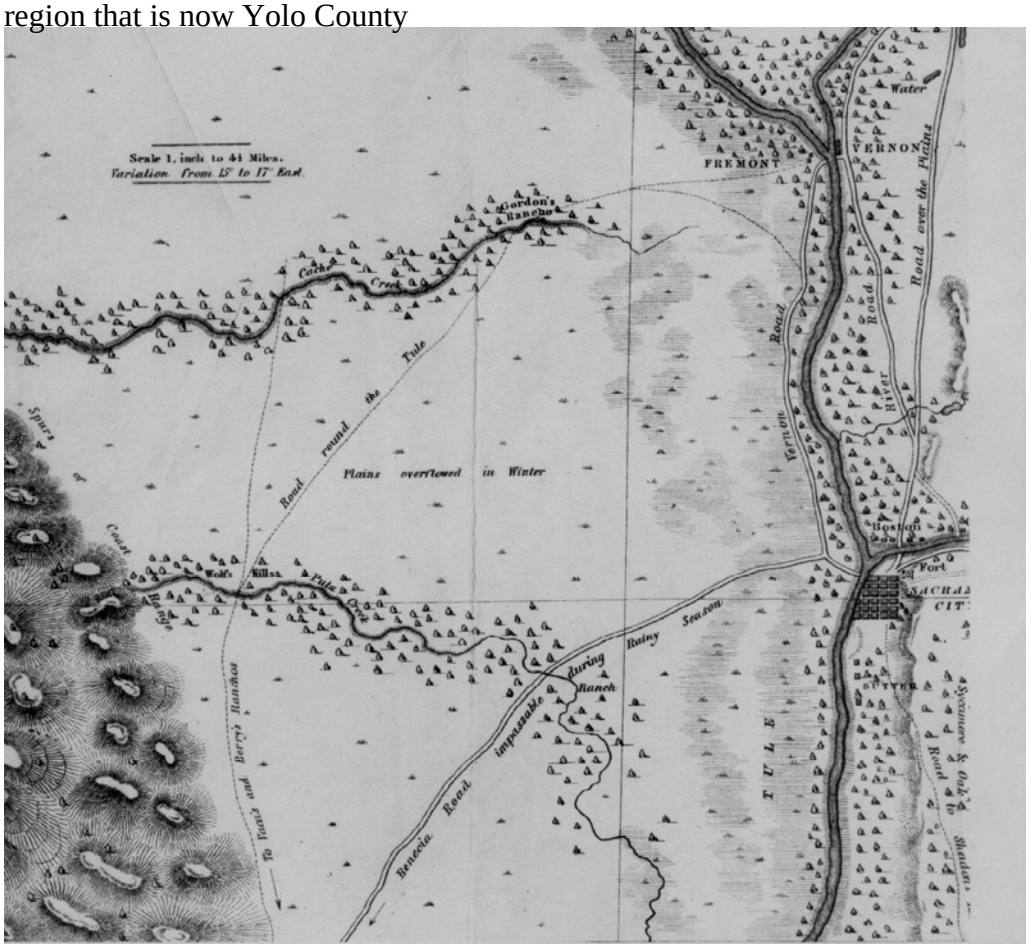
While a comprehensive evaluation of oak woodlands in the pre-settlement area is not a part of this planning effort, this section provides historical maps, aerial photos, anecdotal accounts, and other historical research to provide a glimpse of what Yolo County's oak woodlands may have looked like 150 years ago. Evidence suggests that prior to 1849, in the area that is now Yolo County, oak woodlands composed one of the most significant habitat types. Historical evidence suggests that riparian forests dominated by valley oaks, cottonwoods, and willows formed a wide band of forest along the county's primary waterways including Cache Creek, Putah Creek, Sacramento River, and Babel, Elk, Sutter, and Willow Sloughs. This is in stark contrast to the scattered remnant patches of valley oak woodlands and valley foothill riparian forest found today. Evidence also suggests that although the western portion of the county, including the Blue Ridge, and Capay Hills still supports a considerable extent of oak woodlands, this region once supported far more woodlands than we see today.

In a 1979 Master's thesis from the University of California, Davis, Elizabeth Dutzi provided one of the most thorough reviews of written accounts from the first modern explorers and surveyors to set eyes on the land that now is Yolo County. From this review she reached the following conclusion:

> "Valley oaks, either as homogenous woodlands or as a major constituent of riparian forests, lined the principal rivers of the Central Valley. Farther away from the stream banks, a very open valley oak woodland or savanna predominated, with single oaks or groves of oaks interspersed with large grassland areas. Between these forests large areas of grasslands between the riparian areas were common, especially along the western side of the Valley."

Early survey maps of the region provide more specific information about the original distribution of oak woodlands. One of the most valuable is the map created by General George W. Derby, a U.S. Army topographical engineer who was ordered to the Central Valley to examine the potential for military bases in the region in 1849. His map, although not completely accurate, provides some information about the early conditions of riparian forests and oak woodlands in the northern portion of the Central Valley, including Yolo County. The entire map and a highlighted section that constitutes Yolo County are shown below, including a dramatic band of forest along Putah Creek, Cache Creek, and the Sacramento River. These findings directly match Dutzi's conclusions cited above.

Figure 2. Map created by General George W. Derby in 1849 highlighting the region that is now Yolo County



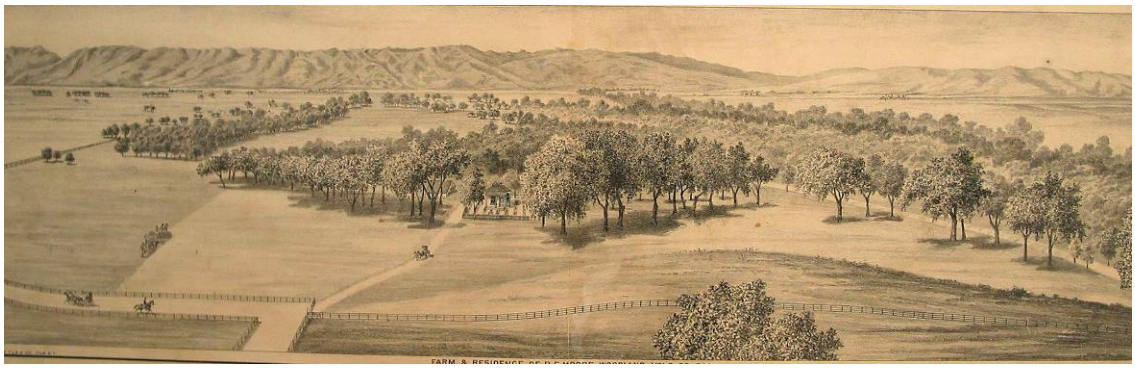
In 1856, a "Botanical Report" was issued by the United States Senate that describes the original conditions of valley oaks along Cache Creek resulting from a railroad survey:

> "The timber belt is composed of the most significant oaks I have ever seen. They are not crowded as in our forests, but grow scattered about in groups or singly, with open grass-covered glades between them; the trunks often seven feet in diameter, soon divide into branches, which spread over an area of which the diameter is considerably greater than the tree. There is no undergrowth beneath them; an unending series of great trunks is seen arising from the lawn like surface."

Evidence suggests that oak woodlands were once common in the area now occupied by the city of Woodland. In 1909 the Whitney and Party soil survey conducted by the U.S Bureau of Soils classified soils series and noted associated vegetation communities. This survey noted large expanses of valley oak woodlands at the terminus of Cache Creek near the modern-day City of Woodland now sits. This evidence is corroborated by a lithography created by a local artist in order to capture the history of Yolo County in

1849 found in an *Illustrated History of Yolo County*, figure 5. Today only remnant single oaks remain in and around the city of Woodland.

Figure 3. A lithograph showing the condition of oak woodlands in and around the City of Woodland in 1849



The Capay Valley, Blue Ridge and Capay Hills still support the largest extent of oak woodlands in the county, but evidence suggests that these woodlands have also been severely altered. Comparative studies of historic photos and current conditions suggest that large areas of oak woodlands were harvested in the 1800s. Much of the current oak woodland in these areas is the result of regeneration that occurred after partial or complete clearing (HT Harvey 1998). The primary impacts to oak woodlands in this region, which include land conversion, lack of regeneration, low groundwater levels and fire, are apparent in the Capay Valley. Evidence suggests that oak woodlands composed of scattered stands and individual trees originally grew throughout the Capay Valley. Much of the native vegetation, including oak woodlands, was removed to make way for the production of almond, peach, and walnut orchards.

V. FACTORS AFFECTING OAK WOODLANDS

While oak woodlands may seem abundant in Yolo County, conservation of the existing oak woodlands is a challenge due to a number of factors that threaten their continued health and longevity. These factors include land conversion resulting from urban, rural, or intensive agricultural development; road and infrastructure expansion; few young oak saplings to replace the existing old oaks (also known as a lack of regeneration); increasingly limited access to groundwater in some areas that increases the mortality of both young and old oaks; and clearing for fire protection around developed areas. A monitoring program of oak woodlands in Yolo County would detail the specific regional threats to these habitats.

Land Conversion

Rural residential and urban development. Rural residential and urban development may result in the conversion of oak woodlands to other uses. Yolo County has historically directed growth to incorporated cities and continues to maintain strict policies regulating the subdivision of private parcels in the unincorporated area, thereby

protecting both oak woodlands and important agricultural land. Development pressure in the unincorporated areas of the county has increased in response to three recent changes: 1) the value of land in other areas attractive for development is rapidly increasing relative to Yolo County; 2) the revenue Yolo County receives to provide services is diminishing in relation to costs; and 3) farmers and ranchers find it increasingly difficult to compete in a global marketplace, therefore making more land potentially available for sale. The Yolo County Board of Supervisors will decide whether to allow additional rural residential development and growth in existing unincorporated cities (such as Knights Landing and Esparto). The Supervisors will make these decisions during the update of the General Plan, expected to finish in 2008.

Agriculture. Approximately 82 percent of the land area in Yolo County is committed to livestock production and cultivated agriculture, including row and field crops, orchards and vineyards (Jones and Stokes 1998). While the extent of cultivated acreage has remained relatively stable since the early 1900s, the mix of crops and land management techniques have fluctuated consistently based on economics and landowner values. Changing market conditions have the potential to increase the conversion of oak woodlands to intensive agriculture, as has been seen in other northern California counties. Oaks woodlands found on these lands are potentially at risk from changes in land use and land management techniques.

Infrastructure. Local and regional housing growth increases demand for new infrastructure, including highway and road expansion. The result of this demand is epitomized by the recent Caltrans proposed a project to expand Highway 16 in the Capay Valley. This project resulted from safety concerns and increased traffic to and from the Cache Creek Casino. Depending on the alternative that Caltrans chooses, the project will remove between 339 and 374 valley oak trees, 17 and 19 interior live oak trees, and 12 blue oak trees.[11] Road expansion projects located in regions where oak woodlands are found will continue to threaten these resources.

Lack of Regeneration

Throughout California, the lack of regeneration in various native oaks has raised serious concern for landowners, policy makers and the public. Several statewide surveys have shown that some native oak species, including blue and valley oak, have inadequate levels of regeneration to sustain their populations over the long term. Oak woodlands need to produce enough new trees to offset the loss of mature trees due to natural mortality factors. This process relies on the successful establishment and growth of new seedlings and eventual recruitment of these seedlings to the sapling and tree stages. Without adequate regeneration, oak stands thin out over time and eventually disappear as the last oaks die.

Acorn production varies widely from year to year. Also, acorns of the oak species found in Yolo County germinate in the winter after they have dropped and do not persist as a seed bank in the soil from year to year. Most oaks regenerate from a bank of persistent

[11] Environmental Impact Report for the Yolo-16 Safety Improvement Project, 2006.

seedlings beneath the canopy, or a "seedling bank."[12] Since most acorns land under or near the canopy of the parent tree, most of the seedling bank is in this area. The shading and buildup of organic mulch beneath oak canopies favors acorn germination and early seedling growth.

Although oak canopy enhances seedling establishment, it suppresses the transition of seedlings to saplings. Persistent oak seedlings, which may be no taller than 6 inches in species such as blue oak, may survive for years in the understory. These seedlings can produce a strong root system but show little shoot growth. In fact, shoots of persistent seedlings may periodically die back to the ground, and resprout from the seedling base in the following growing season.

Understory seedlings typically remain suppressed until competition is removed or eliminated by the decline, death, or removal of overstory trees. Seedlings released from overstory suppression can respond with relatively rapid shoot growth and can grow into saplings that eventually refill the canopy gap. Although a lack of sapling-sized oaks has been used to suggest that oak regeneration is inadequate, oak saplings are not likely to be found in well-stocked woodlands. A lack of saplings in and near recent canopy gaps, however, is clear evidence of inadequate regeneration. In woodlands with stable canopy cover, low populations of persistent seedlings in the understory are the primary indicators of inadequate regeneration.

Although most oak regeneration occurs through this pattern, some acorns are planted beyond the oak canopy by seed-eating animals, especially scrub jays. If these acorns are placed in a favorable seedbed in areas that have good levels of soil moisture, minimal amounts of plant competition, and little or no impact from herbivores, the acorns can produce vigorous seedlings. Pioneer colonization of this type is seen in gardens, landscape beds, and sometimes along roadsides beyond pasture fences where browsing is minimal and road runoff provides additional soil moisture. Artificial methods for establishing oaks from seed are based on creating such favorable conditions through weed control and protective enclosures. These conditions are uncommon in open grasslands used for livestock range, however, so oaks do not typically colonize these areas even if they have historically supported oak woodlands.

Various factors can contribute to poor seedling establishment, short seedling persistence, and lack of recruitment from the seedling to the sapling stage. Some or all of the following factors may constrain regeneration at a given site— alleviating only one constraint may not be adequate to ensure regeneration.

Low acorn production. Most California oaks that have been studied appear to require cross pollination to produce adequate acorn crops. Because oak pollen is dispersed by wind, adequate pollination will not occur in oaks that are far from others of the same species. Hence, isolated trees may produce few if any acorns.

[12] These seedlings are also known as advance regeneration; that is, regeneration that is in place prior to the time it is actually needed.

Poor seedbed conditions. Healthy mature acorns normally fall from trees between September and October, often well before the soil has been wetted by fall rains. Natural mulch composed of leaf litter provides protection for acorns. Mulch prevents acorns from being overheated and desiccated and also protects at least some from being eaten. In areas that lack natural mulch and have been compacted by livestock, few acorns may be able to survive and germinate.

Herbivory. Animals that eat acorns and seedlings can substantially impact the growth and survival of oak seedlings and saplings. Rodents, deer, and livestock all have the potential to limit or eliminate oak reproduction, but the relative importance of each herbivore varies by location. Gophers, ground squirrels, and voles can kill juvenile oaks by chewing and girdling stems. Livestock eat and trample understory seedlings, depleting or eliminating understory advance regeneration. Heavy browsing of released seedlings by livestock or deer can indefinitely suppress their growth and inhibit recruitment to sapling and tree size classes. Interior live oak is less palatable to livestock than valley and blue oak, so grazing impacts these species differently.

Water stress. Due to California's Mediterranean climate, water stress associated with summer drought is an important factor limiting oak seedling survival and growth. Water stress is increased by the presence of non-native annual grasses and forbs in the understory that deplete soil moisture rapidly in the late spring. Shading provided by the oak canopy reduces impacts from temperature and wind speed, thereby reducing water stress. However, overstory oaks ultimately compete with seedlings for soil moisture, suppressing their growth. In riparian areas where soil moisture is less limited, valley oak regeneration can advance to the sapling size class even in the presence of overstory canopy.

Fire. Most of the tree oak species in California are adapted to tolerate fire in varying degrees, but none has been shown to require fire for regeneration. In contrast, studies have shown that even though oak seedlings and saplings resprout readily after topkill, many juvenile oaks are killed by fire. After topkill, resprouting oak saplings require several to many years to recover their aboveground biomass. Repeated destruction of oak shoots in successive years depletes seedling energy reserves and increases the likelihood of mortality. The combination of repeated fire and grazing is especially damaging to oak regeneration, and was historically used to convert woodlands to grasslands.

At a given site, one or more of the factors listed above may be constraining seedling establishment and growth. Restoring regeneration potential may require changes in management practices to alleviate those factors that completely inhibit oak seedling establishment and sapling recruitment. Management changes can have both positive and negative impacts, however. In some areas, complete cessation of grazing can lead to greater competition from non-native grasses and increased vole populations, leading to more seedling damage and reduced oak seedling establishment. Site-specific assessments are generally needed to assess the status of oak regeneration, identify factors that may be limiting regeneration, and develop management strategies that can promote natural regeneration. These same principles apply in areas where attempts are being made to restore oak woodlands.

Low Groundwater Levels

Sinking groundwater tables resulting from groundwater overdraft can be particularly problematic for valley oak survivorship. Valley oaks often produce deep sinker roots that can reach the ground water. This allows the tree to access a constant supply of moisture throughout the summer and permits fast growth of the canopy. Because the tree canopy is dependent on this permanent source of water, a substantial drop in the depth of the water table puts the tree under severe water stress. Although root growth can keep pace with minor fluctuations in the groundwater table, roots cannot grow fast enough to compensate for a rapid drop of several feet or more. Furthermore, once the tree becomes severely water stressed, root growth is adversely affected, which can cause a spiraling cycle of increasing water stress that can severely debilitate or kill mature trees.

Large, mature valley oaks are more susceptible to rapid reductions in water table depth than are younger trees that may be able to adapt more rapidly to changing conditions. In addition, effects of lowered water table depth are more severe in sandier soils that store relatively low amounts of moisture in the soil profile than loam or clay loam soils.

VI. ESTABLISHING PRIORITIES FOR OAK WOODLAND CONSERVATION AND ENHANCEMENT PROJECTS

This section presents a system to help identify high-priority, voluntary oak woodlands conservation and enhancement opportunities. The system for establishing priorities can help willing landowners, public agencies, nonprofit organizations and other project partners identify areas with the highest oak woodland resource values (See Section II). The system uses criteria that reflect these resource values, such as stand composition and distribution, tree cover and density, plant and wildlife habitat availability (including special status species), historical and cultural significance, and recreational opportunities. In addition, the system factors in the threat of loss and potential management constraints. The system will complement the countywide conservation planning effort eventually developed in the Yolo County HCP/NCCP. The HCP/NCCP will provide the overall conservation planning framework for the County, including oak woodlands and other natural communities.

Yolo County encourages organizations and agencies working on oak woodland conservation activities to use the system for establishing priorities described in this section. Yolo County also will use the system as part of the process to certify that projects are consistent with the plan, as required by the Wildlife Conservation Board's oak woodland grant program. Yolo County, with input from the public, a consulting oak woodland ecologist, and the Yolo County Parks, Resources, and Wildlife Advisory Committee (PRWAC), will assign a higher priority for conservation or enhancement projects on oak woodland parcels that provide a greater overall level of benefits.

Yolo County staff will initially solicit information from the project proponent regarding the oak woodland resource values associated with the project. County staff also will use a publicly available Geographic Information System (GIS) data to gather more

information, although available GIS data are limited in scope and resolution. The data do not generally provide sufficient detail on stand composition, stand condition, or other factors to fully assess oak woodland resource values. Information provided by interested landowners or other project proponents will help supplement the GIS data, but some information may be unobtainable due to cost or other factors.

The system to establish priorities uses a layered approach to assign an overall priority to a parcel that can be tailored to the specific requirements of a funding source. The three layers considered are: resource value, risk category, and management constraints. The **resource value** is an aggregate assessment of the natural resource values associated with a given oak woodland and is the most important layer in the prioritization system. The **risk category** is an assessment of the likelihood that the resource will be lost or seriously degraded over various time horizons if no conservation actions are instituted. **Management constraints** reflect the level of land management inputs (for example: to control invasive weeds or promote oak regeneration) needed to maintain the resource value.[13]

The system is designed to provide flexibility and the County can readily modify it by adding additional criteria or adjusting thresholds for priority rankings as needed. In addition, the County has not assigned specific weighting to the various criteria listed below. The relative importance various criteria may change over time, based on the locations and types of conservation projects that have already been completed and the specific requirements associated with available funding sources. These changes can be accommodated by adjusting the importance attributed to any given criterion.

Oak Woodland Resource Values

In this section, the ranking for conservation criteria is based on maintaining the high oak woodland resource values that are already present. The ranking for enhancement criteria is based on a combination of both current resource values and the potential resource values in the enhanced state. The criteria are grouped into four categories:

- Stand Composition, Integrity and Functionality
- Habitat for Plant and Wildlife Species
- Landscape Function
- Human Interactions

A checklist of the 21 criteria used to measure resource value is provided at the end of this section. The County will use separate copies of the checklist to summarize the priority ranking. Since the information available for assessing the various criteria may vary in

[13] Depending on the amount of funding available in any given year and the number of potential projects to be funded, specific threshold levels could be set to simplify evaluation. For example, a minimum risk level might be established as a floor for qualifying projects.

type and quality, the sources of data used and their overall data quality should be noted in conjunction with the priority ranking. Uncertainty associated with the data should be considered in the overall effort to establish priorities and in comparisons between ranked projects.

Stand Composition, Integrity, and Functionality

Criterion 1: Stand Composition. Individual oak species vary somewhat with respect to the type of habitat they provide, the wildlife species they support, and their functions in the landscape. Conservation and enhancement efforts should seek to conserve and maintain the full diversity of oak species present in the county. In considering the oak species present at a site, both the overall rarity of the species within the county and the degree to which the species is protected or threatened will contribute to its overall species ranking. As levels of protection or threat change over time, Yolo County may adjust the relative priority of a given species. The priority ranking based on species in the table below should be considered as a general guide rather than an absolute order.

Priority for Conservation and Enhancement	Stand Composition (Oak Species Present)
High	**Valley oak –** This species may have experienced the greatest loss in its historical range within the county, especially on the valley floor. It has also been eliminated from much of its historic range statewide. Valley floor and riparian valley oak stands have especially high priority. **California black oak** – This species is very uncommon in the county, in part because it is near the limits of its natural range. Populations of black oak in the county have probably been reduced due to historical harvesting. California black oak also appears to be regenerating poorly in at least some counties and may be at risk of attrition due to tree mortality. **Blue oak** – This an important upland species historically diminished by harvesting. It is currently threatened by poor regeneration in many areas. Although fairly common in the Inner Coast Range portion of the county, very little acreage is in public ownership or protected in any way. **Oracle oak** – This natural hybrid of California black oak and interior live oak is likely to be present in very small numbers in various portions of the county where the current or former ranges of the two parental species overlap. Since it is a hybrid, it is primarily a target for conservation rather than regeneration.
Moderate	**Canyon live oak** – This species is relatively uncommon in the county, but a high percentage of the reported acreage is on land owned by the Bureau of Land Management. **Interior live oak –** This is a relatively common species, both in the county and over much of its range in the state. It regenerates reasonably well both by seed and from stump sprouts. It is less favored by browsing animals, so it sustains less browsing damage than valley or blue oak when present in mixed stands. Some interior live oak woodland acreage in the county is on BLM lands.
Low	**Scrub oak** – This species is currently relatively common statewide and in portions of the county. Much of the existing scrub oak habitat in the county is owned by the BLM.

Criterion 2: Distribution of Oak Species. Oak woodlands may contain from one to several oak species. The number of species present typically reflects the variation of environmental and soil conditions at the site. Past management practices, however, can change the composition of the woodlands by selectively removing some species or selectively inhibiting regeneration. Blue oak seedlings, for example, are generally preferred by browsing animals over interior live oak seedlings. As a result, interior live oak may be overrepresented relative to blue oak in areas which were cleared and grazed heavily in the past. A higher conservation priority should be assigned to sites where the current oak distribution is closer to the likely pre-settlement distribution and has not been excessively changed by past management.

Priority for Conservation	Distribution of Oak Species
High	Oak species distribution has not been significantly influenced by past management. Oak species that should be represented on the site are present at levels likely to be representative of historic levels.
Moderate	Oak species distribution moderately influenced by past management. Oak species that should be represented on the site are present but levels appear changed from historic levels.
Low	Oak species distribution heavily influenced by past management. One or more site-appropriate oak species are rare or absent.

Sites with species distributions that have changed as a result of management practices can be appropriate targets for enhancement projects. In general, a higher enhancement rating would apply to sites where an appropriate balance of oak species can be reestablished by encouraging regeneration of species that are poorly represented.

Priority for Enhancement	Distribution of Oak Species
High	A site-appropriate balance of oak species can be reestablished by encouraging regeneration of species that are present, but poorly represented, on a site.
Moderate	A site-appropriate balance of oak species can be reestablished by planting with seeds available from appropriate adjacent remnant trees, but the site currently lacks existing regeneration and trees of some site-appropriate species.
Low	Target species for restoration are lacking on the site and no appropriate local seed source is available.

Criterion 3: Tree Cover and Density. Many of the benefits and services provided by oaks woodlands are directly related to the amount of tree canopy cover on the site. Most of the benefits related to air quality (such as carbon sequestration and particulate

interception), for example, are directly proportional to total canopy cover. The amount of flood protection and erosion protection provided by oak woodlands is also directly related to canopy cover.

The relationship between canopy cover and wildlife habitat is more complex. Some species prefer closed canopy woodlands, whereas others are more apt to utilize openings within the woodlands or edges between woodlands and other habitat types. Hence, sites with less than 100 percent canopy cover may support greater biodiversity overall. One of the goals of the plan is to maximize the total amount of conserved oak woodland canopy cover, while recognizing the importance of including a variety of canopy cover levels within conserved and restored woodlands. Yolo County will consider the level of canopy cover present on adjacent conserved lands when evaluating overall canopy cover.

Tree density (the number of trees per unit area) is related to total canopy cover, but a range of tree densities can give rise to a given level of canopy cover. At excessive tree densities (also known as overstocked stands), trees typically compete with each other for available water and light, so tree growth can be slow and tree condition may be poor. Through attrition of suppressed, the stand may eventually self-thin to a sustainable density, but this process can delay the transition of the woodlands to a desirable density. Also, the presence of numerous dead and declining trees in an overstocked stand may increase the risk of high intensity wildfires. At the opposite extreme, very low density stands, characterized by individual tree canopies separated by large distances (200-300 ft or more) may not be sustainable due to low rates of regeneration, and may be appropriate targets for restoration or enhancement. Apart from these extremes, a relatively wide range of densities may be sustainable, depending on species composition and site characteristics.

For relatively common oak species, such as blue and interior live oak, the following approximate overall ranges of canopy cover can be used: high = 50 percent or more, intermediate = 20 to 50 percent, low = less than 20 percent. For relatively rare species such as valley oak, these cover levels would be inappropriate because canopy cover at most existing sites is relatively low. For species such as valley oak and oak stands that may naturally have densities more typical of oak savannas, canopy cover levels need to be considered on a basis relative to the maximum likely sustainable canopy cover level.

Priority for Conservation	Tree Cover and Density
High	Relatively high levels of tree canopy cover at stand densities that are sustainable for the site.
Moderate	Intermediate levels of tree canopy. Portions of the site may have excessively high or low stand density.
Low	Tree canopy is low or very low. Alternatively, canopy cover levels are higher, but most or all of the stand has unsustainably high tree densities.

Priority for Enhancement	Tree Cover and Density
High	Tree canopy is low or very low, but could be increased through natural or assisted regeneration. Alternatively, canopy cover levels are higher, but portions of the stand have unsustainably high tree densities that could be managed by selective thinning.
Moderate	Intermediate levels of tree canopy. Portions of the site may have low or very low stand density or may show evidence of decline of existing overstory trees.
Low	Moderate to high levels of tree canopy cover at stand densities that are sustainable for the site.

Criterion 4: Stand Size and Connectivity. An overarching goal in conserving and enhancing woodlands is to maintain oak woodlands as functional ecosystems. The functionality of the oak woodland ecosystem is related to its size, its connectivity with other oak woodlands or other native habitats, and its interface with less compatible adjacent land uses.

Larger oak woodland stands are more likely to provide the scale needed to allow for ecosystem processes to function, and therefore generally have greater conservation value than smaller areas (if all other factors are equal). The overall biodiversity of a stand tends to increase with size, since a larger variety of habitat features are more likely to exist in a larger area. Also, some species that require relatively large home ranges are likely to occur only in sufficiently large habitat areas. Small stands with a limited number of trees may not have sufficient genetic variation to provide for long term stability, and are more likely to be threatened by impacts such as fire, disease, or long-term climate variation.

In assessing the overall size of an oak woodland ecosystem, Yolo County will consider the landscape context. Oak woodlands and habitat elements commonly do not end at parcel boundaries, so Yolo County will consider the overall size of the woodland area of which a specific parcel is a part. Hence, a relatively small woodland area can have a high conservation value if it is adjacent to other conserved lands, especially if it forms a linkage between conserved habitats.

Priority for Conservation	Stand Size and Connectivity
High	The oak woodland area is relatively large, constitutes a high percentage of the resource (e.g., for species of limited distribution such as valley oak), and/or is connected with a larger network of oak woodlands and other native habitats which are or have the potential to be conserved as well.
Low	The oak woodland area is too small to ensure a self-sustaining stand and is not connected with other native habitats.

Since most enhancement projects are of limited size, overall size of a project is generally a less important consideration for assigning restoration or enhancement priority. The location of the enhancement project within the landscape and its connectivity to existing stands and habitat is a more important consideration.

Priority for Enhancement	Stand Size and Connectivity
High	Restored area will help reconnect habitat areas or forms an important extension of a larger woodland into a habitat area that is degraded or no longer extant. Projects that connect with past and/or future projects that allow for a larger total restored area also have a high priority.
Low	Small restoration projects that are not connected with other native habitats.

Criterion 5: Stand Geometry. The geometric shape of a parcel is another consideration in assessing its conservation and restoration value, especially if the parcel is adjacent to lands that have been converted from native plant communities to other uses. Land uses such as residential development and intensive agriculture may adversely affect the habitat value of adjacent oak woodlands, and may also limit the options available for woodland management. Impacts generally increase as the amount of interface or edge between the woodlands and developed land uses increases.

Priority for Conservation and Enhancement	Stand or Project Area Geometry
High	Little or no interface between the stand and an incompatible adjacent land use such as urban/residential or intensive agricultural development.
Moderate	Moderate amounts of interface relative to the area of the stand or project area and/or adjacent land uses are only partially incompatible or incompatible uses are buffered at the interface.
Low	High ratio of developed interface length to the overall area of the stand. May be relatively narrow areas with incompatible land uses on both sides or areas with inholdings of incompatible land uses.

Criterion 6: Stand Structure and Sustainability. In the pre-settlement era, most of the oak woodlands in the county probably consisted of mixed age stands. Recruitment of new trees would generally have occurred in relatively small canopy gaps that developed from mortality of individual trees or small clusters of trees. Except in chaparral areas, most fires would not have been stand-replacing events, because most of the oak species present are relatively fire resistant. No other natural phenomena are likely to have caused complete stand replacement in these oak woodlands.

With the onset of widespread clearing for agriculture and fuel, relatively large areas were cleared over short time spans. When regeneration did occur, from seedling advance regeneration and/or stump sprouts, the stands that developed typically were much more even-aged. In some areas, multiple rounds of clearing, especially if only partial, have given rise to multi-aged stands, although these stands probably have less age diversity than in the original stands. Old growth trees (more than about 150 years old) are usually rare or lacking in most second and later growth oak woodland stands.

Stands that are composed primarily of trees regenerated from stump sprouts may have a shorter potential lifespan than stands derived from trees originating from seedlings. Stump sprouts can have poor structure and frequently have decay associated with the old stump. These two factors can cause trees to fail at an earlier age than equivalent trees originating from seedlings.

Stands consisting only of old, decadent trees, especially stump resprouts, may not be sustainable because a high percentage of the trees in the stand could die over a relatively short time period. Furthermore, decadent trees with wood decay and cavities are more likely to be severely damaged or killed by fire. Since most oak seedlings establish best under tree canopy, rapid loss of canopy could impede natural regeneration.

A uniformly young stand has a longer potential lifespan than a decadent stand, but the lack of larger stems and larger dead or dying trees provides lower habitat value for some wildlife species. Also, a young even-aged stand will eventually become an old even-aged stand that could suffer relatively high rates of mortality and canopy loss. For long-term sustainability, a relatively mixed age stand is probably the most sustainable over the long term without requiring management inputs.

For all but very young stands, the presence of advance regeneration in adequate amounts is important for ensuring sustainability. Levels of advance regeneration may be low due to a variety of reasons related to past and current management and other factors.

Priority for Conservation	Stand Structure and Sustainability
High	Multi-aged stands with good levels of seedling advance regeneration.
Moderate	Older even-aged stands with variable levels of advance regeneration or young even-aged stands with little or no advance regeneration.
Low	Declining even-aged stands lacking advance regeneration

Even-aged stands, especially those lacking adequate levels of advance regeneration can be suitable targets for restoration activities aimed at increasing regeneration. By successfully encouraging regeneration to replace dying trees, it may be possible to help reestablish a more mixed-age stand.

Priority for Enhancement	Stand Structure and Sustainability
High	Declining even-aged stands lacking advance regeneration
Moderate	Older even aged stands with variable levels of advance regeneration. Multi-aged stands or young even-aged stands with little or no advance regeneration.
Low	Multi-aged stands with good levels of seedling advance regeneration.

Criterion 7: Contribution to Population Genetics. Individual oak trees can live for hundreds of years, but oak woodlands have occupied most of their current range for many thousands of years. The genetic variation present within a population of oaks is shaped by thousands of years of selection pressures imposed by the underlying soils, varying climate conditions, and other site-specific factors. As a result, most forest trees show some level of adaptation to local conditions. Trees growing in a given area may have survival advantages over trees of the same species that originated in a different area and environment.

Oak pollen is disseminated by wind and oak trees generally need to be pollinated by other individuals (that is, they are primarily cross pollinated rather than self-pollinated). Movement of genetic material via wind-borne pollen tends to ensure that there is genetic variation within stands, but also provides a mechanism for the incremental spread of genetic traits between adjoining stands. The exchange of genetic material between populations arrayed across the landscape allows oak populations to adapt over time to the conditions at a site and to remain viable under changing conditions. Oaks and other native species have already been exposed to very rapid environmental changes initiated by the settlement of California. Furthermore, the loss of oak populations over the past 150 years has already narrowed the genetic diversity in the oak population. In order to maintain oak woodlands as a viable resource in the face of these current pressures and future environmental changes, it is important to maintain the full complement of genetic diversity present within the oaks' range.

To maintain the widest range of genetic diversity within the county's oak population, it is important to maintain oak stands in a variety of oak woodland sites across the range of soil and climate variation found within the county. Populations at the edges of the existing range may be especially critical in that they may represent the greatest level of genetic adaptation to extreme conditions, for example, very dry or wet conditions. In addition, very old trees constitute an important genetic resource in that they may include traits that contribute to longevity, as well as traits that may be less common in the current tree population than they were prior to clearing associated with settlement.

Populations in the main portion of a species' range also need to be conserved to provide a complete complement of genetic resources for the species. Genetic traits found in these main populations, however, are likely to be present in many individuals and may therefore be at low risk of being lost. The conservation priority ranking for this criterion

is therefore lowest for these populations. The highest priority ranking for this criterion are assigned to populations that may contain unique genetic traits that are found in relatively few extant individuals and are therefore at a high risk of being lost.

Priority for Conservation	Contribution to Population Genetics
High	Viable oak populations at the edge of the existing range of the species in the county or on uncommon soil types or environmental situations (slope, aspect, proximity to water, etc.). Stands containing very old oaks.
Moderate	Marginally viable (due to poor condition or low density) populations at or near the edge of the existing range of the species in the county or on somewhat uncommon soil types or environmental situations.
Low	Oak populations within the main portion of the species' range in the county on common soil types / environmental situations.

From the standpoint of enhancement, high priority sites are those that may have unique genetic resources that are likely to be lost without intervention. Such intervention may include operations to salvage and plant seed from particular trees or groups of trees.

Priority for Enhancement	Contribution to Population Genetics
High	Individual very old oaks or unsustainably small oak populations at the edge of the existing range of the species in the county or on uncommon soil types or environmental situations (slope, aspect, proximity to water, etc.).
Moderate	Marginally viable (due to poor condition or low density) populations at or near the edge of the existing range of the species in the county or on somewhat uncommon soil types or environmental situations.
Low	Oak populations within the main portion of the species' range in the county on common soil types / environmental situations.

Habitat for Plant and Wildlife Species

The quality of habitat and the number and types of species present in oak woodlands depend on a variety of factors, including:

Oak species present. The type of habitat provided by evergreen oaks, such as interior live oak or canyon live oak, differs from that provided by deciduous oaks, such as valley, blue or California black oak. Some species, especially insects, may only be associated with a single oak species. Other species may prefer stands with a mix of oak species. Some oak species (valley, blue oak) produce acorns that mature in a single year, whereas others (interior live, California black) produce acorns that mature in the second year after flowers are produced. Since acorn production in oaks varies widely from year to year due to weather conditions that occur during flowering, having both one- and two-year acorn producers in the same stand can provide a more reliable source of food for species that consume acorns.

Oak density (trees per acre) and level of canopy cover. Wildlife species vary in the degree to which they utilize stands with varying amounts of canopy cover: some prefer more open stands, whereas others are more likely to be found in dense stands. The level of shading in the understory, which depends on both stand density and species composition, also affects which native or exotic plant species are likely to be present.

Distribution of tree sizes and ages. Various species that utilize cavities in large stems or prefer tall trees are more likely to occur in stands with larger, older trees. The presence of dead trees (snags) and large downed wood (coarse woody debris) improves habitat value for various wildlife species. This in turn is related to both the stand-age distribution and management of the stand, which affects how long downed wood remains on the ground. The presence of various plant species in the understory or in canopy gaps may be also be related to soil types or features such as vernal pools or riparian areas.

Spatial distribution on the landscape. The distribution of oak woodlands across the landscape has a large influence on habitat quality. The spatial relationship between patches of woodlands and other habitats can influence which species may be found in the oak woodlands and the quality of habitat that the woodlands provide. Oaks along watercourses, for example, provide critical shaded riparian habitat important for fish and other aquatic species. Connectivity between oak woodlands to provide for wildlife movement is also important for many wildlife species. Some species may use oak woodlands for sheltering or nesting but may forage in adjacent habitats, such as agricultural fields, grasslands, or chaparral.

Disturbance. A high level of disturbance within woodlands and the presence of various exotic plant species can reduce the abundance of native species and reduce the overall habitat value of oak woodlands. Habitat quality can also be degraded by the degree to which the habitat is fragmented by residential or agricultural development, particularly if it interrupts movement corridors.

Criterion 8: Native Biodiversity. Settlement of Yolo County resulted in the degradation of natural habitats. In some locations, however, areas exist that still have a relatively diverse array of native species. Even if the native species present are not rare, these areas of high native biodiversity constitute a valuable and relatively rare resource.

Priority for Conservation or Enhancement	Native Biodiversity
High	Oak woodlands include areas with high levels of native biodiversity.
Moderate	Oak woodlands have moderate levels of native biodiversity and/or areas with high native biodiversity are adjacent to the woodland.
Low	Few native species other than oaks are present in or near the woodland.

Criterion 9: Special Status Species. In the broad sense, special status species include species listed by the federal and state government as threatened and endangered species; species that have been proposed for listing but have not yet been officially listed; as well as plant species designated as rare or endangered by the California Native Plant Society (CNPS). Depending on their actual status and other factors, these species may be protected to varying degrees by state and/or federal regulations. Since these species as a group are rare and may be threatened with extinction, conserving their habitat is important for their survival and for maintaining the integrity of the ecosystems in which they are found. Special status species may utilize oak woodlands as an essential part of their habitat, or more commonly, they may utilize oak woodlands habitat in addition to other habitat areas. Furthermore, woodlands adjacent to a given habitat area, such as a stream, may be important for maintaining the integrity of that habitat, for example, by reducing the amount of sediment that would enter the stream via erosion.

Priority for Conservation or Enhancement	Special Status Species
High	One or more special status species utilize a woodland or part of it as essential or preferred habitat.
Moderate	Woodland may be used somewhat by special status species and/or habitat of one or more special status species is adjacent to the woodland.
Low	No special status species utilize the woodland or its adjacent areas.

Criterion 10: Locally Rare or Uncommon Species and Associations. Some species or associations of species (certain plant communities, for example) that are not rare throughout their overall range may be locally uncommon within the county. To maintain the overall biodiversity within the county, it may be important to maintain oak woodlands that are used as habitat for these species.

Priority for Conservation or Enhancement	Locally Rare or Uncommon Species
High	One or more locally rare or uncommon species or associations use the oak woodland or part of it as essential or preferred habitat.
Moderate	The woodland may be used somewhat by locally rare or uncommon species and/or habitat of one or more locally rare or uncommon species or associations is adjacent to the woodland.
Low	No locally rare or uncommon species or associations use the woodland or its adjacent areas.

Criterion 11: Contribution to Maintaining Native Plant and Animal Population. Among areas that serve as habitat for various native species, some areas may be especially critical for various reasons, including:

- Areas that serve as a corridor between different patches of habitat to provide for movement;

- Areas that could serve as important corridors but do not currently serve such a function;

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- Habitat patches that are especially large because they benefit species that require a relatively large home range;

- Outlying populations near the edge of the current range that may have unique genetic characteristics because of their importance for the long-term viability of the species;

- Habitat areas that support robust populations of species and are occupied for most of the year, in comparison to areas that only receive occasional use by the species;

- Habitat used for breeding or foraging during certain seasons.

Hence, in addition to considering whether species utilize a given patch of habitat, we also need to consider how that patch of habitat contributes to the overall viability of a species or group of species within the county.

Priority for Conservation and Enhancement	Contribution to Maintaining Native Plant and Animal Populations
High	Oak woodlands include areas that are critical or important for maintaining populations of one or more native plant and animal species of interest.
Low	Oak woodlands do not function significantly in maintaining populations of one or more native plant and animal species of interest.

Criterion 12: Special Habitat Features and Areas. The presence of special habitat features or elements, including those listed below, increases habitat value for various species.

- Vegetation-related features such as old growth trees, dead trees (snags), large downed wood (coarse woody debris), and trees that shade riparian areas
- Aquatic features such as riparian areas, vernal pools, and ponds
- Physical features such as serpentine soils, burrows, high water tables, and caverns

Other features may provide necessary unique substrates for plant growth or contribute to animal diets. In addition, transitional areas between different habitat types, also known as ecotones, may have a greater mix of species present and may include unique species.

Oak woodlands that serve as habitat for various native species noted above will typically contain a variety of these special habitat features. However, even in the absence of detailed information about species presence, an evaluation of the presence and abundance of special habitat features can provide information on habitat quality and the types of species that could potentially be found in oak woodlands.

Priority for Conservation or Enhancement	Special Habitat Features and Areas
High	Woodland includes a wide variety of special habitat features and areas and/or uncommon types of special habitat features/areas.
Moderate	Woodland includes some special habitat features and areas, generally of relatively common types.
Low	Very few or no native species special habitat features and areas are present.

Criterion 13: Invasive Species Presence and Abundance. Invasive exotic species can compete with or displace native species, reducing the overall native species biodiversity. Virtually every oak woodland habitat in Yolo County is likely to contain some exotic species, especially non-native grasses and forbs in the oak understory. Oak woodlands in which exotics make up a low percentage of the overall species mix, however, have a higher conservation value. In addition, some invasive species are especially disruptive

due to their high reproductive potential, competitive abilities, effects on the overall structure of the plant community, and/or tenacity once established. For example, yellow star thistle and Harding grass are especially problematic in relatively open habitats; tamarisk and arundo are especially disruptive in riparian areas.

Exotic wildlife species can also have a detrimental impact on native species. Wild pigs, for example, negatively affect native habitats. Pigs can directly girdle and kill trees. Their rooting disturbs soil, damaging oak regeneration and making areas subject to increased erosion and invasion by exotic plants. They eat large numbers of acorns, competing with native wildlife for this food source. They also eat large numbers of native bulbs, thereby reducing populations of these slow-growing species. Hence, the presence of a single exotic species can have wide ranging effects on oak woodland habitat.

Priority for Conservation	Presence and Abundance of Invasive Species
High	Oak woodland has relatively low amounts of exotic species and especially disruptive exotic species are absent or very rare.
Moderate	Oak woodland has moderate amounts of exotic species and/or may have localized infestations of especially disruptive exotic species.
Low	Oak woodland is dominated by exotic species and/or may have high populations of especially disruptive exotics.

The elimination or reduction of especially disruptive exotic species is an obvious target for habitat enhancement. Given the nature of many exotic species, however, it can be difficult and often expensive to try to reduce well-established populations of exotic species. Especially if funding is limited, it may be more cost-efficient to suppress or eradicate infestations that are limited in area to prevent spread of a target exotic species into a new area.

Priority for Enhancement	Presence and Abundance of Invasive Species
High	Oak woodland has limited amounts of especially disruptive exotic species that could potentially be eradicated or kept at very low levels.
Moderate	Oak woodland has high populations of especially disruptive exotics, but meaningful reductions in these populations are feasible.
Low	Oak woodland is dominated by exotic species and/or has such high populations of especially disruptive exotics that it is not feasible to substantially reduce their populations. Alternatively, woodland lacks especially disruptive exotic species and exotic species present are either not at high densities or are not amenable to management.

Landscape Function

The benefits provided by an oak woodland and its associated resource value can also be influenced by where it is located on the landscape. Functions such as erosion protection, for example, are more important on steep erodible soils and along watercourses than they are on level ground. In addition, the degree to which a patch of woodland functions as habitat for various species may depend on the degree to which it is adjacent to and connected with other habitats.

Since position in the landscape can affect factors such as wildlife habitat, it is already considered in part in other criteria. However, the relationship between an oak woodland and its surroundings is sufficiently important that it warrants specific consideration. Furthermore, some of the benefits that influence overall resource value are not addressed in the criteria described above.

Criterion 14: Erosion protection. Oaks help reduce soil erosion in several ways. Tree canopy intercepts raindrops and dissipates their energy, reducing their potential to erode soil. Dead leaves and twigs that accumulate on the soil surface under oaks provide further protection against the erosive action of rainfall. Tree roots and their associated mycorrhizal fungi also help to reinforce and stabilize the bulk soil, reducing both the risk of landslides and erosion caused by running surface water (gully erosion and scour along creeks).

A number of factors other than vegetative cover also influence the risk of erosion. Erosion of surface soils is influenced by the amount of rainfall an area receives; the relative erodibility of the soil; and slope steepness, shape, and length. These factors, as well as factors related to vegetation and erosion control practices, are components of the revised universal soil loss equation (RUSLE), which is used to predict soil erosion. On uplands within the county, the erosion protection provided by oak woodlands is most critical in areas with long, steep, convex slopes that have relatively erodible soil types. Landslide risk will also be greatest on steep slopes and varies by soil characteristics. Erosion along drainages and watercourses is affected by soil type, but is also related to the amount and velocity of water flow, which in turn is affected by the geometry of the channel. Undercutting of creek banks by flowing water can cause the banks to fail, dumping large amounts of sediment into the creek. Creek bank failures also expose additional areas of soil to erosion and can lead to severe gullying.

Conservation of woodlands located in areas that are prone to erosion helps prevent the degradation in water quality and overall land resource value that would occur if the trees were removed. Restoring oaks in historically wooded areas that show accelerated erosion in the absence of tree cover can help stabilize these areas and prevent further erosion.

Priority for Conservation or Restoration	Erosion Protection
High	Site surface soils and/or creek banks have a high risk of erosion (for example, highly erodible soils, long, steep slopes, high water flows, narrow channels).
Moderate	Site surface soils and/or creek banks have a moderate risk of erosion (for example, moderately erodible soils, slopes of moderate length and/or incline, wider channels with lower water flows).
Low	Site surface soils and/or creek banks have a low to very low risk of erosion (for example, nearly level soils or erosion-resistant soils on mild slopes, broad channels that only intermittently carry water at low flow rates).

Criterion 15: Water Quality Protection. Oak woodlands on slopes and on nearly level lands near streams play an important role in protecting water quality. As described above, oak woodlands can help minimize sediment loading into creeks and streams. This is especially important in areas where soils contain toxic material, such as mercury or other heavy metals. Trees can also help remediate soil contamination by absorbing heavy metals from the soil. Similarly, oaks and other vegetation along riparian areas can absorb fertilizer nutrients or pesticides associated with agricultural or urban runoff, preventing these materials from reaching surface waters. Because oak foliage can also intercept airborne pesticide drift, oaks along creeks can reduce potential contamination of streams via this route.

Priority for Conservation or Restoration	Water Quality Protection
High	Riparian oak woodlands, especially in areas adjacent to agricultural field or adjacent to urban areas. Upland oak woodlands in areas with heavy metal contamination or other materials of concern that have the potential to run off into streams.
Low	Upland oak woodlands in areas lacking toxic soil contaminants and having low risk of erosion into streams.

Criterion 16: Contribution to Flood Protection. Oak and other trees provide protection equivalent to that provided by floodwater detention basins. Trees temporarily hold rainwater on their leaf and stem surfaces during a rainstorm. This increases the amount of time that it takes for the rain to reach the ground and become runoff. By detaining peak flows for a period of time, flooding risk associated with high rainfall

events is mitigated. The greatest flood protection benefits related to tree canopy cover will be in watersheds that quickly concentrate flows and pose a risk of flash flooding and in areas where runoff conveyance is already near capacity.

Trees also deplete moisture from the soil during the growing season. Compared to annual vegetation, oaks can extract water from the soil profile to a greater depth. Consequently, soils under oak woodland canopy are able to absorb and hold greater amounts of rainfall in the soil than are equivalent soils with only annual grassland cover. This extra storage capacity further reduces the potential for flooding during the rainy season.

Priority for Conservation or Enhancement	Contribution to Flood Protection
High	Oak woodlands in watersheds that drain into areas subject to flooding during high rainfall events of relatively short duration.
Low	Oak woodlands in watersheds draining to areas with little or no flooding risk.

Criterion 17: Location Relative to Other Woodlands and Habitats. As discussed under the section on wildlife habitat above, the habitat value of an oak woodland is strongly influenced by the surrounding landscape. Habitat quality will be greater in oak woodlands that are adjacent to other oak woodlands that increase the overall patch size. The presence of other adjacent native habitats, such as chaparral, can also increase habitat value for some species. In contrast, habitat value for many native species is adversely affected if woodlands are adjacent to developed land uses such as intensive agriculture and urban development. The impact is generally increased as the length of the interface between the woodland and the developed land use increased. Habitat value is further decreased if the woodland habitat is broken into fragments separated by developed uses. Conversely, connections or corridors that fill gaps between woodland patches can improve habitat value.

In addition to effects on wildlife and native plant habitat, other benefits provided by oak woodlands may be affected by the type of land cover on adjacent parcels. Erosion protection and stormwater retention will generally be more effective if oak woodlands cover an entire slope or watershed than if a patch of woodland is surrounded by grasslands.

Priority for Conservation or Enhancement	Location Relative to Other Woodlands and Habitats
High	Position of the oak woodland within the larger landscape amplifies beneficial effects such as wildlife habitat by increasing overall woodland area, minimizing fragmentation, or serving as corridors between patches.
Low	Position of the oak woodland within the larger landscape minimizes beneficial effects such as wildlife habitat because of a high amount of edge with developed land uses, high fragmentation, and lack of connection with other larger functional oak woodlands.

Human Interactions

Another basis for assessing woodland value is the relationship between people and oak woodlands. This relationship is implicit in some of the other ratings. For example, the importance of considering wildlife habitat, erosion protection, and other factors is based in large part on the value that people see in maintaining healthy ecosystems. Beyond the ecosystem services that people derive from oak woodlands, these areas may be valued for their aesthetic qualities, as a recreational resource, and for their cultural or historical significance. As with the landscape functions discussed above, these values are typically dependent on where the woodlands are located. In addition, other factors such as historical uses and events and land ownership (public or private) also influence these values.

Criterion 18: Historic and Cultural Significance. Oak stands or individual trees may have historical significance due to past events or structures that were associated with the trees, historical accounts that mention the trees, the use of specific trees as landmarks or as boundary markers, or other factors. In addition, oak trees and the acorns they provide have been and continue to be important cultural resources for many of the Native American tribes that live in California. Individual oaks or stands of oak may have cultural significance to tribes or individual families. Loss of traditionally-used trees or gathering areas may significantly impact the continuation of cultural practices that span many generations.

In general, oaks and woodlands with historical and/or cultural significance are primarily a target for conservation rather than restoration, though restoration activities that help maintain tree health and the ecological integrity of the site may be appropriate in some situations.

Priority for Conservation or Enhancement	Historic and Cultural Significance
High	Woodlands or trees have documented historical significance and/or past or current use as a Native American cultural resource.
Moderate	Woodlands or trees have possible to likely historical significance and/or past use as a Native American cultural resource, but documentary evidence is not conclusive.
Low	Woodlands or trees have no known or suspected historical significance and/or use as a Native American cultural resource.

Criterion 19: Public Recreation. Compared with various other California counties, Yolo County has a relatively small amount of oak woodland acreage that is available for low-impact public recreational activity such as hiking and equestrian use. Oak woodlands that have the potential to be acquired by public agencies or private nonprofit organizations (such as land trusts) and made available for public recreation provide a resource that is currently quite limited within the county. With adequate planning and monitoring, public access can be designed to be compatible with other conservation goals such as providing wildlife habitat. Furthermore, on public access lands using volunteers, it may be feasible to undertake restoration activities that would not be possible on private lands.

To maximize the benefits associated with public access and minimize potential conflicts with adjacent property owners, public-access parcels should be connected to the degree possible with other lands with public access or ownership. Appropriate measures should be provided to buffer public access areas from adjoining private lands.

Priority for Conservation or Enhancement	Public Recreation
High	Oak woodlands that: -provide low-impact public recreational opportunities compatible with conservation objectives, -are connected with other parklands or public-access areas, and - pose a minimum of conflicts with adjoining land uses.
Low	Privately-owned oak woodlands that do not provide opportunities for public access and use.

Criterion 20: Buffering between Incompatible Land Uses. Oak woodlands can be used to provide a buffer between land uses that would otherwise be incompatible. For example, a band of oak woodland that separates intensive agricultural lands from a residential development can serve to provide visual screening, noise reduction, dust

abatement, and protection from pesticide drift that would reduce conflicts between these two land uses. Because uses of woodlands used as buffers would need to be limited to provide buffering capacity, such lands would typically need to either be publicly-owned or covered by a conservation easement.

Although buffers and hedgerows would primarily be targets for conservation, restoration activities, such as oak planting or invasive species management, may also be directed at these areas to enhance their function.

Priority for Conservation or Enhancement	Buffering Between Incompatible Land Uses
High	Oak woodlands that have the potential to buffer between incompatible land uses by providing physical separation, visual screening, noise reduction, air filtration, and/or other benefits.
Low	Oak woodlands located in areas where they do not serve as buffers.

Criterion 21: Visual Impact. Prominent individual oaks and oak woodlands located in areas where they are commonly seen provide a strong positive visual impact and contribute to the "sense of place" associated with an area. Such woodlands typically provide a variety of other benefits as well, but may be more appreciated by the public at large due to their aesthetic qualities. As with buffers, stands with high visual impact are typically targets for conservation, but restoration activities that improve stand sustainability or enhance other functions such as wildlife habitat may also appropriate in these stands.

Priority for Conservation or Restoration	Visual Impact
High	Oak woodlands with high visual impact, located within view of communities and major roadways.
Low	Oak woodlands located in areas where they are unlikely to be seen by most people.

Risk Categories

Risk categories are based on the likelihood of resource loss or degradation, either through alteration (e.g., change in land use, clearing) or management (e.g., lack of natural regeneration resulting in a type change). As illustrated in the matrix below, Yolo County staff will rank risk based on both the likelihood of resource loss (high, medium, low) as well as the expected time frame for the loss (near, mid, long term). A given parcel may be rated in multiple categories, as shown by X's in the matrix below.

Risk Categories

	Likelihood of loss (in absence of intervention)		
Time frame	High	Moderate	Low
Near term (less than 5 years)		X	
Mid term (5-20 years)	X		
Long term (>20 years)	X		

Current zoning, General Plan designations and urban spheres of influence will be used to help assess likelihood of loss due to urban conversion, but losses due to other activities and processes (change to intensive agriculture, alterations in historic water tables, tree mortality without regeneration) will be inferred or estimated from other information.

The highest overall risk is assigned to woodlands that have a high likelihood of being lost in the near term. However, imminent loss may be difficult to forestall and will tend to require higher financial inputs (e.g., fee title acquisition). Hence, woodlands with a relatively high long term risk but low near term risk may be the more cost efficient targets for funding based on risk parameters. Parcels with very low to no intrinsic risk may not be high priority even if they have a high resource value. This category would include lands that are non-developable due to terrain or other factors if these lands are managed in a sustainable fashion. Because risk categories can change over time, woodlands would need to be both fully protected and permanently managed in a sustainable fashion in order to be considered at no significant risk.

Management Constraints

Management of woodlands can be considered as a factor that contributes to the risk of resource loss/degradation as discussed above. In addition, management can be considered as a separate factor that interacts with the cost-effectiveness of conservation and restoration projects.

Woodlands that are conserved need to be managed in a fashion that will retain or improve their resource value if they are to continue to provide benefits and services. If properties are already being managed in a sustainable fashion that protects or enhances resource values, conservation activities such as conservation easements or fee title acquisition would be more cost effective because no major change in management would be necessary. Future management cost savings will be greatest for sites where sustainability is achieved through few or no major management inputs. In contrast, lands that require a major change in management to attain sustainability may be more expensive to maintain over the long term, particularly if the necessary management changes will be expensive or difficult to implement. For example, good quality riparian oak woodlands on favorable soils typically have good rates of natural regeneration when left in a natural state with little or no active management. In contrast, a riparian oak woodland that has been heavily cleared in the past, compacted by livestock grazing, and colonized by invasive species would require significant changes in management, including some intensive inputs (such as eradication of invasives) to attain long-term sustainability.

For lands where restoration is an objective, ease of restoration is rated as a management factor. Sites requiring relatively small inputs to achieve restoration and those having a higher probability of success have higher priority overall.

Current and potential land uses (such as grazing, intensive agriculture, hunting, public access, etc.) need to be evaluated with respect to whether they are compatible with the protection and enhancement of oak woodland resources. It will also be necessary to consider land uses on adjacent properties to determine how these may impinge on the management potential of the target property. For example, the need to clear vegetation for fire protection around residences may affect the management of the adjacent oak woodland. Activities upstream from a conserved riparian woodland, such as dredging or irrigation runoff, could impact the value of aquatic habitat.

Management Constraints

	Ranking		
	High	**Moderate**	**Low**
Current management compatible with sustained resource value	Yes	partially	no
Level of management inputs to attain or maintain sustainability	low		high
Influence of adjacent land uses or other external factors on management practices	little or no significant influence		significantly constrains management options

Oak Woodland Checklist

	Ranking			Data*		Notes
Resource Values	High	Moderate	Low	Source	Quality	
Stand Composition Integrity, and Functionality						
Oak species present						
Representation of oak species at site						
Tree cover and density						
Stand size, shape, and connectivity						
Stand structure and sustainability						
Contribution to population genetics						
Habitat for Plant and Wildlife Species						
Special status species						
Locally rare or uncommon species or associations						
Overall native biodiversity						
Contribution to maintaining native plant and animal populations						
Special habitat features and areas						
Special habitat features						
Invasive species presence and abundance						
Landscape Function						
Erosion protection						
Water quality protection						
Contribution to flood protection						
Location relative to other woodlands and habitats						
Human Interactions						
Historic and cultural significance						
Public recreation						
Buffering between incompatible land uses						
Visual impact						
Risk Factors						
Management Constraints						
Other values not noted above (specify)						

*Indicate the source (aerial photo, GIS layer, site survey, CNDDB, etc) of data used to assign ranking and data quality (good/fair/poor).

VII. CONSERVATION AND ENHANCEMENT PROGRAM RECOMMENDATIONS

Based on the research conducted during the plan development process, as well as public input received during two public workshops and from interested parties, the Parks and Resources Management Division developed the following recommendations related to implementation of the plan.

General Plan Policy Recommendations

Yolo County is currently conducting the first comprehensive update of the Yolo County General Plan in over 20 years. As part of this process, the Division recommends including the following voluntary oak woodland conservation and enhancement goals and policies in the General Plan. (A summary of existing oak woodland policies in the General Plan is provided in Appendix F.) The goals are the same goals listed in Section I of this plan.

Goals

Goal #1: Protect existing oak woodlands by creating a voluntary program, including landowner incentives, for oak woodland conservation and enhancement.

Goal #2: Encourage the use of land use and infrastructure planning strategies that are consistent with oak woodland conservation efforts.

Goal #3: Direct conservation and enhancement funding and effort to areas that have the highest oak woodland resource values.

Goal #4: Direct mitigation for oak woodland impacts to areas that have the highest oak woodland resource values.

Goal #5: Encourage the long-term stewardship of existing oak woodlands to maintain or improve oak woodland resource values.

Goal #6: Provide funding and technical assistance for oak woodland enhancement efforts that achieve multiple benefits.

Goal #7: Increase the area covered by valley oak and other oak species that are now uncommon in Yolo County because they have been cleared from much of their historical range in the county.

Goal #8: Maximize the total amount of oak woodland canopy cover to achieve erosion, flood, and air quality protection benefits, while recognizing the importance of including a

variety of canopy cover levels within conserved and restored woodlands to provide habitat diversity.

Goal #9: Coordinate oak woodland conservation and enhancement efforts with the Yolo County Habitat Conservation Plan/Natural Community Conservation Plan, the Yolo County General Plan, the Parks and Open Space Master Plan, the Cache Creek Resources Management Plan, and other local and state applicable conservation plans.

Policies

Policy #1: Use the 2007 Yolo County Oak Woodland Conservation and Enhancement Plan to evaluate oak woodland mitigation opportunities that arise as a result of land conversion, including infrastructure expansion or urban and rural development.

Policy #2: Train planners, engineers, and other relevant staff to consider the impact on oak woodlands of land conversion, including infrastructure expansion or urban and rural residential development. Such training includes an understanding of SB 1334, a law enacted in 2004 that requires lead agencies to consider the impacts on oak woodlands as part of the California Environmental Quality Act. Seek grant funding to support this training.

Policy #3: In coordination with other organizations working to educate the public about oak woodland conservation, develop a public outreach and education program to educate landowners, public agencies, and other interested entities about oak woodland resource values and opportunities to conserve and enhance existing oak woodlands. Such opportunities include changes in land management or water management practices. Outreach efforts could include printed materials specific to conditions in Yolo County, web information, and feature articles in regional papers.

Policy #4: Encourage oak woodland enhancement or conservation projects that include an educational component for K-12 or university students.

Policy #5: Encourage the use of Best Management Practices (BMPs) to maintain oak resources in a healthy and safe condition in developed areas. BMPs will include practices for ensuring the long-term protection of oak trees in areas potentially impacted by construction and maintenance practices that maximize the longevity and safety of oaks incorporated into developed settings.

Policy #6: Encourage the University of California, Davis and other research institutions to conduct research on oak woodlands in Yolo County. Investigate the needs of researchers and evaluate options for providing necessary research facilities and access to public land for research projects.

Policy #7: Establish an oak woodland mitigation bank to ensure that oak woodlands with high resource value, as evaluated by system to establish priorities in the 2007 Oak

Woodland Conservation and Enhancement Plan, are available in a timely manner for mitigation resulting from infrastructure expansion and urban and rural development.

Policy #8: Require development plans to consider the protection of oak woodlands and other sensitive resources at an early scoping stage and design projects to minimize impacts to these resources starting at the earliest design stages.

Policy #9: Use only oaks of local genetic stock for plantings located in and near native oak stands to conserve the genetic integrity of local oak populations. Local trees are adapted to local conditions, so conserving genetic integrity is an important part of sustaining local oak populations.

Policy #10: Encourage the use of local native oaks in public landscaping projects where appropriate.

Policy #11: Establish guidelines for county government-led public projects to avoid harm to oak woodlands and individual oaks. Explore the feasibility of establishing oak woodland mitigation guidelines for county government-led public projects.

Policy #12: In partnership with the HCP/NCCP and other interested organizations, explore opportunities to raise funds locally for open space conservation.

Other Recommendations

Yolo County may implement some of these recommendations, but will more often encourage other interested organizations or agencies in the county to lead efforts to implement the recommendations.

Recommendation #1: If funds are available, provide Yolo County staff resources to coordinate implementation of the 2007 Yolo County Oak Woodland Conservation and Enhancement Plan. Duties would include establishing a public outreach and education program, working with interested landowners, public agencies, and non-profit organizations to evaluate conservation and enhancement opportunities, evaluating projects for consistency with the plan, and applying for funding for implementation of conservation and enhancement projects.

Recommendation #2: In coordination with other organizations involved in public outreach related to oak woodland conservation, establish a public outreach and education program that would include online informational and educational resources. The program would educate landowners about funding opportunities for oak woodland conservation and enhancement, as well as voluntary changes in land or water management practices that may benefit oak woodlands. Opportunities include photo exhibits of oak woodlands to increase public awareness, landowner workshops, an oak woodland educational event, or a speaker series. The public outreach and education program should also include middle school, high school and university students. Yolo County should encourage projects that include an educational component for students.

Recommendation #3: Work with the University of California, Davis and the UC Integrated Hardwood Range Management Program (IHRMP) to develop research partnerships that encourage oak woodland research in Yolo County. Currently very little oak woodland research is conducted in Yolo County, possibly due to a lack of formal agreements with public agencies to allow access to properties with oak woodlands. Research that increases the understanding of the ecology and management of oak woodlands in Yolo County should be encouraged and may include projects that evaluate stand structure, examine habitat relationships, and address problems related to oak regeneration and invasive species that impact oak woodlands. Part of this effort should include a literature review of all research conducted to date on Yolo County oak woodlands.

Recommendation #4: Seek grant funds to conduct research related to the extent of existing oak woodlands in the Yolo County portion of the Sacramento Valley. It was beyond the scope of the 2007 Oak Woodland Conservation and Enhancement Plan to provide detailed information on the extent of oak woodlands in the Sacramento Valley because existing oak woodlands data for this area is minimal. In addition, most of the oak woodlands in the Yolo County portion of the Sacramento Valley exist in isolated stands, in contrast to the large, contiguous tracts of oak woodlands found in the foothills of the Blue Ridge. Most likely a researcher will analyze aerial photos of the Sacramento Valley and then visit sites in person to determine the extent and type of oak woodlands. Nevertheless, this research is important because of the presence of the valley oak, one of Yolo County's rarest oak species, in this area, as well as the importance of preserving these remnant stands of oak woodlands.

Recommendation #5: Evaluate the success of implementation of the 2007 Oak Woodland Conservation and Enhancement Plan within 3-5 years of finalizing the plan and revise the plan as necessary. Continue to evaluate implementation of the plan every five years and revise the plan as necessary.

Recommendation #6: Work with local partners to establish a standard protocol for monitoring of oak woodland conservation easements.

Recommendation #7: Work with the experts at the University of California, Davis and elsewhere to establish a standard protocol for implementing and evaluating the success of oak woodland enhancement projects, including tree plantings and changes in land and water management practices. Also develop a cost-effective monitoring program to evaluate the short-term and long-term success of oak woodland enhancement and conservation projects.

Recommendation #8: Use the online Natural Resource Projects Inventory (http://www.ice.ucdavis.edu/nrpi/)**,** hosted by the UC Davis Information Center for the Environment (ICE) to track all existing oak woodland conservation and enhancement projects in Yolo County.

Recommendation #9: Develop a program to help conserve local oak genetic resources and to make locally-adapted oak planting materials available for both public and private oak planting projects.

Recommendation #10: Research landowner stewardship incentives, including cost share incentive payments, tax breaks, landowner assurances, and carbon credits etc. that organizations could use in partnership with Yolo County staff to support oak woodland conservation and enhancement.

Recommendation #11: In partnership with the HCP/NCCP and other interested organizations, explore opportunities to raise funds locally for open space conservation.

Recommendation #12: Explore the expansion of the existing Vegetation Management Plan with the California Department of Forestry and with Audubon California to implement prescribed burns on private lands with excessive fuel loads to benefit native habitat and control noxious exotic weeds.

Recommendation #13: Work with Caltrans and the UC Davis Road Ecology Center to understand oak woodland restoration and enhancement opportunities along Highway 16 and other roads, as well as opportunities to engage additional local entities in Caltrans mitigation activities. (See Appendix D for detail on Caltrans Adopt-A-Highway tree-planting guidelines)

Recommendation #14: Support the efforts of organizations, such as the University of California Cooperative Extension (UCCE), to work with private landowners to increase interest in oak woodland conservation. Also support efforts to reach out to private landowners who are concerned about implementation of the plan.

Recommendation #15: Develop site planning guidelines and work with planners and developers on how to best integrate existing oak woodlands into their projects.

Recommendation #16: Develop a cost-effective monitoring program to evaluate the long term and short term success of the oak woodland conservation and enhancement program.

Recommendation #17: Support efforts to protect existing individual oak trees and plant new oak trees in urban areas and in areas where oak woodlands historically existed.

Recommendation #18: Develop policies and procedures to comply with SB 1334, a bill enacted in 2004 to require counties to consider the impact of projects on oak woodlands through the California Environmental Quality Act.

Recommendation #19: Yolo County should establish an oak woodland conservation and enhancement fund into which mitigation funds, grants, donations, or other funds could be deposited to assist with implementation of the Oak Woodland Conservation and Enhancement Plan.

VIII. IMPLEMENTATION STRATEGY

The success of the 2007 Oak Woodland Conservation and Enhancement Plan is dependent on voluntary participation by landowners and public agencies that own oak woodlands. Implementation of the plan therefore relies heavily on a public outreach and education strategy to encourage willing landowners and public agencies to participate in the program. Implementation will focus on the recommendations outlined in the previous section.

Partners

There are many public agencies and other organizations that are currently working to conserve and enhance oak woodlands in Yolo County. (See Appendix D and E for a description of these organizations and agencies and their oak woodland-related efforts.) Yolo County will work with these agencies to further their efforts through implementation of the plan.

Public Outreach

As described in Recommendation #2, Yolo County will establish a public outreach and education program if funding is available, that is coordinated with education and outreach efforts being conducted through UC IHRMP and other entities. Yolo County also will seek feedback from the general public regarding proposed oak woodland conservation and enhancement projects through presentations to the Parks, Recreation, and Wildlife Advisory Committee and distribution of information through the mailing list of interested individuals created during the plan development process. Upon request, Yolo County staff will brief interested organizations about plan implementation or proposed conservation or enhancement projects. Yolo County staff will make public comments from the initial planning stage, including information from the two oak woodland public workshops, available on the Yolo County website.

Certification Process

The Wildlife Conservation Board (WCB) requires Yolo County to certify that oak woodland projects proposed for WCB funding are consistent with the plan. If an organization or individual proposes a project for WCB funding in the county, Yolo County staff will request that the organization or individual complete a form to provide information about the project. Staff will use this information, as well as other available data, to review the project. Yolo County staff also intends to retain an oak woodland ecologist to review the project, which will include a visit to the site. Staff will use the system to establish priorities described in this plan to evaluate the project and determine its ranking. Staff will present the proposed ranking to the Yolo County Parks, Recreation, and Wildlife Advisory Committee for review before deciding whether the project is consistent with the plan. Yolo County staff will provide information in the future regarding the rank necessary to ensure consistency with the plan.

Schedule

Yolo County will strive to abide by the following schedule for implementation of the plan, but tasks can only be initiated and completed if sufficient funds and staff resources are available.

Year	Task
2007	Use the prioritization system to identify oak woodland conservation and enhancement projects with high resource values eligible for funding from the Wildlife Conservation Board's Oak Woodland Conservation Fund and other sources.
2007	Continue to reach out to private landowners concerned about implementation of the plan, as well as landowners interested in oak woodland conservation on their property.
2007	Work with Yolo County staff and consultants to ensure that voluntary oak woodland conservation and enhancement policies, as well as appropriate implementation measures, are included in the Yolo County General Plan.
2007	Apply for funding from the Wildlife Conservation Board or other sources for high-priority projects. Yolo County, in partnership with interested organizations, will continuously apply for funding in the future as long as there are interested landowners and funding is available.
2007	Work with Caltrans and the UC Davis Road Ecology Center to evaluate mitigation options for the Highway 16 expansion project. At the same time, work to understand oak woodland restoration and enhancement opportunities along highway and roads, as well as opportunities to engage local entities in Caltrans mitigation activities.
2007	Explore the expansion of the existing Vegetation Management Plan with the Wildlife Conservation Board to implement prescribed burns on private lands with excessive fuel loads to benefit native habitat and control native weeds.
2007	Start conversations with UC Davis about establishing research projects in Yolo County.
2007	Research landowner stewardship incentives, including cost share incentive payments, tax breaks, landowner assurances, carbon credits, etc. that Yolo County staff could create in partnership with other entities to support oak woodland conservation and enhancement.
2007	In partnership with the HCP/NCCP and other interested organizations, explore opportunities to raise funds locally for open space conservation.
2008	Work with UC Davis to complete literature review of oak woodland research conducted in Yolo County
2008	If UC Davis can assist, initiate effort to conduct research on remnant oak woodland stands in the Yolo County portion of the Sacramento Valley.
2008	Working with partner organizations, develop draft public outreach and education program.
2008	Finalize public outreach and education program
2008	Create a database of oak woodland conservation and enhancement projects in Yolo County.

2008	Work with the Yolo Land Trust to develop a standard protocol for monitoring oak woodland easements.
2008	Work with experts from UC Davis, UC IHRMP and elsewhere to establish a standard protocol for implementing and evaluating the success of oak woodland enhancement projects. Also develop a standard monitoring protocol for oak woodland conservation easements and oak woodland enhancement projects.
2009	Develop site planning guidelines and work with planners and developers on how to best integrate existing oak woodland into their projects.
2009	Develop a program to help conserve local oak genetic resources and to make locally-adapted oak planting materials available for both public and private oak planting projects.
2010	Evaluate implementation of program and revise plan as necessary.

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APPENDIX A: OVERVIEW OF HCP/NCCP DATA

At the beginning of the planning process, Yolo County conducted an extensive review of existing oak woodlands vegetation data. The goal of this search was to find oak vegetation data that most accurately represented the current extent, diversity, and composition of oak woodlands found in the county. The conclusion of this review was that the best available data was the oak woodland vegetation GIS layer developed by HT Harvey and Associates in 2004, produced as part of an Ecological Baseline Report in support of the Yolo County's joint Habitat Conservation Plan (HCP) and Natural Communities Conservation Plan (NCCP) process. The oak woodland GIS data was developed by synthesizing relevant data from the existing sources outlined below.

1. CALVEG Vegetation Mapping (U.S. Department of Agriculture [USDA]);
2. Countywide aerial photograph (Air Photo USA);
3. California GAP Analysis Vegetation Mapping (California State GAP Program);
4. Napa County Vegetation Mapping (NCVM) (UCD);
5. Yolo County HCP Vegetation Mapping (Yolo County, EIP Associates); and
6. DWR land use data.

The goal of this synthesis was to establish spatially explicit oak woodland polygons with a unified classification scheme for all oak woodland types. The process used Air Photo USA 1 meter aerial imagery to identify vegetation and develop oak vegetation polygons. Oak woodland vegetation was classified based on the hierarchical based classification structure described in the Manual for California Vegetation (MCV). The MVC has been adopted as the standard vegetation classification by state and federal agencies such as the California Department of Fish and Game, the United States Forest Service, National Park Service, and United States Geological Survey. It is also the vegetation classification n system used in the Napa County Vegetation Map (NCVM).

The oak woodland vegetation data relied heavily on the GIS data developed for the NCVM. HT Harvey and Associates extended individual polygons from the NCVM to include those areas with a similar photo signature in Yolo County. New classified polygons were developed in the Capay Hills, Dunnigan Hills, and stream corridors using frequent comparisons of similar polygons previously classified along the Blue Ridge by the NCVM effort. Most of the shrub vegetation was aggregated into a chamise alliance because individual species could not be identified using the Air Photo USA data.

Although these data provide an excellent resource, additional data may be needed. The data fails to capture single oaks and small grouping of oaks that are know to occur as remnant vegetation patches along smaller sloughs, roadsides, and agricultural fields. It also does not capture some oak woodland enhancement projects and horticultural projects, such as those planted along highway interchanges, habitat mitigation, and city-owned parks within the incorporated areas.

APPENDIX B: COMMON WILDLIFE SPECIES FOUND IN OAK WOODLANDS

Common name	*Genus*	*species*	order	Listed?	Woodland type
acorn woodpecker	*Melanerpes*	*formicivorus*	bird		montane (mont)
American crow	*Corvus*	*brachyrhynchos*	bird		valley foothill riparian (v.rip)
American goldfinch	*Carduelis*	*tristis*	bird		v.rip
American kestrel	*Falco*	*sparverius*	bird		mont
Anna's hummingbird	*Calypte*	*anna*	bird		mixed chaparral (m.chap), mont
ash-throated flycatcher	*Myiarchus*	*cinerascens*	bird		mont, valley oak (v.oak)
badger	*Taxidea*	*taxus*	mammal	y	blue oak-foothill pine (b.oak), m.chap
band-tailed pigeon	*Columba*	*fasciata*	bird		b.oak
Bewick's wren	*Thryothorus*	*bewickii*	bird		m.chap, mont
black-chinned hummingingbird	*Archilochus*	*alexandri*	bird		v.rip
blackheaded grosbeak	*Pheucticus*	*melanocephalus*	bird		m.chap, v.rip
blue grosbeak	*Guiraca*	*caerulea*	bird		v.oak
blue-gray gnatcatcher	*Polioptila*	*caerulea*	bird		m.chap, mont
bobcat	*Lynx*	*rufus*	mammal		b.oak
Bullock's oriole	*Icterus*	*bullockii*	bird		v.rip
bushtit	*Psaltriparus*	*minimus*	bird		m.chap, v.rip
California quail	*Callipepla*	*californica*	bird		m.chap, mont
California thrasher	*Toxostoma*	*redivivum*	bird		m.chap
California towhee	*Pipilo*	*crissalis*	bird		m.chap
common kingsnake	*Lampropeltis*	*getula*	reptile		m.chap, mont
Cooper's hawk	*Accipiter*	*cooperi*	bird	y	b.oak, m.chap, mont, v.rip, v.oak
coyote	*Canis*	*latrans*	mammal		m.chap
dark-eyed junco	*Junco*	*hyemalis*	bird		m.chap
downy woodpecker	*Picoides*	*pubescens*	bird		v.rip
elderberry longhorn beetle	*Desmocerus*	*californicus dimorphus*	insect	y	b.oak, m.chap, v.rip, v.oak
foothill yellow-legged frog	*Rana*	*boylii*	amphibian	y	b.oak, m.chap, mont
fox sparrow	*Passerella*	*iliaca*	bird		m.chap
golden eagle	*Awuila*	*chrystaetos*	bird	y	b.oak, mont
golden-crowned sparrow	*Zonotrichia*	*atricapilla*	bird		m.chap
gopher snake	*Pituophis*	*catenifer*	reptile		m.chap, mont
gray fox	*Urocyon*	*cinereoargenteus*	mammal		m.chap
great horned owl	*Bubo*	*virginianus*	bird		mont, v.rip
hairy woodpecker	*Picoides*	*villosus*	bird		b.oak
hermit thrush	*Catharus*	*guttatus*	bird		m.chap
house finch	*Carpodacus*	*mexicanus*	bird		v.rip

Common name	*Genus*	*species*	order	Listed?	Woodland type
house wren	*Troglodytes*	*aedon*	bird		mont
Hutton's vireo	*Vireo*	*huttoni*	bird		b.oak, mont
lazuli bunting	*Passerina*	*aemona*	bird		m.chap, v.rip
lesser goldfinch	*Carduelis*	*psaltria*	bird		m.chap
long-eared owl	*Asio*	*otus*	bird	y	b.oak, mont, v.rip
mountain quail	*Oreortyx*	*pictus*	bird		m.chap
mourning dove	*Zenaida*	*macroura*	bird		m.chap, mont
mule deer	*Odocoielus*	*hemionus*	mammal		b.oak, m.chap
northern alligator lizard	*Elgaria*	*coerulea*	reptile		mont
northern pygmy-owl	*Glaucidium*	*gnoma*	bird		mont
northwestern pond turtle	*Clemmys*	*marmorata marmorata*	reptile	y	b.oak, v.oak
Nuttall's woodpecker	*Picoides*	*nuttallii*	bird		mont, v.rip, v.oak
oak titmouse	*Baeolophus*	*inornatus*	bird		b.oak, m.chap, mont, v.rip, v.oak
orange-crowned warbler	*Vermivora*	*celata*	bird		m.chap
pallid bat	*Antrozous*	*pallidus*	mammal	y	b.oak, m.chap, mont, v.oak
pileated woodpecker	*Dryocopus*	*pileatus*	bird		b.oak
raccoon	*Procyon*	*lotor*	mammal		v.rip
red bat	*Lasiurus*	*blossevillii*	mammal	y	v.rip
red-shouldered hawk	*Buteo*	*lineatus*	bird		v.rip
red-tailed hawk	*Buteo*	*jamaicensis*	bird		mont
rufous-crowned sparrow	*Aimophila*	*rufeceps*	bird		m.chap
sage sparrow	*Amphispiza*	*belli*	bird		m.chap
sharp-shinned hawk	*Accipiter*	*striatus*	bird	y	mont
spotted towhee	*Pipilo*	*maculatus*	bird		m.chap
striped skunk	*Mephitis*	*mephitis*	mammal		b.oak, v.rip
Swainson's hawk	*Buteo*	*swainsoni*	bird	y	b.oak, v.rip, v.oak
western bluebird	*Sialia*	*mexicana*	bird		v.oak
western fence lizard	*Sceloporus*	*occidentalis*	reptile		m.chap
western pond turtle	*Clemmys*	*marmorata*	reptile	y	m.chap, mont, v.rip
western rattlesnake	*Crotalus*	*ciridis*	reptile		m.chap, mont
western screech-owl	*Otus*	*kennicottii*	bird		mont
western scrub-jay	*Aphelocoma*	*californica*	bird		b.oak, mont, v.rip, v.oak
western skink	*Eumeces*	*skiltonianus*	reptile		m.chap, mont
white-breasted nuthatch	*Sitta*	*carolinensis*	bird		mont, v.rip, v.oak
white-crowned sparrow	*Zonotrichia*	*leucophrys*	bird		m.chap
white-tailed kite	*Elanus*	*leucurus*	bird	y	v.oak
wild pig	*Sus*	*scrofa*	mammal		b.oak, m.chap, mont, v.rip, v.oak
Wrentit	*Chamaea*	*fasciata*	bird		m.chap
yellow warbler	*Dendroica*	*petechia*	bird	y	v.rip
yellow-billed cuckoo	*Coccyzus*	*americanus*	bird	y	v.rip
yellow-billed magpie	*Pica*	*nuttalli*	bird		v.rip, v.oak

APPENDIX C: COMMON PLANT SPECIES FOUND IN OAK WOODLANDS

Common Name	*Genus*	*Species*
birch-leaf mountain mahogany	*Cercocarpus*	*betuloides*
big-leaf maple	*Acer*	*macrophyllum*
black oak	*Quercus*	*kelloggii*
blue elderberry	*Sambucus*	*mexicana*
blue oak	*Quercus*	*douglasii*
box elder	*Acer*	*negundo*
buckbrush	*Ceanothus*	*cuneatus*
buckeye	*Aesculus*	*californica*
California blackberry	*Rubus*	*ursinus*
California black walnut	*Juglans*	*californica*
California brome	*Bromus*	*carinatus*
California bay laurel	*Umbellularia*	*californica*
California wild grape	*Vitis*	*californica*
California wild rose	*Rosa*	*californica*
California yerba santa	*Eriodictyon*	*californicum*
canyon live oak	*Quercus*	*chrysolepsis*
chamise	*Adenostoma*	*fasciculatum*
cottonwood	*Populus*	*fremontii*
coyote brush	*Baccharis*	*pilularis*
creeping wild-rye	*Leymus*	*triticoides*
foothill pine	*Pinus*	*sabiniana*
Harding grass	*Phalaris*	*aquatica*
interior live oak	*Quercus*	*wislizeni*
leather oak	*Quercus*	*durata*
oracle oak	*Quercus*	*x morehus*
Oregon ash	*Fraxinus*	*latifolia*
poison oak	*Toxicodendron*	*diversilobum*
redberry	*Rhamnus*	*crocea*
redbud	*Cercis*	*occidentalis*
scrub oak	*Quercus*	*berberidifolia*
silver bush lupine	*Lupinus*	*albifrons*
sycamore	*Platantus*	*occidentalis*
toyon	*Heteromeles*	*arbutifolia*
valley oak	*Quercus*	*lobata*
white alder	*Alnus*	*rhombifolia*
whiteleaf manzanita	*Arctostaphylos*	*manzanita*
willow	*Salix*	*sp.*
yellow star thistle	*Centaurea*	*solstitialis*

APPENDIX D: FEDERAL, STATE, AND LOCAL OAK WOODLANDS CONSERVATION PROGRAMS AND POLICIES

This section describes existing government programs and policies related to oak woodland conservation and enhancement in Yolo County. Yolo County hopes that the Oak Woodland Conservation and Enhancement Plan will help to further these existing efforts and will work with these agencies to implement the plan.

I. Federal agencies

Bureau of Land Management (BLM)
The Bureau of Land Management owns and manages 29,692 acres of federal land in the northwestern section of Yolo County. Their oak woodland management and conservation efforts are outlined in the Cache Creek Coordinated Resource Management Plan, found at http://www.blm.gov/ca/ukiah/CRMP_index.htm. The BLM protects oak woodlands on their lands by prohibiting the collection of firewood and the cutting of dead and live trees and by encouraging academic study of oak regeneration. The recently acquired Payne Ranch, which straddles Yolo and Colusa Counties near Highway 16, represents one of the most significant blue oak woodlands found on BLM land in Yolo County. This ranch was purchased in partnership with the Rocky Mountain Elk Foundation (RMEF) to showcase habitat management for Tule Elk. The BLM manages the ranch primarily for preservation or improvement of habitat values, and also for providing opportunities for a compatible level of primitive recreation. The livestock grazing presently in practice is a high intensity-short duration scheme specifically designed for noxious weed reduction, and is not a grazing lease. The BLM has observed extensive blue oak regeneration on this property. The BLM actively seeks to gain new parcels containing oak woodlands and suitable elk habitat from willing landowners. At this time, they are evaluating a number of parcels for potential acquisition.

Farm Services Agency (FSA)
The FSA operates the Conservation Preserve Program (CRP), funded through the Farm Security and Rural Investment Act of 2002 (Farm Bill). The CRP encourages farmers to convert environmentally sensitive areas to vegetation cover (native grasses, wildlife habitat, trees, filterstrips, or riparian buffers) as a means of protection water quality and habitat. Such habitat enhancement could include oak woodlands.

Natural Resources Conservation Service (NRCS)
The NRCS works with private landowners through two incentive programs funded by the Farm Security and Rural Investment Act of 2002 (Farm Bill).

- The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial assistance for projects promoting agricultural production and environmental quality. Primary program goals are water quality protection and erosion control. EQIP also emphasizes the protection of at-risk species through habitat conservation.

- The Wildlife Habitat Incentive Program (WHIP) is a similar program that provides financial incentives for projects that have a direct benefit to wildlife. The program has a

general focus on the restoration of declining or important native wildlife habitats and the conservation of at risk species.

Through these programs the NRCS works with farmers throughout Yolo County to improve farm practices. Planting of oaks is a regular component of these programs.

II. State agencies

Wildlife Conservation Board (WCB) Oak Woodland Conservation Program
The California Legislature passed the Oak Woodlands Conservation Act in 2001 to encourage protection of oak woodlands throughout the state. The Oak Woodlands Conservation Program offers landowners, conservation organizations, cities, and counties opportunities to obtain funding for projects designed to conserve and restore California's oak woodlands.

California Department of Forestry and Fire Protection
CDF has several programs in place intended to help protect oak woodlands. The Forest Legacy program is a small conservation easement program intended to protect working forests, including oak woodlands. The program is federally-funded through the Forest Service, but is administered through CDF in California. The California Forest Improvement Program is a cost-share program that can pay for preparation of a management plan, oak planting projects, tree shelters to protect oak seedlings and non-commercial thinning and/or pruning projects. The Vegetation Management Program (VMP) provides planning, staff, fire equipment and assumes liability for prescribed burning. Many VMP projects are located in or serve to protect oak woodlands on privately or non-profit-owned ranches. CDF is currently working with Audubon California and local landowners to update a 45,000 acre Vegetation Management Plan in the Blue Ridge.

Caltrans Adopt-A-Highway Program
The Adopt-A-Highway program provides an avenue for individuals, organizations or businesses to help maintain sections of roadside within California's State Highway System. Participants can remove litter, plant trees or wildflowers, remove graffiti and/or control vegetation. Planting trees, including oaks, along highways requires participants to submit a management plan prior to planting. Caltrans has outlined specific guidelines for planting trees.

University of California Natural Reserve System
The University of California Natural Reserve System manages the 6,940-acre McLaughlin Nature Reserve in partnership with U.S. Bureau of Land Management (BLM), California Department of Fish and Game (DFG), and the Homestake Mining Company. This park stretches into Napa, Lake, and Yolo counties and contains a large section of blue oak woodlands. The Natural Reserve System protects its oak woodlands from destruction by changes in land use, but the oak woodlands are not actively managed.

University of California Cooperative Extension (UCCE), Yolo County
In Yolo County UCCE has a long history of working with farmers, ranchers and rangeland managers in helping them address production and natural resource issues. By combining resources and expertise from University of California campuses and the local county office, UCCE conducts research on local and regional issues and effectively extends research-based information to our clientele through workshops and publications. UCCE has several oak woodland experts and many peer-reviewed publications available to assist Yolo County and local landowners in prioritizing, planning, implementing and monitoring oak conservation and regeneration activities.

University of California, Davis
The UC Davis Office of Resource Management and Planning (ORMP) mitigates for the loss of single oaks and oak woodlands through its existing Putah Creek Management Area. This reserve includes 5.5 miles of creek, 70 acres of upland oak savannah, and 350 acres of open native grasslands. Restoration and management protocols for its oak woodlands are spelled out in the Putah Creek Reserve Management Plan. Students propagate and plant oaks throughout the area. The program is funded through a campus-administered habitat enhancement budget.

University of California Integrated Hardwood Range Management Program (IHRMP)
The mission of the IHRMP, established in 1986, is to maintain and increase (where possible) acreage of California's hardwood range resources to provide wildlife habitat, recreational opportunities, wood and livestock products, high quality water supply, and aesthetic value. Program staff includes regional cooperative extension specialists who develop applied research and outreach programs addressing conservation of oak woodlands with local Cooperative Extension offices and various agencies and interest groups. The Extension program also develops newsletters and educational materials. IHRMP also funds a competitive grants research program, primarily for University of California researchers, to develop multi-year projects addressing ecological processes, management applications, and policy instruments to conserve hardwood rangelands.

III. Local agencies

Yolo County

Yolo County Parks and Natural Resources Management Division
Yolo County is actively engaged in the planning, expansion and management of public lands for recreational and ecological purposes. The 679-acre Cache Creek Canyon Regional Park and the 587-acre Otis Ranch Open Space Park located in the northwest corner of the county have the most significant oak woodland cover. The Yolo County Parks and Natural Resources Management Division operates and maintains these parks. Yolo County's Parks and Open Space Master Plan provides a vision for future habitat and recreation improvements. The division hopes to work through the Oak Woodland Conservation and Enhancement Plan to undertake future projects to restore and enhance oak woodlands on these properties.

Yolo County General Plan
The Yolo County General Plan currently contains a number of policies that are related to oak woodlands or oak tree conservation (See Appendix F). Yolo County is currently undergoing a comprehensive General Plan update. This process will include a review of existing ordinances and policies and will direct land use planning the county for the next 20 years. The planning process will include a discussion of policies and actions related to oak woodland conservation and management. The target date for adoption of the new General Plan is November 2007.

Yolo County Habitat Conservation Plan/ Natural Communities Conservation Plan
Yolo County's joint Habitat Conservation Plan (HCP) and Natural Communities Conservation Plan (NCCP) are concerned with preserving sufficient high quality habitat to support multiple native species. Oak woodlands are one of the primary habitats identified for preservation by the HCP/NCCP. These joint plans will establish reserve design, an acquisition strategy and a funding mechanism to achieve their conservation goals. Upon completion, the HCP/NCCP will be an additional source of funds to support oak woodland conservation and restoration.

Municipalities in Yolo County

Davis
The City of Davis has an active open space acquisition program. The own a 60-acre oak savanna restoration project along Putah Creek. A Landmark Tree program protects noteworthy trees from destruction. Davis' Landmark Tree list includes 94 individual native and non-native trees; nine are valley oaks and one is a California live oak. The city hopes to work through the Yolo County Oak Woodland Conservation and Enhancement Plan to identify additional areas within the Davis Planning Area for oak woodland conservation and enhancement.

West Sacramento
The City of West Sacramento has a significant number of intact oak woodlands, and has a number of programs and policies in place to guide the management, protection, and restoration of oaks. The city has a strong tree ordinance, regulating the removal of oaks larger than 16 inches in diameter. All new developments are required to conserve existing oaks through open space set-asides and/or by paying fees of $3.25 per inch dbh. In recent years, several large oak woodland parks were developed through this program, including Heritage Oak Park. West Sacramento also has a well-funded urban tree program. This program was established through the 19 mile Lower Northwest Interceptor (LNWI) sewer line project that generated a $2 million dollar mitigation settlement. The settlement requires planting 5,000 new oaks within the city and establishes a fund with which the city manages its oak planting efforts.

Winters
The City of Winters maintains a list of historic trees of importance, of which three are large oaks. The city owns and maintains a nature park along Putah Creek, in which several hundred oak seedlings were planted, in partnership with the Putah Creek Council (PCC) and Audubon's Land Owner Stewardship Program. All management activities and future plans for this park are outlined in the Winters Nature Park Master Plan.

Woodland
The City of Woodland has a tree ordinance that protects native and non-native heritage trees from removal, including some oaks. A tree replacement program does not promote planting valley oaks because they can damage sewers systems and do not thrive under the well-irrigated conditions typical of most new development projects.

APPENDIX E: PROGRAMS SUPPORTING VOLUNTARY OAK WOODLANDS CONSERVATION ON PRIVATE LANDS

This section describes programs supporting voluntary oak woodland conservation on private lands. Yolo County hopes that the Oak Woodland Conservation and Enhancement Plan will help to further these existing efforts and will work with these organizations to implement the plan.

Audubon California Landowner Stewardship Program
The Landowner Stewardship Program works with private landowners to conserve and restore wildlife habitat on farms and ranches in a manner compatible with existing agricultural operations. Typical projects include the restoration of riparian areas and swales, erosion control, and hedgerow plantings as well as applied research on various species and habitat related to restoration work. Audubon has been involved with several oak woodland restoration projects on large ranches in the Capay and Blue Ridge area. These projects involve planting oak seedlings, establishing cattle fences around plantings and important riparian areas, planting native perennial grasses and controlling non-native invasive weed species to promote seedling survival. Audubon works with landowners and CDF on a 45,000 acre Vegetation Management Plan in the Blue Ridge for prescribed burns that benefit native habitat and help control invasive weeds.

Yolo Land Trust
From the Blue Ridge to Clarksburg and from Davis to Dunnigan, Yolo Land Trust has a long history of helping landowners preserve the landscape. The Yolo Land Trust is a private, non-profit corporation founded in 1988 by farmers, community leaders and conservationists dedicated to protecting Yolo County's land resources, including oak woodlands. Yolo Land Trust's focus on protecting the farm, open space and habitat lands in Yolo County offers long-term solutions to difficult land preservation issues.

Yolo Land Trust works with landowners interested in preserving the conservation resources of their property, such as:

- soils and farmland
- habitat
- open space

To date, Yolo Land Trust has helped landowners place conservation easements on over 6,300 acres, permanently protecting their land for future generations.

Yolo County Resource Conservation District (RCD)
The Yolo County RCD works extensively with private landowners providing guidance, financial resources, and technical skills to improve private lands throughout the County. Most of the projects conducted by the RCD involve hedgerow planting, sediment catchments basins, small riparian plantings, habitat ponds, etc. These projects often incorporate the planting of oaks. The RCD actively works with landowners to develop on-farm conservation plans that help landowners direct their conservation efforts. They also work with landowners to develop monitoring programs that help evaluate the success of their projects. Through these programs oaks are often planted as a component of larger project restoration projects.

Center for Land-Based Learning
The Center for Land-Based Learning implements land-based learning programs to connect the next generation to their environment. Students learn and practice how to steward healthy ecosystems, and are given tools that encourage careers in sustainable agriculture, ecosystem restoration or environmental sciences. One such program is SLEWS — Student and Landowner Education and Watershed Stewardship – which engages high school students in habitat restoration projects that enhance classroom learning, develop leadership skills and result in real habitat restoration.

Each year, participating SLEWS high schools throughout the Central Valley select restoration projects on farms, ranches or other natural areas to adopt for the school year. Many of these high schools are located in Yolo County, and each year, approximately 10-12 restoration sites are chosen as SLEWS sites. Over multiple visits, students plant oaks, cottonwoods and other native species on their site, collect native seeds, build and install bird boxes, remove invasive plants and install irrigation systems, all to increase biological diversity and improve the health of the land. Because CLBL partners with restoration professionals from public agencies, local watershed groups and nonprofit organizations, SLEWS projects have a real and lasting impact on the land.

In the last six years, the SLEWS Program has worked with over 75 different high school classes throughout Yolo, Sacramento, and Solano Counties, and restored hundreds of acres of land. The majority of these projects included an oak woodland restoration component.

Blue Ridge Berryessa Natural Area Conservation Partnership (BRBNA)
The BRBNA is a partnership of public agencies, landowners, and private conservation groups developing an integrated strategy for long term conservation in the BRBNA natural area. The natural area includes the mountainous western portion of Yolo County. This group is working to preserve, protect, and manage significant portions of the valuable oak resources in the county and will be an important partner for Yolo County staff in the future. Their work includes extensive mapping of BBNRA, developing a management plan, and facilitating coordination and collaboration among public, private, and non-profit partners. Additionally the BBNRA works to provide research, information, and education services to partners and to conduct public outreach.

Putah Creek Council (PCC) and Lower Putah Creek Coordinating Committee (LPCCC)
The Putah Creek Council (PCC) was formed in 1988 as a voluntary partnership of individuals interested in protecting and restoring existing riparian vegetation and associated fish and wildlife habitat.. From 1987 to 1994 there was a protracted drought that provided so little flow in Putah Creek that fish became stranded and riparian vegetation began to die. Putah Creek Council initiated a lawsuit in 1989 to establish minimum flows in Putah Creek that in 2000 gave rise to the Lower Putah Creek Coordinating Committee (LPCCC) of which PCC is a core member. The LPCCC's mission is to monitor the new perennial flows, to monitor fish and wildlife and to raise funds for protection and enhancement of the resources of Putah Creek. PCC continues to lead education and outreach programs such as their Community Stewardship Program that includes oak woodland conservation and enhancement activities based on volunteer stewardship. Examples of these projects include the planting of 180 valley oak trees along the banks of Putah Creek over the past two years in a collaborative effort with the, UCD Riparian Reserve and the Society for Conservation Biology. PCC also helped local classes raise and plant 120 valley oak trees along the banks of Putah Creek at the UC Davis Riparian Reserve in February and March 2005. The LPCCC has focused mainly on promoting cooperation with landowners, bank stabilization, removal of solid wastes and weed control that augment existing opportunities for oak restoration. The LPCCC and PCC also promote oak restoration on Putah Creek's major tributaries including Dry Creek and Pleasants Creek. Through recent stewardship planning efforts

PCC and the LPCCC have identified 62 locations on Putah Creek and tributaries where landowners support creek enhancement projects, most of which could include oak restoration.

Cache Creek Conservancy
The Cache Creek Conservancy is a non-profit organization that was created in 1998 to help manage and enhance Cache Creek. It owns and operates the 130-acre Cache Creek Nature Preserve (CCNP). The Conservancy is currently involved in a tamarisk and giant reed eradication project from Capay Dam to I-5. The Conservancy has had limited involvement with oak woodland restoration and management to date, but could be involved in riparian oak woodland enhancement activities in the future.

Tuleyome
Tuleyome is a non-profit organization working to protect and restore the wild heritage and agricultural heritage of the Putah and Cache Creek watersheds, including oak woodlands. This group develops long-term visions and implementation strategies. Recently Tuleyome purchased the 640-acre Ireland Ranch in the Blue Ridge. They will offer docent lead tours to the ranch itself and the abutting 9,100 acres of the Berryessa Peak unit of the BLM managed public lands that also contain oak woodlands.

California Fire Safe Council
The Fire Safe Council provides resources for establishing and maintaining local Fire Safe Councils, such as the FSC Handbook, nonprofit and funding information.

The California Fire Safe Council's mission is to preserve and enhance California's manmade and natural resources by providing leadership and support that mobilizes all Californians to protect their homes, communities and environment from wildfires.

Since its formation in April 1993, the Council has united its diverse membership to speak with one voice about fire safety. The Council has distributed fire prevention education materials to industry leaders and their constituents, evaluated legislation pertaining to fire safety and empowered grassroots organizations to spearhead fire safety programs.

APPENDIX F: YOLO COUNTY GENERAL PLAN

Yolo County is currently updating the Yolo County General Plan. This process will include a review of existing ordinances and policies and will direct land use planning the county for the next 20 years. The planning process will include a discussion of policies and actions related to oak woodland conservation and management. The target date for adoption of the new General Plan is November 2007.

Language from the existing General Plan relating to oaks trees and oak woodlands is listed below:

SH 7. Yolo County shall require retention, of existing trees and vegetation and natural landforms, and shall require landscaping to enhance scenic qualities and/or screen unsightly views, and shall implement regulations to prohibit removal of trees along public rights-of-way without consideration of their scenic or historic value, and shall implement tree conservation or enhancement in new development, with emphasis on **oak** preservation.

LCCI 35. Standards identifying planting procedures and materials, soil amendments and stabilizers, and appropriate species and planting densities for marshland, **oak woodland**, and riparian woodland restoration efforts should be considered guidelines. Variations from these guidelines shall be acceptable if alternative 68 restoration plans have been prepared by a qualified biologist, consistent with the policies of the CCRMP.

LCCI 36. Avoid disturbance to important wildlife habitat features such as nest trees, colonial breeding locations, elderberry host plants for VELB, and essential cover associated with riparian forest and **oak woodland habitat**. This should include sensitive siting of, maintenance access, and recreational facilities away from these features.

LCCD 19. Oaks and drought-tolerant shrubs should be planted on streambank slopes due to the lack of water on the higher elevations. **Oaks** and shrubs should be especially encouraged on slopes facing north or east.

LCCD 31. The following guidelines shall be followed when developing **oak woodland habitat** areas:

a. Trees and shrubs shall be planted in clusters of six (6) to seven (7) individuals, typically consisting of a single species. Some mixed groupings, such as **valley oak** and elderberry may occur where appropriate. Gray pine, however, shall be planted singly (not in clusters) at the higher elevations of the site. Clusters of trees and shrubs shall be planted from twenty-five (25) to fifty (50) feet apart, with native grasses in between.
b. Appropriate species and densities for oak woodland restoration may include the following:

Species (common name)	**Density (number or pounds/acre)**
Valley oak	20
Wild rose	15
Blue elderberry	10
Coyote bush	10
Toyon	10
Redbud	10

Coffeeberry	10
Native blackberry	8
Interior live oak	6
California buckeye	5
Gray pine	3
Creeping wildrye	16 pounds
California brome	10 pounds
California barley	5 pounds
Pina bluegrass	5 pounds
Purple needlegrass	5 pounds

DUNP 52. Appropriate trees within the public right-of-way are to be retained and new street trees planted and maintained. **Oak** trees shall be protected from damage or renewal. New development shall be designed to preserve **oak** trees. Only trees which are either badly diseased, disruptive of street improvements because of root growth, result in significant economic damage, or dangerous to the public shall be allowed to be removed. The installation of street trees shall be made a condition of approval of residential, commercial, industrial, and institutional development along such streets.

Adequate setbacks shall be provided around the base of all **oak** trees to be retained, with grading, construction, and creation of impervious surfaces generally restricted within the dripline of individual trees. Any landscape improvements within the dripline of trees to be retained should be designed by a landscape architect familiar with the sensitivity and growing requirements of native **oaks**, and should ensure that drainage modifications or proposed irrigation does not damage the tree root systems.

MHD 101. Due to the irrigation requirements of the golf course and the poor condition of some of the **oak** trees existing on the site, it is doubtful that these trees can be saved. When vegetation must be removed, the method used will be one that will minimize soil disturbance and will be limited to the area required for immediate construction operations. Removed vegetation shall be disposed of at an authorized disposal area. To facilitate re-establishment of vegetation, topsoil shall be conserved or stockpiled during construction and then replaced.

The policies outlined in the following table are not related specifically to oak woodlands, but could apply to oaks.

Summary of tree and habitat-related language in the General Plan

General Plan 1983	TREE RETENTION: ‣ The County should establish design and site development standards and apply them to **prevent unnecessary disruption of vegetation** (CON 7). ‣ The County shall establish a tree-planting program and **require extensive use of trees** on private and public lands (CON 28). ‣ Yolo County shall **adopt a Tree Preservation Ordinance** and a Grading Ordinance with standards to support Scenic Highways, Open Space, and Conservation policies (SH 4). WILDLIFE HABITAT: ‣ The County shall safeguard existing and encourage development **protection of additional wildlife**

Open Space Element, 2002	BIOLOGICAL RESOURCES: ‣ The County should preserve existing biological resources by **restricting urban to areas** defined as such in urban and community plans. ‣ The County should identify and **preserve scenic corridors** and **establish a habitat mitigation banking program** for environmental mitigation fees through an NCCP. RIPARIAN VEGETATION: ‣ The County should allow **no net loss of riparian habitat** (OG-5). ‣ Development should be directed away from **riparian areas** (OP-7).
Zoning Ordinance	CONSERVATION ZONES: ‣ The Zoning Ordinance **establishes open space zones** in part to conserve wildlife and plant habitat, natural areas and riparian areas (8-2.19). TREE RETENTION: ‣ It requires that **existing trees be retained within rights of way** when trees are healthy, of a desirable variety, and do not interfere with proposed grading (8-1.708).

Source: Yolo County Planning, Resources, and Public Works Department (2003)

APPENDIX G: FUNDING SOURCES AVAILABLE FOR OAK WOODLANDS CONSERVATION

Advisory Committee for Tribal Matters (ACTM) Tribal Mitigation Fund
The Rumsey Community Fund is an important potential regional funding source for oak woodland conservation. This fund was established in 2000 by members of the Rumsey Band of Wintun Indians as part of the philanthropic efforts of the tribal government. The fund provides over $1 million annually to non-profit organizations to strengthen regional programs and services, primarily in the Capay Valley. To date, more than $6 million has been given to local organizations supporting education, community health, arts and humanities, environment, community development and social services.

Integrated Regional Water Management Plan (IRWMP)
Yolo County's Integrated Regional Water Management Plan identifies a number of aquatic and riparian enhancement projects that will benefit oak woodland enhancement efforts along Yolo County waterways. These projects involve the passive and active restoration of riparian forests, possible levee setbacks for flood control purposes, as well as park planning and development activities. Projects in the Yolo County Integrated Regional Water Management Plan are eligible for funding from the state's Integrated Regional Water Management Program, which received $1 billion from the passage of Proposition 84 in November 2006.

Private Foundations
Private foundations are excellent sources of funding for conservation practices on private and public lands. Noted foundations that have funded such efforts in the past include the National Fish and Wildlife Foundation, and the Packard Foundation. The plan recommends more thorough research of these opportunities.

Wildlife Conservation Board Oak Woodlands Conservation Program
In 2001 the California State Legislature passed the Oak Woodlands Conservation Act as means of directly supporting the management and conservation of oak woodlands throughout the state. This Act created the Oak Woodlands Conservation Program administered by the State Wildlife Conservation Board (WCB). The program offers landowners, conservation organizations, cities and counties an opportunity to obtain funding for projects designed to conserve and restore California's oak woodlands. The specific legislative intent of this act is outlined below.

1. Support and encourage voluntary, long-term private stewardship and conservation of California oak woodlands by offering landowners financial incentives to protect and promote biologically functional oak woodlands;
2. Provide incentives to protect and encourage farming and ranching operations that are operated in a manner that protect and promote healthy oak woodlands;
3. Provide incentives for the protection of oak trees providing superior wildlife values on private land, and;
4. Encourage planning that is consistent with oak woodland preservation.

To accomplish the legislative intent, the Act identifies the Wildlife Conservation Board as the entity responsible for implementing Oak Woodlands Conservation Program. The Act authorizes the WCB to purchase oak woodland conservation easements and provide grants for land improvements and restoration efforts. In addition, the WCB is authorized to award cost-sharing incentive payments to private landowners who enter into long-term agreements. Such agreements

will be structured to include management practices that benefit oak woodlands and promote the economic sustainability of the farming or ranching operation.

The Act requires that at least 80 percent of the money be used in grants for the purchase of easements, for restoration activities or for enhancement projects. In addition, the funds may be used for grants that provide cost-share incentive payments and long-term agreements. The remaining 20 percent of the money may be used for public education and outreach efforts by local governments, park and open space districts, resource conservation districts and nonprofit organizations. The remaining 20 percent may also be used for grants to provide technical assistance and to develop and implement oak conservation elements in local general plans.

APPENDIX H: TAX ADVANTAGES ASSOCIATED WITH OAK WOODLANDS CONSERVATION EASEMENTS

An oak woodland conservation easement is a voluntary tool for landowners to protect their land while retaining ownership. A conservation easement is a legal restriction that a landowner places on his or her property to define and limit the type of development that may take place there. When land is protected by an easement, the landowner continues to own the land while role of the entity that holds the easements is to ensure that the resource values are protected over time. Generally, conservation easements are purchased by or donated to a nonprofit conservation organization, such as Yolo Land Trust, which carries the responsibility to enforce the restrictions in perpetuity. The following are tax advantages associated with conservation easements:

Federal and state income tax deductions. If you are donating an easement, you may receive a federal and state income tax deduction for the difference in the value of the property before the easement is granted and its after-easement value (often the difference between the current fair market value of the land and the fair market value of the land with fewer allowed home sites).

Estate tax savings. For 2006, estate taxes begin at 45 percent for amounts over $2,000,000. Under present law, however, the effect of the estate tax is being reduced annually until 2010, in which year there is no estate tax. Then in 2011 the old laws again become effective (exclusion of $1,000,000 and tax rates from 37% to 55%). Although the timing may be a factor in the amount of savings, if you place a conservation easement on your land the land value can be reduced and thus your estate taxes can be lower.

A conservation easement can be a powerful tool to enable land to be passed on within a family. With the very high estate tax rates, in many families that have considerable land holdings, some land may need to be sold in order to raise cash to pay the estate taxes. If you place a conservation easement on your land, the value of the land can be reduced for estate tax purposes, perhaps reducing the taxes to zero or to a level at which no land will need to be sold in order to pay the taxes.

Possible reduction in property taxes. It may, depending upon how recently the property was purchased, the purchase price, and the value of the land after the conservation easement is placed. There may be an opportunity, especially for recent buyers, to get a reduced assessment (and reduced taxes) based on the diminished value of the land after the placing of the conservation easement on the land.