MONTEREY COUNTY PLANNING COMMISSION

Meeting: January 28, 2009 Time: A.M/P.M	**Agenda Item No.:**
Project Description: Review the Draft Monterey County Voluntary Oak Woodland Stewardship Guidelines that will be considered by the Board of Supervisors. An oak woodlands management plan would allow landowners, non-profit organizations and local government entities to be eligible to apply for funds from the State Wildlife Conservation Board for the preservation of oak woodlands primarily through the establishment of voluntary conservation easements.	
Project Location: County-wide	**APNs:** County-wide
Planning File Number: PD061171	**Name:** Monterey County Voluntary Oak Woodland Stewardship Guidelines
Plan Area: All	**Flagged and staked:** N/A
Zoning Designation: All	
CEQA Action: Categorically Exempt according to CEQA Guidelines, Section 15262, Feasibility and Planning Studies	
Department: RMA - Planning Department	

RECOMMENDATION:
Staff recommends that the Planning Commission review and provide staff feedback on the draft Monterey County Voluntary Oak Woodland Stewardship Guidelines.

PROJECT OVERVIEW:
Attached are the draft "Monterey County Voluntary Oak Woodland Stewardship Guidelines" for review prior to going to the Board of Supervisors. On January 8, 2008, the Monterey County Board of Supervisors directed the RMA- Planning Department to move forward on two separate endeavors:

1. Prepare an Oak Woodlands Management Plan for approval by the Board of Supervisors and for submission to the Wildlife Conservation Board. An approved Plan would allow local government entities, landowners and non-profit land trusts to be eligible to apply for funds for the preservation of oak woodlands primarily through the establishment of conservation easements.
2. Develop options for applicants to mitigate impacts to oak woodlands to satisfy State requirements under the California Environmental Quality Act. (Exemptions include agricultural land use and affordable housing.)

Purpose
To allow County landowners, non-profit and public agencies to be eligible to apply for funds for voluntary oak woodland conservation. In order to participate in this program, the Monterey County Board of Supervisors must adopt an "Oak Woodlands Management Plan" by resolution that meets the State program's minimum requirements. After that, the County is required to certify that applications submitted to the Wildlife Conservation Board are consistent with this document to compete for grants. Please see the attached "Q&A" for more information.

Attached are Exhibit A: Questions and Answers on what the Voluntary Oak Woodland Stewardship Guidelines is about; Exhibit B, the draft Monterey County Voluntary Oak Woodland Stewardship Guidelines; and Exhibit C, Appendix B to the Monterey County Voluntary Oak Voluntary Woodland Stewardship Guidelines, a technical document and references for the Stewardship Guidelines. The Stewardship Guidelines were written in collaboration with Mark Stromberg, Ph.D., Resident Director at University of California

Hastings Natural Reserve in Carmel Valley, who volunteered his time in order to get this document completed in 2008.

In a separate effort, as directed by the County Board of Supervisors, staff will develop options to mitigate impacts to oak woodlands pursuant to CEQA (PRC 21083.4) and present recommendations to the Planning Commission for revisions to policies and ordinances to incorporate oak woodlands preservation.

OTHER AGENCY INVOLVEMENT:

- ✓ Public Works Department
- ✓ Environmental Health Division
- ✓ Water Resources Agency
- ✓ Parks Department
- ✓ Monterey County Regional Parks District
- ✓ Agricultural Advisory Committee
- ✓ Cal Fire – Robert Taylor, Division Chief

The above checked agencies and departments have reviewed the stewardship guidelines and some have provided feedback to staff. Informally other organizations, public entities, and private landowners were asked to review the guidelines.

The project was not referred to any Land Use Advisory Committees (LUAC) for review. Based on the current review guidelines adopted by the Monterey County Board of Supervisors per Resolution No. 04-236, this application did not warrant referral to the LUAC because the project as no Initial Study was required.

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January 8, 2009

cc: Front Counter Copy; Planning Commission Members (10); County Counsel; Public Works Department; Parks Department; Environmental Health Division; Water Resources Agency; Taven Kinison Brown, Planning Services Manager; Paula Bradley, Planner; Carol Allen; File PD061171

Attachments:
	Exhibit A	Monterey County Voluntary Oak Woodlands Q & A
	Exhibit B	Monterey County Voluntary Oak Woodlands Stewardship Guidelines
	Exhibit C	Appendix B – Oak Woodlands in Monterey County

This report was reviewed by Taven Kinison Brown Planning Services Manager

Questions and Answers

Monterey County Voluntary Oak Woodland Stewardship Guidelines

December 2008

These Voluntary Oak Woodland Stewardship Guidelines:

- are entirely voluntary, not regulatory.
- are needed to access state funds set aside to assist landowners with oak woodland conservation.
- can help access state funding for educational programs on topics such as Sudden Oak Death.
- can provide background for unrelated, separate statewide oak woodland mitigation requirements.

Why Have Voluntary Oak Woodland Stewardship Guidelines?

In January 2008, the Monterey County Board of Supervisors (BOS) directed the Monterey County Planning Department to move forward on two separate endeavors:

1. Develop voluntary oak woodland stewardship guidelines to qualify Monterey County projects for state funding set aside for oak woodland conservation.
2. Develop oak woodland mitigation options to satisfy State requirements under the California Environmental Quality Act. (Exemptions include agricultural land use and affordable housing.)

Many counties throughout California have already gained access to state oak woodland funds by developing similar voluntary guidelines. Projects in counties with approved voluntary guidelines can compete for state funding to assist interested landowners.

These Voluntary Stewardship Guidelines are completely separate from the state's oak woodland mitigation requirement. The guidelines contain information specific to Monterey County's oak woodlands that may be useful to those involved in developing the mitigation options.

Are the Guidelines Regulatory?

No, they are completely voluntary. However, these voluntary guidelines are necessary to access state funds set aside for oak woodland conservation. The guidelines are adopted by a resolution by the Board of Supervisors. They are not related to and do not affect zoning code or general plan policies.

What Are the Benefits?

Oak woodlands provide Monterey County with many benefits including scenic, open space, and recreational values, productive rangeland, wildlife habitat and watershed protection. Landowners in Monterey County have a long history of working voluntarily with public and private partners to achieve conservation goals. These guidelines can help access state funding for these kinds of projects. They will provide a foundation for voluntary actions to help conserve Monterey County's oak woodlands.

Projects in counties that have voluntary oak woodland guidelines can compete for state funding set aside through the Oak Woodland Conservation Program of the Wildlife Conservation Board. Project examples include conservation easements and restoration as well as education on oak care and management.

Who Prepared the Draft Guidelines?

To develop the draft guidelines, Monterey County enlisted the help of scientists at Hastings Reserve, a University of California biological field station located in Monterey County. They are based on guidelines developed by other counties to qualify for the state's available oak woodland conservation funds. The guidelines include information specific to Monterey County and describe potential voluntary actions for oak woodlands conservation.

For more information contact:
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Oak Woodlands
in
Monterey County

Compiled by

Mark R. Stromberg, Ph.D.
Resident Director, UC Hastings Reserve
Carmel Valley, CA

December 2008

For Jim Griffin

I. INTRODUCTION

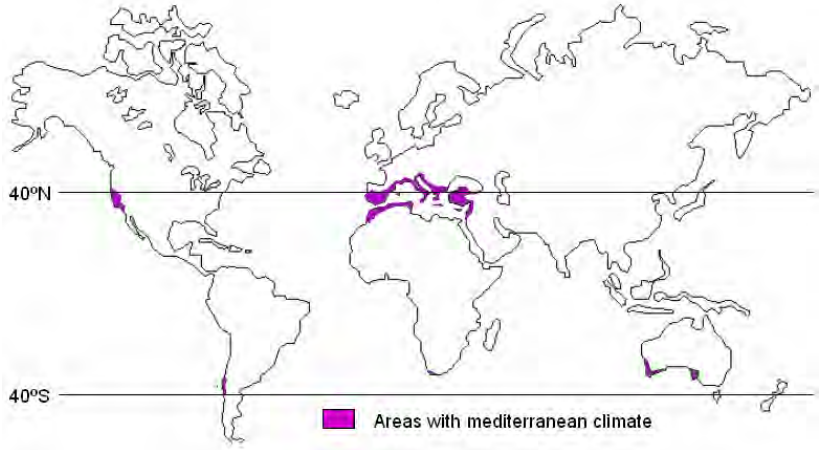
If they were not actually the backbone, then oaks certainly framed civilization (Logan 2005). Wood and stone defined the human built environment for thousands of years, and throughout the world, no tree has been more useful to humans than the oak. Oaks provided abundant food, shelter, fuel, and a strong, flexible structural material that could be shaped by stone, bronze and then steel blades. Ship keels, temple rafters, caskets, casks, wine barrels, corks, vats and tubs were of the highest quality when made with oak. From the Parthenon to Westminster Hall, oak kept the leaders of society dry and secure from the elements (Borza 1987). We continue to age our best wines in oak. Monterey County' natural landscape is dominated by oak woodlands.

The purpose of this document is to present background information and inform people about the natural history of Monterey County's oak woodlands, and provide information on the cultural and ecosystem values of oak woodlands in Monterey County. We will provide information on land use patterns in the oak woodlands and stewardship guidelines and management strategies to maintain the oak woodlands.

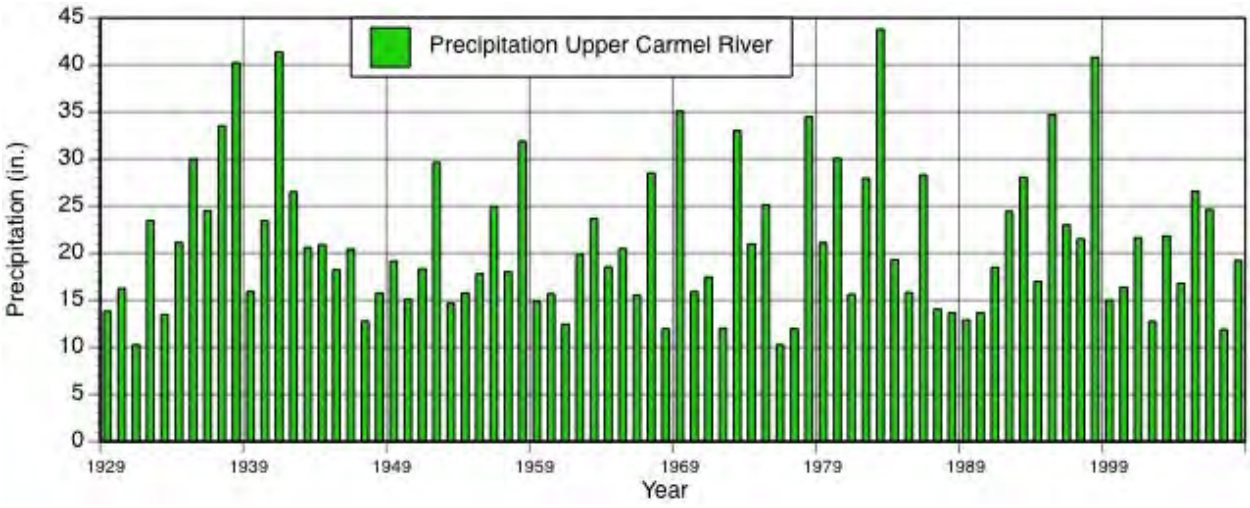
Loss of oak woodlands would change the natural and cultural values of the landscapes in Monterey County. We will summarize the predicted effects of the known threat of sudden oak death to one of the most highly valued oak woodlands. The available information strongly suggests that extensive loss of oak woodland would have significant ecological consequences. We have ongoing decisions on land use that are reducing the oak woodlands with potential effects on wildlife habitat as well as retention of soil and water. Often landowners want to know more about oaks under their care. We will provide information on options to restore, protect and preserve the oak woodlands.

I. Background on Oak Habitats

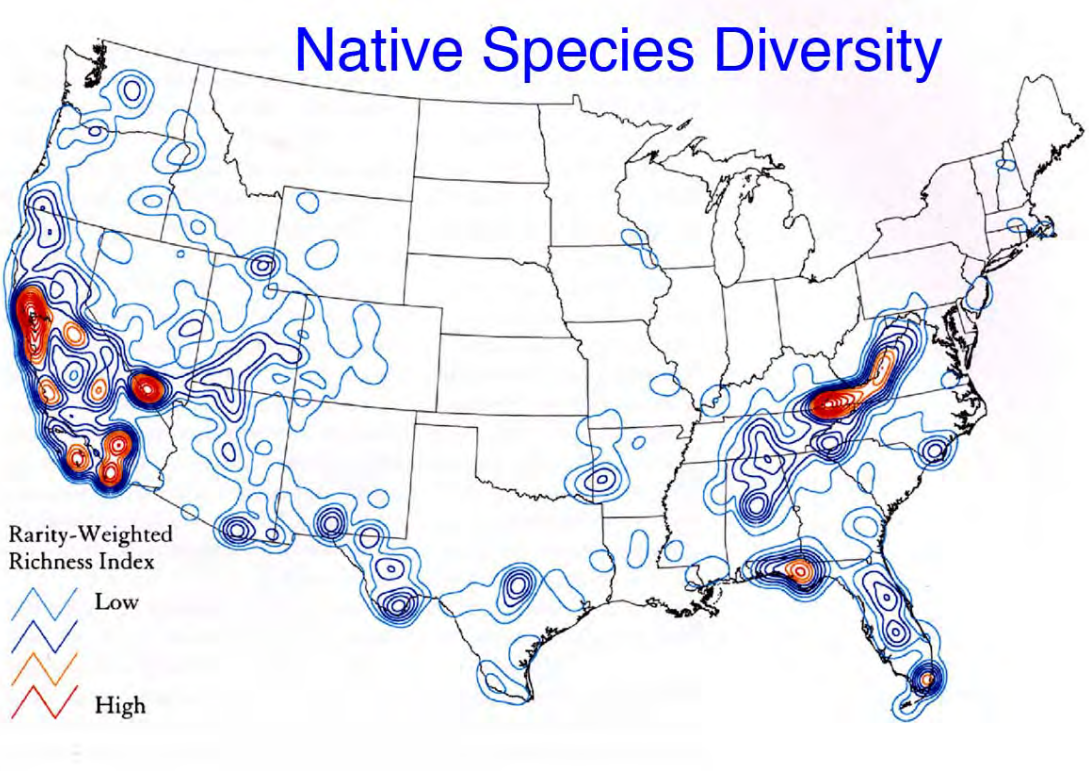
Monterey County is known for world-famous landscapes, dominated by oak woodland and grassland savannas. These landscapes, especially those with a view to the ocean, are in high demand for home sites, and have a world-wide market. These "Pastures of Heaven" as Steinbeck described them, bask in the classic "Mediterranean" climate. Monterey County's warm, dry summers and cool winters are the kind of climate that is extremely popular world-wide (Furlich 2008). Monterey County's climate swings wildly from frequent rains for six months to a seasonal drought with no rain for the rest of the year. Such a climate occurs in only five places in the world and all are known for demanding real estate markets and resorts.



In addition to a drought every year, the rains that actually fall during the winter rain season is highly variable. Rainfall is apparently random and varies anywhere from 7-8 inches to over three feet over the year.



Reflecting the balmy climate and a long history of isolation from similar climates, the plants and animals that are native to Monterey County have managed to co-exist with a remarkable number of neighbors. California has about 5,800 plant species (Hickman 1993); of these, 4,300 occur in the warmer Mediterranean climates of California (Furlich 2008). Even accounting for the large size of California, this (see map above) is more species per unit area than elsewhere in North America (Stein et al. 2000). About 1,400 of the 5,800 plant species are found only in California (endemics) (Hickman 1993). Similar patterns hold for the animal species in California.

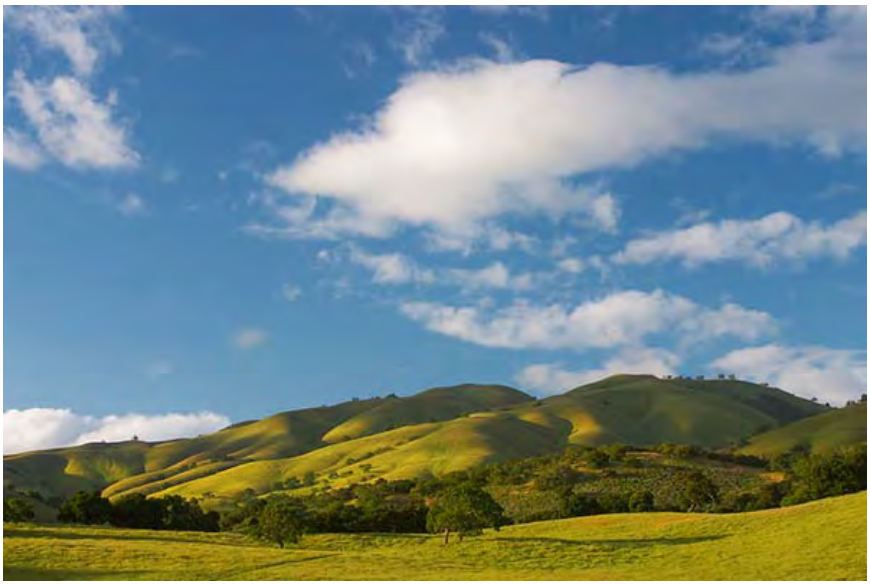


Given such a large pool of potential species in California, 2,055 flowering plant species ended up in Monterey County (Matthews 1992). Thirty-seven of Monterey County's plant species are not found anywhere else in the world, more than any other county in the state. About half of these are in the grassland savannas of oak woodlands.

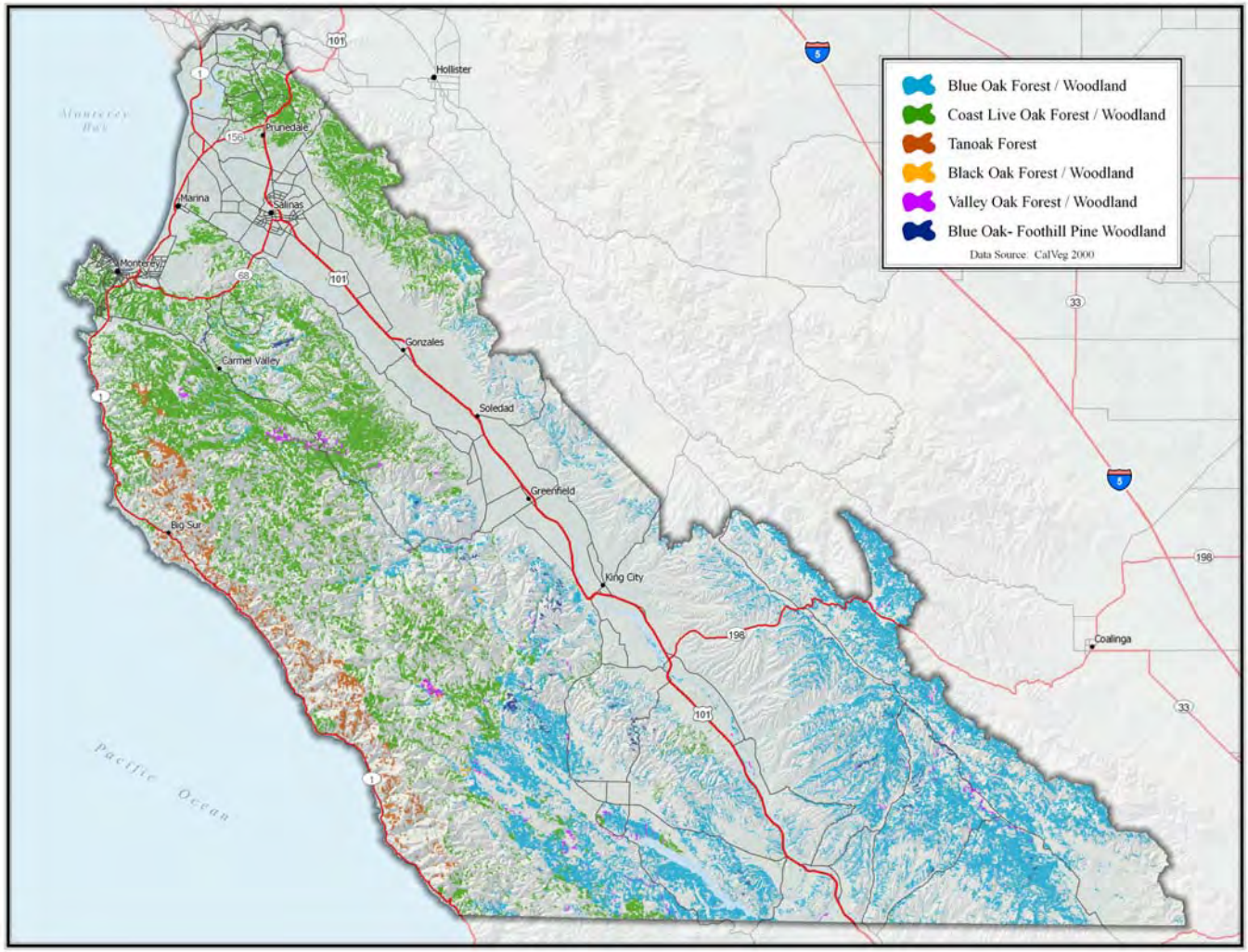
Landscapes in Monterey County reflect the geological history of the state and the local micro-environments. Due to colliding continental plates, our geology map, (and soils maps), are kaleidoscopic. Often within a few hundred feet, one can go from cool, damp hollows with deep rich soils to dry, hot, sunny slopes with shallow rocky soil. Vastly different plants and animals occur in each of the habitats. Relatively unique to California, these very different habitats can be close to each other. Natural communities of plants and animal assemble into groups of species of similar needs for soil, light, water and nutrients. Thus, California's natural communities occur in an almost bewildering array of patches, many quite different but close to each other (Barbour et al. 2007). Monterey County has many natural communities of plants and animals; coastal redwood forests, rivers lined with tall trees, open grasslands and oak woodlands. The number of different natural plant communities is long, but here we are going to provide information about oak woodlands in Monterey County. Oak woodlands dominate the landscape in Monterey County and offer a wide array of values to people, both natural and cultural.

"What marvel of multitudes, apart from man, beasts of every kind, birds of every wing, creeping or flying thing, crypt of every hue, from green and gray, dim and dark, red and blue, black and white, altogether throng the cherishing and useful oaks."

- Kellogg (1882)



II. Monterey County's Oak Woodlands



II-a. Kinds of Oaks

Monterey County has several very different kinds of oak trees. Each kind of oak has a unique story, and they are not simply interchangeable large plants. Each has unique voice in the choir. Let's start the story by introducing the characters; here are their common names and formal names and where they occur as oak woodlands in Monterey County (map). The highlighted oaks (table) are the most widespread and are mapped.

Common Name	Formal Name	Leaves	Acorns	Populations Status
Black Oak	Quercus kelloggii	Deciduous	2 yr	Not well known, SOD host
Coast Live Oak	**Quercus agrifolia**	**Evergreen**	**1 yr**	Extensive, reproducing, SOD host
Oracle Oak	Quercus parvula	Evergreen	2 yr	Small, scattered populations
Interior Live Oak	Quercus wislizenii	Evergreen	2 yr	Small, scattered populations
Blue Oak	**Quercus douglasii**	**Deciduous**	2 yr	Regeneration limited?
Valley Oak	**Quercus lobata**	**Deciduous**	**1 yr**	Rarely replacing young
Oregon Oak	Quercus garryana	**Deciduous**	1 yr	Scattered populations only
Canyon Live Oak	Quercus chrysolepis	Evergreen	2 yr	Scattered populations only
Leather Oak	Quercus durata	Evergreen	1 yr	Scattered populations only
Scrub Oak	Quercus berberidifolia	Evergreen	**1 yr**	Scattered populations only
Tanoak	**Lithocarpus densiflorus**	**Evergreen**	**2 yr**	Decreasing- SOD host

Note: Deciduous leaves fall each year leaving the branches bare. Evergreen leaves fall throughout the year and the branches are generally never bare. SOD- Sudden Oak Death disease.

Oak names are interesting in themselves (Keator and Bazell 1998). "Quercus" is derived from the Celtic for "fine" and "tree". In Italian, oaks are still known as "quercia". Often the formal names reflect the shape of the leaves or names of botanists who published descriptions of each species. Common names often vary between locales, but in Monterey County, they are descriptive. In Monterey County Place Names (Clark 1991), "oak" and "robles" (Spanish for deciduous oak) are very abundant and widespread For a very readable, informative book on California Oaks we would suggest "Oaks of California" (Pavlik et al. 1991).

The University of California Extension Service, since 1987, has sponsored the Integrated Hardwood and Range Management Program. This program has produced nearly 400 publications on applied research relevant to landowners (IHRMP 2008). In addition to these research papers, there have been five symposia sponsored by the US Dept. of Agriculture, Forest Service focused entirely on California oaks (Pillsbury et al. 1997, Standiford et al. 2002). Much of the information presented here is derived from these publications. Much of this effort is directed to produce useful information for landowners who are conserving oak woodlands.

Four of the oaks in the table (highlighted) are the dominant trees in many patches in Monterey County, and can be the only tree in some patches (map). Oak woodlands are generally defined (Gaman and Firman 2006) as places where oaks cover more than 10% of the ground when seen from above ("canopy cover") [Oak Woodlands Conservation Act (PRC 21083.4), Fish and Game Code 1361]. These woodlands can extend from a few to hundreds trees, or for miles. There are many associated plants and animals that depend on these patches of trees for every aspect of their lives. We describe here the most widespread oak woodlands in Monterey County by defining and mapping the distribution of four types of oak woodland. However, recognize that seven oak woodlands can be defined and mapped, with up to 57 sub-types (Allen-Diaz et al. 2007).

II-b Monterey County Oak Woodlands

Coast Live Oak Woodlands

Coast live oaks remain green all year, with a gradual replacement of very prickly, cupped leaves going on all year. Woodlands dominated by Coast live oak are shown in green on the map. They tend to live in places with moderate climates, and they thrive in the cool, foggy coastal areas. In moist areas, species associated with Coast live oak are Pacific madrone, California bay, Tanoak, and Canyon live oak. In dryer areas, species associated with Coast live oak are Valley oak, Blue oak, and Foothill pine. About 252,400 acres of Coast live oak woodlands occur in Monterey County (Gaman and Firman 2006). Coast live oaks are susceptible to a new and uncontrolled plant disease, Sudden Oak Death (SOD). The loss of these large oaks would dramatically change the look of the Monterey County landscape.

Blue Oak Woodlands

Blue oaks are often the dominant tree in the woodlands where they occur, and can be the only tree in large areas of these woodlands. These are shown as blue on the map. About 249,200 ac. of Blue oak woodland occurs in Monterey County. Patches of Blue oak can extend from a few trees to several miles in extent. Blue oak woodlands in Monterey County are often dominated by very old trees (Stahle 2004) (300-800 yr.) with very few sapling or seedlings. Foothill pine, California buckeye, Valley oak, Interior live oak, Coast live oak, Canyon live oak, and California Black oak may also be present. These woodlands are generally associated with steep, hot, dry, often west-facing or south-facing hillsides. Blue oak woodlands are likely to occur in small patches on steep ground and as large blocks with variable canopy cover on gentle slopes. Its understory consists of dominant non-native annual grassland with patches of native grasses such as Needle grass, California Melic, and June grass.

Valley Oak Woodlands

Valley oaks remain in small pockets of relatively undisturbed valley floors and occasionally high on ridges above the valleys. They are shown as purple on the map. In Monterey County and throughout the state, Valley oak woodlands have clearly been reduced more than any other oak woodland (Pavlik et al. 1991). Describing the valley oak woodland of the Santa Clara Valley, George Vancouver (1796) wrote “it could only be compared to a park which had been originally planted with the true old English oak; the underwood had the appearance of having been cleared away and left the stately lords of the forest in complete possession of the soil “ (Pavlik et al. 1991). From 85-100% of the Valley oaks have been lost from the Santa Clara valley (Grossinger et al. 2007). We do not have comparable detailed studies of the relative loss of the Valley oak woodland in Monterey County. However, exemplary stand remain in and near Fort Hunter Liggett and in Carmel Valley. About 6,500 acres of Valley Oak woodlands occur in Monterey County.

Tanoak Woodlands

Tanoaks occur in the cool, often shady watersheds that face the Pacific ocean. In Monterey County they follow up the canyons of the Big Sur coast (Shreve 1927, Readdie 2008). These woodlands are typically co-dominated by redwood trees. Elsewhere in California, Tanoak woodlands are co-dominated by other conifers (Hunter 1997). Tanoak woodlands include at least 40 other shade tolerant plants; Big leaf maple, White alder, Cream bush (Ocean spray), Douglas iris, California bay, California coffeeberry, Arroyo willow, poison oak and various ferns (Readdie 2008). Tanoak woodlands have been particularly hard-hit by SOD. Most Tanoaks in Monterey County were killed by this plant disease in the early 2000’s and over 90% of these stands burned in the 2008 Basin Complex fire. Their extent shown on the map (tan) has certainly been largely reduced by disease and fire. About 23,325 ac. of Tanoak woodland occurred in Monterey County.

Ancient Blue oak on Red Hill, Sierra de Salinas. Dense Blue oak stand in background.

Valley oak stand, typically showing only older, mature trees and lacking saplings and seedlings. Coast live oak woodlands are on the hill in the background.

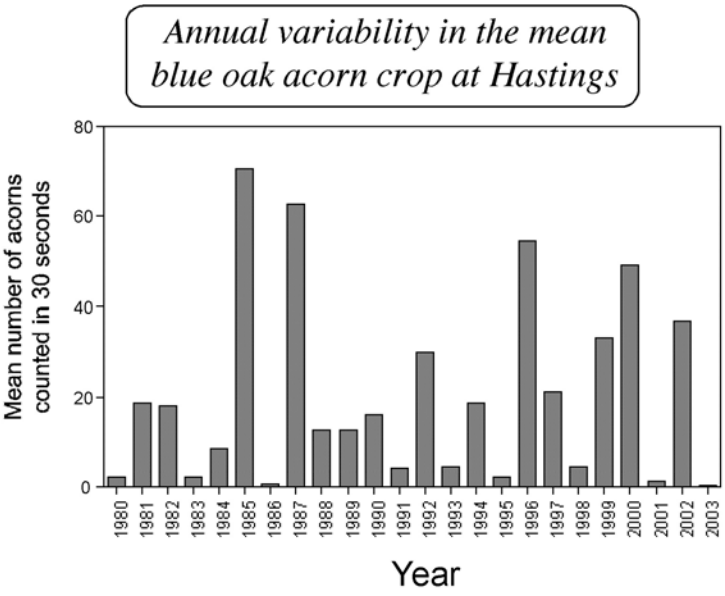
Coast live oaks.

Tanoak woodland central, coastal Monterey County.

II-c. Natural History of Oak Woodlands

Life cycles through oaks on a time scale that vastly exceeds the typical life span of people, so the story of life in oaks must be observed over many trees of various ages in various places. Understanding the forest requires that we understand how individual trees grow (Keator and Bazell 1998).

Stepping into the life cycle at the flower stage, we will start with acorn origin. The age at first reproduction is not well known, but it is likely that for naturally established trees it is at least several decades, with peak acorn production occurring many decades later (Tyler et al. 2006b). Oaks trees have two kinds of flowers- male and female. Flowers emerge in the spring, primarily March and April. The male flowers ('catkins') produce only pollen, and all oaks release pollen into the wind to pollinate a nearby female flower. Oaks do not self-pollinate because on a given tree, the male flowers fall off before the female flowers open. Light on warm, dry, spring days in a flowering oak woodland can be filtered to a yellow haze by clouds of pollen floating on the breeze. This pollen does not effectively pollinate flowers for a very long distance- maybe 200 to 500 feet (Dutech et al. 2005). When the female flowers receive pollen, their ovaries swell and start to produce acorns. In Monterey County, acorns on Blue oaks, Coast live oaks, Valley oaks take one season (spring-fall) to ripen. The black oak and Tanoak acorns require two years to make an acorn.



Acorn production varies dramatically between years in Monterey County. Researchers at the UC Berkeley Hastings Reserve in upper Carmel Valley have counted acorns for many years to examine these patterns (Koenig et al. 1994). In some years, there is very little acorn production across large areas, and in other years ('mast years'), most of the trees have very large numbers of acorns. In general, years with large acorn crops are more likely to be followed by years with fewer acorns and a low year is more likely to be followed by one rich in acorns. A warm dry spring (lots of pollen blowing around?) is often followed by an abundant acorn crop (Koenig et al. 1996) while wet, drizzly spring seasons are more likely to see a poor acorn crop. Another baffling pattern has been revealed by a series of counts of acorns taken on over 500 trees across the state for nearly 20 years by Hastings researchers. There is wide synchrony in acorn production within each species, at least for Blue oak and Valley oak (Koenig et al. 1999). If it is a heavy crop of acorns for a particular Valley Oak in Carmel Valley, it will likely be a bumper crop for Valley oaks across the entire distribution of Valley oaks (200 miles!). Conversely, if the Valley oak in your back yard in Monterey County has few acorns, it is very likely that the Valley oaks in Santa Barbara County and Sacramento are also having a poor crop.

Before the mature acorns can drop from the tree, they are almost all plucked by the local birds and stashed in the ground. Several species store acorns for later use, including the Acorn woodpeckers, Magpies, Scrub jays and Stellar's jays. Scrub jays studied at Hastings each gather about 7,000 acorns if it is a decent crop (Carmen 2004), and incredibly, can recall the locations of up to 5,000 places where they cached acorns in the soil under leaves, roots, pebbles etc. (DeGange et al. 1989). Thus, there is no shortage of acorns planted. After a mast year, there are carpets of Coast live oak seedlings sprouting from forgotten jay caches.

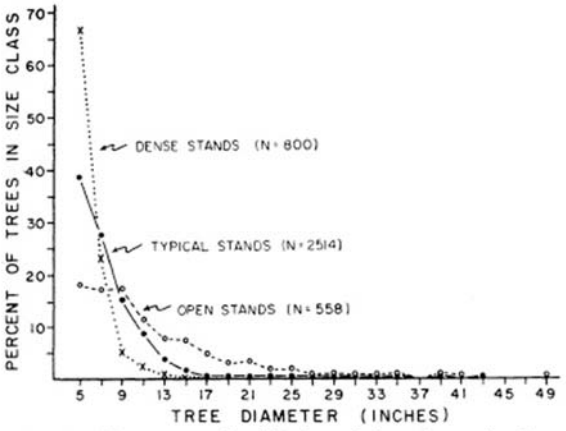
Germination starts immediately in the fall. Acorns are susceptible to fatal drying if the winter rains are delayed or minimal (Tyler et al. 2006b).

Life for the seedling acorn is hard. They put down a tap root almost immediately, and this makes it difficult to transplant seedlings. If the tap root is broken during transplanting, the seedling will die. Seedling acorns must compete with up to 2,000 grass seedlings/sq. ft. (Stromberg et al. 2007) and these non-native, annual grasses can extract soil moisture better than the acorns, often leading to oak seedling death (Gordon and Rice 1993). If they survive the annual weedy grasses, the next gauntlet to run is that of small mammals, particularly gophers (Griffin 1971). Gophers, now flourishing on abundant non-native grasses that dominate the understory of most oak woodlands, are the primary cause of oak seedling death (Griffin 1976, Adams and Weitkamp 1992, Tyler et al. 2006a). Seedlings often succumb to grazing by deer and other animals, unless provided some protection. Seedlings (both planted and naturally occurring) of Coast live oak survived nearly twice as well under a shrub as compared to nearby open grassland areas(Callaway and D'Antonio 1991). Seedlings of Blue oak can be stunted by repeated grazing by deer (or cattle) and can persist for decades as low shrubs (Koenig and Knops 2007). Due to interest state-wide in restoring oaks, a great deal has been learned about how to protect acorns and seedlings from damage at their early stages with metal screen root enclosures and protective tubes for the saplings (McCreary 2000, 2007).

Regeneration of the population of oak trees in California woodlands often appears inadequate. This failure is clearly not at the seedling stage, but later. The causes are not always clear. Saplings in Blue oak and Valley oak woodlands are rare. In a 3-year survey of a the 2,000 ac. Hastings Reserve, ungrazed and with minimal human disturbance since 1937, only a handful of naturally occurring pole-sized saplings of Valley oak were found. Blue oak have scattered patches of seedlings throughout their range, but in a systematic survey of Blue oak woodlands, fewer than half had any patches of seedlings (Standiford et al. 1997) and those present were not adequate for stand replacement. Although there are occasional good acorn years, with many acorns, and in some places there are many seedling oaks, rarely do these seedlings recruit (survive and grow in the population) to larger, “pole-sized” saplings. Recent reviews of all the available data on California’s oak’s “regeneration problem” indicate that Blue oaks might indeed be reproducing. However Valley oaks are just barely reproducing. Clearly both species are potentially reproducing at such a slow rate that we need very long-term monitoring (20 year studies) to detect adequate regeneration (Tyler et al. 2006b, Zavaleta et al. 2007).

Large oak trees can live for hundreds of years, but as they host a myriad of other life forms, they slowly succumb to senescence and eventually the demands of fungi, moss, lichens, woodpeckers, mice, moths, beetles, wasps and weather add up and the tree falls. Valley oaks can be huge (photo) and live up to 800 years (Geniella 2006). Often, fungus destroys the interior of the old trees, and the exterior wood is so hard that coring devices used to age the trees usually break. So, we don’t know the true age of many trees, only their size. Studies of the actual ages of the oak trees at Hastings, with steel bands measuring incremental growth each year, are underway.

A large California oak can produce from 300-500 pounds of acorns in a year (Logan 2005), and on a good year, the yield can easily be four to five times that amount. Hundreds of species consume these acorns. First are the birds and small mammals who pluck most of them from the trees (Carmen 2004). A deer can eat 300 acorns a day and during October, this might be half of its daily food intake (Pavlik et al. 1991). Pigs, bears, woodpeckers, band-tailed pigeons, gray foxes, mice, rats and a myriad of insects, fungus, and bacteria clean up any that are left on the ground. Populations of predators that feed on the acorn-eaters fluctuate in response to how many acorns their prey could find. Acorns are certainly one of the driving factors in wildlife abundance in Monterey County.

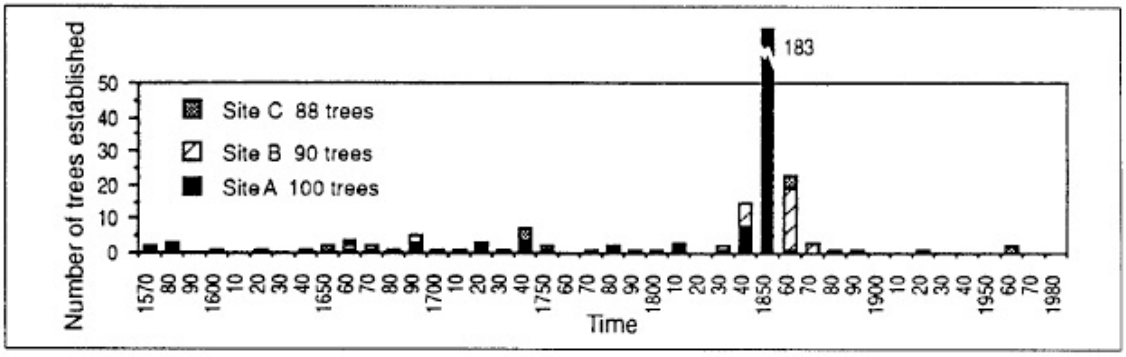


Percentage distribution of size classes in three categories of foothill woodland. Over 90% of the trees sampled were less than 12 inches dbh.

One of the few forestry studies done of mature Blue oaks in Monterey County provides information on the size distribution of these trees (White 1966). In woodlands where the density of trees is high, (414 trees

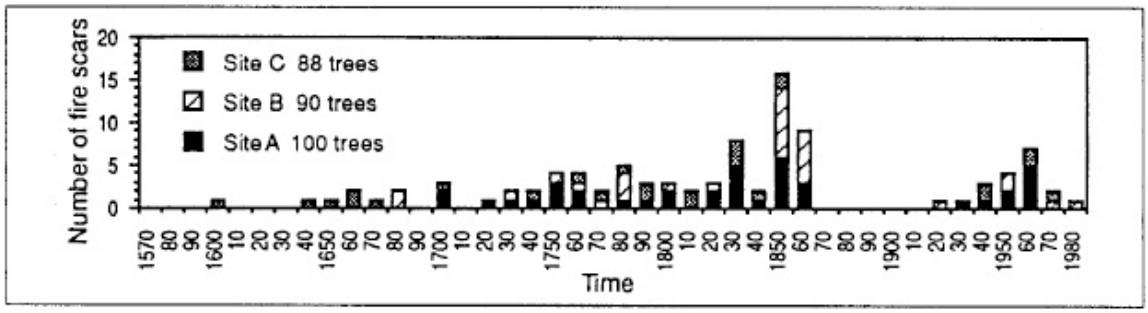
per acre, averaging 7.0” diameter) the individual stems are small (3-8” diameter), and in more open stands with scattered trees (63 trees per acre, average of 14.5” diameter), individual trees tend to be larger (Figure to left, (White 1966). An unpublished report by the University of Arkansas Tree-Ring Lab has compiled and compared annual growth rings of Blue oak on the Hastings Reserve in Monterey County from 1460 to 2004 and it could be used to obtain data on frequency of regional droughts (Stahle 2004). Curiously, tree size is not necessarily a good estimate of tree age- some of the very old trees can be relatively small. A Blue oak with a 10 inch diameter can be 300 years old and a 10 inch Coast live oak can be only15 years old. Coring Blue oaks to obtain age and dendrochronology is difficult and requires special tools as the wood is very dense and standard coring tools are quickly broken. So, often the best data come from studies where trees are cut.

Studies of Blue oak stand history are not available for Monterey County, but a comparable study in the Tehachapi Range was done and suggests the long time scale over which forests of Blue oak operate (Mensing 1991). This is probably the only such study of Blue oak ages, and is based on stumps in a clearing operation. Blue oaks often occur in old-growth stands with trees up to 800 years old (Stahle 2004). Recruitment of young trees of the stand is apparently not continuous. In the Tehachapi range, the years from 1850-1860 saw unusual, abundant recruitment, but very little in other years going back to 1570. Blue oak can survive as both natural and planted seedlings in the grassy understory of existing stands for up to 50 years (Koenig and Knops 2007). Although they can sprout from stumps cut for firewood (White 1966) Blue oak seedlings and sapling are stunted by repeated clipping of leaves and can remain dwarfed for decades (Koenig and Knops 2007).



Number of blue oaks established per decade by site on Tejon Ranch, Kern County, California. Of the 183 trees established in the 1850's, 156 date to 1856, including 61 from site "A", 44 from site "B", and 51 from site "C".

Fires were frequent in oak woodlands before European settlement, and this was followed by a period of decreased fire frequency after settlement. The peak in fire scars in the Tehachapi range co-occurs with the large spike in new blue oaks (Mensing 1991).



Number of fire scars on blue oaks, per decade, by site on the Tejon Ranch, Kern County, California.

Coast live oaks are relatively short-lived oaks (Pillsbury et al. 1997, Pillsbury et al. 2004). Coast live oak stands are between 40 and 110 years of age, although stands have been measured as young as 28 years and as old as 131 years. Typically stands include 60-80 year old trees. Coast live oak stands are often dense, from 100 to 700 trees per acre, and average tree diameter about 5-17 inches. Trees reached maturity and start to decline at 75-80 years. Some coast live trees can live to 250 years (Pavlik et al. 1991). Coast live oaks stump-sprout vigorously by sending out a broad

brushy ring of branches. After 5-10 years, one central branch that cannot be reaching by browsing animals shoots up and becomes the main stem, and the lower brushy branches die back and the tree is effectively replaced (Pillsbury et al. 2004).

Fire in the oak woodlands of Monterey County occurs regularly. A fire history (Table 1) was compiled from tree scars of fires on Junipero Serra Peak (Talley and Griffin 1976) and historic fires in Monterey County indicate that fires occurred about every 10-20 years. After European settlement (1860) the fire interval in the oak woodlands increased somewhat, but there is recent evidence that fire frequencies are increasing in southern and central California, largely due to human sources of ignition (Syphard et al. 2007).

Table 1. Fire History, Oak Woodlands

Fire Name	Year	Ac.
Junipero Serra Pk	1683-1688	?
Junipero Serra Peak	1668-1671	?
Junipero Serra Peak	1700	?
Junipero Serra Peak	1717-1724	?
Junipero Serra Peak	1734-1740	?
Junipero Serra Peak	1758-1759	?
Junipero Serra Peak	1791-1795	?
Junipero Serra Peak	1816-1820	?
Junipero Serra Peak	1829	?
Junipero Serra Peak	1847-48	?
Junipero Serra Peak	1873	?
Junipero Serra Peak	1896	?
Junipero Serra Peak	1901	?

Table 1. (continued)

Fire Name	Year	Acres
Big Sur	1916	1,400
Unknown	1916	2,000
Unknown	1918	2,650
Unknown	1919	2,000
Lost Valley	1921	8,300
Miller Canyon	1928	10,100
Piney Creek	1929	1,300
Black Cone	1933	4,100
Indian Valley	1933	4,800
Reliz Canyon	1942	18,665
Tassajara	1949	1,100
Indian Valley	1950	5,100
Indians	1976	10,000
Marble Cone	1977	117,00
Seco	1985	1,600
Rat Creek	1985	50,000
Wizard	1985	6,000
Seco	1992	1,200
Kirk Complex	1999	13,820
Big Basin/Indians	2008	240,000

Oak woodlands in Monterey County are probably going to see at least a similar frequency of unplanned fires into the foreseeable future. An emerging forest management option is the use of prescribed or planned fires that can reduce the fuel loads and risk of damage (Grossinger et al. 2007).

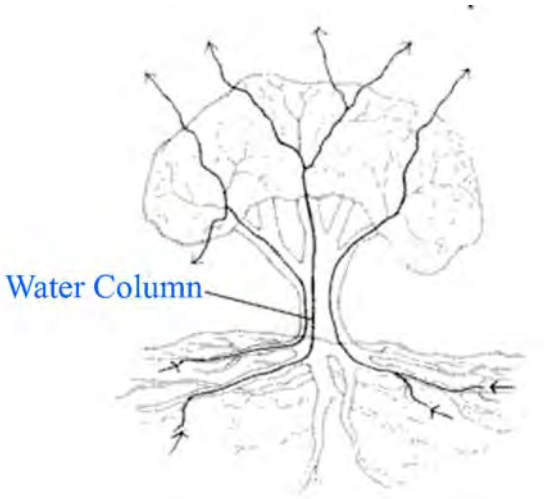
Fire has been a part of the oak woodlands for thousands of years. For the last 10,000 years, lightning fire frequency was one of the lowest in North America and density of Native American people was one of the highest. Further, Native Americans constantly used fire to manage the landscape (Keeley 2002, Anderson 2005, Syphard et al. 2007). The high-frequency, low-intensity fires likely resulted in little mortality of mature oaks, low but continuous tree recruitment (Mensing 1991), and an open understory. Following settlement by Europeans in the mid-1800s, ranchers burned to reduce shrub cover and to increase grassland area and forage production; surface fires were common with average fire-return intervals of 8-15 yr. Fire suppression, begun in the 1940s to 1950s, led to increases in surface and crown fuels, invasion of woody vegetation in the understory, and increased tree density (Purcell and Stephens 2005). In a long-term study (Syphard et al. 2007) it appears that humans are altering both the spatial and temporal pattern of the fire regime; the total area burned each year remains about the same, but the majority of fires are burning closer to developed areas and the more remote forests are no longer burning at their historic range of variability. Since 1910, wildland fire frequency and size in California have not changed, fire frequency and population density are correlated and it appears that expansion of the urban-wildland interface is a key factor in woodland fires (Keeley et al. 1999).

Effects of fire on the oaks are often minimal, as one might expect from such a long association between oak woodlands and fires. An individual tree may appear to be dead immediately after a fire, but mortality is often low (McCreary 2007) and the oaks sprout new branches from the base or the main stem. It may take 1-2 years for the oaks to sprout new growth or replace singed leaves.

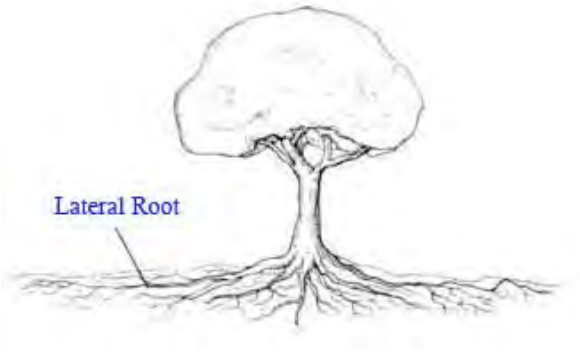
Fires tend to burn in a mosaic pattern in Monterey County oak woodlands, even in the largest fires. For example, in the 2008 Basin/Indians complex fire of 240,000 acres in Monterey County, 24% was unburned, 16% of the area had a low intensity burn, 37% was moderately burned and only 23% was intensely burned (BAER 2008).

Direct effects of fire in oak woodlands on the associated animals are not well studied in Monterey or elsewhere in California (Shaffer and Laudenslayter 2006). Presumably, larger, more mobile animals can flee to the islands of unburned woodlands (Stromberg 1997), and many spend the hot summers underground where the effects of fire are minimal. Fires in oak woodlands affect animals indirectly by changing the habitat- making it more open for a few years, and thus attracting the kinds of animals that select such habitat (Purcell and Stephens 2005). Studies on the effects of fire on small mammals of the oak woodland (mice, woodrats) suggest that fires have minimal, or very short-term effects on populations (Lee and Tietje 2005, Tietje et al. 2008). Fires fit with the mosaic or patchy theme seen time and again in oak woodlands. The fires promote the slightly different patches, and thus the varying plants and animals that co-occur in the oak woodlands. That is, fire increases and maintains biodiversity.

The way an individual oak makes a living on the landscape is important in understanding the ecological functions of the oaks, and the services they provide to people. After all, we too are a species that has been living in the oak woodlands for a long time.



Oaks, like all other plants, convert the air to woody tissue. To do this, they use some water to bind up CO2 (carbon dioxide) from the air into complex chains of carbon loops- initially sugar, then larger carbohydrates like cellulose. To put the CO2 and water together, the oaks have cells in their leaves that use chlorophyll and sunlight to bind the many carbohydrate links. Slender tubes bring water from the soil to the leaves through the branches from microscopic root tips. In fact, there is an unbroken column of water from the roots to the leaves. Tiny holes in the surfaces of the leaves are open to the atmosphere, allowing air in and out. As the water in the leaves dries out, the evaporation pulls water up from the roots. The pull on the column of water can often be up to 300-400 psi. This is quite the pull on the soil. If it fails catastrophically, as it does at times when it is particularly hot and dry, there is sometimes a loud bang as the limb falls off the tree. At night, when the leaves close, the water raised by the deep roots spreads out to the lateral roots. This “hydraulic lift” means that the plants growing above the lateral roots of the oak tree are able to use the water brought up by the oaks (Caldwell et al. 1998).



To feed the constant demand for water in the leaves, the roots must be in contact with soil water. Oak roots spread out laterally often well beyond the outer edge of the tree’s canopy. Some oaks predominantly have a network of fine, shallow roots, and others have a deep “tap” root that heads straight down and seeks deep water (Callaway 1990). When tap roots of seedling Blue oak and Coast live oak hit dry soils, their lateral roots expand. However, if a Valley oak seedling’s tap root extends into dry soil, the entire root system may shrink by 24% (Callaway 1990). This is probably related to why Valley oaks establish and grow more frequently in habitats with deep soils.

Oaks have many algae, fungi and bacteria that start decomposing even standing oaks. Nevertheless, they manage to stand for hundreds of years, often with interiors that have nearly decomposed. In urban settings, the structural integrity of the tree may be compromised by age and decay, so an experienced and well-trained arborist may suggest pruning or reduction of mature trees for safety. For the oak woodland however, the decaying tree is a home to many life forms and a hollow tree may be home to owls, foxes, bats, mosses, lichens and the amazing water bears- one of the few complex animals that can be completely dehydrated, then later wetted and resume life. Oaks support an entire suite of insects- moths, bees and wasps. Some of these are specialists on oak trees.

The oak moth, for instance, has a complex, long-term relationship with Coast live oak (Keator and Bazell 1998). At irregular intervals (10-50 yrs.) they can defoliate Coast life oak in isolated patches during a summer. This moth has been doing this with oak trees for thousands of years. The oaks have a unique hormonal response to this moth that stimulates new leaves without branch elongation, thus preserving the short, stocky aspect of the oak. Few animals can digest the tough, tannin-filled leaves of live oaks, but the oak moth larvae can; this moth frass is broken down in the soil under the trees where it acts as a fertilizer as the oak regrows new leaves.

Specialized tiny wasps, some as small as a period printed on a page, lay eggs in the leaves or twigs of oaks that stimulate a gall. California has at least 122 species of gall-forming wasps in our oak woodlands (Schick 2002) and each kind of wasp produces a unique gall. Blue oaks have the widest array of these often complex, colorful galls. They appear to be harmless to the oak; just another hitchhiker.

Abundance (how many) and diversity (what kinds) of other life in oaks, like elsewhere, is related to the volume of the oak canopy. The larger the volume of canopy, the more kinds of birds, galls, lichens, mosses etc. are present in the tree in populations large enough to be viable in the long term. Thus, dramatic trimming of oaks, or removal of most low branches and many interior branches means a corresponding decrease in the diversity of life that an oak tree can support. Replacement of a mature oak with a canopy 50 feet across with a nursery sapling in a 5 gallon container is not equivalent in terms of the complex of life found in, around and under an oak tree.

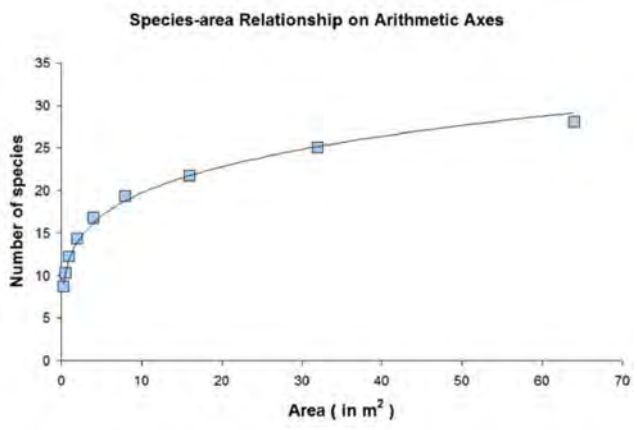
Disease in oaks has become a serious issue in the last 10 years with the detection of a microbe, *Phytophthora ramorum* that causes a syndrome known as sudden oak death (SOD). As this is a threat to commercial nursery plants and the commercial forests of California, it has received intense study (Frankel et al. 2005, Frankel et al. 2008). This *Phytophthora* is one of a group of well-known plant pathogens. A similar form of *Phytophthora* caused the potato blight in Ireland from 1845-1851. The pathogen clogs the fine water vessels in the tree and breaks the water column from the roots to the leaves. Effectively girdled, the tree dies rapidly. Detected in about 1995, this organism resembles a fungus, and has both a swimming form ("zoospore") that moves between trees during rain events and an encapsulated form ("chlamydospores") that can survive in dry soil. It has been spread by human activity, including the movement of nursery plants, across the west coast of North America to Europe (Mascheretti et al. 2008). Simply moving infected soil from place to place (vehicles, hikers, equestrians, etc.) can serve as inoculums for the disease. It can live in host plants and not kill them, but reproduce and make abundant spores that are spread by wind and water. The Bay Laurel, a common tree along the streams and cool canyons of Monterey County's oak woodlands, is a particularly good host. Both the Coast live oak and the Tanoak have been infected by *Phytophthora ramorum*. In Monterey County, the most devastating effects of SOD are seen by the loss of the Tanoaks in Big Sur. Even after extensive search and trials, no resistant individual trees have been found, with mortality near 100% in untreated trees (M. Garbelotto, pers. comm 2008). The spread of the disease appears to be exponential, that is with a slow spread at first and then a rapid expansion to all trees (Mascheretti et al. 2008). No long-term effective treatment has been found for oak woodlands. Some treatments slow the disease in oaks. Oaks woodlands in the seasonally hot, dry interior of Monterey County are not infected, and the spread seems to be highest in damp habitats or in wetter years.

III. Values of oak woodlands

Natural Values

The ability of the oak tree to lift water up from deep below the soil in the seasonally dry, hot summer days continues throughout the night as the tree replenishes leaves that have dried out during the day (Fisher et al. 2007). This "hydraulic lift" (Ishikawa and Bledsoe 2000, Fisher et al. 2007, Querejeta et al. 2007) has many consequences for the plant community around the trees- they have a bit more water and the plants around an oak can produce more biomass. Green rings around oaks are often visible at quite a distance as the surrounding grasslands dry to a golden yellow, but even these fade as the hydraulic lift only brings up enough water to keep the soil wet at depths below 12-15 inches. Even the oaks cannot keep up with how fast the surface soils dry in the hot season.

Oaks add organic matter to the soil, and organic matter increases soil's water holding capacity, increases soil's productivity and can increase nutrient holding capacity (USDA-NRCS 2003). An oak woodland has a tremendous capacity to store our seasonal rainfall and then slowly release it into the streams and wells that provide water to residents of Monterey County. Compared to annual grasslands nearby, the soils under oaks are less dense, have higher pH and greater concentrations of organic carbon, phosphorus, nitrogen and exchangeable Ca, Mg and K (Dahlgren et al. 1997).



Diversity and abundance of life in the oaks depend on the amount of habitat. Consider the number of different things in a storage shed and how you discover them. The longer you look, or the larger the storage shed, the more things you find. Similarly, the number of species you find in an oak woodland depends on the area of oak woodland and how much area of oak woodland you search. The more oak woodland you search, or the larger the woodland you have, the more species.

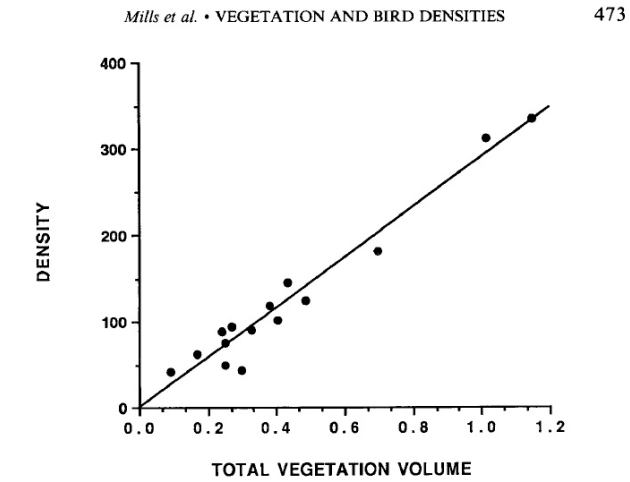


FIG. 1. Total breeding bird density (pairs per 25 ha) as a function of total vegetation volume (TVV) for the 1985–1986 Arizona study sites. Regression equation: y = 290x − 1.0.

Diversity and abundance of life in the oak woodlands also depends on the volume of oak canopy. It is not just enough to have a tree present- the larger the volume of tree canopy present, the more species and the more individuals of each species. The amount of life in an oak is proportional to the volume of the oak canopy. A mature oak 50 feet across contains over 500,000 cubic feet of leafy places for things to live. Both the number of species living in a woodland and the numbers of individuals in the populations depend on the volume of the trees. For instance, for birds, there are linear relationships between the density of breeding bird pairs and total vegetation volume (Mills et al. 1991).

Native life in Monterey county's oak woodlands is diverse. Although similar estimates of diversity can be found in the state-wide wildlife habitat relations studies (Barrett and White 1999), Monterey County woodlands have been studied for decades by biologists at the Hastings Reserve in the Sierra de Salinas. Hastings is very representative of the larger, surrounding woodlands and careful study has revealed at least 1600 species listed in Table 2.

Table 2. Life forms in Monterey County Oak Woodlands			
		Insects	
Lichens-	50	Bees	200
Mosses-	110	Butterflies	60
Liverworts-	14	Moths	150
Vascular Plants	600	Gall Wasps	150
		Birds	200
Invertebrates		Mammals	50
Tardigrades	20	Amphibians	9
		Reptiles	20

This native life, which is largely dependent on the acorns and structures of the oak trees, often has indirect values for society. Some are surprising and beneficial. For instance, the western fence lizard lives in the oak woodlands and depends on the trees for areas to seek insect food. During its life, the tick that carries Lyme disease must spend one of its life stages on the lizard. During that time, while the tick lives on the blood of the lizard, the lizard's blood kills the microbe that causes Lyme disease (Lane and Loye 1989). Thus, the frequency of Lyme disease in Monterey County is comparatively low in people.

Lichens that hang like curtains on the oaks ("Spanish moss") are a combination of algae and fungus. These curtains of lace lichen collect atmospheric dry deposition during the dry season, and at the first rains the water rinsing the lichens is literally black with nutrients caught on the oak's lichens. The surface area of the lichens is huge; hundreds of times the area of the oak leaves in the woodland. Thus, the oak woodland acts as air filters and capture airborne nutrients, primarily nitrogen and sulfur and enrich the soil beneath the oaks (Knops 1994).

Cultural Values

Oaks remove CO2 from the air and sequester this carbon in their tissue. The current carbon dioxide contribution to global warming is in part a byproduct of mankind's conversion of the Earth's forest cover to non-forest land use. For Monterey County, Coast live oak, Tanoak, Valley oak and Blue oak sequester about 5,309,000 metric tons/yr of carbon dioxide (Gaman 2006).

Oak forests certainly are important in storage of ever-increasing atmospheric CO2. Data from pine forests suggests that when most of trees in forest are small and growing rapidly, they remove more atmospheric carbon than a forest dominated by old trees (Mader 2007). Over time, undisturbed forests may have reduced net carbon removal- the mature forest respiration (use of carbon) begins to match the storage of carbon (growth). In models where fuel wood is a primary source of residential building heat, repeated clear cutting a conifer forest to maintain only small trees might lead to a reduction in atmospheric carbon (Mader 2007). Applying this traditional commodity approach to managing Monterey County oak woodlands is probably unjustified as the time required to grow trees worth harvesting is much longer (~ 200-300 years) than that for California's conifer forests (~15 years). Further, Monterey County oak woodlands burn (see above) at intervals short enough (~10 years) to trigger new oak seedlings that have the highest rates possible for carbon sequestration.

Monterey County's oak woodlands have been largely managed for cattle production. Cattle provided income of about $20M in Monterey County in 2006. Cattle rely on the forage produced under the oaks, including the grasses, shrubs and small trees. Most of the oak understory of the oak woodland savannas is dominated by non-native annual grasses (Jackson and Bartolome 2007). Grazing management of these grasslands and oak woodlands has gone on for over 300 years and under many different regimes (Huntsinger et al. 2007). From the 1950's to 1970's, range

management in blue oak woodland experimented with clearing trees to "improve" forage for cattle. However, research done both in the Sierras and Central coast since the 1980s has shown that forage for cattle is improved under oaks and that oaks add value to a ranching operation (Holland 1980, Frost et al. 1991, Bartolome et al. 2002). When the oak woodlands are closely monitored and cattle are moved to adjust grazing, the natural values of much of the oak woodland can be sustained (Jackson and Bartolome 2007). Monterey County's cattle industry is an integral part of the economy and culture.

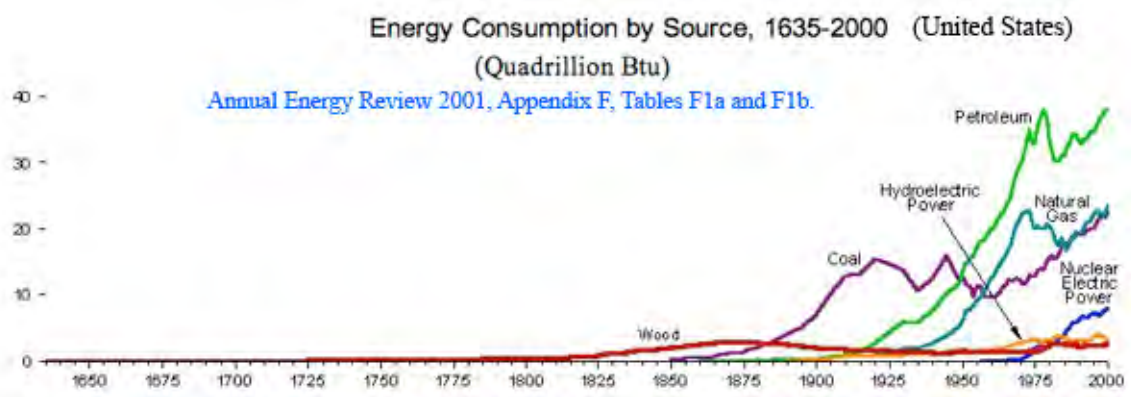
Aesthetic values of oak woodlands are difficult to quantify. An internet search revealed over 350,000 uses of the name "oak" with "real estate" in California, with over 81,000 of these in Monterey County. Clearly oaks and the landscape are linked by street names, business names and place names.

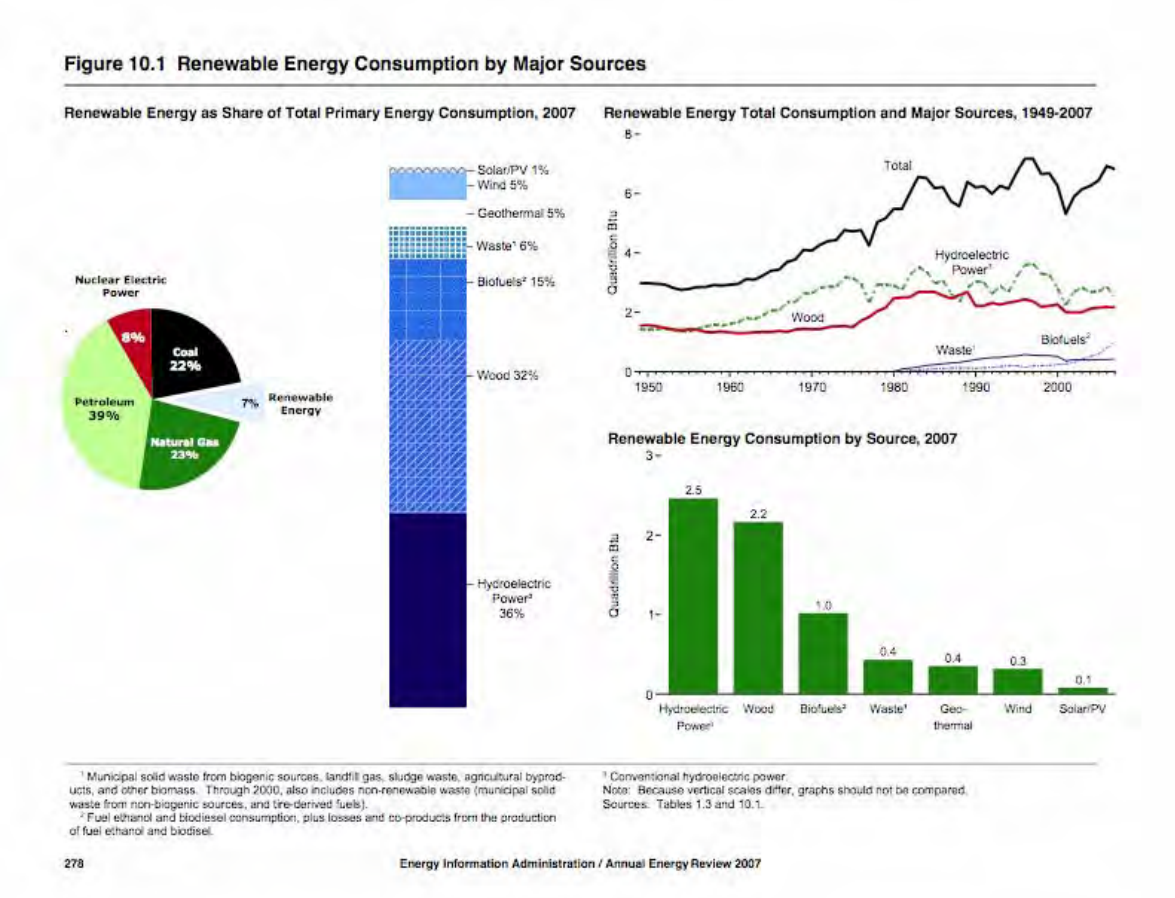
The real estate value of trees to landowners is significant. Oaks on a parcel of land, in a neighborhood, or in an open space all positively affect property values. Various studies have been done to quantify the impact that oaks have on property values. Total lot value increases by nearly 20% when on the edge of a permanent open space dominated by oaks (Standiford et al. 2002). Land with approximately 40 oak trees per acre is worth 22% more than bare lots and house value decreased by $3 per square foot for every 1000 feet a house was from an oak stand. (Sandiford et al. 2000). Additionally single oak trees in a community may be highly valued due to their landmark status or large size.

There have been efforts to quantify the values of individual oaks. In Los Angeles County, a study done by the American Forests in 1985 found that each mature tree provided $275 worth of economic benefits each year as avoided costs for storm water runoff control, increased groundwater infiltration, temperature moderation, air pollution reduction and carbon sequestration. A mature tree on the west side of a house significantly reduces summer air conditioning costs. Homes having mature oak trees typically sell for up to 30% more than homes without them (RCDSMM 2008). The International Society of Arborculture (ISA) has guidelines for estimating the value of a tree, and oak trees are highly ranked because of their roles in our ecosystem. Working with the US Forest Service and other arborists, the ISA has produced a tool ("iTree") that will provided the dollar value of trees in including annual environmental and aesthetic benefits related to energy conservation, air quality improvement, carbon dioxide reduction, storm water control, and property value increases (ISA 2005).

Oak woodlands as an intact ecosystem have been evaluated as a part of the appraisal process in developing conservation easements (Sulak et al. 2004). Considered a free-market approach to land conservation, landowners voluntarily sell or donate the right to develop their lands in the form of an easement, most often to a non-governmental land trust.

Traditional forestry management is often used in woodlands that are primarily used for production of wood products. Monterey County oak woodlands have only limited use for production of sawlogs for construction, furniture and wood working. Valley oak, Blue oak, Coast live oak and Tanoak are not particularly good for woodworking as they tend to grow in relatively short, straight segments and are often highly contorted. Primarily, Monterey County oak woodlands have been managed for grazing or have been thinned or cut for fuel wood. As the use of fossil fuels increased after 1910, demand for fuel wood has decreased(EIA 2008).





Even in 1881, concern for the long-term impacts of fuel wood harvesting was apparent. In the 1881 "History of Monterey County" (Anon. 1881) write:

> *Although the supply of timber is very great in these mountains, it cannot be considered inexhaustible. The rapid increase in population and consequent demand for building material and fuel will in time lead to the denudation of the regions nearest to the large cities. Consequently a preservation policy should be adopted at an early day, by which a portion of the land should retain, at least, the younger growth for future use. It would indeed be a wise policy to enforce a law to this effect if it cannot be done otherwise. The general future good of our State requires it, and especially the places in and near the timbered lands.*

As energy prices rise for heating homes, and demands for fuels for transportation based on biomass rises, California's oak woodlands may see increased harvesting. Wood and other bio-fuels are presently the second most important source of renewable energy in the United States. Much of this wood for fuel is sold as pellets.

Only Coast live oak woodlands have been studied in Monterey County for traditional forestry practices to increase biomass productivity. Thinning stands of Coast live oak to 50 and 100 sq. ft. basal area/acre significantly increased the rate of wood volume produced (2x and 3x respectively) but did not produce any increase in usable sawlog volume (Pillsbury et al. 2004). Almost all of the increase in productivity was in small stems. Although thinning trees to promote the growth of the remaining trees is often used elsewhere in forestry, it appears to be of limited value in Coast live oak woodlands for increasing sawlog production. However, thinning appeared to reduce the severity of fire damage when they did occur over a 17 year period (Pillsbury et al. 2004).

IV.Stewardship Challenges: Patterns of change in oak woodlands

Habitat conversion is reported to have reduced California oak woodlands nearly 50% from their original extent of 10–12 million acres (Bolsinger 1988). Statewide, over 30,000 acres of oak woodlands are converted to residential and commercial uses each year and only about four percent of the remaining woodlands are formally protected (Guisti et al. 2004).

In Monterey County, a recent study (Crous et al. 2007) found that private ranchland covers about 43% of the county's total area and this contains about 50% of the oak woodland in Monterey County. This study showed that between 1986 and 2004, the net loss of private ranchlands was just 2.5%. The rate of conversion, however, seems to be rising. The net conversion of ranchland to non-ranching uses was seven times greater between 1996 and 2004 than in the previous decade. Most (77%) of these conversions went not to urban or suburban development—which accounted for only 7% of conversions—but to gently rolling farmland. Not surprisingly, then, much of the converted ranchland is clustered around the Salinas Valley, a major farming region.

Valley oak is the most threatened of California's oak species, with a distribution that has been impacted seriously by continuing agricultural development, and with local populations becoming progressively sparser, due to ongoing demographic attrition (Griffin 1971, Brown and Davis 1991). This savanna oak occurs naturally on nearly level, often deep soils, in low densities (2–10 trees/ ha) that have seen the most extensive conversion to row agriculture. A further consequence of progressive demographic thinning is that individuals may become reproductively isolated into small, sparse populations, among which pollen movement may become limited. A Valley oak isolated even 1000 yards from other Valley oaks is effectively unable to contribute to future oak woodlands (Sork et al. 2002). All four oak woodlands have been heavily impacted by habitat conversion to agriculture and residential development, or disease, all of which raises public and scientific concern for their long term viability (Pavlik et al. 1991).

Are woodlands in Monterey County increasing or decreasing in area and what is the trend? An ongoing problem is mapping the distribution of the oak woodlands for policy decisions. This is not only a problem in Monterey County, but elsewhere. This problem was explored in a study for the County of Santa Barbara (Davis 2000). Using the best available methods in 1999 they examined a large watershed in Santa Barbara County and found that Valley oaks are scattered over a wide area, and there has been a loss of 19% of the tree density there from 1941 to 1989.

In every county where they have been carefully examined, California's oak woodlands have been reduced from 20% to 100% since European settlement, and the trend continues at varying paces (Bolsinger 1988, Pavlik et al. 1991). Improving our baseline of oak woodland area at present in Monterey County is a critical starting point. Data presented here (map) are based on surveys by Wieslander (Wieslander 1935, 1946) in the 1940s, which were modified by with 1980's aerial photos in the FRAP program (Pillsbury et al. 1991, FRAP 2008). New remote sensing techniques could rapidly and efficiently (Kelly et al. 2008) update and verify our knowledge of the status of oak woodlands in Monterey County.

Whatever the total areas, what is the rate of woodland loss? With today's rising land values, privately owned oak woodlands can be worth far more when used for intensive agriculture or housing than for rangeland. Oak woodlands are up to 10 times more profitable when planted in wine grapes and 100 times more profitable when developed for housing (Johnson 1997). According to a 2001 estimate, more than 30,000 acres of oak woodlands (statewide) are now converted each year, up steeply from the mid-1980s to mid-1990s when losses were estimated at 60,000 acres for the entire decade (Gaman and Firman 2006). We are not aware of any data on how the rate of oak woodland loss in Monterey County over the last 50 years, but it is probably consistent with trends elsewhere in California.

Clearing oak woodlands for other uses can have significant impacts on Monterey County ecosystems. Clearing the land for grapes, especially on steep hillsides, can degrade water quality (Meadows 2007) and reduce the native mammals, particularly predators (Hilty and Merenlender 2002a, b, Hilty et al. 2006). Subdividing large parcels into smaller parcels and housing developments degrades wildlife habitat. For example, in Sonoma County, there are more non-native plants and fewer native birds in 10-to-40-acre parcels than in large parcels (Merenlender and Heise 2000, Luther et al. 2008). Individual ownership of small parcels is increasingly popular around the state; in Nevada County, the average parcel size shrank from 550 acres in 1957 to just nine acres in 2001. We do not have data on how parcel sizes have changed in Monterey County in the last 50 years. Decisions to clear oak woodland have very long-lasting effects. Oak woodlands will take literally hundreds of years to be restored as the oaks grow very slowly.

Yet, some very short-term conversions, for example to grape production, will probably only generate the most ephemeral of agricultural values. Even with the most optimistic models of reducing CO2 and other greenhouse gases, climate models predict enough warming in Monterey County and elsewhere in central and southern California to preclude wine production in the next decade or two (Cahill et al. 2007, Mason 2007).

Climate change may be a more serious, long-term threat to oaks in Monterey County than habitat conversion. Since 1990, the IPCC has reported on the patterns climate change as atmospheric carbon dioxide rises (Houghton et al. 1990). Predictions made nearly a decade ago have held up, and changes appear even more dramatic than first predicted (Pachauri and Reisinger 2007). California faces increased temperatures and dramatic loss of snow pack (30-70% loss of snow with most precipitation occurring as rain) and dramatic changes in the distribution of forest trees (Hayhoe et al. 2004). In a study focused on the central coast, the distribution of plant species was predicted based on the very powerful models that accurately confirm the present distribution of over 500 plant species based on mean nighttime temperatures. Using the various climate models, with varying levels of greenhouse gasses, the future distribution of plant species was predicted. Even with the model that predicts the minimum increases in temperatures, the distribution of plant species is predicted to shift north. What are now blue oak woodlands in Monterey County are predicted to become environments more similar to those where Joshua Trees occur in the Mojave Desert (Loarie et al. 2008). The general pattern of the central coastal mountains with high diversity will continue to be the case, but with a substantially altered plant community. Carmel Valley is already warmer at night in the last two decades (1980s-2000) when compared to earlier decades of the 20th century (unpublished data, Hastings Reserve; J. Knops pers. com). More changes are predicted to occur in the next 2-3 decades, sooner if the CO2 emissions rates continue to increase, as they have (Loarie et al. 2008). Similar changes were predicted in a previous study based both regional and global climate models of Blue oak and Valley oaks in California (Kueppers et al. 2005). That is, Valley and Blue oak ranges are expected to contract overall, but to expand to the north; however, the scale, specific location, and magnitude of these shifts can not be predicted with certainty. It is therefore critical to conserve remaining oak woodlands throughout their current ranges in the county. Reforestation or restoration of oak woodlands in Monterey County needs to consider the usefulness of historic ecosystem conditions as targets and references. It may not be easy or even possible to restore these given the changing biophysical conditions of the California environment (Harris et al. 2006). Considerable evaluation of trends in climate is necessary in considering how and where to restore oak woodlands that can require 300-500 years to reach maturity.

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Monterey County Voluntary Oak Woodland Stewardship Guidelines

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The Monterey County Voluntary Oak Woodland Stewardship Guidelines is designed to promote the voluntary long-term conservation of Monterey County's oak woodland habitats. It provides information on the cultural, economic and ecological values of Monterey County's oak woodlands and encourages oak woodland conservation through voluntary stewardship, habitat protection, education, and outreach.

Monterey County Voluntary Oak Woodland Stewardship Guidelines

TABLE OF CONTENTS

Introduction

The Oak Woodlands Conservation Act (OWCA) enacted in 2001, established a bond fund and mandated the State Wildlife Conservation Board to implement the program to grant funds for oak woodland conservation. The State Oak Woodlands Conservation Program (OWCP) is a voluntary oak woodlands conservation program. It does not establish any County plans, policies or ordinances. The OWCP enables landowners, public agencies and nonprofit organizations to seek grant funding under the California Conservation Act Program if a conservation guideline, such as this, is endorsed by a resolution of approval by the County Board of Supervisors. Such resolutions have been passed by many California counties.

These voluntary oak woodland stewardship guidelines were prepared to promote the appreciation and conservation of Monterey County's oak woodlands. It is intended to serve as a guide for the voluntary stewardship of oak woodlands and will be useful to landowners, including farmers, ranchers, developers, as well as planners, conservationists, educators and others interested in oak woodland conservation. The adoption of this plan by a resolution of the County Board of Supervisors will support partnerships of landowners, local governments and qualified non-profits eligible to seek funding through the Oak Woodlands Conservation Program managed by the California Wildlife Conservation Board (WCB). The California Oak Woodlands Conservation Program provides funding for voluntary projects designed to conserve and restore oak woodlands, educate county residents about the values of oaks, and provide landowners with assistance in voluntary oak conservation. It offers pathways and incentives to help address oak woodland conservation at the county-wide level and to help support farming, ranching and grazing operations that also sustain oak woodlands.

Effective conservation of oak woodlands requires a solid understanding of relevant science including the

biological needs and ecological function of oak woodlands. Please see **Appendix B** (Oak Woodlands in Monterey County) for supporting information, references, and a summary of current scientific literature and studies regarding oak woodlands of California and Monterey County.

Problem Statement

Oak woodlands are one of California's most treasured and iconic landscapes. To many, the sight of majestic oaks rising from the state's rolling foothills forms the core of California's natural persona. Oak woodlands are rich in wildlife and are a favored place for people to recreate, build their homes, and pursue their livelihoods. Unfortunately, oak woodlands are disappearing throughout the state. Millions of acres of California's oak woodlands have been lost since 1950 along with nearly 90 percent of riparian woodlands statewide. Only about one-third of the 10-12 million acres of oak woodlands that once graced our valleys and hills remain. Vast areas have been converted to intensive agriculture, woodcutting, housing and other urban development. Statewide, over 30,000 acres of oak woodlands are converted to residential and commercial uses each year and only about four percent of the remaining woodlands are formally protected. Nearly eighty-percent of the state's oak hardwood rangelands are in private ownership.

Monterey County (2,413,430. acres) is one of the California's top three counties in terms of remaining oak woodland acreage (537,600 ac.). Although much of Monterey's oak woodlands are in Federal ownership, including the Los Padres National Forest and in Fort Hunter Liggett, extensive oak woodlands occur on privately owned lands, primarily in agricultural use as rangeland (1,038,000 ac.). To conserve this valuable natural heritage, Monterey County residents, landowners, and decision makers can work together cooperatively to manage and protect our oak woodlands and their natural and economic values including the ranches, scenic landscapes, ecosystem services, and important wildlife habitats they provide. To do otherwise, will risk losing these values forever and, along with them, much of what

defines the character and quality of life in Monterey County.

Oak Woodlands in Monterey County

Oak Woodlands are a major component of Monterey County's rural landscape. As of 2000, oak woodlands covered more than 22 percent (537,600 ac.) of the total land area of the county. This puts Monterey County among the State's top ten counties in terms of the percentage of land in oak woodland and total oak woodland acreage.

Oak Species in Monterey County

The true oaks are those species included in the taxonomic genus *Quercus*. They include both evergreen and deciduous species. Tanoak, not being a true oak, is included in the Genus *Lithocarpus*. The major oak species represented in Monterey County are:

- Coast Live Oak *Quercus agrifolia*
- Blue Oak *Quercus douglasii*
- Valley Oak *Quercus lobata*
- Tanoak *Lithocarpus densiflorus*

Oaks that occur less commonly or in scattered populations are:

- Canyon Live Oak *Quercus chrysolepis*
- Leather Oak *Quercus durata*
- Oregon Oak *Quercus garryana*
- Black Oak *Quercus kelloggii*
- Oracle Oak *Quercus X morehus*
- Interior Live Oak *Quercus wislizenii*

The California Department of Forestry (CalVeg) has classified and mapped five types of oak woodlands in Monterey County:

Woodland Type	**Acres in Monterey Co.***
Coast Live Oak Woodland	252,500
Blue Oak Woodland	249,200
Tanoak Woodland	23,300
Valley Oak Woodland	6,600
Mixed Black Oak Woodlands	6,000
TOTAL	537,600

*Source: California Department of Forestry CalVeg (2000)

A brief description of the four primary oak woodland habitats follows. A map of the distribution of oak woodland plant communities is attached. (**Appendix C**).

Coast Live Oak Woodlands

The Coast live oak is the characteristic evergreen of this woodland. It is widespread in places with moderate climates and thrives in Monterey's cool, foggy coastal areas. In moist areas, associated species are Pacific madrone, California bay, poison oak, tanoak, and canyon live oak. In dryer areas, species associated with Coast live oak are Valley oak, Blue oak, and Foothill pine. Coast live oaks grow rapidly and produce many seedlings that rapidly become saplings and large trees. A large mature Coast live oak may be 200 years old. Coast live oaks are susceptible to a new and uncontrolled plant disease, Sudden Oak Death (SOD). The loss of these large, majestic oaks would dramatically change the look of the Monterey County landscape.

Blue Oak Woodlands

Blue oak is often the dominant tree in the woodlands where they occur, and can be the only tree in large areas of these woodlands. Patches of Blue oak can extend from a few trees to several miles in extent and often include very old trees (300-800 years old). Blue oak woodlands are generally associated with steep, hot, dry, often west-facing or south-facing hillsides. The dominant understory vegetation consists of wildflowers, non-native annual grassland, and patches of native grasses such as needle grass,

California melic, and June grass. Blue oaks grow slowly and even knee-high saplings can be 50 years old. Blue oak woodlands with enough pole-sized saplings to replace the mature trees are very rare.

Valley Oak Woodlands

Valley oaks remain in small pockets of relatively undisturbed valley floor and occasionally high on ridges above the valleys. Valley oaks are also slow growing, and are very rarely found in populations that enough pole-sized saplings to replace the mature trees. They too can live to 800 years. Valley oak woodlands have a grassy understory and vary from open and savanna-like to forest-like stands with partially closed canopies. Individual trees may reach over 100 feet in height. We do not have detailed studies of the current or past extent of the Valley oak woodland in Monterey County. Currently there is a concern that very few stands of Valley oak have enough saplings to replace the older trees. Exemplary stands remain in and near Fort Hunter Liggett and in Carmel Valley.

Tanoak Woodlands

Tanoaks occur in the cool, often shady watersheds that face the Pacific Ocean. In Monterey County, these woodlands, which often include redwood trees, occur in the canyons of the Big Sur coast. Tanoak woodlands have been particularly hard-hit by sudden oak death. Many tanoaks in Monterey County were killed by SOD in the early 2000's and then burned in the Basin Complex fire of 2008. These burned Tanoak woodlands are sprouting a carpet of seedlings. Prior to the fire, about 23,300 acres of Tanoak woodland occurred in Monterey County.

Values of Oak Woodlands

Cultural and Economic Values

Grazing

Cattle production on large private ranches is the primary economic use of the oak covered landscapes of the Santa Lucia, Sierra de Salinas and Gabilan Ranges of Monterey County. Countywide, ranching in oak woodlands produced an income of over $20 million in 2006. Oak woodlands are valuable to ranching operations because the amount and quality of forage in oak savanna and woodland tends to be higher than in rangelands without oaks. Oak trees act as water pumps, bringing up deep water and making it available to forage plants. These patches of green around oak trees increase soil fertility under oak canopy and produce better forage. In addition, well-managed ranches provide many benefits including wildlife habitat, open-space, fire control, weed management, recreational opportunities such as hunting, and watersheds that produce abundant clean water. The cattle industry is a vital and integral part of the economy and culture of Monterey County.

Real Estate and Scenic

Oak trees, both as woodlands that blanket hillsides or as majestic individual trees, are highly regarded and valued for their scenic qualities. In Monterey County, “oak” is a frequent component of street, business and place names. Oak woodlands and oak trees enhance the value of real estate. Oak woodlands can increase the quality of life for residents and contribute to a community’s economic and fiscal well being. In one study, land with 40 trees per acre appraised at 22-28% more than bare lots. Individual oak trees of large size or landmark status within a community can have exceptional value; $18,000 - $50,000 in 1999. In an urban setting, a single mature tree provides measurable economic benefit each year related to storm water runoff control, increased groundwater infiltration, temperature moderation, air pollution reduction and carbon sequestration. A mature tree on the west side of a house significantly reduces summer air conditioning costs. Homes having mature oak trees typically sell for up

to 30% more than homes without them.

Carbon Sequestration

Oaks use photosynthesis to convert carbon dioxide in the air into wood. Carbon dioxide, an important greenhouse gas, is increasing in the earth's atmosphere from human activities. Converting carbon dioxide into solid wood removes this greenhouse gas from the atmosphere and keeps it sequestered. Oak woodlands in Monterey County remove an estimated 5,300,000 metric tons of carbon dioxide each year. Oak woodlands may therefore have new value in the emerging market of carbon credits. Land owners with oak woodlands may be able to sell carbon credits to those wishing to purchase credits to offset the production of carbon dioxide elsewhere.

Ecosystem Services

Oak woodlands in Monterey County are complex ecosystems that provide a variety of important benefits that can be generally categorized as ecosystem services. These include: 1) improving water quality and quantity through watershed protection, erosion control, filtering and slowing runoff during winter rains, increasing infiltration and ground water storage; 2) protecting and improving soil quality; 3) providing shade in the summer months for people, livestock, vulnerable soils, and streams; 4) providing open space, scenic landscapes and areas for recreation such as hiking, hunting, fishing, and nature photography; 5) storing carbon; and 6) providing habitat that supports hundreds of life forms, plants and wildlife, in fascinating and complex natural communities.

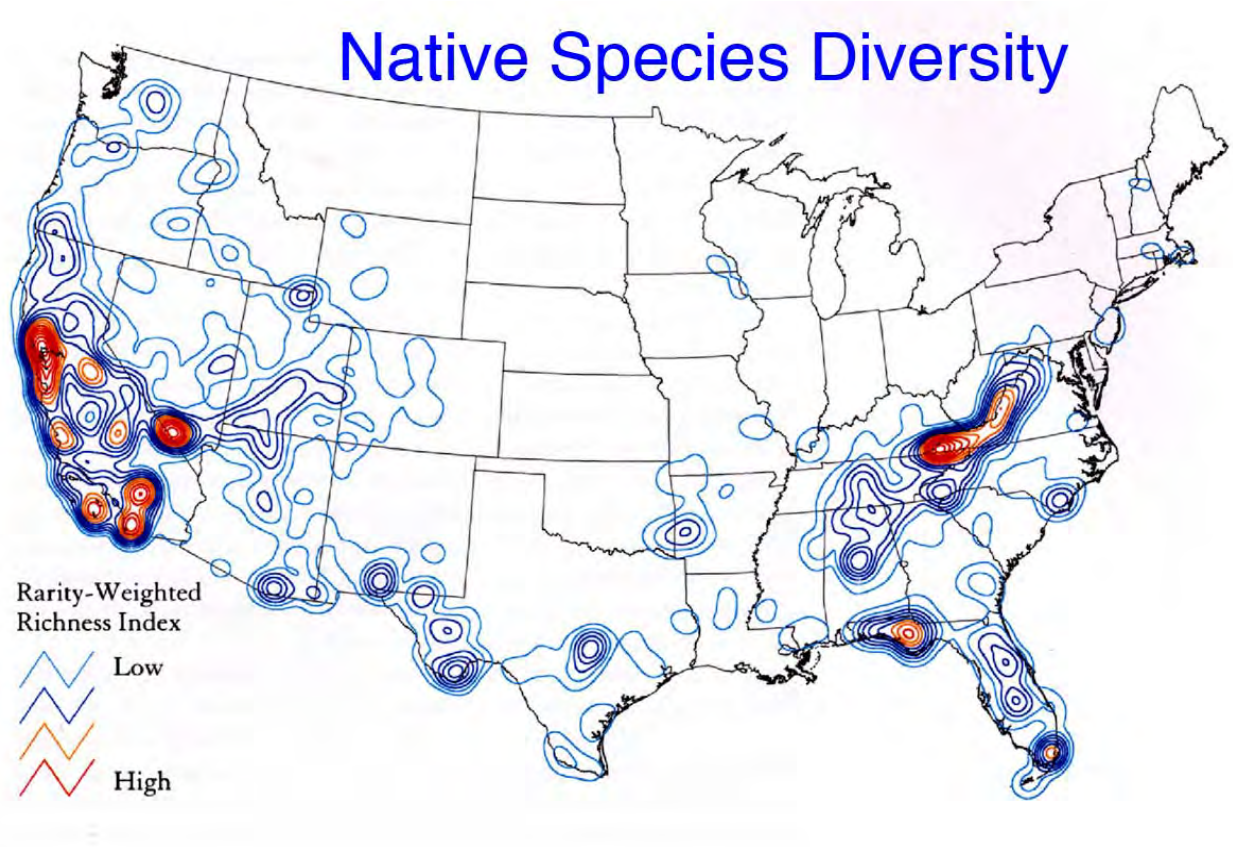
Biological Values of Oak Woodlands

The ability of oaks to lift water from deep in the soil means that in the dry climates of Monterey County, oaks provide a relatively mesic or wet island of soil. Oaks add organic matter to the soil. This organic matter increases the soil's water and nutrient holding capacity leading to increased soil productivity. An oak woodland has a relatively high capacity to store seasonal rainfall and then slowly release it into the streams and wells that provide water to residents of Monterey County. Compared to annual grasslands

nearby, the soils under oaks are less dense, have higher pH and greater concentrations of organic carbon, phosphorus, nitrogen and other soil nutrients.

Wildlife Habitat and Species Diversity

Monterey County is unusual in that it harbors far more native species than other comparable areas in most of the United States (see map). Much of this natural biodiversity of plants and animals lives in and



around the oak woodlands of Monterey County. The mild Mediterranean climate, with wet winters and dry summers, and abundant food provided by acorns allow many animal species to remain year round. Oak woodlands have the richest wildlife species abundance of any terrestrial habitat in California.

Over 1,600 plant and animal species live in and among Monterey County's oaks. A partial list includes: birds (200), mammals (50), amphibians and reptiles (29), bees and butterflies (260), and vascular plans (600). At least fifteen of these species are rare. Many of the most readily recognized and appreciated

wildlife (deer, band-tailed pigeons, wild hogs, etc.) depend on acorns and oaks for much of their food. Most of the small mammals (mice, woodrats, etc.) depend on acorns and, in turn, provide abundant food for predators like bobcat, mountain lions, hawks, owls and eagles.

This diversity of animals can have surprising benefits to people. For example, in California the western fence lizard is the preferred host in the early life of the tick that carries Lyme disease. A protein in the lizard's blood kills the microbe that causes Lyme disease and thus reduces the probability that a tick bite in Monterey County will transmit the disease to humans. This may explain why the risk of contracting Lyme disease in Monterey County is small while the disease is epidemic in some northeastern states where lizards are rare.

Threats to Oak Woodlands

Habitat Conversion

Elsewhere in California, natural stands of oaks that have been present for 500-800 years have been cleared for a variety of reasons. More than 50% of the original extent of oak woodland (10-12 million ac.) has been removed in California. Monterey County's oak woodlands may have escaped much of this historic loss as most of the agricultural development has been in the Salinas Valley where oaks may not have been a dominant vegetation type. However, the demand is increasing to convert lands with oak woodlands to other uses such as agricultural use and development. Fire is a natural part of oak woodland life history. A change in the historic natural fire frequency may be one reason that oak woodlands are converting to other habitat types. Lowering water tables due to groundwater pumping, invasive species, soil compaction from human and animal uses, and destruction of riparian corridors are among the factors contributing to the subtle transformation of oak woodlands.

Isolation

An oak tree can only pollinate and be pollinated if it is roughly within 1,000 yards of another oak. An isolated oak is therefore less able to successfully reproduce. Acorns, so important to much of California's wildlife, are only produced in abundance in years when oak pollen is abundant. Each tree needs a great deal of pollen, and the reduction of oaks to only isolated individuals means the surviving ones will dwindle and as density decreases, the old ones die without leaving new trees to replace them.

Habitat Fragmentation

Formerly, oak trees in Monterey County often lived in extensive forests where one tree was fairly near another, or at least within two-to-five canopy widths from a neighbor. Although many of these forests still exist, much has been lost due to habitat fragmentation. As permanent human development, including roads, row crops, and structures, has expanded into patches of intact oak woodland, savannah and forest, many of these natural communities have become fragmented and degraded. As oak woodlands become smaller and connectivity with similar habitats is cut off, habitat for some plants and animals is eliminated; the ecosystem is simplified and weakened becoming steadily less resilient and sustainable. The system further erodes as individual trees become isolated. When an isolated tree is no longer is able to effectively reproduce, many of the dependent animals and plants that live on or with the trees cannot reach other members of their species. This complex and important ecosystem breaks down as the various components get isolated and slowly die. Eventually only a few ragged old individual oaks are left to live out their days and the woodland is gone.

Sudden Oak Death

In the late 1990s, a new form of a familiar plant disease developed. This new disease, Sudden Oak Death, is caused by *Pytopthora ramorum*, and it has infected many host plants in the north and central coast regions of California. Other forms of *Phytopthora* caused the potato famine in Ireland in the 1800's and more recently have decimated huge area in Australia. *Pytopthora ramorum* propagules are

dispersed through water and can persist for years as spores in the soil. No treatment has been found to be entirely effective in the long term on single high-value oak trees, and no treatment has been found to stop the spread in the oak woodlands along the central California coast. It has caused extensive mortality in Coast live oaks and Tanoaks in Monterey County. Natural spread appears to be slowed by drought or the naturally drier conditions in interior Monterey County.

Energy

Wood is the second highest renewable energy source consumed in the United States. As prices for fossil fuels rise, and demand for renewable energy climbs, oak woodlands will face increased interest as a source for fuel woods. In other parts of North America, commercially cost-effective timber operations for fuel wood (now often sold as pellets) are done with clear cuts where all the trees in an area are cut to the ground. The woodlands are then allowed to grow back, and after some “replacement interval”, the area is clear cut once again. Because oak woodlands in Calfornia have extremely long replacement intervals, they may take hundreds of years to grow large enough trees for cost-effective clear cutting. As demand for fuel wood increases, extensive oak harvesting, even if done relatively selectively, could cause a significant loss of oak woodland.

Climate Change

California’s endemic oak species are sensitive to climatic conditions, including temperature and precipitation, and are distributed in relatively narrow, species-specific climatic envelopes. Future climate conditions in California are expected to shift, with both regional and global climate models predicting warmer and possibly drier conditions in much of the state. Consequent significant range contractions and shifts for some oaks are also predicted. In Monterey County, Valley and Blue oak ranges are expected to contract overall, but to expand in some areas; however, the scale, specific location, and magnitude of these shifts cannot be predicted with certainty. It is therefore critical to conserve remaining oak woodlands throughout their current ranges in the county.

Existing Mechanisms and Policies for Oak Woodland Conservation

California Oak Woodland Conservation Program

In 2001, the California Legislature passed the California Oak Woodland Conservation Act (COWCA). The Act acknowledged the positive impact that oak woodlands have on the monetary and ecological values of property within these environments. As a result of the COWCA, the Oak Woodland Conservation Program was established within the Wildlife Conservation Board (WCB). The program is designed to invite participation and funding to help local jurisdictions and landowners protect and enhance their oak woodland resources. It offers landowners, conservation organizations, cities, and counties the opportunity to obtain funding for projects designed to conserve and restore California's oak woodlands. It authorizes the WCB to fund land protection, land improvements, public education about the values of oaks, and oak woodland restoration. The Act required that at least 80 percent of program dollars be used for grants that fund land protection, restoration or enhancement projects within oak woodlands. The remaining 20 percent of the funds could be used for public education and outreach efforts by local governments, park and open space districts, resource conservation districts, and nonprofit organizations. A requirement for program funding under The Oak Woodlands Conservation Act is the preparation of an oak woodland conservation plan. This document is intended to satisfy the Act's requirement, when backed by a resolution of support by the Monterey County Board of Supervisor's. Proposals for funding to WCB need to be certified by the county to be consistent with these conservation guidelines.

Conservation Easements

A conservation easement is a legal agreement, entered into voluntarily, between a landowner and a non-profit organization or government agency that limits certain uses of the land in order to protect specific conservation values. It allows the landowner to continue to own and use the land and to sell it or pass it

on to heirs. Individually tailored for each situation, a landowner voluntarily agrees to sell or donate certain rights to a private organization or public agency in order to protect conservation values perpetuity. For example, the landowner might give up the right to build additional structures, while retaining the right to ranch or grow crops. Because the land remains in private ownership, with the remainder of the rights intact, an easement property continues to provide economic benefit to the area in the form of jobs, economic activity and property taxes. Future owners are also bound by the easement's terms. An easement may apply to just a portion of the property and need not require public access. Under some circumstance, easements can provide the landowner with certain tax benefits. Conservation easements can be useful for passing land on to the next generation. For example, by reducing the land's development potential, an easement may lower its market value, which in turn may lower estate taxes. The landowner continues to pay property taxes that are usually assessed at a similar rate to properties protected under the Williamson Act.

Williamson Act

The California Land Conservation Act of 1965, known as the Williamson Act, is an agricultural land protection program established to preserve agricultural and open space lands. The Act allows private landowners to establish a contract between counties or cities to voluntarily restrict their land to agricultural and compatible open-space uses. These agreements are established for a rolling term of ten years. In return for the agreement, parcels are assessed at a rate that reflects their agricultural, rather than their potential market value as fully developed property. If a contract is not renewed, it terminates in nine years unless the appropriate governing body within the county approves a formal cancellation. The landowner must then pay a cancellation fee equal to 12.5 percent of the property’s unrestricted fair market value.

Monterey County

The Monterey County General Plan, area implementation plans, goals, objectives and policies address natural resources and include the preservation of vegetation and wildlife habitat and other environmentally sensitive areas. Policies include dedications of land and conservation easements as conservation methods. Monterey County Zoning Ordinance, Title 21 (Non-Coastal) Section 21.64.260 Preservation of Oaks and Other Protected Trees, requires one-to-one replacement for oak trees removed (21.64.260(D)(4). Implementation Plan Part I, Title 20 (Coastal Zone) does not include a tree protection section. The Coastal Area Plans and Implementation Plans provide policies for protection of environmentally sensitive areas including tree resources.

Monterey County, in a separate effort, will address the requirements of Senate Bill 1334, passed by the California Legislature in 2004. This legislation adds Section 21083.4 to the Public Resources Code related to oak woodland conservation. The Act requires the consideration of oak woodland conversion as part of the California Environmental Quality Act (CEQA). SB 1334 requires that a county, in determining whether an environmental impact report, negative declaration, or mitigated negative declaration is prepared; specifically determine whether a project may result in a conversion of oak woodlands that will have a significant effect on the environment. If such a determination of significance is made, the county is required to implement one or more specified alternatives to mitigate the effect of woodland conversion.

Appendix A:

Voluntary Conservation Actions for Oak Woodland Conservation and Stewardship in Monterey County

The conservation of oak woodlands in Monterey County is dependent on the voluntary actions of residents and landowners who value the scenic, ecological, and economic benefits of these unique trees and habitats. The following conservation actions are suggested for residents and landowners to conserve and steward the oak woodlands of Monterey County.

Action 1: Encourage private landowners to maintain and enhance oak woodlands by providing information for landowners about the values of oak woodlands and options for private conservation and development options that seek to maintain viable woodlands.

- Educate county landowners on the long-term economic benefits of maintaining and restoring oak woodlands.
- Specific UC Cooperative Extension practices regarding harvesting should be followed including maintaining an average leaf canopy of at least 30%, retaining trees of all sizes and species at the site, maintaining old hollow trees for nesting, roosting, and feeding wildlife, piling brush to provide wildlife cover, and seeking professional advice before conducting any harvesting.
- Articulate the importance of landscape variables (size, shape, connectivity to other woodlands and important habitats, etc.) that support rich, sustainable wildlife populations associated with oak woodlands.
- Encourage landscape design and development that can enhance property values and retain intact oak woodlands. Monterey County should encourage careful design of new development to minimize the number of oaks that must be removed. Consideration should be given to the total volume of oak canopy to be replaced as well. Consider impacts of construction practices, roads, hard surface run-off, and utilities on the long-term survivorship of oaks on the property. Consider

clustering home sites to preserve wildlife passage and requirements of wildlife for undisturbed space for feeding, resting and reproduction.

- Assist private landowners with information on the values of using oaks as they landscape in the urban and urban-wildland interface. Elsewhere in California, urban foresters have promoted the extensive use of oaks (Sacramento Tree Foundation).
- Promote county support for federal land management that promotes native oak woodlands. Encourage ongoing federal land management that includes regular lower intensity fires. Seek cooperative opportunities to further protection of the oak woodlands of Monterey County on federal lands.

Action 2: Encourage ongoing understanding and research of oak woodlands and related benefits.

- Extensive trials have been done on private ranches and with farmers through the University of California's Integrated Hardwood and Range Management Program (IHRMP). Over 400 publications have been produced, aimed at helping individual homeowners, ranching families and large agricultural operations to conserve and steward their oak woodlands. Seek mechanisms to provide outreach and education to the residents of Monterey County.
- A common concern in all of California's oak woodlands is reproduction of the oaks, particularly the Valley oak and Blue oak. This "regeneration problem" has no clear solution at present. Before we can make meaningful suggestions to conserve the oaks, we need to understand if the lack of fire, various grazing regimes, or other land uses are related to the frequently observed oak stands with few or no young trees.

Action 3: Promote oak woodland conservation and restoration through incentives and sound management and restoration guidance.

- Encourage voluntary protection of oak woodlands through the following mechanisms:
    - Encourage County ranching and farming operations that support large stands of oak woodlands
    - Build partnerships between local government, the development community and non-profits for targeted and meaningful conservation efforts
    - Encourage continuation and initiation of Williamson Act contracts and;
    - Seek conservation easements and other forms of land conservation action.
- Particularly for Valley oak woodlands on deep, level soils, restore oak woodlands that lack natural regeneration. In areas where oaks have been removed and/or are not regenerating, promote voluntary tree planting programs that provide protection of oak seedlings from rodents, browsing by deer and domestic animals, and weeds.
- Participate in state and federal cost share programs and grants for such restoration projects.
- Control invasive, non-native weeds in oak woodlands. This can be particularly effective along county rights-of-way on roads that go from agricultural lands where invasive weeds are largely controlled to sites along roads where the weeds are establishing pioneer populations.
- Where possible, encourage restoration of native plants in the understory as an alternative to exotic grass.
- The appropriate species of oak should be used in restoration of disturbed woodland. In general, the species of oak to be replaced should be the same species as was removed. The species of oaks in Monterey County are distinct and not inter-changeable.
- Recognize where prescribed fire can be safely used as a management tool for invasive species and with monitoring to explore the role of fire in oak stand regeneration.

Action 4: Assess and track progress of voluntary conservation and stewardship programs.

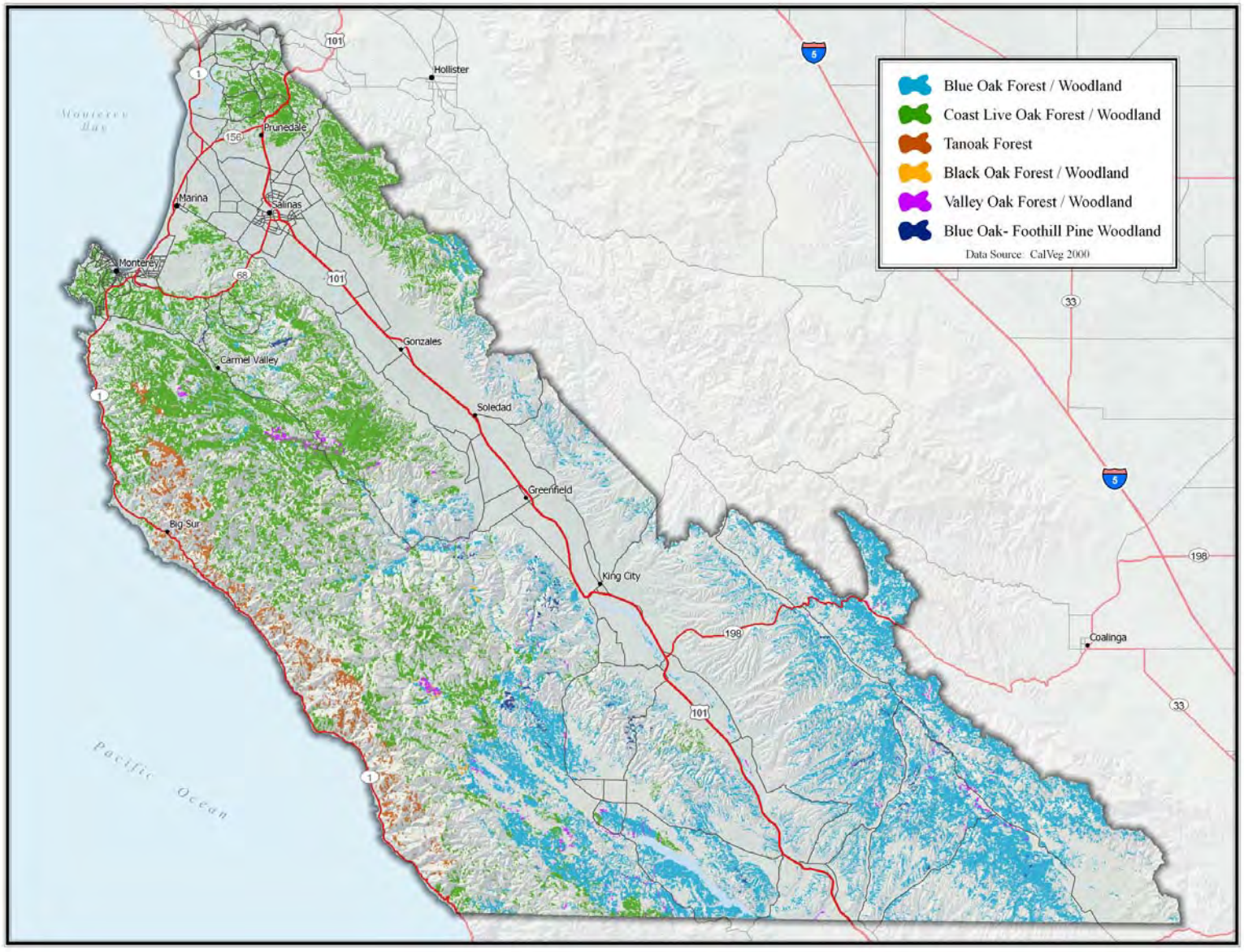
- Document the rate of loss/gain of woodlands in Monterey County. Modern remote sensing could be used to assess the areas of various categories of oak woodlands. These need to be backed up with ground surveys, but similar studies in Santa Barbara County and elsewhere in California oak woodlands have worked out the methodology for determining how much woodland is present. Repeated surveys, at perhaps 5-10 year intervals would provide the information on the certainty and urgency of the problem.

Appendix B:

Oak Woodlands in Monterey County
Background and References

(see attached)

Appendix C. Monterey County Oak Woodland Distribution Map



Appendix D:

Draft Resolution for Monterey County