NAPA COUNTY RCD Resource Conservation District

Acorns To Oaks Educator's Guide

"The magnificent oaks are one great secret of Napa's beauty..."

Smith and Elliott (Illustrations of Napa County 1878, Grossinger 2012)

This guide is published by:

NAPA COUNTY RCD

NapaRCD.org

707-252-4189

1303 Jefferson Street Suite, 500B
Napa, CA 94559

With funding provided by:

Coastal Conservancy

Acorns To Oaks Educator's Guide

This kit contains resources (in PDF file format) related to oak ecology and identification, acorn collection and planting, and youth education activities.

For planting materials and assistance, contact Napa County RCD (NapaRCD.org).

CONTENTS

Oak Ecology and Identification

(1) Introduction to Oak Ecology
Napa County RCD

(2) Four Common Oaks in California
Napa County RCD

(3) Oaks in Napa County
Jake Rugyt and Joe Callizo

Acorn Collection and Planting

(4) Planting Native Oaks
Napa County RCD

(5) Guidelines for Planting Native Oaks
California Department of Forestry and Fire Protection

Youth Education Activities

(6) Biodiversity Study
Napa County RCD

(7) In-class Experiment: Environmental Variables Affect Acorn Germination
Napa County RCD

(8) Climate Change: Calculating Carbon Sequestration by Trees
US Department of Energy

(9) 400 Acre Wood
Project Learning Tree

(10) Forest Field Trip Guide: Walk in the Forest
Project Learning Tree

Additional Resources

(11) Napa County Voluntary Oak Woodland Management Plan
County of Napa

(12) Acorns to Oaks Presentation - Slideshow
Napa County RCD and Friends of the Napa River

(13) Acorns to Oaks Presentation - Notes
Napa County RCD and Friends of the Napa River

Benefits of Oaks

Biodiversity

Oak woodlands are one of the most diverse ecosystems in California. In Napa County, oak woodlands provide habitat for a wide range of flora and fauna, some of which are threatened or endangered.

Valley oak trees are a **keystone species** - a species on which many other organisms in an ecosystem depend, such that if it were lost the ecosystem would change drastically. Valley oaks support approximately 300 animals, 1,100 plants, 370 fungi, and 5,000 insects and invertebrates.

Bears, black-tailed deer, scrub jays, magpies, wood ducks, wild turkeys, quail, flickers and acorn woodpeckers all depend on oaks for food. Insects feed on the leaves, twigs, acorns, bark and wood of oak trees (which in turn are food sources for other larger critters.) Some animals depend on oaks to keep them safe from predators, while others use the branches, cavities, and bark itself as a home. Oaks continue to be useful to wildlife even after they die. Salamanders, worms, snails, termites and ants live in decomposing logs and help turn wood into humus, which enriches soil.

Climate Resiliency

Oaks, as well as other trees, sequester carbon in their mass as they grow. Large, long-lived trees such as oaks convert large quantities of carbon dioxide to various organic compounds that make up wood. Oak woodlands therefore provide a means for helping to offset the increase in atmospheric carbon dioxide levels related to the use of fossil fuels. Soils can also sequester carbon, and soils with high organic content such as those found under oak canopies can hold larger amounts of carbon, thereby reducing the amount of greenhouse gasses that contribute to global warming. Oak canopies also mitigate the effects of global warming by reducing ground surface temperatures. In urban areas, oak trees provide protective shading for houses and people, lowering energy needs for cooling homes.

Water Soil and Air

Oak trees improve air quality by storing carbon dioxide and exhaling oxygen through the process of photosynthesis. The leaves of an oak tree absorb airborne pollutants. It has been observed that one tree can absorb up to 10 lbs. of air pollution in a single year[1] and oaks can live for up to 400 years.

Oaks reduce water pollution by absorbing fertilizer nutrients, pesticides, and other trace contaminants in soil, allowing compounds to break down slowly and be taken up as nutrients. During rains, oak tree canopies capture and slow rainfall. This helps slow the eroding energy of rain drops by intercepting rainwater on leaves and stems surfaces during storms. This process eventually increases the amount of time rain takes to reach the ground and helps reduce potential surface erosion which can impair waterways.

[1] Tree Facts - Seiler, Jeffrey E. NC Cooperative Extension. Feb. 2009

Sudden Oak Death

What is it?

Sudden Oak Death or SOD is an invasive plant pathogen that mortally affects members of the Oak family[2]. This disease affects the leaves, bark, and trunk of oak species such as Tanoak, Coast Live Oak, Shreve's Oak, California Black Oak, and Canyon Live Oak. The fungus-like organism infiltrates woody tissues inside the tree, clogging and blocking water transport cells.

SOD mostly occurs in the United States, and is more prevalent in western regions such as California, Oregon and Washington

How does it spread?

Phytophthora spores are spread in humid and moist conditions and can be transported via soil, rain/wind, dirty toils, and plant materials like leaves and bark[3]. California bay laurel is one of the most prolific hosts of the pathogen, so always beware when working near forests with these species. Take great care when working in forests with California bay laurel and coast live oak trees, or in areas where the pathogen is known to be present. Clean all tools and boots before and after working in outdoor spaces. Removal of infected trees may be necessary.

Identification

SOD is difficult to spot with the naked eye so leaf and twig samples need to be sent to a lab for verification. However, California bay laurel will exhibit browning leaf tips and twig dieback.

[2] Sudden Oak Death - Alexander, J.M. UC Cooperative Extension Statewide Integrated Pest Management . Sept. 2010

Indigenous People and Oaks

Cultural Significance

Oaks are considered medicinal trees by a variety of indigenous people. Oaks are associated with strength and protection. [4] Individual oak trees of great size and age have often been deemed sacred and used as spiritual centers for important tribal gatherings (such as weddings, peace conferences, and naming ceremonies.) Oak trees are also used as a clan symbol in some Native American cultures. Tribes with Oak Clans include the Pueblo tribes of New Mexico, whose Oak Clan is named Hapanyi. Although tribes like the Northwest Coast Indians are known to revere many species of Oaks, The Lenape Indians, also known as the Delaware Indians, have a special connection to a type of Oak called the Sacred Oak. Legend has it that a powerful Lenape chief 's wife became gravely ill. The tribes' wisest healers and medicine men administered herbal medicines, but to no avail. The woman's illness worsened and in desperation, the distressed chief traveled to the Sacred Oak. There, he prayed to the Great Spirit that his wife be saved. Upon his return to camp, he found that, miraculously, she was in good health. It was from this point on that the Chinkapin oak was looked upon as the shrine tree of the Lenape Indians. Something dreadful is said to befall anyone who tries to hurt the tree.

Source of Food

Indigenous people widely use acorns as a source of food. Three days of acorn gathering could result in food stores that would last an entire year[5]. Acorns can be processed into soup, mush, and flour by pounding, grinding, and leeching the tannins from the acorn meal. Records show usage of acorns in California for well over 9,000 years and the "plant part is found in greater quantities in archaeo logical sites than any other edible food. Once leached and cooked, acorn has a slightly nutty flavor and its bland taste makes it an excellent accompaniment to other native foods such as venison, salmon, butterfly pupae, and other insects.

[4] Native American Oak Tree Mythology. Native American Indian Oak Tree Medicine, Meaning and Symbolism from the Myth of Many Tribes. N.p. n.d. Web. 25 Oct. 2015

[5] Indigenous Uses, Management, and Restoration of Oaks of the Far Western United States - Anderson, M. Kat US Dept. of Agriculture. Sept. 2007

Four Common Oaks in Napa County

Valley oak (*Quercus lobata*)[1]




Leaf: Alternate, simple, and deciduous; 2 to 4 inches long; margins typically have 9 to 11 deep, rounded lobes; dull green and often pubescent above, and pale green below.
Flower: Monoecious; male flowers in pendent yellow-green catkins ~ 1 to 2 inches long; female flowers are small, solitary or in clusters of 2-3, and occur in the leaf axils on current year's twigs; appearing in spring.
Fruit: Acorns; shape varies greatly but is usually conical or bullet-shaped; 1 to 2 inches long; caps may be shallow or deep and often have warty knobs; ripen in a single year.
Twig: Slender; gray-brown to brown; pubescent when young but smooth by second year; often bear the spherical galls of native wasps.
Bark: Younger bark is thin (up to 1 inch), gray, and checkered or shallowly fissured; older bark is darker gray, several inches thick, and deeply fissured with flattened ridges.
Form: Large deciduous tree with massive limbs, rounded & spreading crown; branches droop to ground.

Coast live oak (*Quercus agrifolia*)




Leaf: Alternate, evergreen, simple, elliptical to oblong, 1 to 2 1/2 inches long, thick and leathery, convex with edges turning down, spiny margins (holly-like), shiny green above, duller with fuzz in vein axils below.
Flower: Species is monoecious; males in long (2 to 4 inches) narrow drooping catkins, yellow- green; females inconspicuous reddish green spike in leafaxils.
Fruit: An elongated, narrow, light brown acorn, 1 to 1 1/2 inches long, pointy ends, often distinctly cone-shaped; scaly, gray-brown cap covers 1/4 to 1/3 of acorn, matures in one year in early fall.
Twig: Slender to moderate, initially quite fuzzy but later often completely smooth and gray- brown; end buds clustered, reddish brown, broadest at the base with a rounded tip.
Bark: Smooth, gray-brown when young, with age becomes darker with broad, lighter gray ridges.
Form: An evergreen, large (up to 100 feet tall) tree with a short trunk and numerous large, crooked, spreading branches. Crown spread often exceeds its height.

[1] All information taken from Virginia Tech Department of Forest Resources and Environmental Conservation

NAPA COUNTY RCD

Black oak (*Quercus kelloggii*)[2]




Leaf: Alternate, simple, deciduous; pinnately lobed (usually 7 lobes), each lobe is 3-toothed and bristle-tipped, sinuses may be shallow or deep; oblong or obovate in shape, 3 to 6 inches long; yellow-green, smooth and lustrous above and paler below.
Flower: Species is monoecious; inconspicuous, male and female flowers borne in separate aments (catkins), appearing with the leaves.
Fruit: Acorn, 1 to 2 1/2 inches long, reddish brown; cap is deep, covering about half the nut. Require 2 seasons to mature.
Twig: Red-brown, ridged, smooth or minutely hairy; terminal buds are large, pointed, clustered at twig ends.
Bark: Initially smooth and dark gray/black; when mature turning dark brown/black, broad, irregularly plated ridges, about 1 inch thick.
Form: A medium sized broad-leaved deciduous tree (40 to 80 feet tall and 1 to 2 1/2 feet in diameter) with an open, rounded top. At high elevations, it may occur as a large shrub**.**

Blue oak (*Quercus douglasii*)

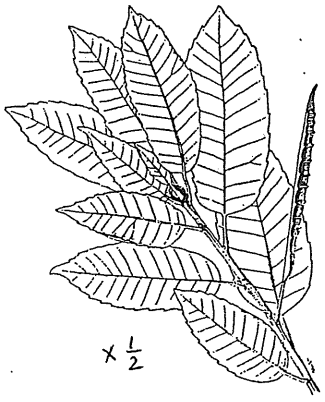



Leaf: Alternate, simple, and usually deciduous (although trees on moist sites may retain leaves); 1 to 3 inches long; margins are usually wavy, but sometimes shallowly and irregularly lobed; upper side of leaf is distinctly bluish-green, especially later in the growing season, while the lower surface is pale green.
Flower: Species is monoecious; males are borne in pendent yellow-green catkins (aments); females are small, often solitary, and occur in the axils of leaves on current year's twigs; appearing in spring.
Fruit: Acorns; oval to gently tapering; 3/4 to 1 1/2 inches long; shallow caps with warty scales; ripen in 1 yr.
Twig: Stout, brittle, and gray to reddish brown.
Bark: Mature bark is light gray and checkered.
Form: A small to medium sized deciduous tree; seldom more than 60 feet tall and 2 feet in diameter. Open grown canopies are typically rounded with many crooked branches.

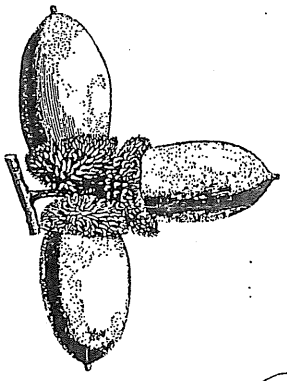
[2] All information taken from Virginia Tech Department of Forest Resources and Environmental Conservation

OAKS IN NAPA COUNTY

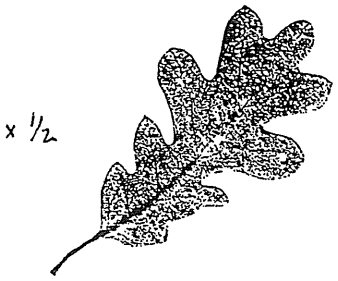
by Jake Ruygt and Joe Callizo

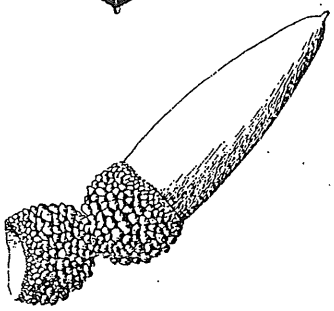


There are about 40 species (kinds) of native trees in Napa County. Of these the most prominent are the oaks which are represented in nearly every plant community with the exception of the marshes. Seven tree species, two shrub species, three shrub varieties, and occasional hybrids, or crosses, occur in Napa County. A close relative, Tan Oak, is also found here.

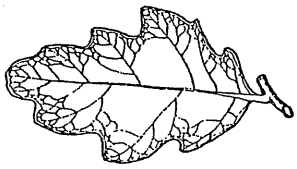


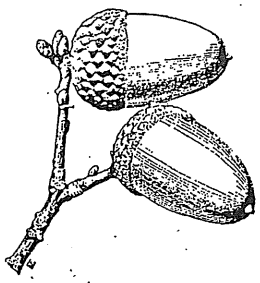
Tan Oak (Lithocarpus densiflora) is an evergreen tree with a conical crown and leaves that have prominent, parallel, lateral veins. In addition, its flowers are borne on erect clusters, where as those of the true oaks (of the genus Quercus) form drooping clusters. It is usually a tree of mid-elevation forests, but in some places, like high up on Mt. St. Helena, it is a component of chaparral, that is: brushland.



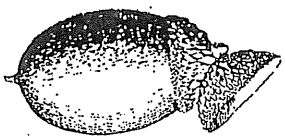


Among the most stately of trees is the Valley Oak (Quercus lobata). It is considered to be one of the largest oak species in the world. This is a deciduous tree (losing all of its leaves for the winter) of grasslands and woodlands, including streamside borders. It is still common in the Napa Valley, but can be better appreciated in its natural setting in less developed areas like Pope and Capell Valleys. Its leaves are characteristically deep-cleft, blunt-lobed, and dark green on their upper surfaces.

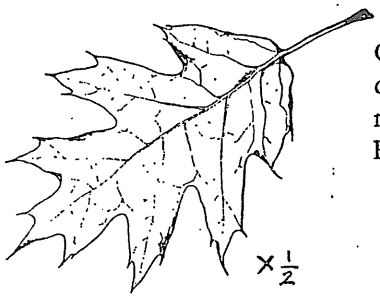


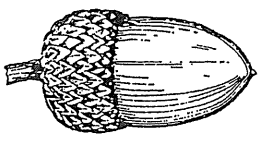


Slower growing and forming woodlands on grassy slopes is the Blue Oak (Q. douglasii), another deciduous species. This tree is most numerous on the east side of Napa Valley, for example, along the Silverado Trail and in the eastern half of the county particularly around Lake Berryessa. Its leaves of bluish color, shallow clefts, and blunt lobes make it easy to identify.

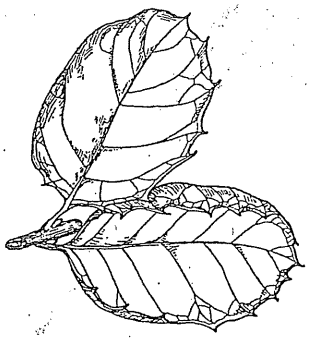


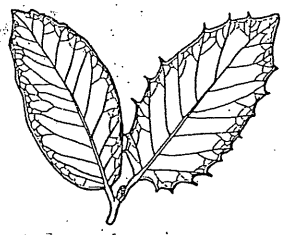
The least common and least known of our deciduous oak trees is the Oregon Oak (Q. garryana). This species resembles Valley Oak in its leaf shape, and Blue Oak in its bark, which is typically of finer texture and lighter color than that of the former. It is found in woodlands mostly west of the Napa Valley at mid to upper elevations. There it often forms groves with crowns nearly touching or overlapping. An understory of the grass, California Fescue (Festuca californica), is almost always present in this plant community.

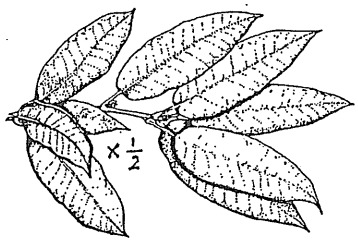


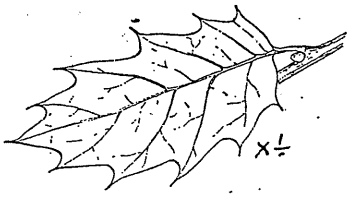


Found both in forests and woodlands is Kellogg's or California Black Oak (Q. kelloggii). It has deciduous, deeply cleft leaves with sharp pointed lobes. This tree is common at middle to higher elevations in Napa County, for example, on Howell Mt. and along Monticello Road above Wooden Valley.

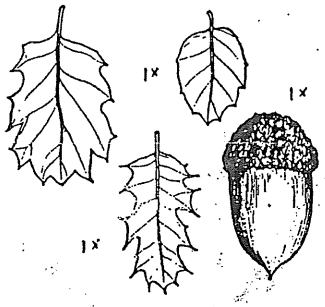




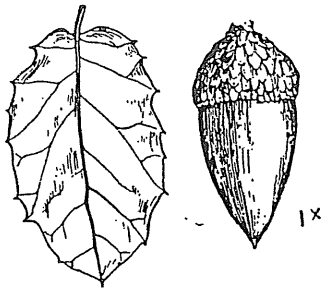




Oracle Oak



Scrub Oak



QUERCUS AGRIFOLIA
VAR. FRUTESCENS

The most common tree in Napa County is probably Coast Live Oak (Q. agrifolia). It is a component of forests, woodlands, and riparian borders. It will even occur sporadically in chaparral. This evergreen, dense, round-headed tree has leaves that are dark green, slightly cupped downward, and have spine-tipped margins. In addition, they tend to be round to egg-shaped and hairy below near the veins. This species is the most common live oak in the western half of the County.

Largely replacing Coast Live Oak as we drive east toward Lake Berryessa is another evergreen tree, Interior Live Oak (Q. wislizenii). The two species are generally similar in habit and form, but the latter has leaves that are nearly flat and oval shaped instead of cupped and roundish and are shiny below.

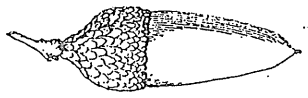
The least common of our evergreen oaks is the Maul, or Canyon Live, Oak. (Q. chrysolepis). This species is usually found in steep canyons or at upper elevations, for example, around Angwin and on Mt. St. Helena. It becomes the dominant oak species above 2000 feet on the slopes of the latter. Its leaves are uncupped and oval like those of Interior Live Oak, but light green above and pale yellowish or grayish beneath. Those of juvenile shoots have toothed margins, where as those of mature trees are mostly untoothed.

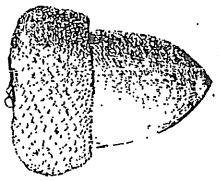
Hybrids between various tree oak species are sometimes found. Named ones include Oracle Oak (Q. X morehus), a cross between Interior Live Oak and California Black Oak, with shiny, thickened (leathery) leaves which are deeply toothed and almost completely winter deciduous; Chase Oak (Q. X chasei), a hybrid of Coast Live Oak and California Black Oak, with leaves that are thickened and hairy at the veins below but deeply toothed, sharp pointed and almost completely winter deciduous; and Epling Oak (Q. X eplingii), a cross between Blue and Oregon Oak, with leaves quite variable. Unnamed hybrids occur between Blue and Valley Oak, with various intermediate forms.

In addition to the trees discussed above, there are a number of oaks in Napa County that are shrub-like in form. Scrub Oak (Q. berberidifolia) is a common component of chaparral except in areas of serpentine (a rock high in magnesium and low in calcium). There it is replaced by Leather Oak (Q. durata). Both are evergreen, but the latter has leaves that are cupped downward, densely hairy below, and has branched hairs on their upper surfaces. On the other hand, the leaves of Scrub Oak tend to be flat, shiny and hairless above while paler with some hairiness on the under side. Hybrids occur between these two species (e.g. near Four Corners west of Angwin) and between either of them and Oregon Oak. Occasionally Scrub Oak is found in oak woodlands where it can persist in the understory for many decades, growing into small trees.

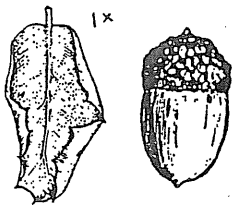
There are also in Napa County shrub forms of Coast (Q. agrifolia var. frutescens), Interior (Q. wislizenii var. frutescens), and Canyon (Q. chrysolepis var. nana) Live Oak. All are evergreen and have leaves very much like those of the corresponding species. They occur typically in chaparral.

For more info., call J. Callizo, 965-2225; or J. Ruygt, 253-1839.

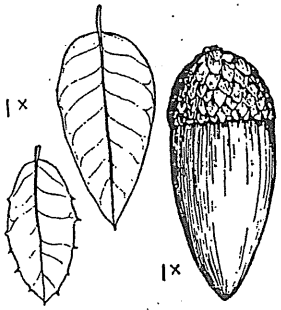




Oracle Oak



Leather Oak



Q. WISLIZENII
VAR. FRUTESCENS

Planting Native Oaks

Selecting a Site

Coast live oaks do well in most parts of Napa County. Valley oaks typically prefer flat areas with a high groundwater table. Black oaks and blue oaks do well on hillsides with relatively dry soils. There should be at least 20' of space between your planting location and the canopies and trunks of other trees, and plant to achieve a mature tree spacing of approximately 20-30'. If livestock are present, acorns, seedlings, and young trees will need protection from trampling and grazing.

Collecting Acorns

Viable acorns are free of insect holes and solid when squeezed. Collect brown acorns from branches if possible; collect when they release easily from the cap. For plantings in Napa County, use acorns collected in Napa County.

To test acorns for viability, put acorns in a bucket of water. Acorns that float are much less likely to germinate. Acorns that sink may be dried and stored in a paper bag in a refrigerator until ready to plant (up to three months).

Acorns ripen in Napa County from late August to late October.

Preparing Your Site & Planting

Clear a 3-5' circle of surface vegetation (unless native plants are present) until you get to mineral soil. Dig into and loosen four inches of soil, and bury three acorns at a depth of 1/2" - 1" deep. If acorns already have sprouted root tips, place the acorn so the root tip is pointed downwards,and be sure not to break root tips. Acorns should be planted horizontally.

Planting acorns should occur before the end of December.

Protecting Plantings

Use a garden stake and plant shelter to protect seedlings from predators. Pound a garden stake into the soil near the acorns deep enough that it will remain firmly in place over the winter. Place a shelter over the acorns and affix to the stake. Shelters can be obtained from Napa County RCD or purchased at garden stores.

Spread 3-6" thick layer of bark mulch around the planting circle to prevent weeds from encroaching upon the seedlings.

Watering & Care

Germination and growth will be observable by end of May (often earlier). Remove weeds around seedlings as soon as possible.

Typically, oaks will receive enough water in a normal winter to sustain themselves throughout the summer; however, supplemental watering can help improve survival during dry months.

NAPA COUNTY RCD

DEPARTMENT OF FORESTRY AND FIRE PROTECTION
135 Ridgway Avenue
SANTA ROSA, California 95401
(707) 576-2935
Website: www.fire.ca.gov

GUIDELINES FOR PLANTING NATIVE OAKS

Oaks dominate the natural landscape throughout much of California's Central Valley, Coast Ranges, and the Cascade and Sierra foothills. In many stands, there appear to be few saplings or young trees. Many observers are concerned that in certain areas valley, blue, and Engelmann oaks may not be regenerating adequately to perpetuate these species. A number of factors have been identified that may be contributing to poor regeneration, including changes in land use, absence of fires and floods, predation by rodents, deer and livestock, soil compaction, and introduced annual grasses.

Natural oak regeneration may require that several environmental factors coincide, such as a summer ground fire followed by a heavy acorn crop, a rainy winter, and a decline in the deer population. Natural regeneration can be supplemented or enhanced by oak revegetation projects utilizing any combination of three techniques:

- collecting and planting acorns
- transplanting oak seedlings
- protecting oak seedlings found growing on the site

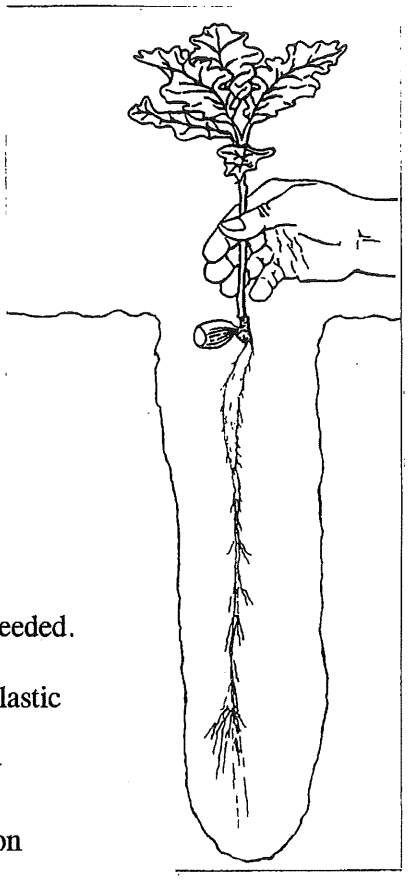
The following recommendations are based primarily on studies performed by University of California Cooperative Extension. They should maximize successful germination, growth, and survival of oaks in most planting situations.

ACORN PLANTING: Acorn planting has the advantages of maintaining local gene pools and costing little or nothing, and is an ideal activity for children. However, it is more labor-intensive and less reliable than planting seedlings.

- To reflect the local range of genetic variability, collect from as many healthy oaks near the planting site as possible (ideally from a minimum of 15 trees). Pick large, heavy acorns after they begin to ripen in the fall. (Ripeness can be determined by golden color and an easily-removed cap.) Acorns picked from the branch are less likely to be damaged by insects than those picked off the ground; discard acorns with holes or cracks. Acorns can also be tested for soundness by submersion in water; discard acorns that float.
- Black oak acorns (black, interior and coast live oaks) should be soaked in water overnight, then surface dried and stored in a cool location such as a refrigerator for two to three months before planting. White oak acorns (blue, valley, Oregon and Engelmann oaks) do not require special handling; if storage is needed, they will keep best if stored in a cool location. Ziplock-style bags, with the tops left open, are ideal for storage.
- **Important note regarding Sudden Oak Death:** The black oaks (especially black and coast live oak) are susceptible to Sudden Oak Death. It is not recommended that they be planted in or near active disease centers or in areas near bay or tanoak trees. White oaks (valley, blue, and Oregon white oak) will have a better chance of surviving in these locations.

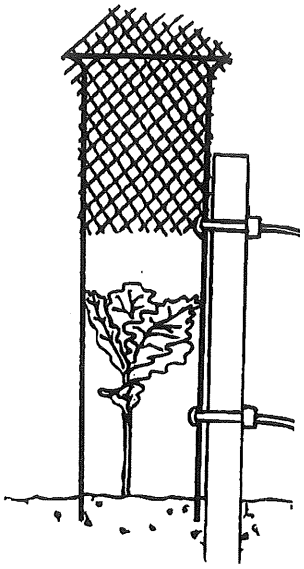
- Germination and growth are best when acorns are planted between November and January 31. In general, plant as soon as enough rain has fallen to soak the soil.
- Plant acorns near the drip lines of any mature oaks on the site. Natural oak seedlings appear to grow best in partial shade. Soil under mature trees also contains mycorrhizae, soil-borne fungi that grow on the roots of trees, increasing their ability to absorb water and nutrients. In the absence of existing oaks, plant in the most sheltered locations, favoring sites with deep, well-drained soils, and a north or east aspect. If possible, add soil from beneath mature oaks to the planting holes, to introduce mycorrhizal fungi. Plant acorns in clusters of three or four, leaving 30 - 40 feet between clusters; (aim for about 40 trees per acre at maturity).
- Prepare the planting site by clearing all vegetation from an area of one square yard. If the soil is compacted, growth may be improved by loosening the soil about one foot deep (a post-hole digger or auger works well for this). Fertilizer has been demonstrated to increase growth in oak seedlings, though opinions vary regarding long-term benefits of use. If fertilizer is tried, use a slow-release compound placed near the bottom of the hole (to encourage seedling top growth and root development without generating a flush of grass). Plant the acorn on its side, no more than two inches deep. If the acorn has sprouted, direct the roots downward. After planting, tamp the soil down firmly. Apply water, if available. If soil in the planting hole settles, add soil as needed.

PLANTING SEEDLINGS: Planting seedlings is more expensive than acorn planting and collection, but also less time consuming and survival rates are generally higher. Make every effort to obtain seedlings from local seed sources. Planting in late fall or early winter, soon after the first good rains, produces optimum growth and survival. "Leggy" seedlings with shoots much longer than the length of the roots may benefit from top pruning.



Planting site selection, preparation, and fertilization recommendations listed for acorn plantings should be followed for planting seedlings. Dig the planting hole a few inches deeper than the length of the roots. Seedlings that are "root-bound" may need the root mass loosened, straightened or trimmed to prevent twining roots from girdling the tree. Take care to keep all roots in a vertical position as the hole is filled. After the soil has been tamped down, place the root crown at or just above ground level. Apply water, if available. If soil in the planting hole settles, add soil and adjust the location of the crown line as needed.

TREE SHELTERS: Tree shelters are tubes made of translucent plastic that enhance tree growth and survival by acting as a miniature greenhouse. Tree shelters reduce water demand, especially on dry sites. Tree shelters also provide protection from herbicide drift, mowing damage, and browsing; they are recommended if predation by meadow mice, gophers, deer or livestock is anticipated.



Install tree shelters over acorns, planted seedlings, or naturally occurring seedlings. Tree growth is optimal when a four-foot shelter is used. Brown-colored shelters are recommended for areas with high summer temperatures. Press shelters three to four inches into the soil; this provides shelter from desiccating winds and some protection from gophers

Stake shelters securely; re-bar is more durable than bamboo or grape stakes. Use metal T-posts if livestock have access to the area. Plastic mesh placed over the top of the shelter will prevent birds and grasshoppers from becoming trapped inside (Note: remove mesh when the tree reaches the top of the tube).

Leave shelters in place two to three years after the tree grows out the top. To reduce the risk of sunburning the bark, remove shelters in the fall. On removal, the lower six inches of the shelter may be cut off and left in place if gopher or vole predation is anticipated.

WEED CONTROL: The acorns or oak seedlings you plant will have a much better chance of surviving if you control the growth of weeds around them. Effective weed control reduces competition for water, and eliminates habitat for a variety of herbivores that prey on oak seedlings, including grasshoppers, meadow mice, and gophers. Weed control options include mowing, mulching, grazing, and herbicide use.

- Mow to provide a minimum clearance of three to four-foot around each seedling. Mulching seedlings with bark chips, straw, compost, or similar materials will also reduce weed growth. Landscape fabric, an artificial form of mulch, can be installed around the seedlings or acorns at planting time and stapled to the ground to provide long-term weed control with a minimal investment of time. However, its use may stimulate tunneling by voles and gophers.
- Seasonal grazing can provide effective weed control in areas where seedlings are fenced or protected by tree shelters staked with T-posts. This is the preferred weed control method where meadow mice populations are high. (Note: hand-weeding the area immediately surrounding each seedling may still be required.)
- Herbicides can also be used to control weeds. A single application at the time of planting is the most cost-effective of all weed-control options. Note that oak seedlings will also be burned or killed if contacted by herbicides. If tree shelters are used, they will protect seedlings from herbicide spray or drift; other materials, such as stove or plastic pipe, can also be used for this purpose.

WATER: Monthly irrigation during the first summer following planting will improve oak growth and survival. In areas where water is not available, good survival can be obtained by utilizing tree shelters. Again, controlling weeds to reduce competition for water is the most critical factor in seedling survival.

LandSmart™
Productive lands. Thriving streams.

Acorns to Oaks
Biodiversity Activity

LandSmart Objectives
Students will:
1. Conduct surveys to observe species diversity in a given area.

2. Calculate, compare, and analyze findings across multiple sites.

3. Discuss the effectiveness and constraints of the biodiversity survey activity.

4. Propose methods and criteria for developing a survey with greater accuracy.

LandSmart Goals
Students understand:
1. Oak trees, primarily Valley Oak, are a keystone species that provide essential ecosystem functions.

2. Changes in land use and management have resulted in the overall decline of oak woodland habitats, species richness, and diversity.

3. People can take actions to voluntarily steward natural resources in their own communities.

Next Generation Science Standards:
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

DCI - LS2.C Biodiversity describes the variety opf species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

"Oak woodlands are the most diverse terrestrial ecosystems in California, supporting at least 300 vertebrate species (including at least 120 mammal, 147 bird, 60 reptile and amphibian species), 1,100 plant species, 370 fungal species, and 5,000 arthropods species (insects and mites.)" (Napa Co. VOWMP 2010)

Biodiversity is a common tool used to understand and describe ecosystems. Valley oak trees are considered "Keystone Species" or a species that play a unique and crucial role in the structure and function of an ecosystem, and without which, the system would be dramatically different or cease to exist.

Warm-up Activity:

Students can survey a section of the school parking lot, counting total cars, and recording the make of each car. Divide the the total number of an individual make ("Toyota" for example) as the numerator, against the total number of cars in the parking lot. The result is the biodiversity index of the proportional presence of that particular "species" within a given "ecosystem" (parking lot.)

If you are unable to use the parking lot activity, 1 - 2 pages of a phone book white pages can be substituted for an in-class version. Count and compare the occurrences of last names against the total number of names found within 1 - 2 pages of a phone book, and calculate for "biodiversity" using names as species.

Instructions:
Form students into small groups and perform small scale survey areas. Use a hula hoop, or a piece of string tied into a 4' diameter loop to create the survey delineation tool. Bring teams to an open space area with plants and trees, and have students randomly choose an area to start their survey.

Emphasize students count the different types of plants found,and not to worry about the exact species name of what they are seeing.

(next page)

NAPA COUNTY RCD Resource Conservation District

LandSmart™
Productive lands. Thriving streams.

Acorns to Oaks
Biodiversity Activity

LandSmart Objectives
Students will:
1. Conduct surveys to observe species diversity in a given area.

2. Calculate, compare, and analyze findings across multiple sites.

3. Discuss the effectiveness and constraints of the biodiversity survey activity.

4. Propose methods and criteria for developing a survey with greater accuracy.

LandSmart Goals
Students understand:
1. Oak trees, primarily Valley Oak, are a keystone species that provide essential ecosystem functions.

2. Changes in land use and management have resulted in the overall decline of oak woodland habitats, species richness, and diversity.

3. People can take actions to voluntarily steward natural resources in their own communities.

Next Generation Science Standards:
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

DCI - LS2.C Biodiversity describes the variety opf species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

Instructions *(continued):*
This can be achieved by working on observation skills, each team member can be assigned one or two or more species to record and name - then describe and show to their team to begin the biodiversity count.

Once teams have defined the types of species, they should try their best to count as many individuals of each plant within their survey area. Things like grass and ground cover can be hard, so they can always count the number of blades in an even smaller space, and then estimate how many they think there are in the total space, which is essentially the point of the activity to begin with.

Record number of individuals of each species, calculate the sum total of all individuals of all species, then divide the species type count against the total sum.

$$\frac{\textbf{\# of species A observations}}{\textbf{Total \# of observations}} = \textbf{Species A Biodiversity Index}$$

Repeat procedure and calculate for all species observed, repeat in additional spaces if time allows.

Extensions:
- Observe for insects, students can dig into the soil, or survey tree branches by wrapping a garbage bag or bucket around a few branches and banging them into the bag or bucket.

- Observe for birds by sitting in place and watching for passing birds, or listening for their calls.

- What factors may affect species diversity? Are more species found near oak trees vs. landscaped areas? What other values do native oaks contribute to the ecosystem?

- How could this method be used to survey a whole forest?

For support contact Napa County RCD at (707)252-4189

NAPA COUNTY RCD
Resource Conservation District

LandSmart™
Productive lands. Thriving streams.

Acorns to Oaks

Germination Experiment Guide

LandSmart Objectives

Students will:

1. Design an experiment to test variables affecting plant growth and survival.

2. Analyze experimental data to describe how cause and effect relationships impact plant growth.

3. Construct an explanation based on experimental observations that supports the claim that plant growth is driven by energy input and produces plant matter (tissues, sugar, carbon.)

LandSmart Goals

Students understand:

1. Oak trees, primarily Valley Oak, are a keystone species that provide essential ecosystem functions.

2. Changes in land use and management have resulted in the overall decline of oak woodland habitats, species richness, and diversity.

3. People can take actions to voluntarily steward natural resources in their own communities.

Next Generation Science Standards:

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Warm-Up Activity:

Form pairs of students. Give each pair the exact same materials, this can be blocks, straws, or equal lengths of rope (anything really.) Each student sits back to back, one student will be the builder, and must build a shape such as a house or star. Builder then describes the shape of the object they have constructed, and the other student must recreate this by description only without seeing the original. Afterwards, students should compare structures. This is part of the 'Experimental Method' where trials are constructed, designed, and communicated so that they can be repeated by others to establish trends and patterns.

Instructions:

Limit the students options to four variables - sunlight, water, soil, nutrients. Set up a control group for the class by planting three tubes with one acorn per tube, and enough soil to fill 2/3 of the tube (soil can be potting mix or dug from anywhere inconspicuous on campus.) These samples should be placed in a window, or outside, and given one cup of water at the end of each week (more may be needed when the acorns begin to form roots and leaves.) Encourage students to make predictions (hypothesis) for each variable being tested.

Sunlight: Sunlight is essential for photosynthesis, oaks vary in their tolerance to shade. Test the effect of sunlight by placing one acorn tube in the shade or indirect sun (indoors is fine), one in a window sill, one under a cardboard box, and one under a small lamp if possible.

Soil: Soils are an important part of any ecosystem and provide a substrate for plants to grow. There are over 64 different types of soils found in Napa County. Examples of ways to test soils are using sand, gravel, clay, mulch, and suspension of an acorn in water. The team should try to vary the types of soils - not necessarily the amounts.

Water: Over 50% of the mass of a tree is composed of water, test how water impacts plant growth.

(next page)

NAPA COUNTY RCD Resource Conservation District

LandSmart™
Productive lands. Thriving streams.

Acorns to Oaks

Germination Experiment Guide

LandSmart Objectives

Students will:

1. Design an experiment to test variables affecting plant growth and survival.

2. Analyze experimental data to describe how cause and effect relationships impact plant growth.

3. Construct an explanation based on experimental observations that supports the claim that plant growth is driven by energy input and produces plant matter (tissues, sugar, carbon.)

LandSmart Goals

Students understand:

1. Oak trees, primarily Valley Oak, are a keystone species that provide essential ecosystem functions.

2. Changes in land use and management have resulted in the overall decline of oak woodland habitats, species richness, and diversity.

3. People can take actions to voluntarily steward natural resources in their own communities.

Next Generation Science Standards:

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Instructions *(Continued)*

Water: Have students manipulate the water variable and observe the effects. Some suggestions are to not water an acorn tube at all, water one tube with half the weekly amount (1/2 cup), place one tube in a cup filled with standing water, and/or mix a tablespoon of salt into the water.

Nutrients: Trees and plants intake small amounts of mineral nutrients from the soil to boost growth. Test this variable by adding fertilizers to the acorn tubes. Liquid fertilizer can be added to the regular watering schedule in differing amounts (over, under, and no fertilization.)

Student groups should test at least two modifications and a control set.

It is recommended that you inspect acorns for insect damage (pin holes), and drop them in a cup of water before planting, any acorns with holes, or that float,will not germinate.

Acorns should be placed horizontally in tubes, and covered by 2" of soil, control plants should receive one cup of water per week, or more if they are drying quickly.

Record results weekly using the attached sheets, student groups should draw or photograph their samples once or twice a month.

At the end of the 12 week period, each group should summarize their results, and present their hypothesis, variables, and conclusion to the class.

NAPA COUNTY RCD Resource Conservation District

For assistance with your classroom experiments, contact the Napa County Resource Conservation District at (707)252-4188

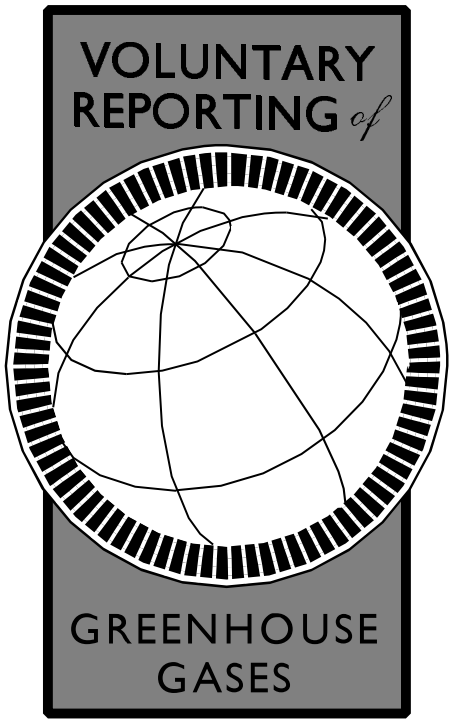
Acorns to Oaks Data Sheet

Group Names:

Briefly describe the numbers of acorns tested and your method here:

Variable Being Tested (circle one): Sun, Water, Soil, Nutrient	Acorn Group 1 (Control)	Group 2	Group 3
Week 1 (write in observations, measure any growth)			
Week 2			
Week 3			
Week 4			
Week 5			
Week 6			
Week 7			
Week 8			
Week 9			
Week 10			
Week 11			
Week 12			

Method for Calculating Carbon Sequestration by Trees in Urban and Suburban Settings



April 1998

U.S. Department of Energy
Energy Information Administration

TABLE OF CONTENTS

INTRODUCTION 1

INSTRUCTIONS 3

URBAN FORESTRY CARBON SEQUESTRATION WORKSHEET 5

WORKSHEET ENTRIES FOR A SAMPLE PROJECT 11

CALCULATING SEQUESTRATION FOR NON-STANDARD TREES 13

To obtain reporting forms or for other information about the Voluntary Reporting of Greenhouse Gases contact the Program's Communications Center at:

Voice: **1-800-803-5182** *Fax*: **(202) 586-3045**
Internet: **http://www.eia.doe.gov/oiaf/1605/frntend.html** *E-mail*: **infoghg@eia.doe.gov**
Mailing Address: Voluntary Reporting of Greenhouse Gases Program, U.S. Department of Energy, Energy Information Administration, EI-81, 1000 Independence Avenue, S.W., Washington, DC 20585.

INTRODUCTION

This document presents a method for calculating the amount of carbon sequestered by trees planted individually in urban and suburban settings. It is intended for use by participants in the Voluntary Reporting of Greenhouse Gases Program, who intend to submit either Form EIA-1605 or EIA-1605EZ to the U.S. Department of Energy's Energy Information Administration. This simplified method can be used by those who have no formal background in forestry.

This method is appropriate only for calculating carbon sequestration by individual ("open grown") trees, such as trees typically planted along streets, in yards, and in parks. Do not use it for calculating carbon sequestration by densely planted trees, as in typical afforestation or reforestation projects where large numbers of trees are planted closely together on one or more acres of land. A separate set of tables designed to assist in calculating per-acre carbon sequestration are available upon request from the Voluntary Reporting of Greenhouse Gases Program by calling 1-800-803-5182.

A further limitation of this method is that it only estimates the greenhouse gas emission benefit associated with the carbon sequestered directly by trees planted. Trees planted adjacent to buildings can significantly reduce cooling and heating needs by providing shade during summer and acting as windbreaks during winter. These reductions in energy consumption result in reduced carbon dioxide emissions, a greenhouse gas. These emission reductions must be calculated separately.

To produce a simplified, easy-to use method, broad assumptions have been made regarding sequestration and mortality rates and site characteristics for a few groupings of tree species. As a result, this method may yield less precise results than a more tailored approach, which takes into account a larger number of the unique characteristics of the planting sites and trees involved in a project. Thus, you should use this method only if it is infeasible to generate estimates based on surveys and direct measurements of the specific trees and planting sites involved in the project.

To use this method, you need to know the species, year planted, and age of the trees when planted. The age of the tree is the most problematic of these items. The tables included for estimating sequestration were designed for reporters who have planted ordinary, nursery-raised trees, typically sold in 15-gallon containers or balled and burlapped. Such "standard" trees are usually approximately one inch in diameter at 4.5 feet above the ground when planted. For the purposes of this method, age is measured from the time the tree is planted. Therefore, standard-sized trees are designated as age 0 when planted. Although this method is easiest to use if your trees were planted at this age, it can be used for trees planted at any age.

The remainder of this document includes the following:

- a worksheet for summarizing calculations of carbon sequestration;
- instructions for performing these calculations, including survival factors (to account for mortality) and sequestration rates;
- worksheet entries for a sample project; and
- instructions for calculating sequestration for non-standard trees (i.e., trees that are younger or older than age 0 when planted).

INSTRUCTIONS

The following worksheet (page 5) is provided for summarizing your calculations of annual carbon sequestration for tree planting projects in urban or suburban areas. Use a separate worksheet for each year you are reporting carbon sequestration. (The Voluntary Reporting of Greenhouse Gases Program is accepting information for 1991 through 1997 for the reporting period ending on July 1, 1998.) Complete the worksheet columns as follows:

Column A — Species Characteristics: List each distinct species of tree included in the project by year. List trees of a different age separately even if they are of the same species (e.g., list one-year-old red cedars on a separate row from two-year-old red cedars). If you are unsure of the name of a species, list it as "Unknown." If the exact age of a tree(s) is unknown, an approximation is acceptable. A list of common tree species is provided in Table 1. Note that each species listed is characterized by type (hardwood or conifer) and growth speed (slow, moderate, or fast). These characteristics will be used subsequently in selecting appropriate survival and sequestration rates. For each species and age category, enter letter codes in the respective columns for tree type (H = hardwood, C = conifer) and growth rate (S = Slow, M = Moderate, F = Fast). If you know whether the trees are hardwoods or conifers, but do not know the exact species (or the species is not included in Table 1), assume the trees have a moderate growth rate. If you do not know whether the species is a hardwood or conifer, assume that it is a hardwood of moderate growth rate.

Column B — Tree Age: Enter the age of the trees in the year for which you are calculating sequestration (the reporting year). Tree age is measured from the time of planting and assumes that trees are planted at a standard size, defined as a tree in a 15-gallon container or a balled and burlapped tree. Nursery-raised trees are typically planted at this size, which is designated as age 0 for the purposes of this method. For example, if you planted a standard-sized tree in 1994, its age in the 1995 reporting year would be 1. If the exact age of a tree(s) is unknown, an approximation is acceptable. If you planted trees that were smaller or larger than this standard size, refer to p. 12 for instructions on determining age.

Column C — Number of Age 0 Trees Planted: Enter the total number of trees of this species and age category originally planted as part of the project. *If the trees were <u>not</u> the standard size (age 0) when planted, you will need to adjust the number of trees planted to reflect a difference in mortality. For example, if you planted 100 trees smaller than the standard size, a fraction—say 15 percent—of the trees might be expected to die before reaching the standard size or age 0. This method requires you to estimate the number of trees surviving to the standard size—in this case 85—and estimate sequestration for these trees. This number is referred to as the <u>effective</u> number of trees planted. See the instructions on p. 13 to make the necessary adjustment.*

Column D — Survival Factor: Enter the survival factor from Table 2 for the tree species. Leave this column blank if you know (or can otherwise estimate) the number of trees surviving at the end of the reporting year. It is necessary to account for mortality, since a fraction of the trees planted inevitably die in each succeeding year. The ideal method for determining the number of trees surviving is to conduct a census of the trees planted. Alternatively, you can estimate survival based on the specifics of your project. If either of these approaches are infeasible, you may use the standard survival factors for urban trees provided in Table 2. However, participant-estimated

survival factors are preferable (if accurate) because the survival factors in Table 2 were developed from a survey of a limited number of scientific studies of urban tree mortality in a small number of U.S. cities, the results of which may or may not approximate the specifics of your project.

Column E — Number of Surviving Trees: Enter the number of trees surviving *at the end* of the reporting year in question. If you do not know or cannot otherwise estimate this number, multiply the original number of trees planted (Column C) by the survival factor (Column D). For example, for fast-growing conifers in the year in which they were planted (age 0), the survival factor would be 0.873, that is 87.3 percent of the trees originally planted are expected to survive to the end of the first year. For the same trees that are age 1 (i.e., trees that were planted in the year prior to that for which sequestration is being calculated), the survival factor would be 0.798. Retain fractions of trees.

Note: If the number of trees in a subset falls below 0.5, assume all of the trees originally planted have died and no carbon has been sequestered in the reporting year. (Provided the estimated number of trees surviving is greater than 0.5, then the probability that <u>one</u> tree survived and sequestered carbon is greater than 50 percent.)

Column F — Annual Sequestration Rate: Enter the annual sequestration rate from Table 2 for the species and age category of the trees during the reporting year in question.

Column G — Carbon Sequestered: Multiply the number of trees surviving (Column E) by the annual sequestration rate (Column F) and enter the resulting number in Column G. Repeat the above process for each species and age category. Sum all of the annual carbon sequestration totals for each species and age category and enter the total in the lower right-hand corner of the table. This is the total amount of carbon sequestered by the project in the reporting year in question.

Note 1: These steps must be repeated using a separate worksheet for each year for which you are reporting.

Note 2: To report in units of carbon dioxide instead of, or in addition to, carbon, multiply the total in Column G by 3.67. To report in short tons instead of pounds, divide by 2000.

Note 3: The amount sequestered is entered under the Emission Reduction or Sequestration column on the EZ form, or as Annual Increase in Schedule II, Section 8, Part III of the Long Form.

The section following Table 2 presents an example worksheet for an urban tree planting project (see p. 11).

URBAN FORESTRY CARBON SEQUESTRATION WORKSHEET

(Calculate each reporting year on a separate worksheet; photocopy if more than one sheet is required)

Reporting year: 19___

A. Species Characteristics (Refer to Table 1)			B. Tree Age	C. Number of Age 0 Trees Planted	D. Survival Factor (Refer to Table 2)	E. Number of Surviving Trees (C x D)	F. Annual Sequestration Rate (lbs./tree) (Refer to Table 2)	G. Carbon Sequestered (lbs) (E x F)
Name	Tree Type (H or C)	Growth Rate (S, M, or F)						
Total Pounds of Carbon Sequestered								
Total Pounds of Equivalent CO2 Sequestered X 3.67								
Equivalent CO2 Sequestered in Short Tons /2000								

Table 1. Common Urban Tree Species

Species	Type	Growth Rate	Species	Type	Growth Rate
Ailanthus, *Ailanthus altissima*	H	F	Maple, bigleaf, *Acer macrophyllum*	H	S
Alder, European, Alnus glutinosa	H	F	Maple, Norway, *Acer platanoides*	H	M
Ash, green, Fraxinus pennsylvanica	H	F	Maple, red, *Acer rubrum*	H	M
Ash, mountain, American,*Sorbus americana*	H	M	Maple, silver, *Acer saccharinum*	H	M
Ash, white, *Fraxinus americana*	H	F	Maple, sugar, *Acer saccharum*	H	S
Aspen, bigtooth, *Populus grandidentata*	H	M	Mulberry, red, *Morus rubra*	H	F
Aspen, quaking, *Populus tremuloides*	H	F	Oak, black, *Quercus velutina*	H	M
Baldcypress, *Taxodium distichum*	C	F	Oak, blue, *Quercus douglasii*	H	M
Basswood, American, *Tilia americana*,	H	F	Oak, bur, *Quercus macrocarpa*	H	S
Beech, American, *Fagus grandifolia*	H	S	Oak, California black, *Quercus kelloggii*	H	S
Birch, paper (white), *Betula papyrifera*	H	M	Oak, California White, *Quercus lobata*	H	M
Birch, river, *Betula nigra*	H	M	Oak, canyon live, *Quercus chrysolepsis*	H	S
Birch, yellow, *Betula alleghaniensis*	H	S	Oak, chestnut, *Quercus prinus*	H	S
Boxelder, *Acer negundo*	H	F	Oak, Chinkapin, *Quercus muehlenbergii*	H	M
Buckeye, Ohio, *Aesculus glabra*	H	S	Oak, Laurel, *Quercus laurifolia*	H	F
Catalpa, northern, *Catalpa speciosa*	H	F	Oak, live, *Quercus virginiana*	H	F
Cedar-red, eastern, *Juniperus virginiana*	C	M	Oak, northern red, *Quercus rubra*	H	F
Cedar-white, northern, *Thuja occidentalis*	C	M	Oak, overcup , *Quercus lyrata*	H	S
Cherry, black, *Prunus serotina*	H	F	Oak, pin, *Quercus palustris*	H	F
Cherry, pin, *Prunus pennsylvanica*	H	M	Oak, scarlet, *Quercus coccinea*	H	F
Cottonwood, eastern, *Populus deltoides*	H	M	Oak, swamp white, *Quercus bicolor*	H	M
Crabapple, *Malus* spp.	H	M	Oak, water, *Quercus nigra*	H	M
Cucumbertree, *Magnolia acuminata*	H	F	Oak, white, *Quercus alba*	H	S
Dogwood, flowering, *Cornus florida*	H	S	Oak, willow, *Quercus phellos*	H	M
Elm, American, *Ulmus americana*	H	F	Pecan, *Carya illinoensis*	H	S
Elm, Chinese, *Ulmus parvifolia*	H	M	Pine, European black, *Pinus nigra*	C	S
Elm, rock, *Ulmus thomasii*	H	S	Pine, jack, *Pinus banksiana*	C	F
Elm, September, *Ulmus serotina*	H	F	Pine, loblolly, *Pinus taeda*	C	F
Elm, Siberian, *Ulmus pumila*	H	F	Pine, longleaf, *Pinus palustris*	C	F
Elm, slippery, *Ulmus rubra*	H	M	Pine, ponderosa, *Pinus ponderosa*	C	F
Fir, balsam, *Abies balsamea*	C	S	Pine, red, *Pinus resinosa*	C	F
Fir, Douglas, Pseudotsuga menziesii	C	F	Pine, Scotch, *Pinus sylvestris*	C	S
Ginkgo, *Ginkgo biloba*	H	S	Pine, shortleaf, *Pinus echinata*	C	F
Hackberry, *Celtis occidentalis*	H	F	Pine, slash, *Pinus elliottii*	C	F
Hawthorne, *Crataegus* spp.	H	M	Pine, Virginia, *Pinus virginiana*	C	M
Hemlock, eastern, *Tsuga canadensis*	C	M	Pine, white eastern, *Pinus strobus*	C	F
Hickory, bitternut, *Carya cordiformis*	H	S	Poplar, yellow, *Liriodendron tulipifera*	H	F
Hickory, mockernut, *Carya tomentosa*	H	M	Redbud, eastern, *Cercis canadensis*	H	M
Hickory, shagbark, *Carya ovata*	H	S	Sassafras, *Sassafras albidum*	H	M
Hickory, shellbark, Carya laciniosa	H	S	Spruce, black, *Picea mariana*	C	S
Hickory, pignut, *Carya glabra*	H	M	Spruce, blue, *Picea pungens*	C	M
Holly, American, *Ilex opaca*	H	S	Spruce, Norway, *Picea abies*	C	M
Honeylocust, *Gleditsia triacanthos*	H	F	Spruce, red, *Picea rubens*	C	S
Hophornbeam, eastern, *Ostrya virginiana*	H	S	Spruce, white, *Picea glauca*	C	M
Horsechestnut, common, *Aesculus hippocastanum*	H	F	Sugarberry, *Celtis laevigata*	H	F
Kentucky coffeetree, *Gymnocladus dioicus*	C	F	Sweetgum, *Liquidambar styraciflua*	H	F
Linden, little-leaf, *Tilia cordata*	H	F	Sycamore, *Platanus occidentalis*	H	F
Locust, black, *Robinia pseudoacacia*	H	F	Tamarack, *Larix laricina*	C	F
London plane tree *Platanus_X_acerifolia*	H	F	Walnut, black, *Juglans nigra*	H	F
Magnolia, southern, *Magnolia grandifolia*	H	M	Willow, black, *Salix nigra*	H	F

Type: H = Hardwood, C = Conifer Growth Rate: S = Slow, M = Moderate, F = Fast

Table 2: Survival Factors and Annual Carbon Sequestration Rates for Common Urban Trees

Tree Age (yrs)	Survival Factors by Growth Rate			Annual Sequestration Rates by Tree Type and Growth Rate (lbs. carbon/tree/year)					
				Hardwood			Conifer		
	Slow	Moderate	Fast	Slow	Moderate	Fast	Slow	Moderate	Fast
0	0.873	0.873	0.873	1.3	1.9	2.7	0.7	1.0	1.4
1	0.798	0.798	0.798	1.6	2.7	4.0	0.9	1.5	2.2
2	0.736	0.736	0.736	2.0	3.5	5.4	1.1	2.0	3.1
3	0.706	0.706	0.706	2.4	4.3	6.9	1.4	2.5	4.1
4	0.678	0.678	0.678	2.8	5.2	8.5	1.6	3.1	5.2
5	0.658	0.658	0.658	3.2	6.1	10.1	1.9	3.7	6.4
6	0.639	0.639	0.644	3.7	7.1	11.8	2.2	4.4	7.6
7	0.621	0.621	0.630	4.1	8.1	13.6	2.5	5.1	8.9
8	0.603	0.603	0.616	4.6	9.1	15.5	2.8	5.8	10.2
9	0.585	0.589	0.602	5.0	10.2	17.4	3.1	6.6	11.7
10	0.568	0.576	0.589	5.5	11.2	19.3	3.5	7.4	13.2
11	0.552	0.564	0.576	6.0	12.3	21.3	3.8	8.2	14.7
12	0.536	0.551	0.563	6.5	13.5	23.3	4.2	9.1	16.3
13	0.524	0.539	0.551	7.0	14.6	25.4	4.6	9.9	17.9
14	0.512	0.527	0.539	7.5	15.8	27.5	4.9	10.8	19.6
15	0.501	0.516	0.527	8.1	16.9	29.7	5.3	11.8	21.4
16	0.490	0.504	0.516	8.6	18.1	31.9	5.7	12.7	23.2
17	0.479	0.493	0.505	9.1	19.4	34.1	6.1	13.7	25.0
18	0.469	0.483	0.495	9.7	20.6	36.3	6.6	14.7	26.9
19	0.459	0.472	0.484	10.2	21.9	38.6	7.0	15.7	28.8
20	0.448	0.462	0.474	10.8	23.2	41.0	7.4	16.7	30.8
21	0.439	0.452	0.464	11.4	24.4	43.3	7.9	17.8	32.8
22	0.429	0.442	0.454	12.0	25.8	45.7	8.3	18.9	34.9
23	0.419	0.433	0.445	12.5	27.1	48.1	8.8	20.0	37.0
24	0.410	0.424	0.435	13.1	28.4	50.6	9.2	21.1	39.1
25	0.401	0.415	0.426	13.7	29.8	53.1	9.7	22.2	41.3
26	0.392	0.406	0.417	14.3	31.2	55.6	10.2	23.4	43.5
27	0.384	0.398	0.409	15.0	32.5	58.1	10.7	24.6	45.7
28	0.375	0.389	0.400	15.6	33.9	60.7	11.2	25.8	48.0
29	0.367	0.381	0.392	16.2	35.3	63.3	11.7	27.0	50.3
30	0.359	0.373	0.383	16.8	36.8	65.9	12.2	28.2	52.7
31	0.352	0.365	0.375	17.5	38.2	68.5	12.7	29.5	55.1
32	0.344	0.358	0.367	18.1	39.7	71.2	13.3	30.7	57.5
33	0.337	0.350	0.360	18.7	41.1	73.8	13.8	32.0	59.9
34	0.330	0.343	0.349	19.4	42.6	76.5	14.3	33.3	62.4
35	0.323	0.336	0.339	20.0	44.1	79.3	14.9	34.7	64.9

Table 2: Survival Factors and Annual Carbon Sequestration Rates for Common Urban Trees (Cont'd)

Tree Age (yrs)	Survival Factors by Growth Rate			Annual Sequestration Rates by Tree Type and Growth Rate (lbs. carbon/tree/year)					
				Hardwood			Conifer		
	Slow	Moderate	Fast	Slow	Moderate	Fast	Slow	Moderate	Fast
36	0.316	0.329	0.329	20.7	45.6	82.0	15.5	36.0	67.5
37	0.310	0.322	0.320	21.4	47.1	84.8	16.0	37.3	70.1
38	0.303	0.315	0.310	22.0	48.6	87.6	16.6	38.7	72.7
39	0.297	0.308	0.301	22.7	50.2	90.4	17.2	40.1	75.3
40	0.291	0.302	0.293	23.4	51.7	93.2	17.7	41.5	78.0
41	0.285	0.296	0.284	24.1	53.3	96.1	18.3	42.9	80.7
42	0.279	0.289	0.276	24.8	54.8	99.0	18.9	44.3	83.4
43	0.273	0.283	0.268	25.4	56.4	101.9	19.5	45.8	86.2
44	0.267	0.277	0.260	26.1	58.0	104.8	20.1	47.2	89.0
45	0.261	0.269	0.253	26.8	59.6	107.7	20.7	48.7	91.8
46	0.256	0.261	0.245	27.6	61.2	110.7	21.3	50.2	94.7
47	0.251	0.254	0.238	28.3	62.8	113.6	22.0	51.7	97.5
48	0.245	0.247	0.231	29.0	64.5	116.6	22.6	53.2	100.4
49	0.240	0.239	0.225	29.7	66.1	119.6	23.2	54.8	103.4
50	0.235	0.232	0.218	30.4	67.8	122.7	23.9	56.3	106.3
51	0.230	0.226	0.212	31.1	69.4	125.7	24.5	57.9	109.3
52	0.225	0.219	0.206	31.9	71.1	128.8	25.2	59.4	112.3
53	0.221	0.213	0.199	32.6	72.8	131.8	25.8	61.0	115.4
54	0.216	0.207	0.193	33.4	74.5	134.9	26.5	62.6	118.4
55	0.211	0.201	0.188	34.1	76.2	138.0	27.2	64.2	121.5
56	0.207	0.195	0.182	34.8	77.9	141.2	27.8	65.9	124.6
57	0.203	0.189	0.177	35.6	79.6	144.3	28.5	67.5	127.8
58	0.198	0.184	0.171	36.3	81.3	147.5	29.2	69.2	130.9
59	0.194	0.178	0.166	37.1	83.0	150.6	29.9	70.8	134.1

WORKSHEET ENTRIES FOR A SAMPLE PROJECT

This example illustrates how the worksheet should be used in calculating the carbon sequestered by a hypothetical tree planting project in 1995. The project involves 100 Norway maples planted in 1993, 75 Norway maples planted in 1992, 35 rock elms planted in 1989, and 437 white spruces planted in 1994. All the trees were standard, nursery-raised specimens (i.e., trees in 15-gallon containers or balled and burlapped) at the time of planting.

The following steps should be taken to complete the worksheet (see Table 3):

1. In Column A, enter each species-age category on a separate line. Note that the species Norway maple occupies two lines, since plantings of that species were made in two distinct years. Enter the appropriate letter code for tree type and growth rate.

2. In Column B, enter the age of each group of trees. The age indicated should be the number of years since planting. For example, the 35 rock elms planted in 1989 would be 6 years old in 1995 (1995 - 1989 = 6).

3. In Column C, enter the original number of trees planted for each species-age category.

4. In Column D, enter the survival factors for each species and age category as listed in Table 2. In the case of the 100 Norway maples planted in 1993, the survival factor for 2-year-old, moderate growth hardwoods is 0.736.

5. Calculate the number of trees surviving in each species-age category at the end of the reporting year by multiplying the original number of trees (Column C) by the survival factor. Enter the resulting number in Column E. For example, the surviving number of Norway maples planted in 1993 is determined by multiplying the 75 trees planted by a survival factor of 0.736, to give 73.6 trees left at the end of 1995. (Retain fractions of trees).

6. In Table 2, find the annual sequestration rate corresponding to each species-age category and enter this rate in Column F. For example, the 2 year-old Norway maples (moderate growth hardwoods) sequester carbon at a rate of 3.5 pounds per tree per year, while the 7-year-old rock elms (slow growth hardwoods) would have sequestered 3.7 pounds of carbon each.

7. For each species-age category, multiply the number of surviving trees (Column E) by the annual sequestration rate in (Column F) to obtain the amount (in pounds) of carbon sequestered in 1995. Enter the resulting number in Column G. For example, the 2-year-old Norway maples sequestered 257.6 pounds of carbon in 1995.

8. In Column G, sum all entries and enter the result on the last row of Column G. This is the total amount of carbon sequestered by this project in the 1995 reporting year (257.6 + 227.9 + 82.9 + 523.1 = 1091.5 pounds in this example). Record this number as the Annual Increase in Section 8, Part III on Form EIA-1605 or Sequestration on Form EIA-1605EZ.

Table 3: Sample Urban Forestry Carbon Sequestration Worksheet

Reporting year: 1995

A. Species Characteristics (Refer to Table 1)			B. Tree Age	C. Number of Age 0 Trees Planted	D. Survival Factor (Refer to Table 2)	E. Number of Surviving Trees (C x D)	F. Annual Sequestration Rate (lbs./tree) (Refer to Table 2)	G. Carbon Sequestered (lbs) (E x F)
Name	**Tree Type** (H or C)	**Growth Rate** (S, M, or F)						
Maple, Norway	H	M	2	100	0.736	73.6	3.5	257.6
Maple, Norway	H	M	3	75	0.706	53.0	4.3	227.9
Elm, rock	H	S	6	35	0.639	22.4	3.7	82.9
Spruce, white	C	M	1	437	0.873	381.5	1.5	572.3
Total Pounds of Carbon Sequestered								1130.7
Total Pounds of Equivalent CO2 Sequestered X 3.67								4149.67
Equivalent CO2 Sequestered in Short Tons /2000								2.07

CALCULATING SEQUESTRATION FOR NON-STANDARD TREES

The preceding method for estimating carbon sequestration was designed for trees planted at a "standard" size, defined as a tree in 15-gallon container or balled and burlapped conifer. At this size, a tree is usually approximately one inch in diameter at 4.5 feet above the ground. For the purposes of this method, age is measured from the time the tree is planted at the standard size. Therefore, standard-sized trees are designated as age 0, even though it will generally take seedlings several years to reach this size.

Trees can also be planted when they are either smaller or larger than this standard size. This section provides instructions on how to adapt the preceding method to estimate sequestration for trees that were a non-standard size when planted. The following adjustments are necessary:

1. The age of the trees planted must be normalized to that of a standard tree. This means determining the number of years that have elapsed since the trees reached (or will elapse before the trees reach) the standard size (age 0).

2. The number of trees planted must be adjusted to reflect differences in mortality. This means estimating the number of trees expected to have survived to age 0 and using this number, the *effective* number of trees planted, in subsequent calculations. (This adjustment will not be necessary if you determine the number of trees surviving by conducting a survey of the trees planted or by a method does not rely on the survival factors presented in Table 2).

The remainder of this section provides instructions for determining the year the trees reach standard size and estimating the effective number of trees planted. In addition, several examples and a sample worksheet are provided to illustrate how these adjustments are made in calculating carbon sequestration.

Normalizing Tree Age

Tables 4 and 5 estimate the ages of hardwoods and conifers, respectively, planted at different sizes. Tree age is the number of years since the tree reached standard size (or age 0). Negative relative ages indicate the number of years *before* the tree will reach age 0. For example, if you planted 100 Norway maples (hardwoods) in 10-gallon containers in 1992, the age of these trees when planted would be -2, which means they would reach age 0 two years later in 1994. The age of the trees in the 1995 reporting year would be 1.

Table 4: Relative Ages and Survival Adjustment Factors for Hardwoods

Size of Tree When Planted	Tree Age	Survival Factor
Bare Root Seedling	-6	.443
10 Gallon Container	-2	.762
15 Gallon Container	0	1.000
Balled and Burlapped	0	1.000

Estimating the Effective Number of Trees Planted

Tables 4 and 5 also provide survival factors for hardwoods and conifers, respectively. These factors are applied to the *actual* number of trees planted to determine the *effective* number of trees planted at age 0. If trees smaller than the standard size are planted, a fraction of the original trees planted would reach the standard size (i.e., survive to age 0). Hence the survival factor is less than 1

when smaller trees are planted. The opposite is true if trees larger than the standard size are planted: the effective number of standard-sized trees one would have to plant would be greater than the number of older trees actually planted in a later year. Hence the survival factors for larger trees are greater than 1. In the Norway maple example above, the effective number of trees planted is determined by multiplying the actual number of trees originally planted (100) by the survival adjustment factor for trees of age -2 (0.762) to give 76.2 trees. This information — 76.2 trees effectively planted in 1994 at age 0 — can now be used to calculate annual carbon sequestration using the worksheet in the normal manner.

Example Calculations

This example project involves calculating carbon sequestration in 1995 for the following non-standard-sized trees (in addition to the 100 Norway maples planted in 1992 from the above example):

- 50 bare root black locust seedlings planted in 1989;
- 120 5-foot blue spruce trees in 1992; and
- 25 15-foot Douglas fir trees in 1991.

The effective number of trees planted at age 0 would be calculated as follows for each species-age category:

Black Locust: Table 4 indicates that the relative age of bare root (hardwood) black locust is -6, which means they would take 6 years to reach age 0. Since they were planted in 1989, they would reach age 0 in 1995. The survival adjustment factor for this tree is 0.443. Therefore, of the 50 planted in 1989, 22.2 could be expected to survive until 1995, which would be the effective number of trees planted.

Blue Spruce: Blue spruce is a moderate-growth rate conifer. According to Table 6, the age of 5-foot trees at planting would have been -1. Since they were planted in 1992, they would have reached age 0 in 1993. As the survival factor is 0.873, the effective number of trees planted at age 0 in 1993 would be 0.873 x 150 or 131.1. The trees would be age 2 in 1995.

Douglas Fir: Douglas fir is a fast-growing conifer. At 15 feet high, its age is +3. Therefore, if planted in 1991, it would have reached age 0 three years earlier in 1988. Given a survival adjustment factor of 1.416, the effective number of trees planted at age 0 in 1991 would be 25 x 1.416, or 35.4. The trees would be age 7 in 1995.

Given values for the effective number of trees planted and tree age, sequestration for 1995 can be calculated using the normal method (see Table 6).

Table 5: Relative Ages and Survival Adjustment Factors for Conifers

Growth Rate	Tree Height in Feet	Tree Age	Survival Factor
Slow	Less than 1	-6	.443
	1 - 2	-5	.507
	2 - 3	-4	.581
	3 - 4	-3	.665
	4 - 5	-2	.762
	5 - 6	-1	.873
	6 - 7	0	1.000
	7 - 8	1	1.145
	8 - 9	2	1.253
	9 - 10	3	1.416
	10 - 11	4	1.475
Moderate	1.6 or less	-4	.581
	1.6 - 3.2	-3	.665
	3.2 - 4.8	-2	.762
	4.8 - 6.4	-1	.873
	6.4 - 8.2	0	1.000
	8.2 - 9.8	1	1.145
	9.8 - 11.4	2	1.253
	11.4 - 13.0	3	1.416
	13.0 - 14.6	4	1.475
Fast	Less than 2.3	-3	.665
	2.3 - 4.6	-2	.762
	4.6 - 6.9	-1	.873
	6.9 - 9.2	0	1.000
	9.2 - 11.5	1	1.145
	11.5 - 13.8	2	1.253
	13.8 - 16.1	3	1.416
	16.1 - 18.4	4	1.475

Table 6: Sample Urban Forestry Carbon Sequestration Worksheet

Reporting year: 19 95

A. Species Characteristics (Refer to Table 1)			B. Tree Age	C. Number of Age 0 Trees Planted	D. Survival Factor (Refer to Table 2)	E. Number of Surviving Trees (C x D)	F. Annual Sequestration Rate (lbs./tree) (Refer to Table 2)	G. Carbon Sequestered (lbs) (E x F)
Name	Tree Type (H or C)	Growth Rate (S, M, or F)						
Norway maples	H	M	1	76.2	0.798	60.8	2.7	164.2
Black locust	H	F	0	22.1	0.873	19.3	2.7	52.1
Blue spruce	C	M	2	131.1	0.736	96.5	2.0	193.0
Douglas fir	C	F	7	35.4	0.630	22.3	8.9	198.5
Total Pounds of Carbon Sequestered								607.8
Total Pounds of Equivalent CO2 Sequestered X 3.67								2230.6
Equivalent CO2 Sequestered in Short Tons /2000								1.12

400-Acre Wood

In this activity, students will play the role of managers of a 400-acre (162 hectare) piece of public forest. Through this role, students will begin to understand the complex considerations that influence management decisions about forest lands.

Copyright 2017, Project Learning Tree. Permission to reprint and distribute this activity has been granted to the Napa County Resource Conservation District for a one-time use in an Acorns to Oaks teacher workshop. Educators in California can receive the complete guide by attending a PLT workshop. Contact Sandy Derby at 530-394-7003 or stderby@ucanr.edu, or visit www.plt.org for more information.

Activity 50

Levels
Grades 7-8

Subjects
Science, Math, Social Studies

Concepts
- Resource management and technological systems help societies to meet, within limits, the needs of a growing human population. (3.6)
- Conservation technology enables humans to maintain and extend the productivity of vital resources. (3.7)
- Natural beauty, as experienced in forests and other habitats, enhances the quality of human life by providing artistic and spiritual inspiration, as well as recreational and intellectual opportunities. (1.10)

Skills
Identifying Main Ideas, Analyzing, Solving Problems

Technology Connections
Spreadsheet/Database Software

Materials
Copies of student pages; a yellow marker; chart paper; colored markers; calculators (optional); masking tape; transparencies and overhead projector (optional)

Time Considerations
Preparation: 60 minutes
Activity: Two to three 50-minute periods

Related Activities
Water Wonders, A Forest of Many Uses, Loving It Too Much, Forest Consequences, Forest for the Trees

OBJECTIVES

- Students will experience the analysis and decision-making involved in managing forest land.
- Students will understand that any land-use decision has a number of consequences for people, wildlife, and plants.

ASSESSMENT OPPORTUNITY

- Have student teams present their plan for 400-Acre Woods to a Community Council (made up of students). Give each team five minutes to explain why their plan should be accepted by the council. After all teams have presented their plans, give the council members time to choose the plan they believe is best. Use team presentations to assess how well students understand the pros and cons of their proposals.

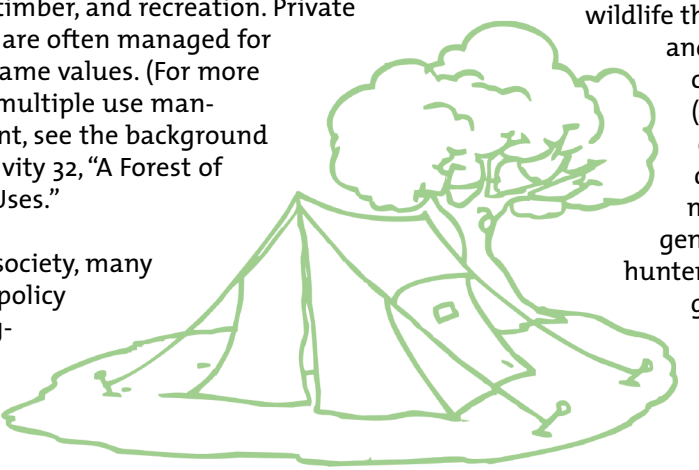
BACKGROUND

Public and private forests cover nearly one-third of our nation's land. More than just trees, forests are made up of a wide variety of species that interact to create a thriving ecosystem. They provide habitats for many species of plants and animals as well as vital resources for people. People use forests in many ways such as harvesting timber, camping, hiking, hunting, and fishing. Forests also provide clean water by anchoring the soil and preventing soil erosion.

The Multiple Use and Sustained Yield Act of 1960 requires that national forests be managed "in a manner to provide the maximum benefit for the general public." Multiple use management of public lands means forest managers must consider values for fish and wildlife, soil, water, timber, and recreation. Private forests are often managed for those same values. (For more about multiple use management, see the background for Activity 32, "A Forest of Many Uses."

In our society, many public policy and legislative decisions are made in terms of costs, benefits, and environmental impacts. Forest managers must consider the economic effects of their decisions about forest lands. But they must also consider the forest's intangible elements such as recreation, water, soil, and wildlife values, even though those items are harder to evaluate. One way to consider the value of a forest for recreational use would be to compare costs and benefits, for example, the cost of developing a campground versus the income from fees charged. Another way is to calculate the number and type of visitors a specific attraction or activity will bring to the forest in a year.

One way to determine the value of wildlife is to measure its contribution to the forest's economic value. Calculate this value by finding out the species of wildlife that live in the forest and if those animals consist of game (hunted) species like deer, turkey, or quail. Then determine the income generated from hunters through licenses, guns, equipment, lodging, and travel.



Copyright 2017, Project Learning Tree. Permission to reprint and distribute this activity has been granted to the Napa County Resource Conservation District for a one-time use in an Acorns to Oaks teacher workshop. Educators in California can receive the complete guide by attending a PLT workshop. Contact Sandy Derby at 530-394-7003 or stderby@ucanr.edu, or visit www.plt.org for more information.

Wildlife's economic value might include other uses that generate income such as wildlife photography and bird watching.

Another way to determine the importance of wildlife is to realize that it has intrinsic value, regardless of its economic value. With this approach, managers view the forest as a complex ecosystem in which every part of the system is important to every other part. If managers maintain each component of the ecosystem, the result will be healthy and assorted wildlife and plant communities, or biodiversity. To figure out how a specific action or nonaction might impact biodiversity, forest managers look at the impact of an action on several wildlife species with different habitat needs.

One impact of human development can be ***fragmentation***. Fragmentation is the process of dividing large, continuous ecosystems and habitats into smaller, isolated parcels. When humans develop a piece of land for homes, roads, businesses, agriculture, parking lots, and other developments, they change the biological community. As the size of a habitat becomes smaller and smaller, more and more animal and plant species are affected. Sometimes, the decline of a certain species can serve as an early indicator that a whole community or ecosystem is changing.

GETTING READY

Make copies of the student pages. Using a light-colored marker, draw a 20" x 20" (50.8 cm x 50.8 cm) grid map of 400-Acre Wood on a piece of chart paper for each team of four or five students. (Teams can also make their own.) The grid should have 400 1" x 1" (2.5 cm x 2.5 cm) squares, each representing 1 acre (0.4047 hectare). On another piece of chart paper, make an identical, but larger, grid to use in group discussion. If you have an overhead projector, you may want to prepare a transparency of the grid.

DOING THE ACTIVITY

1. Introduce the activity by explaining that students will look at several complex issues that face forest managers. Help students brainstorm a list of activities that take place on forest land. List their ideas on the board. Include uses like hiking, fishing, hunting, reading, taking pictures, camping, rock climbing, skiing, snowmobiling, logging, grazing, or mining. Ask the class to look at the list and decide if any activities would conflict with each other if done on the same piece of land.

2. Discuss these questions:

- Which activities would cost the most to provide on forest land?
- Which would bring the most visitors?
- Which would have the greatest impact on the forest ecosystem? On the wildlife there? Would this effect be permanent or temporary?
- Which would cause fragmentation?
- Which would provide for society's most critical needs?

3. Have students read the "If You Were the Boss" student pages. Divide the group into teams of four or five, and explain that each team will decide the best use (or uses) of 400-Acre Wood, which has been donated to the community. Each team will develop a land management plan that will serve the best interests of the entire ecosystem. Make sure students understand that their team can use the entire 400 acres (162 ha) for one use, or can divide it up for multiple uses. For example, they may devote 200 acres (81 ha) to wilderness and hiking, 80 acres (32 ha) to a campground, and 120 acres (49 ha) for harvesting timber or hunting.

4. Before students begin, ask these questions:

- Which forest uses in "If You Were the Boss" are compatible with other uses? (for example, building a campground and hiking trail next to each other)
- Which might be incompatible with each other? (hunting near a campground)
- What could you learn by figuring out the costs, revenues, trees, wildlife populations, and number of visitors for each management plan? (how the plan affects different forest values)
- Are owls, wood rats, and salamanders the only wildlife in the forest? (no) What could you learn about the

© Project Learning Tree

Copyright 2017, Project Learning Tree. Permission to reprint and distribute this activity has been granted to the Napa County Resource Conservation District for a one-time use in an Acorns to Oaks teacher workshop. Educators in California can receive the complete guide by attending a PLT workshop. Contact Sandy Derby at 530-394-7003 or stderby@ucanr.edu, or visit www.plt.org for more information.

forest ecosystem by analyzing the populations of these three species? (By looking at three animals with different habitat requirements, you get an idea of the general health of the forest ecosystem.)

5. Give each team a map (grid) of the 400-Acre Wood. Also give each team a copy of the "What's the Score?" student pages. Each team should discuss various strategies for managing the forest. When the team arrives at a consensus on how the land should be managed, direct members to use "What's the Score?" for a cost and benefit analysis of their plan. They should discuss what impact their plan would have in terms of visitors, wildlife, trees, and cost and revenue.

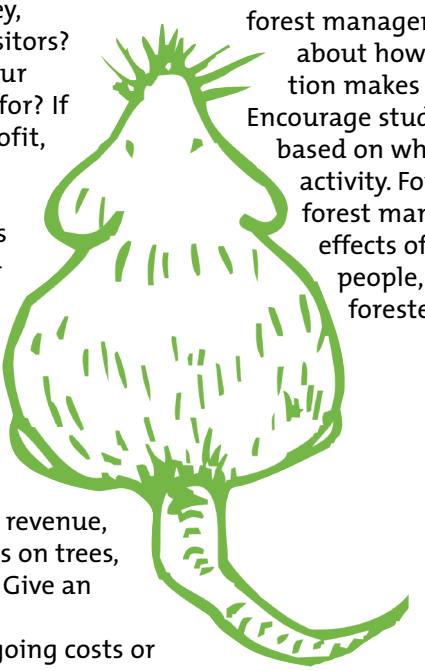
See the PLT website, www.plt.org, for information about obtaining a spreadsheet or database to use in conjunction with the "What's the Score?" student pages.

6. When the teams have completed their management plans, they should use crayons or colored markers to illustrate their plans on the grids. Remind them to include a key showing what different colors and symbols mean.

7. Ask teams to present their plans to the entire group, making clear how they decided on their plans. Have them also report the findings of their "What's the Score?" student pages. Post the maps around the room.

8. Use the large grid map to lead a group discussion of different plans. Ask these questions:

- Which plan enables the most people to enjoy the forest? What is the monetary cost in attracting the most visitors? Are there any other costs besides money?
- Which plan does the most to preserve the forest in its original state? What are the costs of this plan?
- Which plan has the most impact on wildlife and fragmentation? Why should we care if one animal species leaves the forest?
- Which plan seems to provide the best balance of money, trees, wildlife, and visitors?
- How do you think your plan should be paid for? If your plan made a profit, what should happen with the money?
- Which do you think is most important: having the most trees, the most wildlife, or the most visitors? What makes you think so?
- Which do you think is most important —an activity's cost or revenue, or the activity's effects on trees, wildlife, and visitors? Give an example.
- Which items are on-going costs or revenues? Which are one-time costs or revenues?
- What will be the long-term effects of each plan? How will costs or revenue change in the next year? Will the numbers of trees, wildlife, or visitors change?



Enrichment

- Repeat the activity and have each team extend its management plan into the next year, and calculate the effect on money, trees, wildlife, and visitors for the second year.
- Contact the local Forest Service office or forestry agency, and invite a forest manager to talk to your class about how his or her organization makes land-use decisions. Encourage students to ask questions based on what they learned in the activity. For example, how do forest managers weigh the effects of an action on trees, people, and animals in a forested area?

READING CONNECTIONS

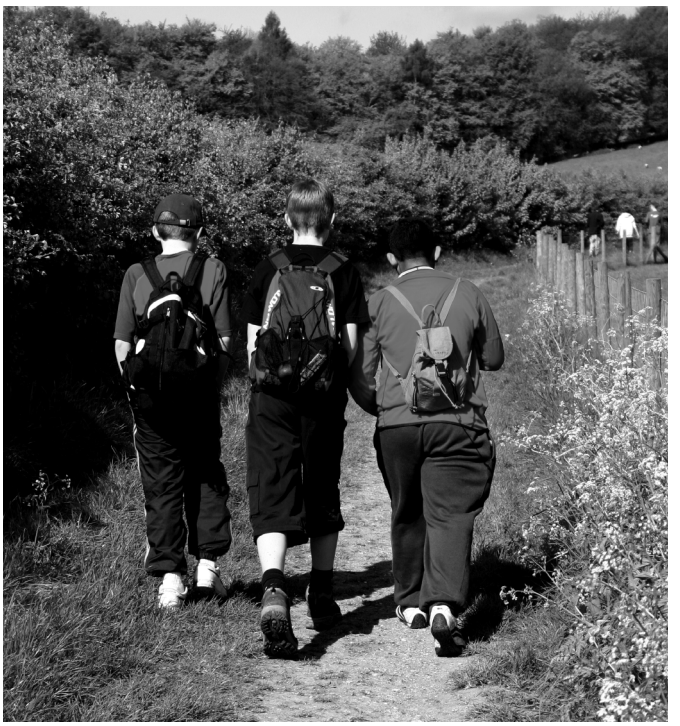
Bryan, Nichol. *Los Alamos Wildfires.* Gareth Stevens. 2003. Describes the events surrounding the wildfire that raged in New Mexico in 2000, and the resulting debate over the policy of prescribed burning, or purposely setting fires as a means of forest management. Grades 4+. ISBN: 0836855078.

Camp, William G. and Thomas B. Daugherty. *Managing Our Natural Resources.* Delmar Learning. 1995. Examines the nature, history, and management of natural resources ranging from soil and water to forests, wildlife, and marine resources. Includes suggested activities and discussion of occupations in the field. Grades 6+. ISBN: 0827367163.

Foster, David R. and John F. O'Keefe. *New England Forests Through Time: Insights from the Harvard Forest Dioramas.* Harvard University Press. 2000. The historical and environmental lessons of New England's landscape are told through the world-renowned dioramas in Harvard's Fisher Museum. This first book based on the dioramas conveys the phenomenal history of the land, the beauty of the models, and new insights into nature. Grades 6+. ISBN: 0674003446.

Heinrich, Bernd. *The Trees in My Forest.* HarperCollins Publishers. 1997. The author takes the readers on an eye-opening journey through the hidden life of a three hundred acre forest. Each of the 24 essays explores a different aspect of the relationships among plants, animals, and people of the forest. Grades 7+. ISBN: 0060174463.

If You Were the Boss



A magnificent forest, 400-Acre Wood, has just been donated to your community. You and your team have the job of deciding what to do with this forest.

As you might have guessed, 400-Acre Wood is 400 acres (162 hectares) in size. An acre is an area of land equal to a square that is 208.7 feet on each side, and 400 acres is a little less than 1 square mile. (A hectare [ha] is 10,000 square meters and is equal to about 2.47 acres. To convert acres to hectares, multiply by 0.4047).

400-Acre Wood is made up of pine forest, with about 150 mature pine trees per acre. In addition, it contains lots of wildlife such as owls, deer, bear, woodpeckers, turkey, quails, wood rats, fish, and woodland salamanders.

Wildlife biologists use something called management indicator species (MIS) to evaluate the impact of people's actions on the environment. For 400-Acre Wood, the indicator species are barred owls, wood rats, and woodland salamanders. Wildlife biologists estimate that 400-Acre Wood currently has two barred owls per 100 acres (40 ha) of forest, and one wood rat and 25 woodland salamanders per acre (0.40 ha). That means a total of 8 barred owls, 400 wood rats, and 10,000 salamanders currently live in 400-Acre Wood.

Because the forest currently has no roads or trails, few people use or visit it.

You and your team will make a map of 400-Acre Wood and develop a management plan for it. You may decide to do one thing with the entire forest. Or you may want to divide the forest and do different things in different areas. You goal is to find what you think is the best balance between visitor enjoyment, trees, wildlife, and money.

Below are the different forest uses you can include in your plan. The "What's the Score?" student page will help you evaluate your plan's total effect on visitors, trees, wildlife, and money.

Wilderness Preserve

The purpose of a wilderness preserve is to allow wildlife and plants to exist without humans interfering. Typically a wilderness preserve has no roads, graded trails, or campsites. Wilderness preserve areas will have the following effects.

Visitors: About 5 people per acre per year will visit the preserve.
Trees: The number of trees per acre will remain the same.
Wildlife: The numbers of owls, wood rats, and salamanders per acre will remain the same.
Money: It will cost money to manage the preserve, and each visitor will pay an entrance fee.

Trails

Graded trails allow different types of visitors to enjoy a forest area, including walkers, cyclists, families with strollers, and wheelchair users. Trails areas will have the following effects.
Visitors: About 25 visitors per acre per year will use the trails.
Trees: Some trees must be cut to build a trail.
Wildlife: The increase in visitors will disturb the wildlife. Owls will leave areas with trails (they sleep during the day when people are about), and trails are dangerous for woodland salamanders as they migrate to pools of water during breeding season. There will be no affect on the wood rat population.
Money: It costs money to build and maintain trails. Trees removed to make the trail can be sold. Each visitor will pay an entrance fee.

(continued on next page)

© Project Learning Tree

If You Were the Boss (continued)

Campground

A campground allows visitors to enjoy a forest area overnight or over the weekend. It typically has a number of campsites, plus picnic tables, fire pits, parking spaces, and bathrooms. A campground also needs to have a road winding through it. A campground has about 4 sites per acre. Campground areas will have the following effects.
Visitors: About 12.5 campers per site per year will come to the campground, or 50 campers per acre per year.
Trees: Trees need to be removed to build the road and the campsites.
Wildlife: A campground and campers will cause all three indicator species—owls, wood rats, and salamanders—to disappear from the area.
Money: It costs money to build and maintain the road, to clear and level the campsites, and to build and maintain the restrooms. It also costs money to manage the campground. Trees removed for the road and campsites can be sold. Campers pay a camping fee.

Hunting

Some forest areas are managed to encourage game animals (deer, turkey, and quail) for hunters. These areas require a road for visitors. Hunting areas will have the following effects.
Visitors: About 1 hunter per acre per year will visit.
Trees: Trees will need to be removed to build the road.
Wildlife: With regulations to keep game populations constant, there should be no effect on the three indicator species—owls, wood rats, and salamanders.
Money: It will cost money to build and maintain the road. It will also cost money for management. Trees removed for the road can be sold. Hunters will pay a hunting fee.

Fishing

To encourage fish for anglers, a lake can be created by damming the forest stream. Fishing areas will have the following effects.
Visitors: About 2 anglers per acre per year will visit.
Trees: Trees will need to be removed to create the lake.
Wildlife: Creating the lake will cause all three indicator species—owls, wood rats, and salamanders—to disappear from the fishing area.
Money: It will cost money to build the dam to create the lake. It will also cost money for management. Trees removed for the lake can be sold. Anglers will pay a fishing fee.

Timber Harvest

Some forest areas are set aside for timber harvesting, which means cutting trees to sell the logs. Using a sustainable yield approach, only a portion of the trees are removed at any given time. This minimizes the effect on wildlife, while producing as many logs as possible over the long-term. For pine trees, which take 35 years to reach maturity, one-fifth of the trees are cut every 7 years. Timber harvest areas will have the following effects.
Visitors: About 5 people per acre per year will visit.
Trees: Trees will be removed to build the road, plus one-fifth of remaining mature trees will be removed.
Wildlife: The timber harvest will have a minimal impact on the three indicator species.
Money: It will cost money to build and maintain the road and for management. The harvested trees can be sold. Visitors will pay a fee.

© Project Learning Tree

What's the Score?

Step 1.
Determine how many acres you plan for each **land use**. The total should be 400 acres.

(_____ acres Wilderness) + (_____ acres Trails) + (_____ acres Campground) + (_____ acres Hunting) + (_____ acres Fishing) + (_____ acres Timber Harvest) = _____ Total Acres

Step 2.
Calculate how many **visitors** per year this plan will attract to your community.

(_____ acres Wilderness x 5 visitors/acre) + (_____ acres Trails x 25 visitors/acre) + (_____ acres Campground x 50 campers/acre) + (_____ acres Hunting x 1 hunters/acre) + (_____ acres Fishing x 2 anglers/acre) + (_____ acres Timber Harvest x 5 visitors/acre) = _____ Total Visitors per Year

Step 3.
Calculate how this plan will affect the **wildlife** management indicator species. Compare the totals you get to the original population of 8 owls, 400 wood rats, and 10,000 salamanders.

Owls: (_____ acres Wilderness) + (_____ acres Hunting) + (_____ acres Timber Harvest) = _____acres that will support owls x 0.02 owls/acre = _____ Total Owls (Note: Round down to the nearest whole owl.)

Wood Rats: (_____ acres Wilderness) + (_____ acres Trails) + (_____ acres Hunting) + (_____ acres Timber Harvest) = _____ acres that will support wood rats x 1 wood rat/acre = _____ Total Wood Rats

Salamanders: (_____ acres Wilderness) + (_____ acres Hunting) + (_____ acres Timber Harvest) = _____ acres that will support salamanders x 25 salamanders/acre = _____Total Salamanders

Step 4.
Calculate how many **miles of trail or road** are needed for your plan.

(_____ acres Trails) ÷ 6 acres/mile = _____ Total Miles of Trail
(_____ acres Campground x 250 ft/acre) ÷ 5,280 ft/mile = _____ miles of road for Campground
(_____ acres Hunting x 100 ft/acre) ÷ 5280 ft/mile = _____ miles of road for Hunting
(_____ acres Timber Harvest x 100ft/acre) ÷ 5280 ft/mile = _____ miles of road for Timber Harvest

Step 5.
Calculate how many mature **trees** remain based on your plan.

(_____ miles of Trail x 0.36 acres/mile) x 150 trees/acre = _____
(_____ miles Campground road x 1.45 acres/mile) x 150 trees/acre = _____
(_____ miles Hunting road x 1.45 acres/mile) x 150 trees/acre = _____
(_____ acres of Fishing) x 150 trees/acre = _____
(_____ miles Timber Harvest road x 1.45 acres/mile) x 150 trees/acre = _____
(_____ acres Timber Harvest x 1/35 harvested) x 150 trees/acre = _____
Total trees removed _____

60,000 mature trees in 400-Acre Wood – trees removed = trees remaining _____

(continued on next page)

© Project Learning Tree

What's the Score? (continued)

Step 6.

Calculate the **revenue and costs** associated with your plan, and determine the net profit or loss.

Revenue

Fees (per year)

_____ Wilderness visitors x $2 fee per visitor = $_____
_____ Trails visitors x $2 fee per visitor = $_____
_____ Campground campers x $20 fee per site ÷ 2 campers per site = $_____
_____ hunters x $5 fee per hunter = $_____
_____ anglers x $2.50 fee per angler = $_____
_____ Timber Harvest visitors x $2 fee per visitor = $_____

Sale of Trees

_____ trees removed for Trails x $50 per tree = $_____
_____ trees removed for Campground road x $50 per tree = $_____
_____ trees removed for Hunting road x $50 per tree = $_____
_____ trees removed for Fishing x $50 per tree = $_____
_____ trees removed for Timber Harvest x $50 per tree = $_____

Total Revenue $_____

Costs

Management Costs (per year)

_____ acres Wilderness x $2.50 per acre = $_____
_____ acres Trails x $50 per acre = $_____
_____ acres Campground x $200 per acre = $_____
_____ acres Hunting x $5 per acre = $_____
_____ acres Fishing x $2.50 per acre = $_____
_____ acres Timber Harvest x $5 per acre = $_____

Construction Costs

_____ miles of Trail x $100 per mile = $_____
_____ miles Campground road x $600 per mile = $_____
_____ acres Campground x 4 sites per acre x $1000 per site = $_____
_____ miles Hunting road x $600 per mile = $_____
_____ acres Fishing x $3000 per acre = $_____
_____ miles Timber Harvest road x $600 per mile = $_____

Total Costs $_____

Profit or Loss

(Total Revue $_____) – (Total Costs $_____) = $_____ Net

If the Net amount is positive, it is a profit; if is it negative, it is a loss.

© Project Learning Tree

Walk in the Forest

A GUIDE FOR PROMOTING FORESTS & FOREST MANAGEMENT

Share and print out this manual of ideas and make notes as you plan your walk in the forest! (Downloaded from www.forestfoundation.org/publications

American Forest Foundation

Society of American Foresters
Growing better all the time

Table of Contents

INTRODUCTION 3
GOALS OF WALK IN THE FOREST 3
KEY FOREST AND FOREST MANAGEMENT CONCEPTS 4
- Additional Talking Points 5

PLANNING A WALK IN THE FOREST GUIDELINES 8
- Before the Walk 8
- Day of Walk 11
- After the Walk 11

EXAMPLE #1: WALK IN THE FOREST FOR CHILDREN 12
- Benefits of a Children's Walk in the Forest 12
- Before the Walk 12
- Day of the Walk 13
- After the Walk 14
- Helpful Tips for Working with Kids 15
- Sample Agenda for Students 16
- Connecting Kids to Nature Activities 17

EXAMPLE #2: WALK IN THE FOREST FOR TEACHERS 20
- Benefits of a Teachers' Walk in the Forest 20
- Before the Walk 21
- Day of Walk 23
- After the Walk 23
- Sample Promotional Flyer for teachers 24

EXAMPLE #3: WALK IN THE FOREST FOR LOCAL LEADERS 25
- Before the Walk 25
- Day of Walk 26
- After the Walk 26

EXAMPLE #4: WALK IN THE FOREST FOR TREE FARMERS & FAMILY LANDOWNERS 27
- Before the Walk 27
- Day of Walk 29
- After the Walk 29

PROMOTION
- Share Your Plans with SAF and AFF! 30
- Sample Press Release 31
- Sample Letter to the Editor 32
- Ideas for Using Walk in the Forest Logos 33

WALK IN THE FOREST EVALUATION 34

RESOURCES 35

The Walk in the Forest program is a wonderful opportunity for the public to experience forests and forestry hands-on.

APRIL 22
EARTH DAY

LAST FRIDAY IN APRIL
ARBOR DAY

3RD SATURDAY IN MAY
NATIONAL WALK IN THE WOODS DAY

3RD FRIDAY IN OCTOBER
NATIONAL WALK IN THE FOREST DAY

This guide will help you plan an event—for adults, families, students or teachers. A Walk in the Forest helps audiences of all ages unplug from their busy lives and witness the wonder of nature. It provides a great opportunity for people to appreciate forests, and to teach others about the benefits forests provide and how forest management can enhance those benefits.

This guide was developed and produced by the Society of American Foresters (SAF) and the American Forest Foundation (AFF). SAF is the scientific and educational association representing nearly 17,000 professional foresters and natural resource professionals in the United States. The Society's primary objective is to advance the science, technology, education, and practice of professional forestry for the benefit of all society. AFF works on-the-ground with families, teachers and elected officials to promote stewardship and protect our nation's forest heritage. A commitment to the next generation unites our nationwide network of forest owners and teachers working to keep our forests healthy and our children well-prepared for the future they will inherit.

There are many opportunities throughout the year to plan a Walk in the Forest. Each season brings with it something new to show and tell about trees and the forest. The **third Saturday in May is National Walk in the Woods Day™**, and on that day the American Forest Foundation invites its network of family forest owners and American Tree Farm System® Certified Tree Farmers to offer tours of their properties, or simply take their own families and friends for a walk in the woods. **On the third Friday in October, SAF local units and state chapters join with local educators and landowners to hold a Walk in the Forest Day.** If you can't participate in, or plan an event for National Walk in the Woods Day™ or National Walk in the Forest Day, consider another spring date to tie in with Arbor Day or Earth Day, or another fall date to take advantage of colorful foliage. **National Arbor Day is the last Friday in April**, but many states observe it on different dates according to their best tree-planting times.

The guidelines in this kit will help you plan your event. A planned project is a successful project! The length and detail of the walk will depend on your audience. If your walk involves teachers and their students, or families and their children, AFF's Project Learning Tree® program can provide some engaging and fun activities for youth. Use this guide to plan your walk, and for more guidance, contact Louise Murgia, Director of Field Services at the Society of American Foresters or Vanessa Bullwinkle, Director of Communications at the American Forest Foundation.

GOALS OF WALK IN THE FOREST

> **Inform the public of the many benefits of trees and forests.**
> **Increase public awareness of the dynamic nature of the forest.**
> **Help the public understand that foresters are uniquely qualified to help maintain the integrity of forest environments while providing many benefits for society.**
> **Inform the public that private family forestland owners have multiple and diverse objectives and that their investment in forest management results in benefits that we all enjoy.**

KEY FOREST AND FOREST MANAGEMENT CONCEPTS

Trees and forests have many benefits.

- Environmental benefits include soil stability, air and water quality, and carbon storage.
- Ecological benefits include landscape diversity and habitat for plants and animals.
- Economic benefits include the forest products industry, suppliers of outdoor recreation equipment, etc.
- Recreation includes activities in the forest such as hiking, camping, and hunting.
- Aesthetics is the pleasure derived from the visual beauty of the forest.

Forests are dynamic and change composition over time.

- Biotic influences on forests include animals, insects, diseases, and non-native invasive species.
- Abiotic influences include flooding, drought, fire and wind events such as hurricanes and tornadoes.
- Competition for resources (sun, water, nutrients) occurs between organisms of the same species and different species.
- Succession is the replacement of one community of plants by another.

Foresters maintain the integrity of the forest while providing benefits for society.

- There is demand for forest products including paper, solid wood, and energy.
- Supplying these products through management does not necessarily compromise a forest's integrity.
- Foresters complete a multi-disciplinary curriculum including ecology, silviculture, forest health, economics, and policy that prepares them for their profession.
- Many states require licensing or registration criteria that may include a code of ethics.
- Foresters use equipment such as a diameter tape, clinometer, and increment borer to gather data in order to make prescriptions.
- Forest management techniques such as herbicide application, prescribed fire, thinning, or final harvests are used to deliver a desired outcome.
- Often these techniques mimic natural events, and may appear harmful in the short-term but have long-term benefits.

Private family forestland owners have multiple and diverse objectives and their investment benefits the public.

- Individuals and families own forests for a variety of reasons, including quality of life, environmental values, investment income, and/or recreation.
- A landowner invests his or her time and money in forest management activities to accomplish his/her objective(s).
- A landowner's investment in forest management also provides benefits to society, for example, a prescribed fire lowers the risk of uncontrolled wildfire.
- Other societal benefits from private forestland management include clean air and clean water, soil creation and stabilization, and protection of biological diversity.
- A landowner's participation in forest certification programs like the American Tree Farm System is verification of sustainable forest management.

Additional Talking Points

- ☐ Focus on **current issues**, such as biodiversity, biomass, wildland-urban interface, or forests with high conservation value.
- ☐ Explain the **history of forestry** in the United States and your state and discuss trends using the U.S. Forest Service's Forest Inventory Analysis.
- ☐ Explain **residential tree and landscape care**, including species selection and planting, impacts on energy use, root damage, and proper pruning.
- ☐ **Observe a harvest** operation in progress, explain what is happening, and point out measures being taken to avoid harming the surrounding environment.
- ☐ Showcase an example of **ecosystem restoration** such as a longleaf pine forest in the Southeastern U.S. Coastal Plain.
- ☐ Show the use of **good silvicultural practices** in a wetland environment.
- ☐ Discuss the **current health of local forests** and tell guests how they can help keep forests healthy, for example, removal and prevention of non-native invasive species.
- ☐ Discuss the **history of the Society of American Foresters** and the **American Forest Foundation's Tree Farm** or **Project Learning Tree** programs.
- ☐ Discuss the Society of American Foresters' **mission to advance** the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish professional excellence; and, to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society.

☐ Discuss the importance of **private forest owners** to protecting America's forest legacy and point out the value of the American Tree Farm System (ATFS)—the largest and oldest sustainable woodland system in America. ATFS is a network of family forest owners protecting 26 million acres of forest land.

☐ Discuss the importance of **environmental education** and how it is vital that the next generation have an understanding and appreciation for the natural world. Describe how Project Learning Tree (PLT), uses forests as a window on the world to engage students of all ages in outdoor learning. PLT has a 50-state network and trains more than 30,000 educators a year.

☐ Gather local and national **forest facts** to share.

- 56% of America's forests are privately owned and of this private forest land, most (62%) is owned by families and individuals. The remaining private forest land is owned by corporations, conservation organizations, clubs, Native American tribes, and others.
- 25% percent of America's fresh water comes from private forests
- 60% of at-risk wildlife depends on private forests for habitat.
- More than 90% of our wood products in America come from private forests.

FOCUS OBSERVE EXPLAIN SHOW GATHER DISCUSS

PLANNING A WALK IN THE FOREST GUIDELINES

Before the Walk

Establish Objectives

Who?

- ☐ Set your objectives, taking into consideration the goals of the walk.
- ☐ Determine your target audience. Examples include students, teachers, landowners, elected leaders, government officials, conservation groups, clergy, scouts, civic groups, media, or the general public. (See examples for specific groups in later pages.)
- ☐ Consider audiences that may have different viewpoints or values about the forest. Consider whether these groups should attend the same walk or if the walks need to be separate.

What?

- ☐ What do you want participants to learn? Do you want to address a current "hot" issue or provide a general overview?
- ☐ What two or three major points do you want visitors to know or understand? See key concepts.
- ☐ Partnering with an SAF Chapter or an AFF state Tree Farm committee or Project Learning Tree state program can ensure that your walk becomes an annual program.
- ☐ Inviting local, state, and federal agencies, forest industry, loggers, consultants, and conservation groups to volunteer may help develop valuable partnerships.

Select a Location

Where?

- ☐ Will the site support your objectives? Is it easily accessible? Do you need permission or a permit to use the site? Is there adequate parking? Will you need restroom facilities?
- ☐ Consider a certified Tree Farm, U.S. National Forest or National Park, urban forest, planting or harvesting operation, seed orchard or nursery.

Insurance

- ☐ SAF state societies, divisions, and chapters are covered by the SAF National Office's liability insurance. For details contact SAF Finance and Administration Department at (301) 897-8720, ext. 103.
- ☐ Walk in the Forest programs sponsored by either the state Tree Farm or Project Learning Tree committees can also be covered by the American Forest Foundation's liability insurance. Contact the Tree Farm program coordinator at 202-463-2733 at least one month before your project and request the liability rider application. Follow up with the program coordinator to ensure coverage.

Consider the Timing

When?

- ☐ A common date facilitates national event publicity. SAF selected the third Friday in October based on school schedules, weather, and fall foliage in many areas of the country. AFF selected the third Saturday in May. If you can't participate in the national Walk in the Forest Day or National Walk in the Woods Day™, consider another date.

- ☐ Spring dates tie in well with Arbor Day or Earth Day. A weekday event in May is a good time for teachers. For the most part, school tests are over and teachers are looking for field day opportunities for their students.
- ☐ Summer may be difficult with students but teachers need professional development hours just like foresters and they may be more available in the summer.
- ☐ Autumn is the time to appreciate the aesthetics of the forest and can be used to engage curiosities of the fall colors.
- ☐ Make provisions for a rain date.

Develop a Plan

How?

- ☐ Designate one person as the coordinator to direct planning and to have primary responsibility for the program.
- ☐ Solicit support from SAF members, Project Learning Tree facilitators, American Tree Farm System members.
- ☐ Decide what you will show. Don't try to do too much. Keep it simple and not too technical.
- ☐ Decide whether to direct guests to learning stations staffed by experts or keep the entire group together with one or more leaders talking.
- ☐ Designate someone to promote the event to your desired audience.
- ☐ Develop a program flyer, see sample, and distribute SAF, Tree Farm, or PLT brochures or fact sheets with the program flyer.
- ☐ Designate someone responsible to attract media to your event, develop press releases, and speak to the media during the event. This person should be free to move about the event with the media.
- ☐ Consider your audience may not want media attention.
- ☐ Assign someone to be responsible for taking photos and/or video of the event.
- ☐ Designate someone responsible for securing local sponsors and apply for grant funds to offset costs.
- ☐ Establish a budget.

Establish Itinerary

- ☐ Determine if your walk will include a meal. Consider a picnic lunch during a break or at the end of the walk, or guests can bring bag lunches. Provide water.
- ☐ Layout the location of each information point.
- ☐ Identify the station presenters and determine what their needs are for materials.
- ☐ Remember to include rest stops, briefing periods, and refreshments in the agenda.
- ☐ Coordinate refreshment and lunch details as well as trash disposal.
- ☐ Send reminders to presenters on times, what is expected, final schedules, etc.

Arrange Parking and Transportation if Necessary

- ☐ Consult and respect the wishes of the landowner. (See the guidelines for Tree Farmers and Family Forest Owners on page 27.)
- ☐ Reserve transportation. Vans are in high demand during the summer and should be reserved well in advance.
- ☐ Consider accessibility of buses on forest roads.
- ☐ Avoid caravans of automobiles due to the risk of accident and their effects on forest roads.

Invite Guests

- ☐ For school groups, make contact at the beginning of the school year before field trip plans are set.
- ☐ For others, extend your invitations four to six weeks in advance. Share your itinerary, the who, what, when, where and why.
- ☐ Provide information about what to wear and what to bring, e.g., long pants, closed-toe-shoes, insect repellant, a hat.
- ☐ Ask for an RSVP. Designate someone to handle registration.
- ☐ Send press releases about your event to local media. Include the date, time, location, length, why your audience should participate, dress requirements, etc.
- ☐ For landowners, promote your event in state Tree Farm committee newsletters, state forestry agency publications, and state forest association publications.
- ☐ For the general public, list the event in community calendars, hang signs in libraries and stores.

Prepare Information Packet to Give to Walk Participants

Extras

Consider including these items:

- ☐ Schedule and a map of the area
- ☐ Briefing paper with key forestry terms they are likely to hear, issues to be discussed, etc.
- ☐ Photographs of "before and after" management
- ☐ Names and contact information of the walk's facilitators for follow-up
- ☐ A list of supporters for the walk
- ☐ State forest facts (available from state agencies or associations)
- ☐ SAF, PLT, and Tree Farm brochures
- ☐ Seedlings or seed packets with planting instructions for participants
- ☐ Sample activities for families to lead with children while out for a walk in the woods. Download these one-pagers from PLT's "Connecting Kids to Nature" series from **www.forestfoundation.org/family-activities**.
- ☐ Make nametags. Consider tree cookie name tags. With a dab of hot glue and a pin, they make excellent name tags. Use color-coded name tags to distinguish leaders from guests.
- ☐ Collect giveaways from donors.

Walk through Planned Itinerary

Rehearse

- ☐ Two weeks in advance, do a dress rehearsal!
- ☐ Clear obstacles from the path and look for any potential distractions, hazards or illegal activities.
- ☐ Do trail maintenance if necessary.
- ☐ Calculate travel time needed between stops.
- ☐ On remote forest roads, flagging turns and stops can be helpful.
- ☐ Be comfortable with your location and material; ask yourself, will the walk be interesting? Does the walk meet your objectives?
- ☐ Revise itinerary as needed.
- ☐ Collect helpful items: air horn to rotate stations, sunscreen, bug spray, toilet paper, hand wipes, first aid kit, and camera.
- ☐ Is there a situation or activity planned that requires guests to wear hard hats or safety goggles?

DAY OF WALK

Ready, Set...

Pre-Walk

- ☐ Arrive early.
- ☐ Review the site for any potential hazards and flag the boundaries.
- ☐ Welcome guests and have them sign in with name, address, and emergency contact information.
- ☐ Distribute nametags and walk information packet.
- ☐ Give brief introduction with information about the walk sponsors and an explanation of the site.
- ☐ Give an overview of the day's activities.
- ☐ Review a map that shows the project boundaries and facilities.
- ☐ Describe the plan for bad weather. In hot weather, tell guests to make sure they drink plenty of water to avoid dehydration.
- ☐ Allow time for a brief question and answer session.

Go!

Proceed with Walk in Accordance with Schedule

- ☐ Stick to the schedule while respecting individual needs.
- ☐ Avoid technical jargon; answer all questions candidly.
- ☐ Be sure to listen carefully and avoid doing all the talking.
- ☐ Remember safety precautions.
- ☐ Involve the audience, for example ask open-ended questions about the topic rather than a question that could be answered with a yes or no.
- ☐ Be animated. Have good eye contact with your audience.
- ☐ Most importantly, remember to make the walk fun!

Q & A

Conclusion

- ☐ Give a summary or a fun quiz covering the tour, highlights, etc.
- ☐ Allow time for a final question and answer session.
- ☐ Distribute and collect evaluation forms. Encourage participants to complete the section on the evaluation form to sign up to receive news, information and resources from the sponsors, or join for example, Facebook.com/AmericanForestFoundation or Twitter@AmForestFndn.
- ☐ Encourage additional contact with SAF, AFF, Tree Farm, or PLT volunteers. Offer to schedule a Project Learning Tree workshop for educators, Tree Farm certification for landowners, or follow-up visit by an SAF member.
- ☐ Thank guests for attending and make sure all guests have transportation.
- ☐ Collect trash and dispose of it properly.
- ☐ Notify the landowner that the event has concluded and the site is in order.

AFTER THE WALK

Thank you

- ☐ Clean up the site—leave no trace.
- ☐ Send thank you letters to all participants, volunteers, sponsors, and the landowner.
- ☐ Summarize the participant evaluations and distribute to partners.
- ☐ Evaluate guests' attitudes: did the tour have a positive effect? What worked and what didn't? Answer unresolved questions immediately.
- ☐ Distribute a post-event press release (include a quote if you can from a student, teacher, or other guest about the event and what they learned or experienced) and photographs to your local media, and SAF and AFF's communications department.
- ☐ Begin preparations for the next Walk in the Forest!

Example #1
WALK IN THE FOREST FOR
CHILDREN

This outline supplements the Planning a Walk in the Forest guidelines on page 8. These guidelines are well suited for the elementary grade level, but can also be adapted for other grade levels.

Benefits of a Walk in the Forest for Children

> Teach children about forests, forestry, and foresters. Parents and educators also benefit from exposure to the information presented to the children.
> Provide children with a positive outdoor, hands-on learning experience about forests, natural resources, forestry, and foresters.
> Increase children's awareness, appreciation of, and respect for nature, forests, and foresters.
> Expose children to the many benefits of forests—biological, aesthetic, recreational, educational, environmental, and economic.
> Expose children to the many aspects of forestry, such as forest management, fire prevention, forest health, forest products, forest ecology, and wildlife management.

BEFORE THE WALK

Who?
What?

Determine Your Audience and Objectives

- ☐ Decide how the walk can best support your goals and the goals of the school or youth organization.
- ☐ Decide which grade levels you wish to target and how many students can attend.
- ☐ Contact an educator, school administrator, or youth leader to suggest a walk.
- ☐ Contact your state's Project Learning Tree Coordinator for assistance. Visit **www.plt.org** for contact information.

Meet with Educator or Youth Leader

Where?

- ☐ Be prepared to discuss the goals and show how they correlate with state learning standards.
- ☐ Decide when and where to hold the walk—on or near school grounds is best to avoid excessive travel.
- ☐ Set your agenda according to your goals. **See attached sample.**
- ☐ Provide teachers with materials they can use to prepare students for the walk, such as books, posters, or hands-on items.
- ☐ Encourage educators or youth leaders to provide questions they would like answered at each station.

Pre-Walk Introduction

- ☐ Visit the school or youth group one to two weeks before the walk so volunteers can meet the students and vice versa.

Gear Up

- ☐ Provide teachers with sample activities that differ from activities that will be conducted on the day of the walk. See attached **Connecting Kids to Nature** activities. You can download these and others from www.forestfoundation.org/family-activities. These are more simple versions of activities from Project Learning Tree's curriculum guides.
- ☐ Read a forestry-related book or show a video or slide show.
- ☐ Have children brainstorm how many items come from trees and then show samples and discuss some of the products.
- ☐ Briefly explain what a forester does and demonstrate some tools.
- ☐ Have each student write answers to the following on an index card along with his or her name: "What do I want to know about forests or foresters?"
- ☐ Conduct a pre-walk test of knowledge/attitudes about forests.

Helpers

Define the Responsibility of the School

- ☐ Divide students into groups.
- ☐ Provide at least two adults per group (for example one teacher and one parent).
- ☐ Encourage students to dress properly (long pants and closed-toe shoes).
- ☐ Bring a school nurse or someone else to distribute medication and first aid if this becomes necessary.

DAY OF THE WALK

Serious Fun

Focus the Children's Attention without Delay

- ☐ Set the tone of the walk immediately.
- ☐ Consider giving instructions about the walk and other logistics while children are still seated on the bus.
- ☐ Set clear and simple rules. Sample rules include the following:
  - Stay on paths whenever possible.
  - Watch where you are walking so you avoid crushing plants and animals.
  - Do not pick flowers and leaves unless directed.
  - Walk quietly to focus on observation.
  - Do not litter.

Topics

Possible Topics and Associated PLT Activities during the Walk

- ☐ Count tree age using growth rings and/or an increment borer.
- ☐ Show how to measure trees, determine board feet, etc.; relate this to how many trees it takes to build a house.
- ☐ Show how dead trees are home to a lot of living creatures.
- ☐ Explain how seeds are carried (by wind, water, squirrels, etc.).
- ☐ Explain the types of food that come from trees (maple syrup, etc.).
- ☐ Show a recently planted area with seedlings sprouting and explain the life cycle of trees.
- ☐ Identify the living creatures in the woods.
- ☐ Do leaf rubbings with crayons and explain the parts of a leaf.
- ☐ Show the parts of a tree and compare them to vital human functions. Explain that trees essentially use their leaves for breathing and then ask what else a tree needs to live. Someone will probably mention eating and you can explain how trees "eat" through their roots.

- ☐ Show the kids an insect gall and explain how the tree has encased encroaching insect eggs.
- ☐ Find a hole or pruned branch and show how the tree covers the wound.
- ☐ Consider using these activities from Project Learning Tree's *PreK-8 Environmental Education Activity Guide* on your walk. Contact your state's PLT coordinator to get this and other PLT curriculum guides.
  - Measurements: PLT Activity #67 "How Big is Your Tree"
  - Forest products: PLT Activity #13 "We All Need Trees"
  - Habitats: PLT Activity #23 "The Fallen Log"
  - Seed dispersal: PLT Activity #43 "Have Seeds Will Travel"
  - Tree ID: PLT Activity #64 "Looking at Leaves"

Conclusion

Q & A

- ☐ Allow time for a question and answer session.
- ☐ Ask children what they learned and liked best about the walk.
- ☐ Ask the teacher to have the students write a thank you with their answer to what they liked best about the walk.

Extras

- ☐ Children love souvenirs! Give away SAF and AFF items like pencils or magnifying lenses, etc.
- ☐ Give educators or youth leaders an evaluation form to complete.
- ☐ Schedule a follow-up classroom session.

AFTER THE WALK

Suggestions for a Follow-Up Visit to the Class

Recall

- ☐ Ask questions and get feedback.
- ☐ Use the index cards to make sure the children can answer the questions they originally asked about forests.
- ☐ Have the kids draw pictures or collaborate on a class mural depicting what they learned on the walk.
- ☐ Conduct a post-walk test and compare to the pre-walk test to see if students' knowledge or attitudes about forests have changed.
- ☐ Help the children plant trees on school grounds.
- ☐ Show the SAF video, "Foresters: Growing Forests for Our Future."
- ☐ Leave worksheets or PLT activities with educators or youth leaders for their use.
- ☐ Encourage educators or youth leaders to contact SAF or their state PLT coordinator for teaching tools and other resources, and professional development opportunities.

Ps & Qs

- ☐ Have the children write thank you notes to the landowner whose property they toured, or SAF/AFF and other volunteers who helped organize the walk.

NOTE: If you cannot do a follow-up visit, have the educator or youth leader give the children a follow-up quiz. Research projects could be assigned by the educator or youth leader based on what the students learned from the walk.

HELPFUL TIPS FOR WORKING WITH KIDS

Think

- ☐ It is better to interpret and aid children in their exploration rather than just give information.
- ☐ If a child comes up with a wrong answer help guide them to the correct answer.
- ☐ Be aware of teachable moments. If children's attention strays to follow a woodpecker or other animal, incorporate it into the walk—why is the woodpecker hammering that tree? Why that tree?
- ☐ Use superlatives: that tree has the biggest cones, the most colorful flowers, or the most interesting trunk. Everyone reacts enthusiastically to superlatives.

Touch

- ☐ Satisfy the children's need to touch, smell, and taste (with a disclaimer of danger) whenever opportunities to use these senses present themselves. The smell of sassafras or juniper, the taste of maple syrup, or the fact that it took 12 of us to hug that tree all are ways for children to code their memories with positive associations to trees.

Do

- ☐ Many books are available to help teach about trees and forests. Try *Sharing Nature with Children, The Classic Parents' and Teachers' Nature Awareness Guidebook* by Joseph B. Cornell.
- ☐ Project Learning Tree offers plenty more helpful tips and reading connections in its activity guides.

Sample questions asked by 4th and 5th graders:

> How many acres are in the forest? How many trees? Have you counted the trees?

> What tree is the biggest in the forest? Can we plant a tree?

> Are there animal tracks in the forest? How does wildlife use trees?

> Are deer living in the forest? Can we feed the deer our lunch?

> I want to walk in the mud. Can we get dirty?

SAMPLE AGENDA FOR STUDENTS

Society of American Foresters and Project Learning Tree
WALK IN THE FOREST
Alabama Nature Center, Lanark
Tuesday, April 19, 2011

Station 1 – Mammals, Alabama Department of Conservation and Natural Resources
Station 2 – Reptiles, Alabama Wildlife Federation
Station 3 – Soils & Water, Natural Resource Conservation Service
Station 4 – Raptors, Southeastern Raptor Rehabilitation Center
Station 5 – Project Learning Tree—"How Big is Your Tree," Registered Forester
Station 6 – Freshwater Fishing, Alabama Wildlife Federation
Station 7 – Project Learning Tree—"Looking at Leaves," Carignan Forestry Consultants
Station 8 – Project Learning Tree—"Birds and Worms," Alabama Department of Ag and Industries

Agenda

Time	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H
9:00	PLEASE WAIT ON BUS FOR YOUR GUIDE. SNACK AT YOUR FIRST STATION.							
9:30	1	2	3	4	5	6	7	8
9:50				ROTATE				
9:55	2	3	4	5	6	7	8	1
10:15				ROTATE				
10:20	3	4	5	6	7	8	1	2
10:40				ROTATE				
10:45	4	5	6	7	8	1	2	3
11:05				ROTATE				
11:10	LUNCH AT YOUR FIFTH STATION. WE WILL PLACE YOUR COOLER THERE.							
12:00	5	6	7	8	1	2	3	4
12:20				ROTATE				
12:25	6	7	8	1	2	3	4	5
12:45				ROTATE				
12:50	7	8	1	2	3	4	5	6
1:10				ROTATE				
1:15	8	1	2	3	4	5	6	7
1:35			HAVE A SAFE TRIP HOME!					

Connecting Kids to Nature

Try this activity in a forest—a natural place to learn!

For over 35 years, Project Learning Tree® has used the forest as a "window" to help young people gain an awareness of the world around them and their place within it. Blending a walk in the forest with a fun and engaging PLT activity creates a powerful learning experience for children of all ages. Here's one idea in a series from PLT that introduces the concepts of **structure and scale.**

Activity 70: Soil Stories

In this activity, students explore differences in soil types and composition.

Doing the Activity

Who doesn't like getting their hands a little dirty? The next time a child in your care decides to dig a hole in the ground, turn it into an educational opportunity. Describe to children that you will conduct an experiment to analyze the soil sample they have just collected. As you dig and collect soil samples, ask:

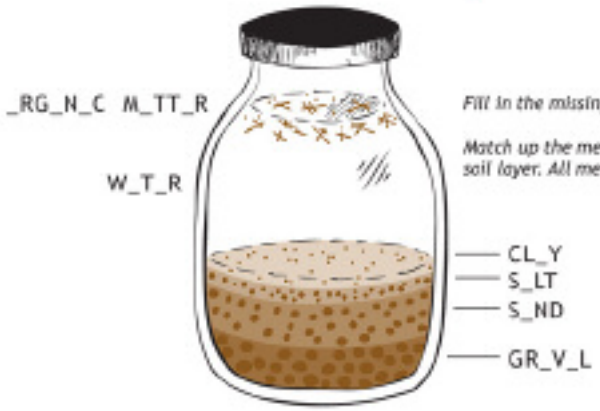
- What do trees and other plants get from soil? If so, why?
- Do different plants have different soil needs?
- Describe the soil: What color is it? How does it smell? How does it feel?

Have children make a "soil shake" by placing one half cup of soil into a jar with a lid and adding two cups of water. Ask them to predict what will happen if they shake the closed jar and let it settle for a few hours. Then, try it. Over time, soil layers will become visible. Gravel will fall first; then sand, silt, and clay; organic matter (leaves, twigs, stems) will remain floating in the water. Have children draw a picture of the layers formed by their soil shake, or collect and test soil samples from other areas (forest, field, yard) for comparison.

Safety! Get permission before taking soil samples. Use plastic jars, if possible.

Challenge students to complete the "Soil Composition" diagram, reminding them that the largest particles fall to the bottom first.

Soil Composition



Fill in the missing vowels to label the soil layers.

Match up the measurements with the appropriate soil layer. All measurements are in millimeters (mm).

a) 2.0 - 0.06 mm
b) greater than 2.0 mm
c) less than 0.002 mm
d) 0.06 - 0.002 mm

Adapted from Activity 70: Soil Stories from Project Learning Tree's *PreK-8 Environmental Education Activity Guide*.

Discover how PLT can help you teach... from nature!

- Attend a workshop near you to receive PLT activity guides, ideas, and materials.
- To contact your local PLT State Coordinator, visit www.plt.org or call 202-463-2475.

Answers: c) clay, d) silt, a) sand, b) gravel, water, organic matter

Project Learning Tree® (PLT) is a program of the American Forest Foundation.

Connecting Kids to Nature

Try this activity in a forest—a natural place to learn!

For over 30 years, Project Learning Tree® has used the forest as a "window" to help young people gain an awareness of the world around them and their place within it. Blending a walk in the forest with a fun and engaging PLT activity creates a powerful learning experience for children of all ages. Here's one idea from PLT that introduces the concept of **forest cycles.**

Activity 78: Signs of Fall

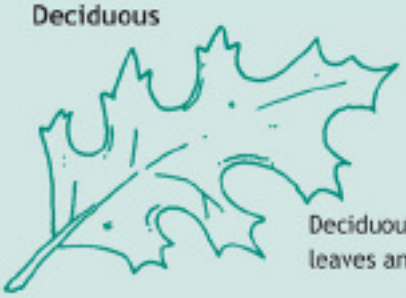
In this activity, children look for signs of autumn. They observe the annual change of seasons, and investigate why leaves of deciduous trees change color in the fall.

Doing the Activity

As autumn approaches, take children on a walk through a wooded area, schoolyard, local park, or neighborhood sidewalk to look for signs of fall. Point out the differences between *deciduous* and *evergreen* trees. Have children find at least five of each and collect sample leaves. Create leaf rubbings by covering a leaf with a piece of paper and rubbing a crayon over it. The leaf's margin and veins will appear. Use crayons to match the fall colors found in the leaves. Encourage critical thinking by asking:

- What signs of fall can you see in the trees and on the ground?
- How many different leaf colors can you find?
- What will happen to the leaves?

Deciduous



Deciduous trees lose their leaves annually. Example: Oak

Evergreen

Evergreen trees keep their leaves (needles) year-round. Example: Pine

Have children use the colorful fall leaves to create a picture. For ideas, see *Leaf Man* by Lois Ehlert, published by Harcourt Children's Books, 2005, ISBN: 0152053042.

Adapted from Activity 78: Signs of Fall from Project Learning Tree's *PreK-8 Environmental Education Activity Guide*.

WHY DO LEAVES CHANGE COLOR?

With fall's colder temperatures and shorter days, the cells of deciduous tree leaves begin to die. The dead cells block water and nutrients from the leaf. *Chlorophyll*, the green pigment in the leaves, breaks down and the yellow and red pigments begin to show through.

Native Americans had legends to explain the fall colors. Invite children to create their own imaginative stories.

Discover how PLT can help you teach... from nature!

- Attend, host, or sponsor a local PLT workshop where participants receive PLT activity guides, ideas, and materials.
- Contact your PLT State Coordinator. Visit www.plt.org or call 202-463-2475 for their contact information.

www.plt.org

PLT®

Project Learning Tree® (PLT) is a program of the American Forest Foundation.

Connecting Kids to Nature

Try this activity in a forest—a natural place to learn!

For over 30 years, Project Learning Tree® has used the forest as a "window" to help young people gain an awareness of the world around them and their place within it. Blending a walk in the forest with a fun and engaging PLT activity creates a powerful learning experience for children of all ages. Here's one idea from PLT that introduces the concept of **measurement.**

Activity 67: How Big Is Your Tree?

Trees come in various shapes and sizes. In this activity, children will measure trees in different ways and become familiar with tree scale and structure. They will also learn the importance of standard units of measure and measuring techniques.

Doing the Activity

Any time you are outside, select a tree for children to measure. Begin by asking youth how they might measure something without the proper tools. Then challenge children to measure small outdoor objects (leaves, branches, rocks) using their own body parts: a foot, hand, arm, or finger. Guide children to your selected tree and ask them to estimate the following:

- Height
- Circumference
- Diameter at Breast Height (DBH)
- Width of Canopy (or Crown Spread)

Depending on the age and ability of the children, you may want to provide a six inch ruler or five foot piece of string for assistance. You can request that calculations be estimated in body measurements (hand spans, arm lengths, etc.) or accepted units of measure (feet, meters, etc.) Ask: why might it be useful to measure trees?

On a sunny day, show students how to measure shadows and use a ratio comparison to determine tree height. The mathematical proportions are outlined in the box below. Invite children to practice using the illustrated example.

$$\frac{\text{Tree's Height}}{\text{Tree's Shadow}} = \frac{\text{Child's Height}}{\text{Child's Shadow}}$$

OR

$$\text{Tree's Height} = \frac{\text{Child's Height} \times \text{Tree's Shadow}}{\text{Child's Shadow}}$$

Adapted from Activity 67: How Big is Your Tree? from *Project Learning Tree's PreK-8 Environmental Education Activity Guide.*

Discover how PLT can help you teach... from nature!

- Attend a workshop near you to receive PLT activity guides, ideas, and materials.
- To contact your local PLT State Coordinator, visit www.plt.org or call 202-463-2475.

www.plt.org

PLT®

Project Learning Tree® (PLT) is a program of the American Forest Foundation.

Answer: x = 42 feet

Example #2
WALK IN THE FOREST FOR
TEACHERS

This outline supplements the Planning a Walk in the Forest guidelines on page 8. This example combines a Walk in the Forest with a Project Learning Tree educator workshop.

Benefits of a Walk in the Forest for Educators

> **Teach educators about forests, forestry, and foresters.**
> **Provide educators with positive outdoor, hands-on learning experiences about forests, natural resources, forestry, and foresters.**
> **Increase educators' awareness, appreciation of, and respect for nature, forests, and foresters.**
> **Explain to educators the many benefits of forests—biological, aesthetic, recreational, educational, environmental, and economic.**
> **Expose educators to many forest issues, e.g., forest management, fire prevention, forest health, forest products, forest ecology, and wildlife convservation.**
> **Encourage educators to share their knowledge and understanding with students in the classroom and out-of-doors.**
> **Encourage educators to take their students outside to learn about trees and forests.**

The Goals of a PLT Workshop

> **Encourage educators to approach learning and teaching from an ecological and multi-disciplinary perspective.**
> **Prepare educators to use PLT materials by modeling a sample of PLT activities and teaching strategies.**
> **Show educators how they can incorporate PLT into their current and future lesson plans and curriculum.**
> **Increase educators' confidence in teaching environmental education concepts and taking their students outdoors to learn.**
> **Enrich educators' knowledge of content included in PLT lessons.**
> **Create a setting in which educators can meet other professionals in their region interested in environmental education.**
> **Provide a fun and motivating forum that encourages educators to enjoy their own learning process.**

Project Learning Tree provides tens of thousands educators every year with environmental education curriculum materials and resources to help them incorporate teaching about the environment into their everyday lesson plans—and take their students outdoors to learn. More than 500,000 educators have been trained to use PLT curriculum, reaching more than 75 million students.

NOTE: A PLT workshop must be coordinated by a trained Project Learning Tree facilitator. Costs for PLT workshops and PLT curriculum materials vary from state to state. For help identifying PLT facilitators, or to become a PLT facilitator, contact your state PLT coordinator. Visit **www.plt.org** *for contact information.*

BEFORE THE WALK

Develop a Plan for a PLT Workshop in Conjunction with a PLT Facilitator

Who?

- ☐ Determine target audience (for example, preK through 12th grade educators in public or private schools, home school parents or tutors, camp staffs, Girl Scouts and Boy Scout leaders, state Parks and Recreation Department staffs, university professors of pre-service teachers, forestry or environmental science majors).

When?

- ☐ Contact the school's science coordinator several months in advance to select a teacher in-service day for the PLT workshop and another date for the walk, or one date for a combined workshop and field day. Similarly, contact your targeted nature center, university department, regional youth group or education center, etc.
- ☐ Submit a Project Learning Tree workshop proposal to your state's PLT coordinator as soon as the date is established with an estimated number of participants. Post the workshop on your state's and National PLT's website and promote in other ways, as appropriate.

$$

- ☐ Apply for grant money from National SAF or through local sponsorship to offset costs of the workshop and the PLT curriculum guides.
- ☐ Create a registration form, including payment information (if applicable), and confirmation letters for participants to be sent upon receipt of the registration form—include list of participants, directions, what to expect/wear, etc.
- ☐ Plan for giveaways for the teachers. Your state forestry department, a forest products company, or a local nursery might be willing to donate seedlings or seed packets with planting instructions or other giveaways. PLT and SAF also have promotional items.

Establish Objectives for the Walk

- ☐ What topics do you want to cover? What PLT activities will you use to address these topics?
- ☐ Determine if the PLT activities meet the objectives of a Walk in the Forest and the needs of the teachers (i.e. grade level, subject, etc.)
- ☐ What two or three major points do you want teachers to know or understand? (See pages 4-6 for some **Talking Point** ideas, and consider local, national, or international issues.)
- ☐ Connecting teachers with foresters (in local, state, and federal agencies, forest industry, or consulting firms), conservation organizations, and your state's PLT program will help develop valuable partnerships.

Plan the Itinerary

- ☐ Allow one hour to welcome all participants, conduct a PLT activity "ice-breaker," and give an introduction to PLT.
- ☐ Plan to divide participants into groups based on their school, or grade level they teach, or for rotating a large group through several stations.
- ☐ Layout the location of each station, decide which PLT activity will be conducted at each station, and assess material needs. Use a hands-on PLT activity at each station—you're in the woods, take advantage of it!
- ☐ Plan to gather all participants in one place at the end of the walk to distribute the PLT curriculum guide books, *Hike Through the Guide*, "Lesson Planning Worksheets," an evaluation form, and to wrap up.

Extras

Prepare Information Packet to Give to Walk Participants

Consider including these items:

- ☐ Walk schedule and map of walk area
- ☐ Briefing paper with key forestry terms, issues to be discussed, etc.
- ☐ Photographs (e.g., harvesting methods)
- ☐ State forest facts (available from state agencies or associations)
- ☐ Website resource list
- ☐ Information about trails in the area to take students to, or tips on how to start their own trail on their school campus. Provide information about PLT's *GreenWorks!* grants for funding to develop a trail, plant trees, improve a forest, or another environmental service-learning project.
- ☐ PLT workshop objectives
- ☐ SAF and PLT brochures and information
- ☐ Participant list
- ☐ Names/phone numbers of SAF/PLT contacts for further information
- ☐ Correlations to state and national academic standards for the PLT guides that will be distributed (available online at **www.plt.org**)
- ☐ Blank "Lesson Planning Worksheets" (found in the back of PLT's *PreK-8 Environmental Education Activity Guide*)

Finalize Plans

- ☐ Place an order through the PLT workshop facilitator for the appropriate number of PLT curriculum guides based on the number of registered participants.
- ☐ Send invitations to media to cover the event. Have a designated spokesperson.
- ☐ Gather PLT supplies and props for the facilitators of each station.
- ☐ Coordinate lunch details
- ☐ Send reminders to presenters on times, what is expected, final agenda, etc.
- ☐ Collect giveaways from donors.
- ☐ Prepare PLT certificates

Registration Information

- ☐ Organize a registration table and develop a sign-in sheet (including payment information if applicable)
- ☐ Make nametags. Consider using tree cookies (a cross-cut section of tree stem) for the tags.

"The visits into the woods and mills was a wonderful experience that gave a whole new perspective on forestry, and the dedication to stewardship by those working in and managing the forests."

Martha Borden, Maine middle school teacher

DAY OF WALK

Pre-Walk

- ☐ Welcome guests and ask them to check in at the registration table.
- ☐ Distribute nametags, group assignments, and walk information packet.

Proceed with Walk in Accordance with Schedule

Get Set, Go!

- ☐ Start on time.
- ☐ Gather all participants together in one place for the welcome, icebreaker, and introduction to PLT.
- ☐ Give brief information on safety (i.e., snakes, poison ivy, and heat), restrooms, lunch, and the site.
- ☐ Allow time for a brief question and answer session.
- ☐ Break out into different groups and send participants to their first station stop. Rotate stations to the sound of a horn.
- ☐ At each station, the presenters should introduce themselves, conduct the activity, involve the audience, i.e., ask open-ended questions about the topic rather than a question that could be answered with a yes or no.

Conclusion

- ☐ Bring the group back together for the conclusion. Distribute PLT curriculum guides, *Hike Through the Guide*, and "Lesson Planning Worksheets."
- ☐ Promote other PLT workshops including facilitator training, PLT *GreenWorks!* grants, and Teachers Conservation Institute if present in your state.
- ☐ Allow time for a final question and answer session.
- ☐ Encourage additional contact with SAF members and PLT facilitators.
- ☐ Distribute and collect both PLT's workshop evaluation form and a Walk in the Forest evaluation form.
- ☐ Thank guests for attending and make sure all guests have transportation.
- ☐ Have a giveaway table that participants can collect items as they leave and pick up their PLT certificates. Have volunteers staff the table.

AFTER THE WALK

Surveys

- ☐ Review surveys. Evaluate what worked and what didn't work.
- ☐ Return completed PLT workshop participant surveys, PLT facilitator survey including names of all PLT facilitators who volunteered, and all remaining PLT materials to your state PLT coordinator.

SAMPLE PROMOTIONAL FLYER FOR TEACHERS

PLT®

The Cornerstone for Environmental Education

Project Learning Tree's "Walk in the Forest"

Project Learning Tree is an award-winning environmental education program designed for teachers, non-formal educators, and other resource professionals working with youth from preschool through grade 12.

PLT uses the forest as a "window" on the world to increase students' understanding of our environment; stimulate students' critical and creative thinking; develop students' ability to make informed decisions on environmental issues; and instill in students the commitment to take responsible action on behalf of the environment.

You are invited to "Walk in the Forest" with Project Learning Tree and the Society of American Foresters!

On the walk, learn about trees, the forest ecosystem, and how professional foresters care for the forest. We will follow a trail through Tuskegee National Forest. Please dress for cold weather and wear hiking boots.

To sign up, please complete the attached application and mail it to the address indicated on the form, or email your information to wifinfo@gmail.com. To learn more about Project Learning Tree go to www.plt.org.

When: 10:00 a.m.–4:00 p.m. January 6, 2012

Where: Visitor parking at Tuskegee National Forest, Tuskegee, Ala.

Cost: Free

Questions: Joe Smith
555 Alabama Street
Tuskegee, AL 36104
(334) 555-1212
wifinfo@gmail.com

Project Learning Tree® Alabama

Example #3
WALK IN THE FOREST FOR
LOCAL LEADERS

This example supplements the Planning a Walk in the Forest guidelines on page 8. Use these guidelines to invite your elected officials and community leaders to see first-hand sustainable forest management, and discuss decisions that impact forests in your area.

Benefits of a Walk in the Forest for Local Leaders

- **> Educate your elected officials and local opinion leaders about forests and forest management.**
- **> Help policymakers understand the important role forests play in the community, providing clean air, clean water, and jobs.**
- **> Demonstrate the commitment in time and resources it takes to responsibly manage forests.**
- **> Educate community leaders and local officials about environmental issues and decisions impacting forests.**
- **> Become a resource for an elected official and their staff for information about forestry in your state or local area.**

NOTE: For assistance with this type of program consider contacting your state forestry association, or the governmental affairs directors at SAF and AFF.

BEFORE THE WALK

Determine Your Audience and Objectives

Where?

- ☐ Do you want to explain a local forestry-related issue? Teach elected officials about forestry or foresters in their district? Sway opinion on a particular bill or proposed piece of legislation? Address a real-life decision on a forestry or environmental issue in your community? Increase awareness of the forestry profession?
- ☐ Consider addressing a current "hot" issue.
- ☐ Attract attendance by inviting a well-known resident such as a landowner or executive of a forest products company to be a walk speaker.
- ☐ Look for an opportunity to combine your walk with a tour of a local mill.

Invite Elected Officials, Opinion Leaders

What?

- ☐ Contact up to six weeks in advance.
- ☐ Welcome participation from elected official's staff members as well.

Who?

- ☐ Send personal invitations with background information on forestry, what will be seen on the walk, and who the speakers are; request RSVP.
- ☐ Follow-up with a phone call, to confirm receipt of the invitation and answer any questions.
- ☐ Invite the elected official to deliver remarks at the event and work with the legislator's staff to provide talking points.
- ☐ A few days before the event, confirm attendance and agenda.

Invite Media

- ☐ Check with the legislators or other VIPs to determine if media presence is desired.
- ☐ Invite media to the event and be sure to let them know which legislators or other VIPs have confirmed they will attend, and who the speakers are.
- ☐ Consider inviting:
  - TV, radio, newspaper, and magazine reporters
  - environmental/forestry reporters, outdoor freelance reporters
  - nature/science reporters
  - business/economic reporters
  - feature/local news reporter
  - newsletter editors of local outdoor groups, community associations, etc.
  - bloggers
- ☐ Send a press release or media advisory one week before the event, and be sure to follow up with another email or phone call two days before the event.
- ☐ Prepare press kits. Include a press release, with approved quotes from a legislator or other VIP, and other background information such as forest fact sheets, and SAF and AFF briefings on forest issues.
- ☐ For assistance, contact the communications staff of your state forestry association, SAF or AFF.

DAY OF THE WALK

Hello!

Introduction

- ☐ Welcome guests as they arrive and distribute nametags.
- ☐ Introduce all speakers.
- ☐ Review the walk agenda and answer preliminary questions.
- ☐ Distribute materials such as SAF and AFF program brochures, SAF and AFF briefings on forest issues, forest fact sheets.

Proceed with Walk

- ☐ Allow time for questions, discussion, and photographs.

Conclusion

Q & A

- ☐ Allow time for a final question and answer session.
- ☐ Distribute and collect evaluation forms.
- ☐ Offer to be a resource for elected officials and their staff for information about forestry in your state or local area.

AFTER THE WALK

Thank you

Send Thank You to All Participants and Volunteers

- ☐ Offer SAF and AFF as a source of information.
- ☐ Provide any pertinent follow-up materials from the walk.

Extras

Monitor Press Coverage

- ☐ Send copies of articles, photos, or a description of radio and TV broadcasts, etc., to the SAF and AFF communications staff.

Example #4
WALK IN THE FOREST FOR

TREE FARMERS & FAMILY LANDOWNERS

This outline supplements the Planning a Walk in the Forest guidelines on page 8.
The American Forest Foundation has designated the third Saturday in May as National Walk in the Woods Day™ to encourage Tree Farmers and other private forest owners to treat family, friends, and neighbors to a walk in your woods. This national day acknowledges the dedication of Tree Farmers and other families and individuals who are stewards of America's woodlands.

Benefits of a Walk in the Forest for Landowners

By sharing your Tree Farm or woodland with others you can:

> Help spread the word about the importance of family forests to wildlife, clean water, recreation, and wood products.

> Share with others the joys and rewards of caring for your woodlands.

> Help other people who don't own woodlands understand why caring for America's family forests is so important.

> Show off your accomplishments and commitment to sustaining America's forest heritage!

Before the Walk

Choose a day

When?

☐ If you cannot commit to offering a tour of your property on National Walk in the Woods Day™, consider another date:
- Take advantage of colorful fall foliage
- Look at school schedules
- Coordinate a date to tie in with spring's Arbor Day or Earth Day
- Does your community have a 'special' day that is locally celebrated?

Whom do you want to invite?

Who?

☐ Maybe it's just your family, your children, or grandchildren? Perhaps friends that you have talked with for years about your woods?

☐ If you are interested in hosting a larger group, consider the following:
- A local school, Scout troop, or youth group looking for a field trip
- Your state legislature is discussing a bill that would affect your woods and your elected officials could benefit from seeing first-hand the good work you do to manage your forest.
- Your forester has asked you to share your property with other local landowners.
- Your church, other local groups you belong to, or business leaders in your community are interested in touring your property.

What do you want to share?

- ☐ A recent accomplishment, for example, bird boxes, a newly-thinned area, restored wetlands, or another management activity
- ☐ A unique feature on your property, for example, an historical site, grave yard, or a favorite rock outcropping
- ☐ Your favorite trail
- ☐ An overall appreciation for ecosystems and the dynamics of nature
- ☐ A "hot" issue or a discussion of policies that impact you

Develop a plan

Get Help

- ☐ Do not hesitate to contact the forester who helps you manage your property for assistance with your walk in the woods. Support can also come from American Tree Farm System members and volunteer foresters (**www.treefarmsystem.org/**in-your-state), Project Learning Tree trained facilitators or educators (**www.plt.org/**plt-in-your-state), local naturalists and forestry colleagues, an Extension forester, a local university or high school resource instructor.
- ☐ Decide what you want to show, and what you want your guests to learn at the site(s).
- ☐ Decide if the walk will be led by you, by another professional, or if it will be self-guided.
- ☐ Is there room at the central meeting point for vehicles to park, and to turn around? If it is a field, do you need to mow it to reduce fire hazard from the vehicles?
- ☐ Is the area you want to share accessible by foot? How will you get there? Have maps available that help your guests know where they are and where they are going.

Lunch

- ☐ Are bathroom facilities available?
- ☐ Consider hosting a picnic lunch, catered by your family, a local restaurant, or other co-hosting organization.
- ☐ Seek local sponsors, with whom you do forestry or other business, for support to offset the costs of the day.
- ☐ Contact local media for radio, newspaper, and/or television coverage.

Safety Considerations

- ☐ Make sure there are no low hanging tree limbs blocking the path of your walk. Use a pruning saw and shears to trim vegetation in strategic places so visitors, young or old, can make their way along the path.
- ☐ Walk your woods ahead of time. Make sure that the trail is in good shape and there is safe and sound footing for your guests. Think about what you can highlight on the walk.
- ☐ Make sure restricted areas are clearly marked.
- ☐ Offer an alternative path if the walk goes near a water's edge.
- ☐ Ensure young children are supervised at all times.
- ☐ Pay particular attention if your guests will be using motorized equipment, such as all-terrain vehicles or farm tractors. Will there be a situation in which guests need hard hats or safety goggles?
- ☐ Is anyone trained in CPR? Do you have water stations? These are important to ensure a safe and enjoyable walk.

Insurance

- ☐ Review your property's insurance policy and/or seek professional legal advice for specifics to your property.

☐ As a landowner, you will incur some risk when people are on your property. For more information, you can review "Timberland Liability: Are You at Risk?" in the Nov/Dec 2009 issue of *Tree Farmer* magazine.

DAY OF THE WALK

Hello!

☐ Welcome guests as they arrive.
☐ Review the walk agenda and answer preliminary questions.
☐ Allow time for questions, discussion, and photographs.

AFTER THE WALK

Evaluate

☐ Evaluate what worked and what didn't work.
☐ Would I like to do this again? Can I handle more people? Would fewer have been better?
☐ Did I have good answers to all the questions?

PROMOTION

SHARE YOUR PLANS WITH SAF AND AFF!

Let us know what you plan to do by answering these project questions. This information will help us keep track of projects around the country, and enable us to help publicize your walk.

RETURN TO:

Society of American Foresters
5400 Grosvenor Lane
Bethesda, MD 20814
Fax: 301-897-3690
safweb@safnet.org

Vanessa Bullwinkle
Director of Communications
American Forest Foundation
1111 19th Street NW, Suite 780
Washington, DC 20036
Phone: 202-463-2472
Fax: 202-463-2461
vbullwinkle@forestfoundation.org

Organizing unit and partners:

Contact name(s), email, and telephone number(s):

What type of walk are you planning?

Who is your walk audience?

Date of your walk:

Additional materials or assistance requested:

Other comments:

Attach copies of plan outlines and any promotion/advertising materials created to date.

SAMPLE PRESS RELEASE

FOR IMMEDIATE RELEASE
[Date]

Contact:
[Name, email address, and cell phone number]

Local Foresters Take Fourth Graders on a "Walk in the Forest"
Hands-on activities teach students the many benefits forests provide for people

[CITY, STATE]—The White Mountain Chapter of the Allegheny Society of American Foresters in partnership with Pennsylvania Project Learning Tree will take fourth graders and teachers from Newtown Elementary School on a Walk in the Forest on Friday, October 21 from 9 am-noon at Will and Edna Hamilton's Tree Farm. Foresters will lead the children on a Walk in the Forest and teach them about forests and trees and how foresters work to keep the forests healthy and thriving. Teachers will receive an introduction to the award-winning Project Learning Tree curriculum while the children participate in several hands-on PLT activities.

The Walk in the Forest program is part of a national campaign coordinated by the Society of American Foresters (SAF) and the American Forest Foundation (AFF). Foresters, environmental educators, and Tree Farmers across the country are inviting school children, teachers, lawmakers, and community members to get outdoors and enjoy the woods on October 21. These walks are designed to be both fun and educational to help people develop an appreciation for nature and an understanding of why caring for America's forests is so important.

"Children and teachers will learn about forests and their importance to people, our health, the environment, and the economy," said [name, organization/affiliation]. "The walk will get children outside and active, having fun and learning about nature."

About the Society of American Foresters
The Society of American Foresters is the scientific and educational association representing nearly 17,000 professional foresters and natural resource professionals in the United States. The society's primary objective is to advance the science, technology, education, and practice of professional forestry for the benefit of all society. The White Mountain chapter has about 120 members. The majority of members are employed by the Pennsylvania Department of Environmenta1 Resources, Bureau of Forestry; others work for the foresty industry or are professors or researchers at Pennsylvania State University. www.safnet.org

About the American Forest Foundation
The American Forest Foundation (AFF) works on the ground with families, teachers, and elected officials to promote stewardship and protect our nation's forest heritage. A commitment to the next generation unites our nationwide network of forest owners and teachers working to keep our forests healthy and our children well-prepared for the future they will inherit. For more information, visit www.forestfoundation.org.

Note to editors: You are invited to cover this event and can expect good photo opportunities and comments from the children.

SAMPLE LETTER TO THE EDITOR

Revise the example below, or develop your own. Visit the media outlet's website and follow instructions for submitting a letter to the editor. Typically letters to the editor should not be more than 150 words.

October 22, 2011

Sue Jones (get name if possible)
Editor, *Daily News*
220 Jones Bridge Road
Simpson, PA 17806

Dear Ms. Jones:

American children ages 3-12 are spending 27 percent of their time with electronic media, and only 1 percent outdoors—sad but true. If we wish for today's youth to become tomorrow's stewards, we must engage them with the outside world.

As a member of the White Mountain Chapter of the Society of American Foresters, in partnership with Pennsylvania Project Learning Tree, I had the pleasure yesterday of taking fourth grade students and teachers from Newtown Elementary School to Will and Edna Hamilton's Tree Farm for a Walk in the Forest. It was a joy to see the children get excited when they saw a woodpecker pecking a tree, or when they explored under a log.

On the walk, children learned about forests and their importance to people and the environment, while their teachers learned some new ways of incorporating nature into the classroom. Some of these students and teachers had never been in the woods before, so this was not only a wonderful learning opportunity, but also a personally enriching experience for the children.

The Walk in the Forest program is coordinated naionally by the Society of American Foresters and the American Forest Foundation (AFF).

Sincerely,
Susan Green
Chair, White Mountain SAF Chapter

IDEAS FOR USING WALK IN THE FOREST LOGOS

The Walk in the Forest digital logo can be used in many ways. Use the suggestions outlined below or let your imagination run wild and promote the Walk in the Forest program.

For SAF logo contact:
Louise Murgia
Society of American Foresters
Director of Field Services
Phone: 202-463-2472

For AFF, PLT, or Tree Farm logos contact:
John Otte
American Forest Foundation
jotte@forestfoundation.org
Phone: 202-463-2428

- ☑ Use the logo on letters, invitations, brochures, and flyers.
- ☑ Use the logo on small, inexpensive items to give away to children who participate in your walk. Examples: stickers, rulers, erasers, folders, etc.
- ☑ Print t-shirts or hats with the logo for walk volunteers to wear to identify themselves. For T-shirts, place partner organizations' logos, including the SAF, PLT, and Tree Farm logos as appropriate, on the back.
- ☑ Make a large walk banner to hang at your walk site, and include organizational logos as appropriate.

WALK IN THE FOREST EVALUATION

Thank you for joining us on our Walk in the Forest today. We hope you enjoyed the experience. To help us evaluate the success of our walk, please answer the following questions. A walk leader will collect this before you leave.

1. Were the goals of the Walk in the Forest clear to you?

2. Did the Walk in the Forest meet the stated goals?

3. Did the topics help meet the stated goals? Any topics omitted?

Topics	Not Appropriate				Appropriate
A. _____	1	2	3	4	5
B. _____	1	2	3	4	5
C. _____	1	2	3	4	5
D. _____	1	2	3	4	5

4. Did the speakers cover their topics in an interesting and informative way?

Speakers	Needs Improvement				Excellent
A. _____	1	2	3	4	5
B. _____	1	2	3	4	5
C. _____	1	2	3	4	5
D. _____	1	2	3	4	5

5. Was the venue appropriate for meeting the goals?

6. How have your impressions of forests and foresters changed?

7. Please note any questions that were left unanswered.

8. Please share any recommendations for ways to improve the walk.

9. AFF and SAF communicates electronically through several newsletters and other publications. Provide us with your name, address, and email address and tell us your interests, and we'll make sure to keep you informed on our latest news, information and resources, and action alerts.

Thank you!

RESOURCES

Web Sites

Connecting Kids to Nature activities **www.forestfoundation.org/family-activities**
Project Learning Tree Coordinators **www.plt.org**
Tree Farm Committees **www.treefarmsystem.org**
Society of American Foresters State Societies and Chapters **www.safnet.org**

Books

For Adults:
Last Child in the Woods by Richard Louv
Sharing Nature with Children, The Classic Parents' and Teachers' Nature Awareness Guidebook by Joseph B. Cornell

For Children:
Dawn Publications
The Giving Tree by Shel Silverstein
The Man Who Planted Trees by Jean Giono

Insurance

Society of American Foresters
Finance and Administration Department
Phone: 301-897-8720, ext. 103

American Forest Foundation
American Tree Farm System Program Coordinator
Phone: 202-463-2733

Promotion

Society of American Foresters
5400 Grosvenor Lane
Bethesda, MD 20814
Phone: 866-897-8720 • Fax: 301-897-3690
safweb@safnet.org

American Forest Foundation
1111 19th Street NW, Suite 780
Washington, DC 20036
Vanessa Bullwinkle
Director of Communications
Phone: 202-463-2472 • Fax: 202-463-2461
vbullwinkle@forestfoundation.org

Logos

For AFF, PLT, or Tree Farm logos:
John Otte
American Forest Foundation
Phone: 202-463-2428
jotte@forestfoundation.org

For SAF logos:
Louise Murgia
Society of American Foresters
Phone: 866-897-8720, ext. 118
murgial@safnet.org

A Tradition of Stewardship
A Commitment to Service

2010

Napa County Voluntary Oak Woodland Management Plan

October 26, 2010

This page intentionally left blank

Napa County Voluntary Oak Woodland Management Plan

October 26, 2010

Table of Contents

I. Introduction 6
- A. PURPOSE 6
- B. PREPARATION OF THE PLAN 7
- C. FOCUS ON VOLUNTARY ACTIONS 7

II. Value of Oak Woodlands 8
- A. CULTURAL/HISTORICAL 8
- B. FLOOD PROTECTION 8
- C. EROSION CONTROL 9
- D. WATER QUANTITY & QUALITY PROTECTION 9
- E. AIR QUALITY/CARBON SEQUESTRATION 10
- F. PLANT & WILDLIFE HABITAT 10
- G. SCENIC & PUBLIC RECREATION 10
- H. ENHANCED PROPERTY VALUE 11
- I. VITICULTURAL/AGRICULTURAL 11
- J. OTHER VALUES 11

III. Oak Woodland Communities in Napa County 12
- A. HISTORICAL EXTENT OF OAK WOODLANDS 12
- B. CURRENT STATUS OF OAK WOODLAND COMMUNITIES 13
  - 1. Oak Woodland Communities 14
  - 2. Protected Oak Woodlands in Napa County 15

IV. Current Oak Woodland Policies & Regulations 16
- A. COUNTY POLICIES & REGULATIONS 16
  - 1. Napa County General Plan 16
  - 2. Napa County Code 19
    - A. Conservation Regulations 19
    - B. Floodplain Management Regulations 20
    - C. Viewshed Protection 20

B. OTHER LOCAL POLICIES……..... 21
1. Watershed Information Center & Conservancy (WICC) Strategic Plan……... 21
2. Napa County Regional Park & Open Space District (RPOSD)Master Plan…….....22

C. STATE POLICIES & REGULATIONS…….. 23
1. California Endangered Species Act……..……. 23
2. California Environmental Quality Act (CEQA)…….…... 23
3. California Oak Woodland Conservation Act (2001) and Oak Woodlands Conservation Act (SB 1334-2004)……..… 24
4. Natural Heritage Preservation Tax Credit Act (AB 94-2009)…….....25
5. Z'Berg Nejedly Forest Practice Act (1973)……..…26
6. California Fish & Game Code…….….. 26
7. Greenhouse Gas (GHG) Emission Reduction (AB32 & SB375) …….. 27

D. FEDERAL POLICIES & REGULATIONS…….. 28
1. Endangered Species Act…….…….... 28
2. Clean Water Act…… 28
3. Other Federal Policies/Regulations……...…… 29

V. Threats to Oak Woodlands……...…….. 30
A. LACK OF REGENERATION……30
1. Low Acorn Production……...……... 31
2. Poor Seedbed Conditions…….…… 31
3. Herbivory on Seedlings/Sapling……..……... 31
4. Water Stress and Groundwater…….…… 32
B. FIRE FREQUENCY AND SEVERITY……..……..33
C. LAND USE/HABITAT CONVERSION…… 34
1. Rural Residential & Urban Development……..…… 34
2. Agricultural Conversion……..……... 34
3. Infrastructure Development…….……... 35
D. DISEASES: SUDDEN OAK DEATH & OTHERS……...35
E. CLIMATE CHANGE AND ECOTONE/SPECIES MIGRATION……..……... 36
F. WOODCUTTING FOR FIREWOOD PRODUCTION…… 36

VI. Establishing Priorities for Oak Woodland Conservation & Restoration..... 37
A. Current Efforts Underway..... 37
B. Priority Conservation & Restoration Criteria..... 39

VII. Voluntary Mechanisms for Encouraging Long-term Oak Woodland Conservation..... 40
A. Outreach & Education 40
B. California Oak Woodland Conservation Program 40
C. Oak Woodland Conservation Easements..... 41
D. Cost-Sharing & Financial Agreements..... 42
E. New Grant Funding Opportunities..... 42
F. Williamson Act..... 43
G. Opportunities for Collaboration..... 43

VIII. Oak Woodland Protection through Sustainable Best Management Practices (BMPs) and CEQA Mitigation..... 44
A. Sustainable Best Management Practices..... 45
B. CEQA Mitigation Measures..... 46

IX. Recommendations for the Future..... 47
A. Education & Outreach..... 47
B. Mitigation bank..... 48
C. Pilot Restoration Projects..... 48
D. Research & Monitoring..... 48
E. Removing Obstacles to Restoration..... 48
F. Nursery Propagation Program 48

List of Sources..... 50

Endnotes..... 51

Appendices..... 52

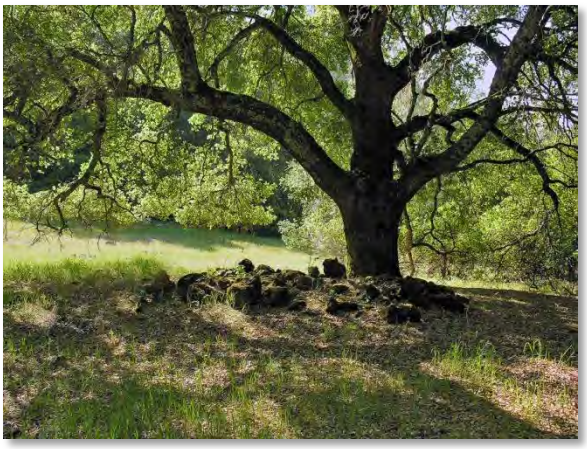
Napa County Voluntary Oak Woodland Management Plan

October 26, 2010

I. Introduction

Napa County has the greatest density of oaks of any county in California, with thirty-three percent of the county covered by oak woodlands[1]. These oak woodlands are one of the defining features of Napa County's scenery, and provide numerous recreational and ecological benefits. In addition to more common species of oak, Napa County contains many of California's remaining vanishing valley oaks, which make up only one percent of the state's oak population, but almost six percent of Napa County's oaks[2].

Despite Napa County's slow growth conservation efforts, oak woodlands remain at risk from development and natural hazards. To address these and other risks, public agencies, non-profit organizations, and property owners can all work together to protect our natural resources. This voluntary management plan will help to coordinate conservation efforts to preserve and restore Napa County's oak woodland resources.



A. Purpose

The purpose of this Voluntary Oak Woodlands Management Plan is to provide a conservation framework for the preservation of our oak woodland resources. This Plan provides a summary of the location, condition and value of Napa County's oak woodlands; identifies potential threats; outlines conservation strategies; supports landowners/ agencies/ non-profits eligibility for grants under the California Oak Woodlands Conservation Program; and improves communication and collaboration among those interested in the long-term health and viability of Napa County's oak woodlands.

This Oak Woodlands Management Plan will help to achieve the following:

1. Protect existing oak woodlands by creating a voluntary protection and conservation program, including landowner incentives, for conservation and enhancement of oak woodland;

2. Direct conservation and enhancement funding toward areas that have the highest oak woodland resource values;

3. Direct mitigation for oak woodland impacts to areas that have the highest oak woodland resource values and are in need of protection and/ or enhancement;

4. Encourage the long-term stewardship and vitality of existing oak woodlands to maintain or improve oak woodland resource values;

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

6. Increase the area covered by oak species that are now uncommon in Napa County because they have been cleared from much of their historical range in the county;

7. Encourage land use, transportation, and infrastructure planning that is consistent with oak woodlands conservation efforts; and

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

This Oak Woodlands Management Plan has been designed to be consistent with the Napa County General Plan, the Napa County Regional Parks and Open Space Master Plan, and other applicable local and state conservation plans. The adoption of this Plan by a resolution of the County Board of Supervisors will also enable the County to obtain funding support through the California Oak Woodlands Conservation Act of 2001. The Act provides funding for projects designed to conserve and restore oak woodlands, public education/ outreach, and for landowner assistance.

B. Preparation of the Plan

While California state law does not require that cities and counties adopt oak woodland management plans, the development and adoption of a plan will help to protect this important resource and enable private landowners, public agencies, and non-profit organizations to seek grant funding under the California Oak Woodlands Conservation Act (see Appendix A). This Voluntary Oak Woodland Management Plan was prepared with input from a wide range of community stakeholder groups and representatives concerned about the conservation of oak woodlands in Napa County, which included the Napa Valley Vintners, Sierra Club, Napa County Farm Bureau, Napa Valley Grape Growers, Napa County Resource Conservation District, Natural Resources Conservation Service, and others.

C. Focus on Voluntary Actions

The focus of this Plan is on achieving oak woodlands conservation through voluntary, collaborative action by private and public landowners, public agencies, non-profit and other community organizations, and community volunteers. This Plan establishes the foundation upon which agencies, conservation groups and non-profits will take the lead in working with willing landowners, seeking grants, preparing and holding conservation easements, and designing and implementing stewardship plans to

preserve and restore Napa County's oak woodlands. It is anticipated that Napa County, local cities and towns, Napa County Regional Park and Open Space District, the Land Trust of Napa County, Napa County Resource Conservation District, U.S. Natural Resources Conservation Service, and other non-profit conservation organizations will use this Plan as a basis for cooperation.

II. The Value of Oak Woodlands

Oak woodlands provide residents and visitors of Napa County with scenic opportunities and important reminders of our unique local history and ecology. They also provide important wildlife habitat, help improve air and water quality, slow runoff, prevent erosion, mitigate flooding, provide recreational opportunities and benefit vineyard owners through pest management. This section provides a brief overview of these and other resource values provided by oak woodlands

A. Cultural/Historical

Artifacts of the Native American people who historically lived in Napa County tend to be co-located with oak woodlands, which provided them with the acorns they relied upon for food. According to local historian Lin Weber, shamans of the Wappo people would offer prayers for the health of the oak trees, and the Wappo named months of the year after the seasonal phases of oaks.[3] Present day oak stands or individual trees may have historical significance due to past events or structures that were associated with them. Many historical accounts mention the trees and the use of specific trees as landmarks or as boundary markers. The earliest European settlers found refuge from the hot valley sun for themselves and their livestock under oaks and benefited economically from the use of oaks for building material and firewood. Oak woodlands also created venues for recreation and public events. Napa County's remaining oak woodlands continue to serve as a reminder of our cultural and historical heritage.

B. Flood Protection

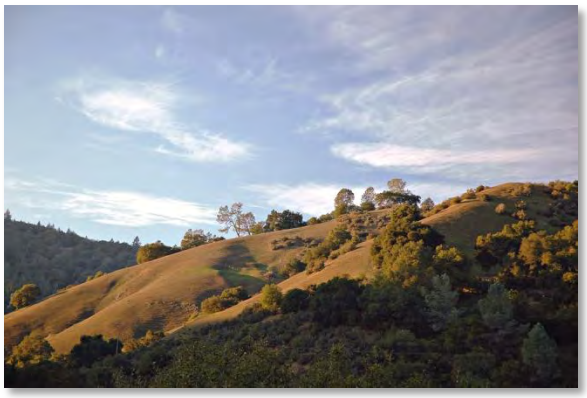
The Napa River is historically prone to flooding, causing damage to homes and vineyards within its floodplains. Oak woodlands play a part in minimizing the strength and effect of the river's floodwaters. Oaks slow the eroding energy of rainfall with their canopies by temporarily hold rainwater on their leaf and stem surfaces during a rainstorm, increasing the amount of time rain takes to reach the ground and contribute to runoff. Oak woodland canopies capture 20-30% more rainfall than do grasslands, and their contribution to organic matter in the soil improves its water holding capacity.[4] As a result, they have a high capacity for detaining peak flows from rainfall events that

would otherwise run in larger volumes and at higher velocities into streams, contributing to flooding, erosion, and sediment and nutrient concentrations that can harm water quality. The greatest flood protection/ attenuation benefits related to tree canopy cover are in watersheds that quickly concentrate flows and pose a risk of flash flooding and in areas where runoff conveyance is already near capacity. Oak trees also capture and transpire moisture from the soil during the growing season. Compared to annual vegetation, oaks can extract water from the soil profile to a greater depth. Consequently, soils under oak woodland canopy are able to absorb and hold greater amounts of rainfall than equivalent soils with only annual grassland cover. This extra storage capacity further reduces the potential for flooding during the rainy season and promotes groundwater recharge.

C. Erosion Control

Oaks help control soil erosion in several ways. Oak woodland canopy intercepts raindrops and dissipates rainfall energy, reducing potential surface erosion. Oak leaf-fall and twigs that accumulate on the soil surface under oak woodland canopy also provide further protection against the erosive action of rainfall. In addition, tree roots and their associated symbiotic soil fungi promote the formation and stability of fine and course soil aggregates which help to promote soil cohesion and stability, reducing the risk of landslides and gully/ rill erosion. Oak woodlands located on soils and slopes prone to erosion can also help prevent degradation in water quality and uphold soil/ land productivity. The planting of oaks in areas historically known to support oak woodland that currently exhibit accelerated erosion from lack of tree cover can help to stabilize and prevent further erosion in these areas.

D. Water Quality Protection



Oak woodlands, whether located on the hillsides or on level lands near streams, play an important role in protecting water quality. By minimizing soil erosion as noted above, oak woodlands can help reduce sediment transport and washing of fine sediments into local waterways. High levels of sediment in waterways can negatively impact the aquatic food supply by reducing habitat available for fish, aquatic invertebrates and other organisms important to the diets of fish and birds. The Napa River is currently listed as impaired for sediment and a Sediment Total Maximum Daily Load (TMDL) is in the process of being adopted by the State.

The contribution of oaks and other vegetation to erosion prevention near waterways is especially important if soils contain excessive nutrients, pathogens or high levels of toxic material (natural or human concentrated), such as chemical contaminants, mercury or other heavy metals. Putah Creek, for example, has elevated levels of mercury in the soils of the bed and banks of its tributaries and is the focus of State regulatory efforts (TMDL)

to reduce mercury levels. Oaks and other vegetation also help reduce soil contamination by absorbing heavy metals, fertilizer nutrients, and pesticides from the soil and intercepting sediments containing these pollutants, thereby preventing these materials from reaching surface waters. Oaks and associated permanent vegetation along waterways can also reduce potential waterway contamination from airborne pesticide or herbicide drift, since oak foliage can intercept airborne pesticides/ herbicides.

E. Air Quality Protection and Carbon Sequestration

Oaks and other plants directly reduce ozone pollution by absorbing and destroying ozone within their leaves. The leaves also intercept airborne particulates, helping to lower ground level concentration of these pollutants. Oaks, as well as other trees, also sequester carbon in their mass as they grow. Large, long-lived trees such as oaks convert large quantities of carbon dioxide to various organic compounds that make up wood. Oak woodlands therefore provide a means for helping to offset the increase in atmospheric carbon dioxide levels related to the use of fossil fuels. Soils can also sequester carbon, and soils with high organic content such as those found under oak canopies can hold larger amounts of carbon, thereby reducing the amount of greenhouse gasses that contribute to global warming.[5] Oak canopies also mitigate the effects of global warming by reducing ground surface temperatures. In urban/ developed areas oak trees provide protective shading for houses and people, lowering the need for air conditioning and aiding in the maintenance of air quality. Shading provided by trees can also reduce the amount of volatile organic compounds (VOCs) released from vehicles[6]. Because VOCs are precursors to photochemical smog, lower VOC levels result in lower levels of ground-level ozone.

F. Plant and Wildlife Habitat

Oak woodlands are the most diverse terrestrial ecosystems in California, supporting at least 300 vertebrate species (including at least 120 mammal, 147 bird, 60 reptile and amphibian species), 1,100 plant species, 370 fungal species, and 5,000 arthropods species (insects and mites).[7] In Napa County, oak woodlands provide habitats for a wide range of flora and fauna, many of which are threatened or endangered at the state and federal level. Each type of oak woodland found provides unique habitat structure for the plants, invertebrates, fish, and wildlife that inhabit them. Some oak woodland types provide a greater diversity of ecological benefits than others, depending on the complexity of the vegetation structure, oak density (trees per acre), level of canopy cover, distribution of tree sizes and ages, and other factors. The habitat value of any oak woodland type may also vary according to its health, location in the landscape, extent, and current management strategies.

G. Scenic and Public Recreation

Oak woodlands are enjoyed by Napa County residents and visitors alike, simply for their beauty, whether driving or cycling along the roadways or through hiking, birdwatching, equestrian, or other recreational opportunities. Many recreational trails in Napa County are located in or pass through oak woodlands. Recreational activities contribute significantly to the quality of life a well as providing local economic benefits

generated by visitors enjoying this important and unique resource. Tourism remains one of Napa County's primary industries. The scenic beauty of the area, known for its lush vineyards against a backdrop of grassy, oak-covered hills, complements and adds to the draw of Napa County as a world renowned destination.

H. Enhanced Property Values

The retention of oak woodlands within a community can contribute to a community's overall economic well being. Woodlands contribute to increased property values and a subsequent increase in property tax revenues. One study in Southern California showed that a 10% decrease in the distance to an open space preserve increased the value of 4,800 surrounding lots by over $20 million dollars, significantly increasing tax revenue to the county. In addition, lots containing native oaks have been found to be valued at a 27% premium over properties having no trees. Individual trees of large size or landmark status within a community were found to increase property values by an additional $18,000 to $50,000 each (Standiford 1999). Studies comparing tree populations and property values also indicate that retaining approximately 40 trees per acre generally provides optimal lot coverage and yields the highest market value premium, roughly 22% to 27%, over bare land (Standiford 1999).[8]

I. Viticultural/Agricultural

Sustainable vineyard practices incorporate biodiversity throughout the vineyard to help minimize insect pests and disease. Oak woodlands are the most diverse ecosystems in California, and when they are in proximity to vineyards they provide habitat for predatory species that help manage the populations of vineyard pests such as deer, rabbits, gophers, and starlings. Cutting down oak trees on the edge of vineyards can increase the chances of Armillaria root rot infecting the vineyards, and may recruit recolonizing species that host Peirce Disease. Sustainable vineyard practices are also being promoted by the Napa Sustainable Winegrowing Group (NSWG), Napa County Farm Bureau, Napa Valley Grapegrowers, the Napa Valley Vintners/ Napa Green Certified Land Program (third party certified voluntary program) and others that seek to restore, protect and enhance the watershed, as well as through various river and stream restoration efforts (e.g. - Napa River Rutherford Reach Restoration Project).

J. Other Values

- provide fodder for grazing livestock;
- provide fuel/ firewood;
- provide wood products
- spiritual/ emotional
- *and others…..*

III. Oak Woodland Communities of Napa County

A. Historic Extent of Oak Woodland Communities

An often overlooked impact to native California habitats is the loss of the state's once expansive valley oak savannas. Among the most iconic and common California landscapes 150 years ago, the open valley floor of Napa County historically contained extensive communities of Valley oak woodland (see map-Appendix B-1). Canopy cover is thought to have been open to locally dense with valley oak the dominant tree. Blue oak, California black oak, and coast live oak were probably minor constituents of this community. The understory was similar to that of native grassland communities, with a mosaic of seasonal wetland interspersed.

Lawrence & Houseworth, 1860/1870. 1796. Mt. St. Helena from Mount Lincoln. Photo courtesy of the Society of California Pioneers: LH1796, album 3 in box B001771

The Wappo Native Americans were the sole inhabitants of the Napa Valley until the late 1700's. Their cultural practices included hunting and the selective gathering of plants, including acorns from several oak species, which were made into flour and comprised an important part of their diet. Spanish colonization began in 1769, when the first expedition to the Bay area arrived, which initiated the decline of the indigenous cultures and began to alter the land use practices. Sheep and cattle ranching began in the early-mid 1800's and intensified following the land grants of this time. As development increased along the valley floors in the mid to late 1800s, Napa County's oaks, particularly valley oaks, decreased in number. A range of more intensive land uses were introduced from 1848-70 including agriculture, with cattle grazing eventually giving way to grain production, followed closely by vineyards.

Turrill & Miller, 1906. Noon Time - Five Tons of Prunes
Photo courtesy of the Society of California Pioneers: C027508

Napa County was created in 1850, as one of the original 27 counties of California. One of the first known hillside vineyards would be planted just south of Calistoga in 1852 by Jacob Schram and vineyard development would continue to grow throughout the 1860-70s. Viticulture would replace grain as the predominant crop by the 1880's and by 1890 there were approximately 18,000 acres in vines.[9] But it would be decimated by disease (phylloxera) in the 1890's leading to a substantial conversion to orchards and by 1900 there were only 2,000 acres remaining.[10]

However, by 1910 the acreage of bearing vines was recovering, with approximately 13,000 acres[11] in vineyards. But orchards remained important, with grapes and prunes the dominant crops along with smaller amounts of pears and walnuts. Prohibition would significantly impact the wine industry from 1919-1933 after which it would begin a gradual recovery until the 1960s, when more rapid expansion would begin again. From the 1970s to the present day, hillside oaks would come under increasing pressure from vineyard conversions as the county's rocky, steep slopes were discovered to produce excellent grapes and wine.

The historical land use and extent of oak woodlands in the Napa Valley from the 1800's to the present day has been studied by the San Francisco Estuary Institute (SFEI) and their work has contributed to our current understanding of the changes that have occurred in our oak communities over time. This historical context plays an important part in developing future restoration and conservation priority areas for valley and riparian oak woodlands. SFEI's research will be published by University of California Press in the upcoming "Napa Valley Historical Ecology Atlas".

Note: A map of the estimated Historical Extent of Oak Woodlands and other natural features for valley floor portions of the Napa Valley of the 19th century is provided in Appendix B-1. Additional mapping of the hillsides is currently under development by the San Francisco Estuary Institute (SFEI) and other areas of Napa County have not been mapped at this time.

The Valley's Great Oaks….

Before 19th-century impacts of orchard agriculture, valley oaks formed a relatively dispersed, open pattern of light and shade that dominated many California valleys, from Ojai to Napa. These oaks provided critical food and habitat for native wildlife, shade and beauty for local people and their livestock, and healthy creeks through nutrient and water retention. Scattered, stately valley oak trees were fundamental to the character of the Napa Valley, and were one of the most celebrated characteristics of the area in early accounts:

"The magnificent oaks are one great secret of Napa's beauty. Their rustling leaves and finely formed tops are the glory of the landscape scenery..." (Smith and Elliott -1878)

The landscape photograph on the opposite page, taken between 1900 and 1910, depicts the dispersed, open pattern of a typical valley oak savanna. The trees dominated the valley landscape and yet, almost paradoxically, they took up relatively little space. The valley was "studded with gigantic oaks……..though not so close together as to render it necessary to cut away to prepare the land for cultivation" (Bartlett -1854).

"A great variety of oaks stood, now severally, now in a becoming grove, among the fields and vineyards" (Stevenson -1883)

B. Current Status of Oak Woodland Communities

There is a great diversity of oaks in California and within Napa County, exhibiting a widespread distribution and a persistence throughout geological time. Some grow as tall and stately trees with large undivided trunks, while others are ground hugging shrubs that are densely branched. Oaks are flowering plants belonging to the genus *Quercus,* which is the Latin name for oak. It is derived from two Celtic words, *quer*, meaning fine and *cuez,* meaning tree. Oak trees also have a unique combination of features which include distinctive wind pollinated flowers, a fruit we all know as the acorn, a strong complex wood, and the ability to live for many decades, and even centuries.[12]

Depending upon various environmental factors, oaks contribute to three *structural* types of natural vegetation: forest, woodland, and savannah. In forests their leaf canopy overlaps to produce a deep and constant shade, usually associated with streams and rivers (riparian) or moist upland slopes (montane). Oak trees also form woodlands which are more open and where sunlight is more penetrating because leaf canopies touch but seldom overlap. Savannahs are the most open and spacious with oak trees far apart and scattered over the grassland, and they are usually the driest and warmest environments[13].

To gain a better understanding of the distribution of oaks you must also look at their natural environment. How an oak grows and reproduces is affected by physical factors such as climate, soil, fire, light and also by biological factors such as the animals and other plants that occur in the same landscape. When considered together oaks and other associated species form an oak community, which reflects the various interactions between the species including competition, herbivory and predation[14].

An overview of the oak woodland communities of Napa County is provided in the following section, along with additional details which can be found in Appendix B.

1. Oak Woodland Communities

Oak woodland communities are categorized by the dominant tree species and the degree of foliage cover, with woodland defined as having a canopy coverage of 10%[15] or greater and trees spaced far enough apart to allow for a variety of shrubs, herbaceous plants, and grasses in the understory[16]. Mixed and coast live oak communities tend to dominate in the southwest of the county, while blue, leather and interior live oak dominate the communities on the hotter, drier eastern areas. California black oak woodlands are found at higher elevations, especially in the Atlas Peak region. Valley oak and associated communities are common within the flat alluvium of the Napa River and its tributaries. Oak riparian woodland resides adjacent to the County's streams and waterways, protected from present day development through local stream buffer regulations and state and federal fish and water quality protection programs.

Due to Napa County's slow growth and agricultural preservation policies, nearly 90% of the county remains as open space, including grazing lands, agricultural crops, woodland and forest, with oak woodlands the most common land cover. Oak woodland is the most common land cover in the County, occurring on over 167,000 acres or 33% of the County's area[17] (see Appendix B and B-2/ map). It occurs throughout the County across a broad range of elevations, on gentle to steep slopes. It is most common in the Southern Interior Valleys of Napa County, where it constitutes almost 70% of the land cover. There are 13 vegetation types (alliances or associations) recognized within the Information Center for the Environment Map (ICE Map/ UC Davis) oak woodland group (BDR-2005). Six of these are dominated by evergreen oak species, six are dominated by deciduous oak species, and one is a mixture of deciduous and evergreen

oaks. The four most common oak woodland types in the County are mixed oak woodlands, (evergreen) coast live oak (*Quercus agrifolia*) woodlands and interior live oak woodlands, and (deciduous) blue oak woodlands. Oregon white oak (*Quercus garryana*) woodland and California bay woodlands are considered sensitive communities by the California Department of Fish and Game (DFG 2000). Valley oak woodlands were identified by the *San Francisco Bay Area Gap Analysis* as a high priority for conservation (Wild 2002). Vernal pools, which are also a sensitive community, have been documented to occur within the County's oak woodlands.

Note: For a more detailed description of Oak Woodland Vegetation Types/Wildlife/Special Status Species in Napa County see Appendix B. The current mapped Distribution of Oak Woodlands in Napa County (2009) is provided in Appendix B-2.

2. Protected Oak Woodlands

Almost 25 percent or 123,619 acres of the land in Napa County is dedicated open space owned in fee title by public agencies or land conservation organizations, such as the Land Trust of Napa County.[18] The Federal Government is the largest public property owner with nearly 63,000 acres of land and water. The Federal Bureau of Land Management manages most of this land in the northeastern part of Napa County with the Federal Bureau of Reclamation managing the remainder around Lake Berryessa. The State of California is the second largest owner of public open space lands with 42,393 acres. Most of this land is managed by the State Department of Fish and Game and includes the Napa-Sonoma Marshes near the mouth of the Napa River, and property north of Lake Berryessa, including the Knoxville Wildlife Area.

The State Department of Parks and Recreation owns and operates the Robert Louis Stevenson, and Bothe-Napa State Parks. Other State agencies such as the Department of Veterans Affairs own smaller parcels of land. Local governmental agencies such as the cities of Napa and Vallejo which operate domestic water systems own important properties associated with their water supply reservoirs and American Canyon owns the Newell Open Space Preserve. Napa County holds a lease from the state for Skyline Park until the year 2030, and operates the park through a concessionaire agreement with a local non-profit association. These lands provide an important measure of protection for Napa County's oak woodlands.

In areas that are privately owned, oak woodlands are effectively protected if they are located on slopes over 35%, within stream setbacks (35-150 ft), or within sensitive domestic watersheds (60/ 40 canopy retention), because of the provisions of Napa County's Conservation Regulations(see Section IV.A.3). Oak woodlands that are privately owned and protected through these regulations, compliment the protection provided via public ownership and conservation easements.

Note: A map of Protected Oak Woodlands in Napa County (2009) is provided in Appendix B-3.

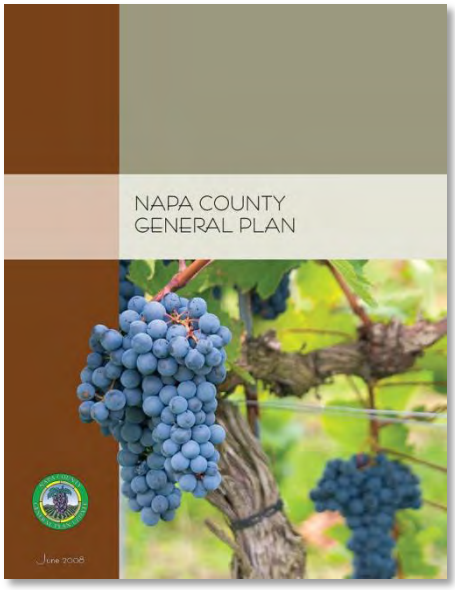
IV. Current Oak Woodlands Policies & Regulations

A broad range of existing policies, state and federal regulations, and local ordinances assist Napa County in conserving and protecting oak woodlands. This section discusses the local, state, and federal policies and regulations that are relevant to the protection of oak woodland resources in Napa County.

A. County Policies & Regulations

Napa County has a number of existing policies and regulations that provide for the protection and management of oak woodlands. The following are excerpted or summarized from the Napa County 2008 General Plan Update and associated Environmental Impact Report (EIR) and related implementing actions, mitigation measures and ordinances.

1. Napa County General Plan



The Napa County General Plan serves as a broad framework for planning the future of Napa County and it is the official policy statement of the Board of Supervisors to guide private and public development. The Zoning Ordinance, individual development project proposals, and other related plans and ordinances must be consistent with the goals and policies of the General Plan. While the General Plan was prepared with a time horizon of at least 20 years, periodic review and possible amendment is required to adjust to changing conditions, values, expectations, and needs of the community.

The General Plan program level EIR, certified in June 2008, identified potential future impacts and determined that the impact to sensitive biotic communities, including oak woodlands, would be significant and unavoidable because the potential loss of sensitive biotic communities anticipated by the year 2030 cannot be fully mitigated. However, a number of mitigation measures were identified to lessen anticipated impacts, and were included in the Conservation Element of the General Plan. Oak Woodlands protection is addressed by many of the resulting policies, most specifically in Policy CON-24 and Action Item CON NR-7.

Natural Resources Goals and Policies

Goal CON-2: Maintain and enhance the existing level of biodiversity.

Goal CON-3: Protect the continued presence of special-status species, including special-status plants, special-status wildlife, and their habitats, and comply with all applicable state, federal, or local laws or regulations.

Goal CON-4: Conserve, protect, and improve plant, wildlife, and fishery habitats for all native species in Napa County.

Goal CON-5: Protect connectivity and continuous habitat areas for wildlife movement.

Goal CON-6: Preserve, sustain, and restore forests, woodlands, and commercial timberland for their economic, environmental, recreation, and open space values.

Policy CON-15: The County shall establish and update management plans protecting and enhancing the County's biodiversity and identify threats to biological resources within appropriate evaluation areas, and shall use those plans to create programs to protect and enhance biological resources and to inform mitigation measures resulting from development projects. [Implemented by Action Item CON NR-2]

Policy CON-18: To reduce impacts on habitat conservation and connectivity:

a) In sensitive domestic water supply drainages where new development is required to retain between 40 and 60 percent of the existing (as of June 16, 1993) vegetation on-site, the vegetation selected for retention should be in areas designed to maximize habitat value and connectivity.

Policy CON-22: The County shall encourage the protection and enhancement of natural habitats which provide ecological and other scientific purposes. As areas are identified, they should be delineated on environmental constraints maps so that appropriate steps can be taken to appropriately manage and protect them.

Policy CON-24: Maintain and improve **oak woodland habitat** to provide for slope stabilization, soil protection, species diversity, and wildlife habitat through appropriate measures including one or more of the following:

a) Preserve, to the extent feasible, oak trees and other significant vegetation that occur near the heads of drainages or depressions to maintain diversity of vegetation type and wildlife habitat as part of agricultural projects.

b) Comply with the Oak Woodlands Preservation Act (PRC Section 21083.4) regarding oak woodland preservation to conserve the integrity and diversity of oak woodlands, and retain, to the maximum extent feasible, existing oak woodland and chaparral communities and other significant vegetation as part of residential, commercial, and industrial approvals.

c) Provide replacement of lost oak woodlands or preservation of like habitat at a 2:1 ratio when retention of existing vegetation is found to be infeasible. Removal of oak species limited in distribution shall be avoided to the maximum extent feasible.

d) Support hardwood cutting criteria that require retention of adequate stands of oak trees sufficient for wildlife, slope stabilization, soil protection, and soil production be left standing.

e) Maintain, to the extent feasible, a mixture of oak species which is needed to ensure acorn production. Black, canyon, live, and brewer oaks as well as blue, white, scrub, and live oaks are common associations.

f) Encourage and support the County Agricultural Commission's enforcement of state and federal regulations concerning Sudden Oak Death and similar future threats to woodlands. [Implemented by Action Item CON NR-7]

Action Item CON NR-7:

The County shall adopt a voluntary Oak Woodland Management Plan to identify and mitigate significant direct and indirect impacts to oak woodlands. Mitigation may be accomplished through a combination of the following measures:

a) Conservation easement and land dedication for habitat preservation;

b) Payment of in-lieu fees; and/ or

c) Replacement planting of appropriate size, species, area, and ratio.

Policy CON-25: The County shall disseminate information to land owners regarding habitat conservation and other natural resources goals and build partnerships to accomplish effective outreach regarding policies, incentives, and regulations.

Policy CON-28: To offset possible additional losses of riparian woodland due to discretionary development projects and conversions, developers shall provide and maintain similar quality and quantity of replacement habitat or in-kind funds to an approved riparian woodland habitat improvement and acquisition fund in Napa County. While on-site replacement is preferred where feasible, replacement habitat may be either on-site or off-site as approved by the County.

b) Climate Protection and Sustainable Practices for Environmental Health Policies

Policy CON-65: The County shall support efforts to reduce and offset greenhouse gas (GHG) emissions and strive to maintain and enhance the County's current level of carbon sequestration functions through the following measures:

a) Study the County's natural, agricultural, and urban ecosystems to determine their value as carbon sequesters and how they may potentially increase.

b) Preserve and enhance the values of Napa County's plant life as carbon sequestration systems to recycle greenhouse gases.

Oak Woodlands policies in the General Plan's Conservation Element are complemented by the goals and policies provided in other elements of the General Plan. Agricultural preservation policies, including large minimum lot sizes, concentration of urban uses in designated urban areas, and "Measure J/ P" requirements for a public vote to change the General Plan land use designation from agricultural to non-agricultural uses have minimized the conversion of oak woodlands and other open spaces. In addition, Recreation and Open Space policies support the acquisition of open space through financial and other incentives to encourage dedication in easement or fee title of significant fish and wildlife habitats and other open space resources to public agencies and non-profit land conservation organizations, acceptance of mitigation funds and dedications of easements or property for the purpose of resource protection, consistent with program goals, and utilization of federal, state, and regional funding to supplement local funding for providing sustainable, long-term stewardship of open space resources and habitats.

2. Napa County Code

The Napa County Code contains a number of ordinances and regulations whose provisions directly and indirectly serve to support the protection, conservation and management of oaks and oak woodlands throughout Napa County. These include the Zoning Ordinance (Title 18), which contains the Conservation Regulations (Chapter 18.108) and the Viewshed Protection Regulations (Chapter 18.106), and the Environment (Title 16) which contains the Floodplain Management Regulations (Chapter 16.04). A summary of some of the applicable provisions of these chapters is provided below.

A. CONSERVATION REGULATIONS – CHAPTER 18.108

The Conservation Regulations were adopted in 1991 and were intended to balance the desires for environmental and agricultural sustainability in Napa County. These regulations established procedures for review of projects that might have an effect on water quality or other natural resources issues. Some of the protections provided by the Conservation Regulations include:

- Preservation of existing vegetation/ trees where necessary for the preservation of threatened plant or animal species(18.108.100);

- Protection of streams with setbacks of 35-150 feet based upon slope, to provide for the retention of existing riparian oak woodland and forest, as well as other riparian plant species (18.108.025);
- Protection of sensitive domestic water supply drainages through maintenance of 60% of tree canopy cover and 40% of shrubby/ herbaceous cover(1993) to help provide water quality protection and the long-term retention of oak and other woodlands, as well as other plant species(18.108.027);
- Protection of erosion hazard areas (18.108.070) by requiring erosion control plans for agricultural projects on slopes over 5%. Discretionary projects also require CEQA review which provides for the evaluation of potential oak woodlands impacts (see Section IV.C.2 on CEQA)

B. FLOODPLAIN MANAGEMENT REGULATIONS – CHAPTER 16

The Floodplain Management Regulations (Chapter 16.04) cover a variety of activities, including the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters. Floodplain management provisions seek to preserve riparian vegetation in order to preserve fish and game habitats; prevent or reduce erosion; maintain cool water temperatures for fish; prevent or reduce siltation; and promote wise uses and conservation of woodland and wildlife resources of the county. All development activities within riparian zones, 50 feet from the top of stream banks or 100 feet from the top of bank of the Napa River downstream of Zinfandel Lane, require a permit. These regulations also limit the type and amount of riparian vegetation that may be removed within the riparian zone (Sec 16.04.750).

C. VIEWSHED PROTECTION REGULATIONS – CHAPTER 18.106

The Viewshed Protection Regulations were adopted to protect the scenic quality of the County by ensuring that improvements are compatible with existing land forms, particularly ridgelines, and that views of the unique geologic features and existing landscape of hillside areas are protected and preserved. These regulations are intended to:

- Provide hillside development standards to minimize the impact of man-made structures and grading on views of existing landforms, unique geologic features, existing landscape features and open space as seen from designated public roads within the County;
- Protect and preserve views of major and minor ridgelines from designated public roads;
- Minimize cut and fill, earthmoving, grading operations and other such man-made effects on the natural terrain to ensure that finished slopes are compatible with existing land character; and
- Promote architecture and designs that are compatible with hillside terrain and minimize visual impacts.

B. OTHER LOCAL POLICIES

1. WICC Strategic Plan

The Watershed Information Center and Conservancy (WICC) educates and supports the community in its efforts to maintain and improve the health of Napa County's watershed lands. The WICC Board of directors serves as an advisory committee to the Napa County Board of Supervisors. The role of the WICC is to assist the Board of Supervisors in their decision-making process and serve as a conduit for citizen input by gathering, analyzing and recommending options related to the management of watershed resources. Although the WICC's focus is more expansive than just oak and oak woodlands, the watershed conservation and management goals and strategies of the WICC serve well to forward the protection and conservation of the County's oak woodlands. The following are excerpts and summaries from the WICC Board's Strategic Plan:

Vision

Napa County's watersheds will maintain a balance of natural processes to support healthy native fisheries, an abundance of native plants and wildlife, and water quality that meets state standards. The Napa River and its tributaries, no longer listed as impaired, will be a nationwide example of what a community, working together, can do to improve the health of its watersheds *(excerpt)*.

Goals

Watershed Conservation & Management

Improve watershed health throughout the entirety of Napa County, which includes its cities and towns, by supporting community efforts to protect and enhance all watershed lands and natural processes with an emphasis on riparian corridors and native species and their habitats.

- Identify, conduct and coordinate watershed studies and monitoring that will improve the community's understanding and management of its watershed resources.
- Identify key watershed areas for restoration, enhancement, and/ or permanent protection.
- Work with and support landowners, citizen organizations, districts and agencies to permanently protect key watershed lands.

Communication, Coordination & Partnerships

Build and strengthen effective partnerships to foster communication, coordination and involvement among all those working to improve the health of Napa County's watersheds.

- Coordinate and facilitate watershed planning, research, and monitoring efforts among Napa County organizations, agencies, landowners, and citizen organizations to limit gaps and overlaps and improve consistency between watershed-related activities.
- Support organizations with a watershed restoration focus.

Education and Outreach

Enable the community - those who live in, work in and visit the County's watersheds - to understand the importance of watershed stewardship and watershed health and be actively involved in improving the health of the County's watersheds.

- Provide targeted watershed conservation and stewardship-related education and information to various subsets of the community including the agricultural community, educators, urban and rural residents, and sub-watershed organizations of Napa County.
- Support appropriate public access to Napa County's watershed lands where suitable to build appreciation and understanding of the County's watersheds and their resources.

2. Napa County Regional Park & Open Space District Master Plan

The Regional Park and Open Space District (RPOSD) Master Plan (2008-13) is organized around four broad goals of facility development, open space preservation, educational programs and District operations and partnerships. The first three goals are derived from the County General Plan and the resolutions establishing the function and responsibility of the District. The fourth goal addresses District operations and management.

These goals are as follows:

- Provide opportunities for outdoor recreation through the development of a system of parks, trails, water resource activities, open space and related facilities.
- Preserve, restore and protect open space lands, natural resources and special habitat areas.
- Provide historical, cultural and environmental education programming opportunities.
- Provide for District management and interagency partnerships.

In addition to the four goals, the Master Plan identifies and incorporates a number of guiding principals that are intended to define general policies the District should follow during this five year period. Some examples of the guiding principles that provide for the protection of woodland and other natural resources are as follows:

- Pursue acquisitions from willing sellers that will help round out the boundaries of or connect together currently isolated tracts of public lands, in order to improve resource stewardship, protect core habitats as well as habitat corridors and to allow trail connections.

- Within the context of the long-term goals and objectives contained in this Master Plan, take advantage of unique time-sensitive opportunities to acquire or protect significant open spaces and habitat.

C. STATE POLICIES & REGULATIONS

1. California Endangered Species Act

The California Endangered Species Act (CESA) protects wildlife and plants listed as endangered or threatened by the California Fish and Game Commission. The CESA is administered by the California Department of Fish and Game (DFG). The CESA prohibits all persons from taking species that are state listed as endangered or threatened except under certain circumstances. The CESA definition of *take* is any action or attempt to "hunt, pursue, catch, capture, or kill." Section 2081 of the Fish and Game Code provides a means by which agencies or individuals may obtain authorization for incidental take of state-listed species, except for certain species designated as "fully protected" under the California Fish and Game Code. A take must be incidental to, not the purpose of, an otherwise lawful activity. Requirements for a Section 2081 permit are similar to those used in the federal Endangered Species Act (ESA) Section 7 process, including identification of impacts on listed species, development of mitigation measures that minimize and fully mitigate impacts, development of a monitoring plan, and assurance of funding to implement mitigation and monitoring. Since a number of CESA species rely upon oak woodlands for food, shelter and migration, the CESA provides an important means of offering protection for oak woodlands in Napa County.

2. California Environmental Quality Act

The California Environmental Quality Act (CEQA) is the regulatory framework that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. A "project" (as defined under statute) would have a significant environmental impact on biological resources if it has the potential to substantially affect a rare or endangered species or the habitat of that species; riparian habitat, wetlands or other sensitive communities; interfere with the movement of resident or migratory fish or wildlife; or diminish habitat for fish, wildlife, or plants. Analysis of environmental impacts under CEQA begins by establishing a baseline of current conditions that may be impacted by a proposed project. Potential oak woodland impacts are currently evaluated through the CEQA review process conducted for discretionary projects. Oak woodland management planning can help to identify oak

woodland resources, assess baseline conditions, assist in determining thresholds of significance and offer appropriate and effective impact mitigation opportunities and or programs. Napa County has also adopted Local Procedures for Implementing CEQA (2006) to provide the public with information on the criteria, policies, and procedures used in the environmental review process (www.countyofnapa.org/ ceqa). Changes to CEQA specifically addressing oak woodlands were included in the Oak Woodlands Conservation Act described below. Updates to the CEQA Guidelines specific to climate change and greenhouse gas (GHG) emissions are expected in January, 2010.

3. California Oak Woodlands Conservation Act (AB 242-2001) and the Oak Woodlands Conservation Act (SB 1334 - 2004)

The California Oak Woodlands Conservation Act (COWCA) (Assembly Bill 242), enacted in 2001, recognizes the importance of California's oak woodlands, the critical role of private landowners, and the importance of private land stewardship. The Act further acknowledges how oak woodlands increase the monetary and ecological value of real property and promote ecological balance. The Legislature created the Oak Woodlands Program with the expressed intent of accomplishing the following:

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

To accomplish the legislative intent, the Act identifies the Wildlife Conservation Board (WCB) as the responsible entity to implement the Oak Woodlands Conservation Program. The Act authorizes the WCB to purchase oak woodland conservation easements and provide grants for land improvements and restoration efforts. In addition, the WCB is authorized to award cost-sharing incentive payments to private landowners who enter into long-term agreements, which include management practices that benefit oak woodlands and promote the economic sustainability of farming/ ranching operations. To qualify for grant funding, a county or city must have an adopted Oak Woodlands Management Plan, and also certify that grant proposals are consistent with the Plan.

The Act requires that at least 80 percent of the money be used for grants for the purchase of easements, for restoration activities or for enhancement projects. In addition, the funds may be used for grants that provide cost-share incentive payments and long-term agreements. The remaining 20 percent may be used for public education and outreach efforts by

local governments, park and open space districts, resource conservation districts and nonprofit organizations. Within the 20 percent category, funds may also be used for grants designed to provide technical assistance and to develop and implement oak conservation elements in local general plans. While the Act specifies how the monies are to be allocated, the Act requires that priority be given to grants that result in the purchase of oak woodland conservation easements.

The Oak Woodlands Conservation Program offers landowners, conservation organizations, cities and counties, an opportunity to obtain funding for projects designed to conserve and restore California's oak woodlands. While the Program is statewide in nature, it provides opportunities to address oak woodland issues on a regional priority basis. The Program is designed to help local efforts achieve oak woodland protection. More importantly, this Program provides a mechanism to bring farmers/ ranchers and conservationists together in a manner that allows both to achieve that which is so valued — sustainable ranch and farming operations and healthy oak woodlands.

The Oak Woodlands Conservation Act (Senate Bill 1334) became law on January 1, 2005 and was added to the CEQA statutes as Public Resources Code Section 21083.4. This act requires that a county must determine whether or not a project would result in a significant impact on oak woodlands. If it is determined that a project may result in a significant impact on oak woodlands, then one or more of the following mitigation measures are required:

1. Conserve oak woodlands through the use of conservation easements;
2. Plant an appropriate number of trees, including maintenance of plantings and replacement of failed plantings;
3. Contribute funds to the Oak Woodlands Conservation Fund for the purpose of purchasing oak woodlands conservation easements; and
4. Other mitigation measures developed by the county.

Exemptions are allowed for certain purposes (CEQA 21083.4.d), including affordable housing projects, and conversion of oak woodlands on agricultural land that includes land that is used to produce or process plant and animal products for commercial purposes.

4. Natural Heritage Preservation Tax Credit Act of 2000 (as amended, AB 94 - 2009)

This Assembly Bill (AB 94) reauthorized the Natural Heritage Preservation Tax Credit Act. The purpose of this Tax Credit Program is to protect wildlife habitat, parks and open space, archaeological resources, agricultural land and water by providing state tax credits for donations of qualified land (fee title or conservation easement) and water rights to a designated organization or agency (state/ local government or non-profit). The program objectives include the fostering of public/ private partnerships to resolve land use and water disputes; assisting habitat stewardship; and demonstrating the state's commitment to protect natural resources by rewarding landowners who perceive habitat as an asset rather than a liability. The property and contribution must be approved by the California Wildlife Conservation Board. A taxpayer is allowed an

income tax credit of up to 55% of the donated property's fair market value for donations made on or after January 1, 2010. Any unused credit may be carried over for eight years. The Franchise Tax Board (FTB) is required to report the amount of NHP credit claimed by tax year to the WCB. Protection of oak woodlands through this act provides a tax incentive to landowners wishing to donate their property to a state or locally designated agency or non-profit.

5. Z'Berg Nejedly Forest Practice Act (1973) (California Forest Practice Rules)

The California Forest Practice Rules (Rules) (Title 14, California Code of Regulations Chapters 4, 4.5 and 10) implement the provisions of the Z'berg-Nejedly Forest Practice Act of 1973. Under the Rules, owners of timberland proposing to convert that timberland to another use (as defined in Section 1102) must obtain a Timberland Conversion Permit (TCP) from the California Department of Forestry and Fire Protection. As part of the permitting process, the applicant is also required to submit a Timber Harvest Plan (THP), prepared by a licensed forester, demonstrating that the timber harvest will incorporate feasible mitigation measures to substantially lessen or avoid significant adverse environmental impacts. While oaks are a non-timberland species not directly regulated, a THP/ TCP cannot be approved if implementation of the plan as proposed would result in either a "taking" or finding of jeopardy of a listed species.

6. California Fish and Game Code

The California Fish and Game Code offers protection for a variety of fish and game species and the habitats they rely upon. Oak woodlands offer habitat, shelter and forage for many of California's protected species. Management of oak woodlands for the protection and conservation of California's fish and game go hand in hand with oak woodland preservation goals locally and across the state.

Fully Protected Species

The California Fish and Game Code provides protection from take for a variety of species. Certain species are considered *fully protected*, meaning that the code explicitly prohibits all take of individuals of these species except for take permitted for scientific research. Some species are protected under the California Fish and Game Code, but not fully protected.

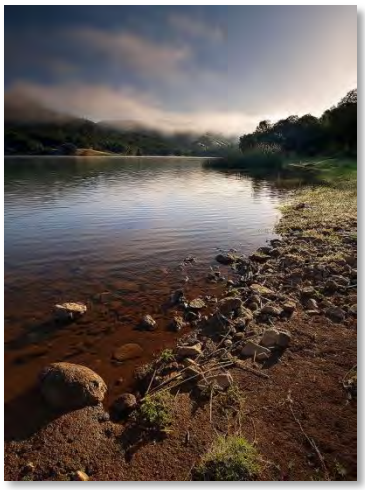
The Department of Fish and Game (DFG) maintains the California Natural Diversity Database (CNDDB), a database containing information on the location and characteristics of special-status species occurrences. The database contains information related to the accuracy of each occurrence, such as the spatial resolution of the occurrence mapping, the year when the occurrence was last documented, and the

identity of the person who documented the occurrence. Updated CNDDB data are released every six months. Special status species are plants and animals that are legally protected under the federal Endangered Species Act (ESA), California Endangered Species Act (CESA) or other federal, state or local regulations and are designated as endangered, rare, or threatened. Napa County is home to approximately 114 special status plant species and 24 special status wildlife species, with more than 50 special status plant and wildlife species associated with oak woodlands (BDR, 2005).

Protection of Birds and their Nests

Eggs and nests of all birds are protected under Fish and Game Code Section 3503, nesting birds (including raptors and passerines) under Sections 3503.5 and 3513, and birds of prey under Section 3503.5. Migratory non-game birds are protected under Section 3800, and other specified birds under Section 3505.

Stream and Lake Protection



DFG has jurisdictional authority over streams and lakes and the wetland resources associated with these aquatic systems under California Fish and Game Code Sections 1600 et seq. California Fish and Game Code Section 1600 et seq. was repealed and replaced in October of 2003 with new Sections 1600–1616 that took effect on January 1, 2004 (Senate Bill No. 418 Sher). DFG has the authority to regulate work that will ~~–~~substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake." DFG enters into a streambed or lakebed alteration agreement with the project proponent and can impose conditions in the agreement to minimize and mitigate impacts to fish and wildlife resources. A lake or streambed alteration agreement is not a permit, but rather a mutual agreement between DFG and the project proponent. Because DFG includes under its jurisdiction streamside habitats that may not qualify as wetlands under the Federal Clean Water Act (CWA) definition, DFG jurisdiction may be broader than Corps jurisdiction.

7. Greenhouse Gas (GHG) Emission Reduction (AB32 & SB375)

In 2006, the State Legislature enacted Assembly Bill 32 (AB 32), requiring the California Air Resources Board (CARB) to design measures and rules to reduce GHG emissions statewide to 1990 levels no later than 2020. The measures and regulations to meet the 2020 target are to be put in effect by 2012, and the regulatory development of these measures is ongoing by CARB, the designated lead agency. A Scoping Plan was approved by the CARB on December 12, 2008 which provides the outline for actions to reduce California's GHG emissions. The Scoping Plan now requires CARB and other state agencies to adopt regulations and other initiatives reducing GHGs. CARB also

adopted California Climate Action Registry (CCAR) Forestry Protocols in 2007 (updated in 2009) to provide tools for voluntary carbon accounting in the forest sector. Forests can absorb (sequester) and store carbon long-term, and they have the potential to provide significant greenhouse gas (GHG) reductions when managed for carbon benefits. Adoption of the protocols represented the Board's endorsement of a technically sound approach for carbon accounting in voluntary forest projects.

In September 2008, the Legislature enacted Senate Bill 375, which established a process for the development of regional targets for reducing passenger vehicle GHG emissions. Through the SB 375 process, regions throughout the state will develop plans designed to integrate development patterns and transportation networks in a manner intended to reduce GHG emissions.

Neither the State nor Napa County has adopted explicit thresholds of significance for GHG emissions. While some might argue that *any* new emission would be significant under CEQA, recent amendments to the State CEQA guidelines suggest that agencies must consider the extent to which a project compiles with requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions. The Bay Area Air Quality Management District adopted CEQA significance thresholds on June 2, 2010 for GHG emissions related to development projects, such as industrial/ commercial and residential development. The BAAQMD guidelines also place emphasis on climate action plans.

D. Federal Policies & Regulations

1. Endangered Species Act

The federal Endangered Species Act (ESA) protects fish and wildlife species that have been identified by the U.S. Fish and Wildlife Service and/ or the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) as endangered or threatened. It also protects the habitats in which they live. *Endangered* refers to species, subspecies, or distinct population segments that are in danger of extinction throughout all or a significant portion of their range while *threatened* applies to species, subspecies, or distinct population segments that are likely to become endangered in the near future. The ESA protects oak woodlands when they are habitat to an endangered species such as the pallid bat or the Cooper's hawk, both resident species of Napa County's oak woodlands. USFWS and NOAA Fisheries administer the ESA directly or through state and local public trust agencies.

2. Clean Water Act

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977.

The CWA is the cornerstone of surface water quality protection in the United States. (The Act does not deal directly with ground water nor with water quantity issues.) The statute employs a variety of regulatory and nonregulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

For many years following the passage of the CWA, EPA, states, and Indian tribes focused mainly on the chemical aspects of the "integrity" goal. During the last decade, however, more attention has been given to physical and biological integrity. Starting in the late 1980s, efforts to address polluted runoff have increased significantly. For "nonpoint" runoff, voluntary programs, including cost-sharing with landowners are the key tool. For "wet weather point sources" like urban storm sewer systems and construction sites, a regulatory approach is being employed.

Evolution of CWA programs over the last decade has also included something of a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach equal emphasis is placed on protecting healthy waters and restoring impaired ones. A watershed approach addresses a full array of issues, including riparian oak woodland services to improve water quality, not just those issues subject to CWA direct regulatory authority.

3. Other Federal Policies/Regulations

At the federal level, the Bureau of Reclamation‘s (BOR) Lake Berryessa property is governed by a Visitors Services Plan (VSP) as presented in a Record of Decision (ROD). The VSP ROD, released in June 2006, prescribes basic management principles to guide and support lake-wide integration of Government and commercial operations in the best interests of the visiting public. The VSP ROD limits future development of the concession areas to facilities that support short-term, traditional, non-exclusive, and diverse recreation opportunities at the lake. Reclamation will partner with other Government agencies, private landowners, and private organizations to design/ construct a regional trail system for non-motorized recreation, to include a multipurpose shoreline trail.

The other major federal agency is the Bureau of Land Management (BLM). The lands under its ownership within Napa County are governed by a Resource Management Plan (RMP) approved in 2006. BLM‘s mission is very broad, encompassing resource protection, resource development, hunting, off-road vehicle use, hiking, camping, mountain bicycling and horseback riding. Each federal agency generally has its own policies to protect oak woodlands, and they are subject to the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Federal Land Policy & Management Act (FLPMA), and other internal agency laws, policies, and regulations.

V. Threats to Oak Woodland Communities

Because Napa County has a long history of open space and agricultural preservation policies, the county's oaks are at less risk from development than are other counties in our region, but conversion of oak woodlands does occur and is projected to continue. Conservation of the existing oak woodlands in Napa County is a challenge due to a number of factors that threaten their continued health and longevity. Some of these threats include: lack of regeneration, conversion to agricultural land (primarily vineyards), fragmentation of oak communities, sudden oak death, reduced access to groundwater, increased suppression of fire and risk of catastrophic fire damage both human and natural caused. A summary of current potential threats to our oak woodlands are provided below.

A. Lack of Regeneration

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

Acorn production varies widely from year to year. Most oaks regenerate from a bank of persistent seedlings beneath the canopy, or a "seedling bank." Some species germinate in the winter after they have dropped and do not persist as a seed bank in the soil from year to year. Since most acorns land under or near the canopy of the parent tree, most of the seedling bank is in a very localized area. The shading and buildup of organic mulch beneath oak canopies favors acorn germination and early seedling growth. Although oak canopy enhances seedling establishment, it suppresses the transition of seedlings to saplings. Persistent oak seedlings, which may be no taller than 6 inches in species such as blue oak, may survive for years in the understory. These seedlings can produce a strong root system but show little shoot growth. In fact, shoots of persistent seedlings may periodically die back to the ground, and re-sprout from the seedling base in the following growing season.

Understory seedlings typically remain suppressed until competition is removed or eliminated by the decline, death, or removal of overstory trees. Seedlings released from overstory suppression can respond with relatively rapid shoot growth and can grow into saplings that eventually refill the canopy gap. Although a lack of sapling-sized oaks has been used to suggest that oak regeneration is inadequate, oak saplings are not likely

to be found in well-stocked woodlands. A lack of saplings in and near recent canopy gaps, however, is clear evidence of inadequate regeneration. In woodlands with stable canopy cover, low populations of persistent seedlings in the understory are the primary indicators of inadequate regeneration.

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

Some or all of the following factors may constrain oak regeneration at a given site. Alleviating only one constraint may or may not be adequate to ensure successful regeneration.

1. Low acorn production

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

2. Poor seedbed conditions

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

3. Herbivory

Animals that eat acorns and seedlings can substantially impact the growth and survival of oak seedlings and saplings. Rodents, deer, wild turkeys and pigs, and livestock all have the potential to limit or eliminate oak reproduction, but the relative importance of each herbivore varies by location. Gophers, ground squirrels,

and voles can kill juvenile oaks by chewing and girdling stems. Livestock eat and trample understory seedlings, depleting or eliminating understory advance regeneration. Heavy browsing of released seedlings by livestock or deer can indefinitely suppress their growth and inhibit recruitment to sapling and tree size classes. Interior live oak is less palatable to livestock than valley and blue oak, so grazing impacts these species differently.

4. Water Stress and Groundwater

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

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

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

B. Fire Frequency and Severity

Napa County has a long and active wildfire history. The County is characterized by narrow valleys surrounded by steep, hilly terrain. With its long, dry summers and rugged topography, Napa County has a high wildland fire potential. In the last several decades the combination of firefighting technology, fire suppression policy, environmental regulations and developmental trends has led to increasing fuel loads, greater occupancy of remote wildlands and greater potential for catastrophic wildfire. Over the past 30 years (mid-1970s to 2004) wildfires have burned approximately 232,000 acres of land in or directly adjacent to Napa County; a County of approximately 482,000 acres (BDR, 2005). The Rumsey fire, which burned 40,000 acres in October of 2004, was the largest of the year. Spread across Yolo and Napa Counties, it cost over $10,000,000 to suppress and caused $1,000,000 in damages. And in 2008, the Wild Horse Valley fire burned more than 4000 acres in eastern hills along the Napa and Solano county line.

Climate and landscape characteristics are among the most important factors influencing hazard levels. Weather characteristics such as wind, temperature, humidity and fuel moisture content affect the potential for fire. Of these four, wind is the dominant factor in spreading fire since burning embers can easily be carried with the wind to adjacent exposed areas, starting additional fires. While the County has a characteristic southerly wind that originates from the San Francisco Bay (which becomes a factor in fire suppression), during the dry season the County experiences an occasional strong north wind that is recognized as a significant factor in the spread of wildland fires (City of Napa 2004). Landscape characteristics such as steep slopes also contribute to fire hazard by intensifying the effects of wind and making fire suppression difficult. Vegetation type influences wildfire hazard levels as well. For example, landscapes dominated by chaparral are more flammable than other vegetation types. The combination of highly flammable vegetation, steep inaccessible wildlands, and high levels of recreational use can result in wildfire risk and hazards of major proportions.

Most of the tree oak species in California are adapted to tolerate fire in varying degrees. Mature oaks can survive frequent, low intensity fires, while younger trees regenerate after low-intensity fires by resprouting. However, studies indicate that while oak seedlings and saplings resprout readily after topkill, many juvenile oaks are killed by fire. After resprouting oak saplings require several to many years to recover their aboveground biomass. Repeated destruction of oak shoots in successive years depletes seedling energy reserves and increases the likelihood of disease and mortality. The combination of repeated fire and grazing is especially damaging to oak regeneration, and was historically used to convert woodlands to grasslands. Native Americans used

fire as a tool to manage oak woodlands, although the frequency of anthropogenic burning during the Native American period is unknown. European ranchers used fire to keep rangeland open and to stimulate forage production, probably burning every 8–15 years (Sandiford 1994). Fire suppression beginning in the 1950s has changed the fire regime in oak woodlands from frequent, low-intensity fires to infrequent, high intensity, fires. Such high-intensity fires can lead to the loss of oak woodlands. Approximately 52% of Napa County's oak woodlands are at high or very high risk for fire.[19]

C. Land Use/Habitat Conversion

Oak woodlands in the County are being lost through conversion to agriculture, urban and rural residential development and to a lesser extent commercial development and infrastructure. In some areas, such as the eastern hills, the rate of oak woodland conversion to vineyards has been higher than in other areas of the county. However, Napa County's large minimum lot sizes, one percent annual limit on growth and urban-centered growth policies have restrained development in the unincorporated county, essentially conserving many natural areas containing oak woodlands.

1. Rural Residential and Urban Development.

Rural residential and urban development may result in the conversion of oak woodlands to other uses if the development occurs in areas where oak woodlands exist today. However, Napa County has historically directed growth to the incorporated cities/ town and to a limited number of designated urbanized areas. The 2008 General Plan Update maintained this policy framework and perpetuated restrictions on the subdivision of large private parcels in the unincorporated area. These growth policies have resulted in the protection of oak woodlands (as well as locally important agricultural land), and the Draft EIR prepared for the General Plan Update estimated that only 119 to 145 acres of woodland (deciduous oak woodland, evergreen oak woodland, and mixed willow woodland) will be lost due to rural residential and urban development in the County between 2005 and 2030.

2. Agricultural Conversion.

Approximately 20 percent of the land area in Napa County is committed to agriculture, including vineyards, orchards, rangeland, and other crops. The extent of vineyard acreage has grown steadily in more recent years due to the growing demand for premium wine and winegrapes. The Draft EIR prepared for the General Plan Update in 2008 assessed the impacts of continued vineyard development by developing a projection of new vineyards (specifically, 10,000 to 12,500 new acres between 2005 and 2030), and by assessing a number of scenarios representing possible distribution (i.e. the location) of vineyard development. The result of this analysis was an estimate that between 2,682

and 3,065 acres of woodlands (deciduous oak woodland, evergreen oak woodland, and mixed willow woodland, non-native woodland, valley oak woodland, and white alder woodland) will be lost due to vineyard development in the County between 2005 and 2030.

While current market conditions have the potential to slow the rate of conversion of oak woodlands to intensive agriculture, oak woodlands that are located on potentially productive agricultural soils remain at risk and make up 58,526 acres, or 36% of Napa County's current oak woodlands. Between 1993 and 2002, one half of one percent of Napa County's oak woodlands (approx. 733 acres) were converted to vineyards, including several acres of sensitive oak communities.[20]

3. Infrastructure Development.

Local and regional growth in tourism, jobs, and housing increases demand for new infrastructure, including highway and road expansion, as well as electrical, water and wastewater services. The end result of this demand is often the expansion of infrastructure projects which can temporarily or permanently impact existing oak woodlands. On a more regional level, large roadway expansion projects will likely continue to threaten California's oak woodland resources.

D. Disease: Sudden Oak Death

Oak woodlands in Napa County are also threatened by Sudden Oak Death (SOD), a fungal disease caused by the pathogen *Phyophthora ramorum*. First detected in the mid-1990's, the disease is responsible for widespread tree mortality in the central coast region of California. It is now known to infect over 70 ornamental and wildland plant species and genera and that number has been dramatically increasing every year. SOD is usually recognized as a forest phenomenon and it is not typically seen in true landscape settings, although more recent findings at numerous retail nurseries and wholesale growing grounds may alter that picture. While the term –sudden" refers to the relatively rapid browning of the foliage, a tree showing these symptoms has in actuality already been infected for months or years with the pathogen.

Fourteen counties in California – from Monterey to Humboldt – are currently known to be infested with SOD in natural settings. Because the pathogen requires a moist environment to germinate and disperse, most infestations are found in fog-belt or densely wooded, riparian areas. Natural spread usually occurs by wind-driven rain, soil erosion, and streams. In Napa County, with a few exceptions, SOD has been confirmed mostly on the western side of the county – in the Mayacamas Mountains. The disease is not expected to survive in hot, dry climatic conditions that exist in such areas as Pope Valley and Lake Berryessa. However, wet years may allow for the spread of the disease throughout the County and there is some concern that the pathogen could adapt to Napa County's warmer, drier climate. In Napa County, SOD mainly affects Coast Live Oak, California Black Oak, Tanoak, and California Bay Laurel. Valley Oak, Blue Oak, Oregon Oak, –scrub" oaks, and other members of the so-called –white oak" group are

not susceptible to SOD. While certain oaks may die from the disease, most other host plants display only leaf spots and/ or branch/ twig dieback, mortality occurring only under extreme conditions. The Bay Laurel is the primary culprit responsible in California for allowing the spores of P. ramorum to germinate and spread to the oaks.

The vast majority of oak mortality seen in Napa County is due to causes other than SOD. Other diseases and pests like oak root fungus, crown rot, and various insects, as well as soil compaction, grade changes, and root injury contribute significantly to the decline and eventual death of numerous trees.

Comprehensive state, federal, and international quarantine measures have been instituted to minimize the likelihood of the artificial (i.e.-human) spread of SOD. The movement of host plant material, such as nursery stock, firewood, and green waste out of Napa County is tightly restricted. The Napa County Agricultural Commissioner's Office has information available for property owners to help reduce the chances of spreading the disease, as well as for those who take part in recreational activities, such as hikers, mountain bikers, and horse riders, in areas that may be experiencing SOD.

E. Climate Change and Ecotone/Species Migration

Napa County is home to a diverse population of plants species which in turn support a wide range of wildlife species, including many rare, threatened and endangered species. Native plants and animals are increasingly at risk as temperatures rise and scientists are reporting more species moving to higher elevations or more northerly latitudes in response. Increased temperatures also provide a foothold for invasive species of weeds, insects and other threats to native species. The increased salinity and flow of water resources could adversely affect the food supply and spawning conditions for native fish, and the natural cycle of plant flowering and pollination could be affected.

In Napa County, climate change may result in decreased genetic diversity, a reduction in seed dispersal, decreased or extirpated populations, and long-term distribution changes. Currently there is an invasion of Douglas Fir in the west and Foothill Pine in the east with subsequent succession causing many oak stands to become overtopped and lose vigor. The current fir and pine populations expansions are taking place to the detriment of oak and other hardwoods.[21]

Natural disasters such as drought, wildfires, and flooding can be instigated by temperature and precipitation changes.[22] Scientists at U.C. Santa Cruz are concerned that rising temperatures and decreasing rainfall associated with global climate change will cause almost half of California's oaks to die out by 2090.[23] These forecasts focus particularly on blue oak and valley oak species, both of which are represented in continually decreasing numbers in Napa County.

F. Woodcutting for Firewood Production

Woodcutting can be an integral part of a sustainable woodland management plan that balances sustainable yield harvesting with habitat protection and agricultural use. If

firewood harvesting is not severe, effects on wildlife and stand structure can be negligible (Garrison and Standiford 1997). However, indiscriminate cutting without regard for habitat continuity, lack of replanting or protection of saplings, removal of nest or wildlife trees, and thinning to produce a monoculture can all contribute to reduction of overall quality of the woodland habitat and eventual loss of the woodland resources. From an economic (and recreational) perspective, removal of oak trees or damage to the viability of the woodland may also decrease the habitat potential for game species.

VI. Establishing Priorities for Oak Woodland Conservation and Restoration

Successful oak woodland conservation efforts will require an on-going commitment by the community based upon cooperation and collaboration among private landowners, public agencies, non-profits, and others. Napa County has already begun efforts in support of oak woodland conservation and restoration, including several on-the-ground projects, property acquisitions by the Regional Park and Open Space District, and others.

A. Current Efforts

Some of the priority projects currently underway in the County include:

- **Rutherford Dust Napa River Restoration Project.** A plan to provide for the long-term management and restoration of a 4.5 mile reach of the Napa River from Zinfandel Lane bridge to the Oakville Crossroad. Initiated in 2002 by the Rutherford Dust Society (RDS), the RDS and Napa County pioneered an innovative partnership to realize this vision. Project objectives include the reduction of erosion, flood damage and sediment loading, and the restoration of salmonid/ aquatic habitat and riparian habitat, including oak woodlands. Project development and funding was provided by the property owners, Napa County/ Flood District and multiple state agencies. A comprehensive design for the project was completed in October 2008 and construction began in July 2009. For California's agricultural sector and beyond, this project provides a community-based leadership model for watershed restoration.

- **Oakville Napa River Restoration Project.** The second large-scale Napa River restoration project, this plan provides for the restoration of a 10 mile reach of the river between Oakville Crossroad and Oak Knoll Avenue. As with the RDRT project, the Oak Knoll project is a collaborative effort supported by property owners along the reach. The project is intended to control erosion

and flooding, and preserve/ restore salmonid and riparian habitats, including oak woodlands. Napa County provided local matching funding to enable the project to acquire a grant from the State Water Board for the first phase of work. A conceptual design for the project is currently underway.

- **South Wetland Opportunity Area Restoration Project (SWOA).** As part of the restoration objectives for the Napa County Flood Protection Project (Project) the Napa County Flood Control and Water Conservation District (District), in partnership with the Army Corps of Engineers, restored physical processes and enhanced ecological functions and habitat to over 850 acres of naturally functioning floodplains and tidal marshes within the Napa River Watershed; including the creation of over 77 acres of valley oak woodland habitat. The SWOA, purchased with funds from the District and protected in perpetuity through a conservation easement, ensures the permanent protection of a mosaic of native habitat types within Napa County.
- **Acquisition of Berryessa Vista Wilderness Park.** The County in 2008 granted the Napa County Regional Park and Open Space District Proposition 12 capital grant funds available to the County, to assist the District in acquiring 224 acres south of Lake Berryessa. The acquisition ensures permanent protection of this natural landscape, one-third of which consists of oak woodlands comprised of Interior Live Oak.
- **Acquisition of Moore Creek Watershed Lands.** The County in 2008 granted funds to the Napa County Regional Park and Open Space District to match other funding for the acquisition and improvement of 673 acres of open space in the Moore Creek watershed. Approximately one-third of this property is oak woodlands containing valley oak, coast live oak and blue oak.
- **Support for the Napa County Regional Park and Open Space District.** The County annually provides operational funding for the District, which in part assists with preservation and restoration of oak woodlands. In 2008 the District obtained a conservation easement to 39 acres at Linda Falls; approximately 10 acres of this property consists of mixed oak alliance (coast live oak, others). In 2009 the District planted valley oaks and coast live oak as part of the restoration of approximately 1,000 feet of Moore Creek. In addition, in 2010 the District is planning on restoration of 5 acres of valley oak and coast live oak woodland at the Napa River Ecological Reserve.
- **Support for California Native Plant Society.** In 2009 the County's Wildlife Conservation Commission awarded a grant to the California Native Plant Society-Napa Chapter to support their native plant garden and nursery located at Skyline Wilderness Park. The garden helps educate the public about the value of native oaks, and the nursery propagates many species of native plants including local oak varieties for use in restoration projects in many parts of Napa County.

B. PRIORITY CONSERVATION & RESTORATION CRITERIA[24]

To support continued conservation and restoration efforts throughout the County, evaluation criteria can help to identify high-priority, voluntary oak woodland conservation and restoration opportunities. This section provides an overview of suggested criteria that can assist willing landowners, public agencies, nonprofit organizations and other project partners in identifying priority areas with the highest oak woodland resource values. The evaluation criteria assess a broad range of oak woodland resource values, such as stand composition and distribution, tree cover and density, plant and wildlife habitat availability (including special status species), historical and cultural significance, and recreational opportunities (see Appendix D-Conservation & Restoration Evaluation Criteria). In addition, the criteria factor in the threat of loss and potential management constraints, and complement countywide conservation and watershed planning efforts.

The evaluation criteria assist in establishing priorities by using a three (3) layered approach to assign an overall priority to a parcel which can be tailored to the specific landowner or funding source requirements. The three-layers considered in the ranking system are:

(1) **resource value** - an aggregate assessment of the natural resource values associated with a-given oak woodland (most important layer in the prioritization system);
(2) **risk category** - an assessment of the likelihood that the resource will be lost or seriously–degraded over various time horizons if no conservation actions are instituted; and
(3) **management constraints** – a measure reflecting the level of land management inputs needed to maintain the resource value (e.g.-control invasive species, promote oak regeneration).

The evaluation criteria are designed to provide flexibility and can be modified over time by adding criteria or adjusting thresholds for priority rankings as needed to address changing resource needs. Specific weighting has not been assigned to the various criteria, as their relative importance may change over time based on the locations and types of conservation projects that are implemented and their effectiveness. The County's Geographic Information System (GIS) provides data on oak woodland species, density and distribution, which can be supplemented by field and other site specific information in areas where the scope and resolution of GIS data may be limited.

Napa County encourages organizations and agencies working on oak woodland conservation activities to use the criteria for establishing priorities for conservation and restoration, and to facilitate projects that are consistent with these priorities through advance planning and transactional assistance. Napa County will use the criteria as part of the process to determine if conservation projects are consistent with the County's Voluntary Oak Woodland Management Plan, as required by the Wildlife Conservation Board's oak woodland grant program. A higher priority will be assigned for conservation or enhancement/ restoration-projects on oak woodland parcels that provide the greatest overall level of benefits based upon the ranking system, with input from property owners and their consulting oak woodland ecologist, the Napa County Regional Park & Open Space District, and the public.

VII. Voluntary Mechanisms to Encourage Long-term Conservation by Private Landowners

A. Outreach & Education

Outreach and education are important cornerstone components in the protection, restoration and enhancement of Napa County's oak woodlands. Targeted outreach and education provides improved awareness, understanding and needed volunteerism. These efforts should be directed toward several key audiences:

- Public at-large
- Private landowners in oak woodland areas
- Public agency managers and decision makers
- Local government decision makers and planners
- Non-profit and volunteer organizations

Implementation actions may include:

- Website/ Online information
- Workshops
- Brochures/ Handouts
- Oaks Appreciation Day/ Week/ Month
- Environmental/ Green event participation/ sponsorship
- Distribution of information to teachers, landowners, decision makers
- Establishment of a Speakers Bureau
- Public service announcements (radio, cable, print)
- Local Cable Access Channel
- Inclusive project coordination and participation
- Others opportunities as they arise.

B. 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 was designed to provide $10 million annually to help local jurisdictions protect and enhance their oak woodland resources. It offers landowners, conservation organizations, cities, and counties an 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, oak education, and restoration.

The Act requires 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 can be used for public education and outreach efforts by local governments, park and open space districts, resource conservation districts, and nonprofit organizations. Within the 20 percent category, funds can also be used for grants designed to provide technical assistance and to develop and implement oak conservation elements in local general plans (McCreary 2004) (CWCB 2001). The WCB's funding in recent years has derived primarily from several large bond initiatives. In 2008, the WCB contributed to more than 100 projects with approximately $112 million of WCB grant expenditures matched by nearly $143 million in partner contributions.

A requirement for program funding under the Act is the preparation of an oak woodland management plan. To qualify for grant funding, a county or city must have an adopted Oak Woodlands Management Plan, and also certify that grant proposals are consistent with the Plan. This document has been prepared to satisfy the Act's requirements. Once adopted by the Napa County Board of Supervisors, Napa County and its residents will be eligible for grant funding under the COWCA.

C. Oak Woodland Conservation Easements

A conservation easement is a legal agreement between a landowner and a non-profit organization or government agency that restricts the type of uses allowed on the property in order to protect its conservation values. It allows the landowner to continue to own and use the land, within the constraints of the contract, and to sell it or pass it on to heirs. Each easement is individually negotiated and only certain rights to the land are purchased or donated. For example, the landowner might give up the right to build additional structures, while retaining the right to ranch or grow crops.

Conservation easements run with the land and are generally permanent, with future owners also bound by the terms of the agreement. An easement may apply to just a portion of a parcel and usually does not need to allow public access. In some cases, fee simple purchase may be a preferred alternative, when public ownership and access is also warranted, as in a public park or trails. Currently there are more than 15,000 acres under conservation easements in Napa County, not including lands with easements also owned in fee title by a public agency.[25] If an easement is donated to a qualified public agency or land conservation organization, and benefits the public by permanently protecting important resources, such as oak woodlands, it may qualify as a tax-deductible charitable donation. Conservation easements may also lower the property's assessed value (annual property tax), and estate tax when passing land on to the next generation.

In Napa County, lands under a conservation easement are usually assessed at a similar rate as properties protected under the Williamson Act (California Land Conservation

Act of 1965). Conservation easements may also enable landowners and/ or their heirs to avoid paying capital gains taxes. In addition, the State of California offers up to a 55 percent state income tax credit for donations of conservation easements, subject to various limitations.

D. Cost Sharing Agreements

According to information provided by the Wildlife Conservation Board under the Oak Woodlands Conservation Program, agreements for cost-sharing incentive payments can include management practices that benefit the goals of the landowner and oak woodlands. The length of the long-term agreement is dependent upon the nature of the project, the goals of the landowner and benefits to the oak woodlands. Typical long-term agreements could run 15 to 45 years. Cost-share incentive payments could include, but are not necessarily limited to: compensation for not cutting trees for firewood; long-term payment to keep the land in open space, management cost to implement a plan designed to benefit the landowner and the oak woodlands; reimbursements for conservation improvements; and compensation for alternative grazing or farming practices.

The Napa Field Office of the USDA Natural Resource Conservation Service (NRCS) is the largest provider of cost sharing agreements in Napa County. The NRCS provides approximately $100,000 annually in cost share funding for conservation practices, some of which directly benefit native oaks. For the five year duration of the 2008 Farm Bill, the NRCS will continue to provide cost share agreement funding through two USDA programs. The Environmental Quality Incentives Program (EQIP) provides cost share funding for conservation practices by farmers and ranchers and the Wildlife Habitat Incentives Program (WHIP) provides cost share funding for conservation practices benefiting wildlife for any landowner.

E. New Grant Funding Opportunities

While State grant funding opportunities have become more difficult to come by due to the current economic conditions and budget problems, other sources are available to potentially fund oak restoration and conservation efforts. The Wildlife Conservation Commission of Napa County provides annual grants that are intended to support the preservation, propagation, and protection of fish and wildlife in Napa County. The funding for these grants is provided by California Department of Fish and Game fines and settlements, as well as local fines and settlements that are designated for this purpose from enforcement actions.

The Wildlife Conservation Commission consists of eight (8) members: Four (4) At-Large/ Citizen Representatives, One (1) Sportsperson or Angler, One (1) Youth, One (1) Wildlife Conservation Representative and One (1) Member of the Conservation, Development and Planning Commission. The Commission meets annually in August to review the grant applications and make recommendations to the Napa County Board of Supervisors on the expenditure of funds. The total amount of grant funds available for project proposals is typically $12,000 to $15,000, but may be up to $50,000 depending upon funding availability and demonstrated project needs in any given year. Past

project proposals have included wildlife rehabilitation, native habitat enhancement, environmental education programs and species monitoring studies.

F. WILLIAMSON ACT

The California Land Conservation Act of 1965, also known as the Williamson Act, is a land protection program established to preserve agricultural and open space lands. By participating in the Williamson Act (Act), landowners are able to protect large tracts of farmland and open space from development and reserve it for agricultural use. Much of this contracted land in Napa County also contains contiguous areas of oak woodland habitat. Williamson Act contracts are established for a rolling term of 10 years. In return, parcels are assessed at a rate which reflects their agricultural and open space uses rather than their full market value. If a contract is not renewed, it normally terminates nine years after non-renewal. Early cancellation of a contract can result in substantial penalties. Currently, there are more than 71,000 acres restricted by Williamson Act contracts[26] in Napa County of which approximately 40 percent[27] is oak woodland.

G. OPPORTUNITIES FOR COLLABORATION

Numerous collaborative efforts are currently underway throughout Napa County that provide excellent examples of voluntary efforts. Some of the more notable projects of the Napa County Regional Park and Open Space District, the Land Trust of Napa County, the Napa Green Certified Land program, and the Napa River Rutherford Dust Restoration Project are outlined below.

The **Napa County Regional Park and Open Space District**, approved by the voters in 2006, was established to partner with other public agencies and land conservation organizations in protecting open space, preserving natural resources and enhancing habitat. Since its formation, examples of District projects included (1) protecting 224 acres of oak woodlands by acquiring the property through a bargain sale from the Land Trust of Napa County, (2) forming a partnership with the Napa County Resource Conservation District and the Department of Fish and Game to restore Valley Oak habitat at the Napa River Ecological Reserve, (3) initiating a partnership with the Napa County Flood Control District for the long-term protection of riparian habitat, oak woodland restoration and improved environmental education opportunities in the South Napa Wetlands, as well as other stream bank restoration efforts, and (4) obtaining grant funding from the State Coastal Conservancy to acquire and protect 673 acres of open space including extensive oak woodlands in the Moore Creek watershed.

The **Land Trust of Napa County** has been conserving agricultural and natural open space for several decades. In addition to holding thousands of acres of oak woodland which are protected through donated conservation easements, the land trust has helped broker major transactions which have enabled other agencies to protect more than

12,000 acres of oak woodlands; the most notable of these is the extensive Knoxville Wildlife Area now managed by the Department of Fish and Game. The Land Trust has completed the acquisition of more than 4,165 acres of open space in Palisades northwest of Angwin. Known as the Wildlake-Duff property, the area contains the Bell Canyon watershed, which provides 80 percent of the drinking water for St. Helena, and will forever provide oak woodland habitat for wildlife, allowing native plant species to thrive in a pristine area. Long-term preservation of the area will likely include cooperative management by the Land Trust, the California Department of Parks and Recreation and the Napa County Regional Park and Open Space District, as well as additional funding from both public and private sources.

Sustainable vineyard practices are being introduced through the **Napa Green Certified Land Program**, a third party certified, voluntary program for Napa County vintners and grape growers that seeks to restore, protect and enhance the regional watershed. The program includes not only farmed or vineyard land, but also non-farmed and wild land, roadways, steam banks, drainage and more within a specific property. Plan details are unique to each owner‘s property and include restoration of wildlife habitat, healthy riparian environments and more with sustainable agriculture practices. Approximately 33,150 acres are currently enrolled in the program and more than 16,900 acres are certified, with thousands more about to receive official certification. A majority (90%) of the Napa River watershed is in private ownership making this public/ private partnership, Napa Green, vital to our community. The certification is in partnership with Fish Friendly Farming, National Marine Fisheries Service, the Napa County Department of Agriculture‘s Department of Pesticide Regulation, and the Regional Water Quality Control Board among others.

In 2002, the Rutherford Dust Society Board of Directors voted unanimously to empower a subcommittee, the **Rutherford Dust (Napa River) Restoration Team** (RDRT or "our dirt"), to initiate a plan to manage and restore the river. This committee includes over 25 riverside property owners. Since that date, RDRT has successfully pioneered an innovative partnership with Napa County to realize this vision. Building upon over 5 years of detailed engineering and ecological studies, a comprehensive design for the entire 4.5 mile reach was released in October of 2008 for environmental and regulatory review. Project construction commenced with Phase 1 in July 2009, starting at the upstream boundary of the project area at the Zinfandel Lane Bridge. For California‘s agricultural sector and beyond, this project provides a community-based leadership model for watershed restoration. It is arguably one of the most ambitious initiatives of its kind, and one of the few comprehensive reach-scale restoration projects in the region to move beyond just planning into on-the-ground implementation.

VIII Oak Woodland Protection Through Sustainable/Best Management Practices (BMPs) & CEQA Mitigation

In addition to adopting and implementing protective policies and regulations, Napa County also supports oak woodland conservation by working with individual applicants to create development plans that optimally preserve oak woodlands while

meeting the applicants' needs. This may include the incorporation of a wide range of Sustainable/ Best Management Practices (BMPs) into the design of the projects, as well as the incorporation of effective environmental impact (CEQA) mitigation measures.

A. Sustainable Best Management Practices (BMPs)

For oak woodland as well as other natural resource protection, a wide range of sustainable BMPs can be incorporated into the project design (vineyard, winery or other projects). Project planning and BMPs are important components to developing effective management plans that address all aspects of the property and its use. A set of BMPs can be developed to promote oak woodland management, and outline a suite of practices to achieve soil and water conservation, stable drainage, riparian corridor enhancement, fisheries enhancement and long-term improvement and sustainability.

These are an important part of the Napa Green Certified Land Program and Fish Friendly Farming, where Farm Plans are developed to address all aspects of the vineyard/ property. The planning process involves several steps, which include:

1) An inventory/ assessment of the natural resources, streams, soils, topography, and vegetation of the property as well as an analysis of current management practices;
2) Identification of needed changes to management practices or new vineyard design and application of program Beneficial Management Practices (BMP's) to the property;
3) Identification of erosion site or road repair projects; stream corridor and fisheries habitat projects and other improvements; preparation of an implementation program for both vineyard management changes and restoration projects including potential cost share sources; and
4) A requirement for photo documentation of changing site conditions and progress towards the goals and objectives of the plan and BMP implementation.

Recommendations for Best Management Practices are summarized in Appendix D from various publications on oak woodland protection, maintenance, and restoration, as well as contributions by local and other experts. These include information/guidelines for the maintenance, restoration, and rehabilitation of oak woodlands, disturbance around oaks and protecting trees from construction impacts, care of oak trees, building around oaks and oaks in the home garden, and others. Interested property owners as well as various professionals are encouraged to consult these resources for additional information.

Note: A summary of Sustainable BMPs for Oak Woodlands is provided in Appendix D.

B. CEQA Mitigation

Through the CEQA review process for discretionary projects, such as vineyards and wineries, mitigation measures are included to ensure that potential impacts are addressed. The General Plan Natural Resource Goals and Policies provide the primary direction for oak woodland protection and conservation in Napa County and require the following actions:

> **Policy CON-24** Maintain and improve **oak woodland habitat** to provide for slope stabilization, soil protection, species diversity, and wildlife habitat through appropriate measures including one or more of the following:

a) Preserve, to the extent feasible, oak trees and other significant vegetation that occur near the heads of drainages or depressions to maintain diversity of vegetation type and wildlife habitat as part of agricultural projects.

b) Comply with the Oak Woodlands Preservation Act (PRC Section 21083.4) regarding oak woodland preservation to conserve the integrity and diversity of oak woodlands, and retain, to the maximum extent feasible, existing oak woodland and chaparral communities and other significant vegetation as part of residential, commercial, and industrial approvals.

c) Provide replacement of lost oak woodlands or preservation of like habitat at a 2:1 ratio when retention of existing vegetation is found to be infeasible. Removal of oak species limited in distribution shall be avoided to the maximum extent feasible.

d) Support hardwood cutting criteria that require retention of adequate stands of oak trees sufficient for wildlife, slope stabilization, soil protection, and soil production be left standing.

e) Maintain, to the extent feasible, a mixture of oak species which is needed to ensure acorn production. Black, canyon, live, and brewer oaks as well as blue, white, scrub, and live oaks are common associations.

f) Encourage and support the County Agricultural Commission‘s enforcement of state and federal regulations concerning Sudden Oak Death and similar future threats to woodlands.

For green house gases(GHG) and carbon sequestration, the Napa County General Plan calls on the County to complete an inventory of green house gas emissions from all major sources in the County by the end of 2008, and then to seek reductions such that emissions are equivalent to year 1990 levels by 2020. The General Plan also states that "development of a reduction plan shall include consideration of a 'green building' ordinance and other mechanisms that are shown to be effective at reducing emissions." Overall increases in GHG emissions in Napa County were assessed in the Environmental Impact Report (EIR) prepared for the Napa County General Plan Update and certified in June 2008. GHG emissions were found to be significant and unavoidable

despite adoption of mitigation measures that incorporated specific policies and action items into the General Plan.

Napa County is currently developing an emission reduction plan, and in the interim requires project applicants to quantify and reduce GHG emission through a variety of strategies. For larger land and agricultural/ vineyard conversion projects involving proposed oak tree removal, the county requires an analysis of pre- and post project change in carbon storage capacity and sequestration rate for remaining and future vegetation. Until the County's Climate Action Plan is complete, determination of significance and applicable mitigations are made on a case by case basis. If impacts are found to be significant, projects may be required to incorporate GHG reduction methods, which could include: avoidance, conservation or preservation of oaks/ trees, replanting native/ drought tolerant vegetation, use of ground cover and limited tilling, limiting the amount of non-pervious materials, building on existing and/ or degraded sites, using existing materials, limiting new vehicle trips, improving the overall energy efficiency and environmental sustainability of the proposed project/ operation, and GHG offsets. Additional mitigation strategies may be developed as a result of the Climate Action Plan effort currently underway *(also see Recommendations for the Future).*

IX. Recommendations for the Future

Oak woodland conservation will require a sustained commitment by the community in order to assure that we will pass on healthy and productive oak woodlands to future generations. Napa County will continue to implement the policies and action items contained in the General Plan as a part of the County's continued commitment to the conservation of natural resources, and the protection of agriculture and open space. Development of a Climate Action Plan for Napa County is also on-going at this time and it is expected to provide further support for the county's oak woodland conservation efforts. Additional recommendations to support the current Oak Woodland protection efforts that are underway in Napa County include:

A. Education & Outreach

- Publications about Napa County's historical and current oak woodland resources (e.g.-SFEI Historical Ecology Atlas)
- Recognition or Designation of Heritage Oak Trees
- Promoting efforts to "re-oak" the valley by incorporating oak trees into designed landscapes associated with roads, parking lots, residential and non-residential developments.
- Encourage the proper management of existing oak woodlands in Napa County, including the reduction of fire hazard, which can be a significant threat to oak woodlands.

B. MITIGATION BANK

- Development of an Oak woodlands conservation and enhancement fund *(in-lieu mitigation fee, carbon trading/offsets)*

C. PILOT RESTORATION PROJECTS

- Pilot projects/ small experiments to demonstrate or test different methods of oak woodland conservation
- Information sharing regarding projects/ experiments results

D. RESEARCH & MONITORING

- South Wetlands Opportunity Area(SWOA) monitoring/ data
- Hyper-spectral/ remote sensing of vegetation types
- Carbon Sequestration

E. REMOVING OBSTACLES TO RESTORATION

Streamlined permitting from Resource Agencies

F. NURSERY PROPAGATION PROGRAM

Support for local propagation (nursery programs) and availability of seedlings and saplings for replanting and restoration

---

Re-Oaking the Valleys……

While the old oak savannas are nearly gone, naturalistic patterns of valley oaks and other native trees could be recreated, even in highly developed areas. Such a re-oaking plan needs to occur at a landscape scale to consider how oaks fit in to the larger picture of natural spaces for humans and wildlife. Within this landscape context, trees could be strategically reintroduced along roads, fence lines, and public spaces, and focused on the several soil types that correlate with most of the historical trees (>50% of trees are associated with ~20% of the soil area). These efforts would build on a significant number of surviving trees that have been maintained as shade tress and landscape elements in public spaces, private residences, wineries and vineyards, and would help reverse the long-term decline in valley oaks. As well as returning a signature part of our California heritage to everyday life, such an effort would also provide a number of other valuable ecological services to the contemporary landscape. Landscape trends and restoration opportunities are currently being observed through projects in Napa Valley, Sonoma Valley, and eastern Contra Costa County. Preliminary investigations with plant ecologists, wildlife ecologists, and urban foresters indicate that the native trees could, with careful design, be re-integrated within developed landscapes in densities and patterns reflective of the historical landscape. Such an effort, coordinated at a regional scale, would benefit native oaks, especially the now relatively rare valley oak, and a range of other native wildlife. It would also provide urban forestry functions such as shading, urban runoff reduction, carbon storage, and aesthetic/ cultural value. A re-oaking plan would show how to maximize ecological benefits, while addressing challenges of appropriate planting context, maintenance issues, and jurisdictional approaches.

Some of the potential benefits include:

- Return a signature aspect of California's heritage to local valley communities
- Improve habitat quality and connectivity for species such as the acorn woodpecker, white-breasted nuthatch, oak titmouse, and pallid bat
- Increase valley oak distribution, population connectivity, and genetic viability
- Add younger age-classes to the oak population to prevent eventual extinction
- Increase nutrient and water retention to improve creek and Bay health
- Increase resiliency of the oaks to climate change
- Reduce heat island effect of urbanized areas
- Carbon offsets for municipalities
- Add value to homes and businesses from the aesthetic and shade benefits of oaks
- Create opportunities for local residents to learn about and participate in urban ecology.

While more attention is often focused on the environmental enhancement of our coasts, rivers, and uplands, the valleys -- where most people live -- receive little restoration effort because of a perceived lack of ecological opportunity. However, the structure of the native valley oak landscape lends itself to the integration of ecological values with social needs. The potential to dramatically increase oak presence and native wildlife habitat in once prime habitat areas should be recognized.

Note: A concept to reintegrate or in-fill native oak trees within developed landscapes, such as along roads and public spaces (parks, trails), as well as restoration projects and other opportunities.

San Francisco Estuary Institute (SFEI) 2010

List of Sources

Agricultural Commissioner's Office, Napa County
State Board of Agriculture-Horticultural Commissioners Report. 1910/1916.
Walker, Andrew. *American Society for Enology/Viticulture Meeting Proceedings.* 2000

California Oaks Foundation. *Oaks 2040: The Status and Future of Oaks in California.* Online: [http://www.californiaoaks.org/html/2040.html]

Calaveras County. *Calaveras County Voluntary Oak Woodland Management Plan*. 2007

Department of Energy. *FAQ; DOE Consortium for Research on Enhancing Carbon Sequestration in Terrestrial Ecosystems*. Online: [http://csite.esd.ornl.gov/faqs.html]

El Dorado County. *El Dorado County Oak Woodland Management Plan*. 2008

Gasser, Don. Registered Professional Forester/Certified Forester/Arborist. *Interview*.2010

Giusti, Gregory A., Douglas D. McCreary and Richard B. Standiford. *A Planner's Guide for Oak Woodlands*. University of California Agriculture and Natural Resources. 2005.

Giusti, GA. *Oak Woodlands of Mendocino County: An Assessment of Their Distribution, Ownership Patterns, and Policies and Projects Affecting Their Conservation.* 2001

Grossinger, Robin. *Re-Oaking the Valleys: A Strategy to Re-integrate Native Trees within Developed Landscapes.* San Francisco Estuary Institute. 2009

Grossinger, Robin, Erin Beller, Josh Collins and Shari Gardner. *The Napa River Watershed Historical Ecology Project.* San Francisco Estuary Institute. 2008

Le Roux, Kerry. *"Global Warming Threatens California's Oak Trees*," *Mid-County Post*.

Merenlender, Adina M. and Julia Crawford. *"Vineyards in an Oak Landscape."* University Division of Agriculture and Natural Resources. 1998.

Napa County. *Napa County General Plan & Environmental Impact Report.* 2008

Napa County. *Napa County Baseline Data Report.* 2005.

Napa County Transportation & Planning Agency. *Napa Countywide Community Climate Action Plan (draft).* 2009

Napa County. *Watershed Information Center & Conservancy (WICC) of Napa County Strategic Plan.* 2005.

Pavlik, Bruce M. et al. *Oaks of California*. Cachuma Press Inc. 1991, June 2006rev

Pinney, Thomas. *A History of Wine in America - From the Beginning to Prohibition.* UC Press. 1989

Placer County. *Placer County Oak Woodland Management Plan*.

Public Resources Code. Oak woodland definition, PRC 4793(e); also F&G Code 1361(h).

Napa County Regional Park & Open Space District. *Master Plan 2008-2013*. 2009

San Luis Obispo County. *San Luis Obispo County Voluntary Oak Woodland Management Plan*. 2003

Santa Barbara County. *Santa Barbara County Oak Restoration Program 1994-2005 Final Report*.

Santa Clara County. *An Oak Woodlands Management Plan for Santa Clara County*. 2005

Society of California Pioneers. *Mt. St. Helena from Mount Lincoln.* 1860/1870. 1796

Society of California Pioneers. *Noontime – Five Tons of Prunes.* 1906

Tehama County. *Tehama County Voluntary Oak Woodland Management Plan*. 2005

Ventura County. *Ventura County Oak Woodland Management Plan*. 2007

Weber, Lin. *Old Napa Valley: The History to 1900.* Wine Ventures Publishing. 1998.

Yolo County. *Yolo County Oak Woodland Conservation and Enhancement Plan.* 2007.

End Notes

[1] NC BDR, 2005
[2] NC BDR, 2005
[3] Weber, 1998
[4] Giusti et al, 2005
[5] Dept. of Energy
[6] Yolo-OWCEP, 2007
[7] Yolo-OWCEP, 2007
[8] Tehama-VOWMP, 2005
[9] Ag Comm/Walker, ASEV, 2000
[10] Pinney, History of Wine, 1989
[11] Ag Comm/Hort Comm Report, 1910/1916
[12] Pavlik, Oaks of Calif, 1991/2006
[13] Pavlik, Oaks of Calif, 1991/2006
[14] Pavlik, Oaks of Calif, 1991/2006
[15] BOF/PRC4793e/F&GC1361h
[16] SCC-OWMP, 2005
[17] NC BDR, 2005
[18] NC RPOSD, 2009
[19] NC GP/EIR, 2008
[20] NC BDR, 2005
[21] Don Gasser, Interview, 2010
[22] NCTPA CAP, 2009
[23] Le Roux
[24] Yolo-OWCEP, 2007
[25] NC RPOSD, 2009
[26] Napa County Assessor
[27] Napa County GIS

Appendices

Appendix A

Appendix A: California Oak Woodlands Conservation Act (AB 242 - 2001)
Oak Woodlands Conservation Act (SB1334 - 2004)

Appendix B

Appendix B: Oak Woodland Communities

Appendix B-1 to 4: Oak Woodland Maps

- B-1 Map of the estimated Historical Extent of Oak Woodlands and other natural features in the Napa Valley of the 19th century
- B-2 Map of the current Distribution of Oak Woodlands in Napa County (2009)
- B-3 Map of the Protected Oak Woodlands in Napa County (2009)
- B-4 Map of the Oak Woodlands at Risk in Napa County (2009)

Appendix C

Appendix C: Oak Woodlands Conservation & Restoration Evaluation Criteria

Appendix D

Appendix D: Sustainable Best Management Practices (BMPs) for Oak Woodlands

Appendix E

Appendix E: Guidelines for Oak Woodland Conservation Program Submittals

Appendix F

Appendix F: Resolution of Adoption for the Napa County Voluntary Oak Woodland Management Plan

Appendix A

California Oak Woodlands Conservation Act

Assembly Bill No. 242

CHAPTER 588

An act to add Article 3.5 (commencing with Section 1360) to Chapter 4 of Division 2 of and to add and repeal Section 1363.5 of, the Fish and Game Code, relating to oak woodlands conservation.

[Approved by Governor October 7, 2001. Filed with
Secretary of State October 9, 2001.]

LEGISLATIVE COUNSEL'S DIGEST

AB 242, Thomson. Wildlife conservation: oak woodlands. The existing Wildlife Conservation Law of 1947 establishes the Wildlife Conservation Board, and requires the board, among other things, to determine the areas in the state that are most essential and suitable for wildlife production and preservation, as prescribed. This bill would enact the Oak Woodlands Conservation Act to provide funding for the conservation and protection of California's oak woodlands. The bill would create the Oak Woodlands Conservation Fund in the State Treasury, and would authorize the expenditure of moneys in the fund, upon appropriation by the Legislature, for purposes of the act. The bill would require the board to administer the fund, as prescribed, and would provide that moneys in the fund shall be available to local government entities, park and open-space districts, resource conservation districts, private landowners, and nonprofit organizations for implementation and administration of the act, as provided. The bill would require each city or county planning department that receives a grant for the purposes of the act to report to the city councilor board of supervisors of the county, as appropriate, on the uses of those funds within one year from the date the grant is received. The existing Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (the Villaraigosa-Keeley Act) provides that not less than $5,000,000 of the proceeds of bonds issued under that act be allocated, upon appropriation by the Legislature, for the preservation of oak woodlands. This bill would provide for the transfer of not less than $5,000,000 and not more than $8,000,000, as determined by the Wildlife Conservation Board, to the Oak Woodlands Conservation Fund to be used for the purposes of the bill.

The people of the State of California do enact as follows:

SECTION 1. The Legislature hereby finds and declares all of the following:

(a) The conservation of oak woodlands enhances the natural scenic beauty for residents and visitors, increases real property values, promotes ecological balance, provides habitat for over 300 wildlife species, moderates temperature extremes, reduces soil erosion, sustains water quality, and aids with nutrient cycling, all of which affect and improve the health, safety, and general welfare of the residents of the state.

(b) Widespread changes in land use patterns across the landscape are fragmenting the oak woodlands wildland character over extensive areas. (c) The future viability of California's oak woodlands resources are dependent, to a large extent, on the maintenance of large scale land holdings or on smaller multiple holdings that are not divided into fragmented, nonfunctioning biological units.

(d) The growing population and expanding economy of the state have had a profound impact on the ability of the public and private sectors to conserve the biological values of oak woodlands. Many of the privately owned oak woodlands stands are in areas of rapid urban and suburban expansion.

(e) A program to encourage and make possible the long-term conservation of oak woodlands is a necessary part of the state's wildlands protection policies and programs, and it is appropriate to expend money for that purpose. An incentive program of this nature will only be effective when used in concert with local planning and zoning strategies to conserve oak woodlands.

(f) Funding is necessary to sufficiently address the needs of conserving oak woodlands resources for future generations of Californians.

(g) California voters recognized the importance of funding that is needed to sufficiently protect the state's oak woodlands by passing Proposition 12, the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (the Villaraigosa-Keeley Act), which included not less than five million dollars ($5,000,000) for oak woodlands conservation.

SEC. 2. Article 3.5 (commencing with Section 1360) is added to Chapter 4 of Division 2 of the Fish and Game Code, to read:

Article 3.5. Oak Woodlands Conservation Act

1360. This article shall be known, and may be cited, as the Oak Woodlands Conservation Act.

1361. For purposes of this article, the following terms have the following meanings:

(a) "Board" means the Wildlife Conservation Board established pursuant to Section 1320.

(b) "Conservation easement" means a conservation easement, as defined in Section 815.1 of the Civil Code.

(c) "Fund" means the Oak Woodlands Conservation Fund.

(d) "Land improvement" means restoration or enhancement of biologically functional oak woodlands habitat.

(e) "Local government entity" means any city, county, city and county, district, or other local government entity, if the entity is otherwise authorized to acquire and hold title to real property.

(f) "Nonprofit organization" means a tax-exempt nonprofit organization that meets the requirements of subdivision (a) of Section 815.3 of the Civil Code.

(g) "Oak" means any species in the genus Quercus.

(h) "Oak woodlands" means an oak stand with a greater than 10 percent canopy cover or that may have historically supported greater than 10 percent canopy cover.

(i) "Oak woodlands management plan" means a plan that provides protection for oak woodlands over time and compensates private landowners for conserving oak woodlands.

(j) "Special oak woodlands habitat elements" means multi- and single-layered canopy, riparian zones, cavity trees, snags, and downed woody debris.

1362. It is the intent of the Legislature that this article accomplish all of the following:

(a) Support and encourage voluntary, long-term private stewardship and conservation of California's oak woodlands by offering landowners financial incentives to protect and promote biologically functional oak woodlands over time.

(b) Provide incentives to protect and encourage farming and ranching operations that are operated in a manner that protects and promotes healthy oak woodlands.

(c) Provide incentives for the protection of oak trees providing superior wildlife values on private lands.

(d) Encourage local land use planning that is consistent with the preservation of oak woodlands, particularly special oak woodlands habitat elements.

(e) Provide guidelines for spending the funds allocated for oak woodlands pursuant to the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (the Villaraigosa-Keeley Act (Chapter 1.692 (commencing with Section 5096.300) of Division 5 of the Public Resources Code)).

(f) Establish a fund for oak woodlands conservation, to which future appropriations for oak woodlands protection may be made, and specify grant making guidelines.

1363. (a) The Oak Woodlands Conservation Fund is hereby created in the State Treasury. The fund shall be administered by the board. Moneys in the fund may be expended, upon appropriation by the Legislature, for the purposes of this article.

(b) Money may be deposited into the fund from gifts, donations, funds appropriated by the Legislature for the purposes of this article, or from federal grants or loans or other sources, and shall be used for the purpose of implementing this article, including administrative costs. Funds from the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (the Villaraigosa-Keeley Act (Chapter 1.692 (commencing with Section 5096.300) of Division 5 of the Public Resources Code)), but not including funds dedicated as matching funds for the federal Forest Legacy Program, shall be deposited in the fund.

(c) To the extent consistent with the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (the Villaraigosa-Keeley Act (Chapter 1.692 (commencing with Section 5096.300) of Division 5 of the Public Resources Code)), the board may use money designated for the preservation and restoration of oak woodlands in the Oak Woodlands Conservation Fund for projects in conjunction with the California Forest Legacy Program (Div. 10.5 (commencing with Sec. 12200) of the P.R.C.)), but only for the purposes specified in this article and only if the following requirements are met:

(1) The Department of Forestry and Fire Protection shall make an initial recommendation to the board.

(2) The board may deny any initial recommendation to the Department of Forestry and Fire Protection. Subsequently, if the department alters an initial proposal, in a manner that the board determines to be significant, the board may withdraw its initial approval of the recommendation at any time during the process.

(d) The purposes for which moneys in the fund may be used include all of the following:

(1) Grants for the purchase of oak woodlands conservation easements. Any entity authorized to hold a conservation easement under Section 815.3 of the Civil Code may hold a conservation easement

pursuant to this article. The holder of the conservation easement shall ensure, on an annual basis, that the conservation easement conditions have been met for that year.

(2) Grants for land improvement.

(3) Cost-sharing incentive payments to private landowners who enter into long-term conservation agreements. An agreement shall include management practices that benefit oak woodlands and promote the economic sustainability of farming and ranching operations.

(4) Public education and outreach by local government entities, park and open-space districts, resource conservation districts, and nonprofit organizations. The public education and outreach shall identify and communicate the social, economic, agricultural, and biological benefits of strategies to conserve oak woodlands habitat values, including watershed protection benefits that reduce soil erosion, increase streamflows, and increase water retention and sustainable agricultural operations.

(5) Assistance to local government entities, park and open-space districts, resource conservation districts, and nonprofit organizations for the development and implementation of oak conservation elements in local general plans.

(6) Technical assistance consistent with the purpose of preserving oak woodlands.

(e) Not more than 20 percent of all grants made by the board pursuant to this article may be used for the purposes described in paragraphs (4), (5), and (6) of subdivision (d). Not less than 80 percent of funds available for grants pursuant to this article shall be expended for the purposes described in paragraphs (1), (2), and (3) of subdivision (d).

(f) Notwithstanding any other provision of law, this article governs the expenditure of funds for the preservation of oak woodlands pursuant to paragraph (4) of subdivision (a) of Section 5096.350 of the Public Resources Code.

1363.5. (a) Commencing on June 30, 2003, and annually thereafter, the board shall report to the Legislature and the Governor concerning the activities and expenditures of the fund.

(b) (1) In the first report to the Legislature, the board shall provide its best estimate of the total amount, in terms of acreage, species, and coverage, of oak woodlands habitat purchased with funds from the Habitat Conservation Fund and other funds pursuant to the California Wildlife Protection Act of 1990 (Chapter 9 (commencing with Section 2780) of Division 3.

(2) In each subsequent annual report, the board shall update the information required by paragraph (1) to reflect additional oak woodlands habitat purchased with funds from the Habitat Conservation

Fund pursuant to Chapter 9 (commencing with Section 2780) of Division 3, and any purchases made with moneys deposited in the Oak Woodlands Conservation Fund.

(c) The board shall annually provide its best estimate in the report, the acreage, cover, and species of oak woodlands habitat purchased with all moneys from the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Fund.

(d) The board shall make all information available online at its Web site.

(e) This section shall become inoperative on July 1, 2020, and, as of January 1, 2021, is repealed, unless a later enacted statute that is enacted before January 1, 2021, deletes or extends the dates on which it becomes inoperative and is repealed.

1364. Moneys in the fund shall be available to local government entities, park and open-space districts, resource conservation districts, private landowners, and nonprofit organizations for the purposes set forth in subdivision (d) of Section 1363.

1365. The board shall develop and adopt guidelines and criteria for awarding grants that achieve the greatest lasting conservation of oak woodlands. The board shall develop these guidelines in consultation with the Department of Forestry and Fire Protection, the Department of Food and Agriculture, the University of California's Integrated Hardwood Range Management Program, conservation groups, and farming and ranching associations. As it applies to the award of grants for the implementation of this article, the board criteria shall specify that easement acquisitions that are the most cost-effective in comparison to the actual resource value of the easement shall be given priority.

1366. (a) To qualify for a grant pursuant to this article, the county or city in which the grant money would be spent shall prepare, or demonstrate that it has already prepared, an oak woodlands management plan that includes a description of all native oak species located within the county's or city's jurisdiction.

(b) To qualify for a grant pursuant to this article, the board shall certify that any proposed easement was not, and is not, required to satisfy a condition imposed upon the landowner by any lease, permit, license, certificate, or other entitlement for use issued by one or more public agencies, including, but not limited to, the mitigation of significant effects on the environment of a project pursuant to an approved environmental impact report or to mitigate a negative declaration required pursuant to the California Environmental Quality Act (Division 13 (commencing with Section 21000)) of the Public Resources Code.

(c) To qualify for a grant under this article, the applicant shall demonstrate that its proposal provides protection of oak woodlands that

is more protective than the applicable provisions of law in existence on the date of the proposal.

(d) A county or city may develop an oak woodlands management plan. A nonprofit corporation, park and open-space district, resource conservation district, or other local government entity may apply to the board for funds to develop an oak woodlands management plan for a county or city, but the county or city shall maintain ultimate authority to approve the oak woodlands management plan.

(e) The process for developing an initial oak woodlands management plan, and the adoption of significant amendments to a plan, as determined by the county or city, are subject to the Ralph M. Brown Act (Chapter 9 (commencing with Section 54950) of Part 1 of Division 2 of
Title 5 of the Government Code).

(f) A proposal by a local government entity, nonprofit corporation, park and open-space district, private landowner, or resource conservation district for a grant to be expended for the purposes of this article shall be certified by the county or city as being consistent with the oak woodlands management plan of the county or city. If the land covered by the proposal is in the jurisdiction of more than one county or city, each county or city shall certify that the proposal is consistent with the oak woodlands management plan of each county or city.

(g) If two or more entities seek grant funding from the board pursuant to this article for the same jurisdiction, the county or city shall designate which entity shall lead the efforts to manage oak woodlands habitat in the area.

1367. On or before April 1, 2002, the board and the Department of Forestry and Fire Protection shall develop a memorandum of understanding regarding the protection of oak woodlands that does all of the following:

(a) If necessary, creates a specific process for working together to use money from the fund in conjunction with the California Forest Legacy Program Act of 2000 (Division 10.5 (commencing with Section 12200) of the Public Resources Code).

(b) Lists elements a county or city shall include in its oak woodlands management plan. Items included in the plan shall assist a county or a city to specify conservation priorities and prevent oak woodlands habitat fragmentation while minimizing the cost and administrative burden associated with developing the plan. The elements may include any or all of the following:

(1) Tree inventory mapping.

(2) Oak canopy retention standards.

(3) Oak habitat mitigation measures.

(4) A procedure to monitor the effectiveness of the plan and to modify the plan as necessary.

(c) Designates an online repository for oak woodlands management plans that will be easily accessible to the public and any other state agency involved in oak woodlands conservation efforts.

(d) Discusses the relationship between oak woodlands conservation efforts under this article and efforts by other state agencies to protect oak woodlands, including efforts to combat sudden oak death, and outlines a plan, as necessary, for coordinating with these agencies.

1368. The board may not approve a grant to a local government entity, park and open-space district, resource conservation district, or nonprofit organization if the entity requesting the grant has acquired, or proposes to acquire, an oak woodlands conservation easement through the use of eminent domain, unless the owner of the affected lands requests the owner to do so.

1369. A city or county planning department may utilize a grant awarded for the purposes of this article to consult with a citizen advisory committee and appropriate natural resource specialists in order to report publicly to the city council or the board of supervisors on the status of the city's or county's oak woodlands. Each city or county planning department that receives a grant for the purposes of this article shall report to the city council or to the board of supervisors of the county, as appropriate, on the use of those grant funds within one year from the date the grant is received.

1370. No money may be expended from the fund to adopt guidelines or to administer the fund until at least one million dollars ($1,000,000) is deposited in the fund.

1372. Nothing in this article grants any new authority to the board or any other agency, office, or department to affect local policy or land use decision-making.

SEC. 3. An amount not less than five million dollars ($5,000,000) and not more than eight million dollars ($8,000,000), as determined by the Wildlife Conservation Board, from moneys in the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Fund available for oak woodlands conservation pursuant to paragraph (4) of subdivision (a) of Section 5096.350 of the Public Resources Code shall be transferred to the Oak Woodlands Conservation Fund created pursuant to Section 1363 of the Fish and Game Code, to be used for the purposes of Article 3.5 (commencing with Section 1360) of Chapter 4 of Division 2 of the Fish and Game Code.

BILL NUMBER: SB 1334

CHAPTERED BILL TEXT

CHAPTER 732

FILED WITH SECRETARY OF STATE SEPTEMBER 24, 2004
APPROVED BY GOVERNOR SEPTEMBER 24, 2004
PASSED THE SENATE AUGUST 26, 2004
PASSED THE ASSEMBLY AUGUST 23, 2004
AMENDED IN ASSEMBLY AUGUST 17, 2004
AMENDED IN ASSEMBLY JUNE 17, 2004
AMENDED IN ASSEMBLY JUNE 7, 2004
AMENDED IN SENATE MAY 24, 2004
AMENDED IN SENATE APRIL 28, 2004
AMENDED IN SENATE MARCH 31, 2004

INTRODUCED BY Senator Kuehl
(Coauthor: Senator Romero)
(Coauthors: Assembly Members Hancock, Koretz, and Liu)

FEBRUARY 18, 2004

An act to add Section 21083.4 to the Public Resources Code, relating to oak woodlands conservation.

LEGISLATIVE COUNSEL'S DIGEST

SB 1334, Kuehl. Oak woodlands conservation: Environmental quality.

(1) The Oak Woodlands Conservation Act provides funding for the conservation and protection of California's oak woodlands. The California Environmental Quality Act (CEQA) requires a lead agency to prepare, or cause to be prepared, and certify the completion of, an environmental impact report on a discretionary project that it proposes to carry out or approve that may have a significant effect on the environment, as defined, or to adopt a negative declaration if it finds that the project will not have that effect. CEQA also requires a lead agency to prepare a mitigated negative declaration for a project that may have a significant effect on the environment if revisions in the project would avoid or mitigate that effect and there is no substantial evidence that the project, as revised, would have a significant effect on the environment. CEQA provides some exemptions from its requirements for specified projects. This bill would require a county, in determining whether CEQA requires an environmental impact report, negative declaration, or mitigated negative declaration, to determine whether a project in its jurisdiction may result in a conversion of oak woodlands that will have a significant effect on the environment, and would require the county, if it determines there may be a significant effect to oak woodlands, to require one or more of specified mitigation alternatives to mitigate the significant effect of the

conversion of oak woodlands. The bill would exempt specified activities from its requirements. By imposing new duties on local governments with respect to oak woodlands mitigation, the bill would impose a state-mandated local program.
(2) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement. This bill would provide that no reimbursement is required by this act for a specified reason.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Section 21083.4 is added to the Public Resources Code, to read:

21083.4. (a) For purposes of this section, "oak" means a native tree species in the genus Quercus, not designated as Group A or Group B commercial species pursuant to regulations adopted by the State Board of Forestry and Fire Protection pursuant to Section 4526, and that is 5 inches or more in diameter at breast height.
(b) As part of the determination made pursuant to Section 21080.1, a county shall determine whether a project within its jurisdiction may result in a conversion of oak woodlands that will have a significant effect on the environment. If a county determines that there may be a significant effect to oak woodlands, the county shall require one or more of the following oak woodlands mitigation alternatives to mitigate the significant effect of the conversion of oak woodlands:

(1) Conserve oak woodlands, through the use of conservation easements.
(2) (A) Plant an appropriate number of trees, including maintaining plantings and replacing dead or diseased trees.
(B) The requirement to maintain trees pursuant to this paragraph terminates seven years after the trees are planted.
(C) Mitigation pursuant to this paragraph shall not fulfill more
than one-half of the mitigation requirement for the project.
(D) The requirements imposed pursuant to this
paragraph also may be used to restore former oak woodlands.
(3) Contribute funds to the Oak Woodlands
Conservation Fund, as established under subdivision (a) of Section 1363 of the Fish and Game Code, for the purpose of purchasing oak woodlands conservation easements, as specified under paragraph (1) of subdivision (d) of that section and the guidelines and criteria of the Wildlife Conservation Board. A project applicant that contributes funds under this paragraph shall not receive a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project.
(4) Other mitigation measures developed by the county. (c) Notwithstanding subdivision (d) of Section 1363 of the Fish and Game Code, a county may use a grant awarded pursuant to the Oak Woodlands Conservation Act (Article 3.5 (commencing with Section 1360) of Chapter 4 of Division 2 of the Fish and Game Code) to prepare an oak conservation element for a general plan, an oak

protection ordinance, or an oak woodlands management plan, or amendments thereto, that meets the requirements of this section.

(d) The following are exempt from this section:

(1) Projects undertaken pursuant to an approved Natural Community Conservation Plan or approved subarea plan within an approved Natural Community Conservation Plan that includes oaks as a covered species or that conserves oak habitat through natural community conservation preserve designation and implementation and mitigation measures that are consistent with this section.

(2) Affordable housing projects for lower income households, as defined pursuant to Section 50079.5 of the Health and Safety Code, that are located within an urbanized area, or within a sphere of influence as defined pursuant to Section 56076 of the Government Code.

(3) Conversion of oak woodlands on agricultural land that includes land that is used to produce or process plant and animal products for commercial purposes.

(4) Projects undertaken pursuant to Section 21080.5 of the Public Resources Code.

(e) (1) A lead agency that adopts, and a project that incorporates, one or more of the measures specified in this section to mitigate the significant effects to oaks and oak woodlands shall be deemed to be in compliance with this division only as it applies to effects on oaks and oak woodlands. (2) The Legislature does not intend this section to modify requirements of this division, other than with regard to effects on oaks and oak woodlands.

(f) This section does not preclude the application of Section 21081 to a project.

(g) This section, and the regulations adopted pursuant to this section, shall not be construed as a limitation on the power of a public agency to comply with this division or any other provision of law.

SEC. 2. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because a local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act, within the meaning of Section 17556 of the Government Code.

Appendix B

Oak Woodland Communities

Oak Woodland Vegetation Types:

a. Mixed Oak Woodland

General Distribution

Most oak woodlands in the County are mixed oak woodlands with more than one co-dominant oak species.

Dominant Plants

Mixed oak woodlands where interior live oak and blue oak are co-dominants are common east of the Napa River watershed. Other mixed oak woodlands are composed of coast live oak and valley oak in low elevations, with canyon live oak on steep slopes. The mixed oak alliance also includes stands dominated by deciduous oaks, such as California black oak (*Quercus kelloggii*) (see below). Other tree species found in mixed oak woodlands include big-leaf maple (*Acer macrophyllum*) in wetter areas and madrone (*Arbutus menqiesii*) in drier settings. Conifers such as Douglas-fir (*Psuedotsuga menzeisii*) or Ponderosa pine (*Pinus ponderosa*) form minor components of this community at higher elevations, as does foothill pine at lower elevations. The understory is characterized by annual grassland species, with patches of shrub species such as hillside gooseberry (*Ribes californica*), and poison oak, vines such as hairy honeysuckle (*Lonicera hispidula*), and herbaceous species such as rigid hedge nettle (*Stachys ajugoides*) and miner‘s lettuce (*Claytonia perfoliata*) (Sawyer and Keeler-Wolf 1995). Other commonly found understory species may also include coffeeberry, toyon, manzanita, and spicebush (Sauer 2010).

Common Wildlife

Most wildlife species associated with the mixed oak habitat are also found in other oak woodlands and chaparral. However, birds such as ash-throated flycatcher (*Myiarchus cinerascens*), Hutton‘s vireo (*Vireo huttoni*), orange-crowned warbler, lark sparrow (*Chondestes grammacus*), Bullock‘s oriole (*Icterus bullockii*), Lawrence‘s goldfinch (*Carduelis lawrencei*) and lesser goldfinch (*Carduelis psaltria*) are primarily found in this type of woodland. This habitat shares many of the same mammal and herpetofauna as chaparral described above. Oak woodlands can be extremely productive for wildlife. Acorns provide an important food source for many species of birds and mammals, as do the numerous insects that feed on oaks. Mature stages of oak woodland development provide suitable or optimal breeding conditions for many wildlife species, with abundant food and large living trees used for nesting (Mayer and Laudenslayer 1988).

Special-Status Species

Golden eagles forage in oak woodlands, while Lewis's woodpecker (*Melanerpes lewis*) is a winter resident of this community. Clara Hunt's milk-vetch (*Astragalus clarianus*) may grow in openings in oak woodlands, while Brewer's western flax (*Hesperolinon breweri*) is found on serpentine slopes in oak woodlands. Additional information and a list of special-status species associated with oak woodlands in the county can be found in the Napa County Baseline Data Report (BDR 2005-appendix B-C).

b. Evergreen Oak Woodland

General Distribution

Coast live oak woodlands are common at low elevations in the southern Napa watershed. They may be found on gentle slopes in low foothills, especially on the east side of the Napa Valley, as well as on steep southerly slopes where it is found with chaparral species. Interior live oak woodlands are found east of the Napa River watershed. Mixed broadleaf woodlands are found on mesic slopes in central and western County (Thorne et al. 2004)

Dominant Plants

Evergreen oak woodlands in the County are dominated by coast live oak and interior live oak.

Coast Live Oak Woodland

The coast live oak woodland community is characterized by an open to nearly closed canopy of coast live oak, with madrone and California bay generally under 10–15% relative cover, and a dense understory of poison oak, rigid hedge nettle, and hairy honeysuckle, in addition to perennial grasses and forbs.

Interior Live Oak Woodland

Relatively pure stands of interior live oak are rare in the County. They often include a minor component of foothill pine and coast live oak, and an understory of toyon, buckeye (*Aesculus californica*), bay, coffeberry, Indian warrior (*Pedicularis densiflora*), and Pacific pea (*Lathyrus vestitus*), in addition to perennial grasses and forbs. Shrubs in the understory may include poison oak and yerba santa (*Eriodictyon californicum*).

Mixed Broadleaf Woodlands

Mixed broadleaf woodlands feature California bay or madrone as co-dominants with coast live oak, California black oak, and canyon oak. Douglas-fir and big-leaf maple may comprise up to 5% of the canopy. Such woodlands occur in approximately 4% of the County. The understory community is typically a mix of hazelnut (*Corylus cornuta*) and oceanspray (*Holodiscus discolor*), and vines such as poison oak, toyon, and California blackberry (*Rubus ursinus*). Grasses are a

minor component here including Geyer's oniongrass (*Melica geyeri*) and Torrey's melica. Ferns and leaf litter are prominent on the forest floor.

Tanbark Oak Woodlands

This cover type is uncommon or rare as mapable stands, and it is usually in close proximity to conifers such as Douglas-fir (*Psuedotsuga menzeisii*) or Redwood (*Sequoia sempervirens*) in mesic settings. It is more often a component of the California Bay-Madrone-Coast Live Oak NFD Super Alliance.

Common Wildlife

Many species are primarily associated with oak woodlands, including reptiles such as western skink (*Eumeces skiltonianus*) and northern alligator lizard (*Elgaria coerula*); amphibians such as ensatina (*Ensatina eschscholtzii*) and California slender salamander (*Batrachoseps attenuatus*); and birds such as Nuttall's woodpecker (*Picoides nuttallii*), warbling vireo (*Vireo gilvus*), chestnut-backed chickadee (*Poecile rufescens*), black-throated gray warbler (*Dendroica nigrescens*) and black-headed grosbeak (*Pheucticus melanocephalus*). Typical mammal species found in this habitat include those described for chaparral communities.

Special-Status Species

Lewis's woodpecker is a winter resident of this oak woodland community and golden eagles forage in oak woodlands. Clara Hunt's milk-vetch may grow in openings in oak woodlands, while Brewer's western flax is found on serpentine slopes in oak woodlands. Additional information and a list of special-status species associated with oak woodlands in the county can be found in the Napa County Baseline Data Report (BDR 2005-appendix B-C).

c. Deciduous Oak Woodlands

General Distribution

Blue oak woodlands occur primarily east of Chiles Valley to the County line (Thorne et al. 2004). California black oak woodlands are found at higher elevations, especially in the Atlas Peak region. Valley oak riparian woodlands are found along major riparian corridors, especially along the Napa River and its tributaries.

Dominant Plants

Deciduous oak woodlands in the County are dominated by blue oak. Blue oak woodlands make up approximately 9% of the County. California black oak becomes a more important component of deciduous oak woodlands at higher elevations, and valley oak is more common along riparian corridors.

Blue Oak Woodlands

Blue oak woodlands vary from closed canopies of blue oak to very open stands. In all cases, blue oak makes up at least 80–90% of relative cover (Thorne et al. 2004). The understory is characterized by annual grassland species, with patches of shrub species such as common manzanita (*Arctostaphylos manzanita*), buckeye, hillside gooseberry, and poison oak (Sawyer and Keeler-Wolf 1995). Foothill pine frequently occurs as a minor overstory tree with less than 15% relative cover.

Black Oak Woodlands

Black oak woodlands are located on gentle to moderate slopes trending in most directions except south. They typically occur at higher elevations, particularly in the Atlas Peak region, and comprise a larger component of deciduous woodlands at this elevation.

Oregon White Oak Woodlands

Uncommon as mapable stands, this type is generally a component of more mesic mixed oak stands. Several nearly pure stands were mapped on gentle slopes west of the Napa Valley and north of the city of Napa.

Valley Oak Woodlands

Valley oak riparian woodlands are characterized by one of two suites of co-dominant tree species, either California bay, coast live oak, walnut and ash, or Fremont cottonwood (*Populus fremontii*) and coast live oak. Valley oak woodland also occurs on the open valley floor, where it was historically quite extensive. Valley oak riparian woodlands are described in more detail under the Riparian Woodlands section below.

Common Wildlife

Wildlife communities associated with deciduous oak woodland are similar to those described in evergreen mixed oak woodland. Notable exceptions include relatively rare species including wintering Lewis‘s woodpecker, yellow-billed magpie (*Pica nuttalli*) and phainopepla (*Phainopepla nitens*).

Special-Status Species

Many special-status species occurring in evergreen oak woodlands also occur in deciduous oak woodlands (Appendix A). Some special-status species are more closely associated with deciduous oak woodlands, sometimes because they are found in the riparian areas or higher elevations where deciduous oak woodlands are found. For example, long-legged myotis *(Myotis volans*) is found in high elevation woodlands, while ringtail cat and marsh checkerbloom (*Sidalcea oregana* ssp. *hydrophila*) are found in riparian woodlands.

d. Riparian Woodland and Forest

General Distribution

Riparian woodlands and forests are an uncommon but highly valuable land cover in the County, occurring on over 11,000 acres (2%) of the total land area in the County. Over half of the County's riparian woodland is found in the Western Mountains (32% of County total) areas and Napa Valley Floor (20%). Eastern Mountains (10%) and Pope Valley (9%) areas also have significant areas of riparian woodland. They occur throughout the County along riparian and stream corridors.

Dominant Plants

There are seven types (alliances or associations) that are strongly associated with riparian and stream corridors, two of which are Valley Oak associations: Valley oak–(California bay-coast live oak-walnut-Oregon ash) riparian forest NFD association; and Valley oak–Fremont cottonwood–(coast live oak) riparian forest NFD association. The others are Coast redwood alliance, Coast redwood–Douglas-fir/ California bay NFD (not formally defined) association, White alder (*Alnus rhombifolia*) (mixed willow–California bay–big leaf maple) riparian forest association, Brewer willow alliance, and Mixed willow super alliance. Several of these communities are considered sensitive by the Department of Fish and Game (DFG): Valley oak woodlands are the most common riparian woodland type in the County, followed by Coast redwood- Douglas-fir/ California bay forests. General distribution and dominant plants of the valley oak-Fremont cottonwood woodlands are discussed with other oak woodland types above.

Valley Oak Riparian Woodlands

Valley oak riparian woodlands are characterized by one of two suites of co-dominant tree species, either California bay, coast live oak, walnut and ash, or Fremont cottonwood (*Populus fremontii*) and coast live oak. Valley oak riparian woodlands, while constituting a small fraction of the County's overall area, are especially valuable in terms of protecting water quality and providing wildlife habitat. If valley oak riparian woodlands are not heavily grazed, they may contain riparian vegetation in the understory, such as bracken fern (*Pteridium aquilinum*), Santa Barbara sedge (*Carex barbarae*), arroyo willow (*Salix lasiolepis*), California rose (*Rosa californica*), common snowberry (*Symphoricarpus albus*), California blackberry, and wild grape (*Vitus californica*). Valley oak woodland also occurs on the open valley floor, where it was historically quite extensive. Although there is little data to help describe this vegetation type, canopy cover is thought to have been open to locally dense with valley oak the dominant tree. Blue oak, California black oak, and coast live oak were probably minor constituents of this community. The understory was similar to that described under native grassland with a mosaic of seasonal wetland interspersed.

Common Wildlife

Riparian woodlands support one of the most diverse groups of plants and animals in the County on a per area basis. Riparian woodlands are highly productive systems because they receive nutrients and water from higher elevations. High bird abundance and diversity in riparian forests and woodlands result from this productivity (Holstein 1984). Intact riparian woodlands are essential for steelhead trout (*Oncorhynchus* spp.) Several species are primarily associated with this riparian habitat, including amphibians such as Pacific tree frog (*Hyla regilla*); birds such as downy woodpecker (*Picoides pubescens*) and wide-ranging mammals such as those described for chaparral and oak woodlands. Many bird species associated with oak woodland habitats are also found in riparian woodlands.

Wildlife habitat is greatly enhanced by riparian vegetation, which provides shade, food, and nutrients for aquatic invertebrates that form the basis of the food chain (Riparian Habitat Joint Venture 2004). Coarse woody debris from riparian trees and shrubs is also an important feature of in-stream habitat, forming scour pools and logjams used by amphibians, insects, and fish (Riparian Habitat Joint Venture 2004). Riparian forests and woodland may be the most important habitat for California landbird species, providing breeding and over wintering grounds, migration stopover areas, and movement corridors (Riparian Habitat Joint Venture 2004). The quality of riparian wildlife habitat is enhanced by multilayered, structurally complex vegetation, including canopy trees and a shrub layer, and food sources such as berries and insects.

Special-Status Species

Of the County's 69 special-status wildlife species, 19 depend on this habitat type, while only 2 of the County's 81 special-status plant species do. Napa County's riparian forests also contain some of the last native remaining stands of Northern California black walnut (*Juglans californica* var. *hindsii*), located in Wooden Valley (California Natural Diversity Database 2004).

e. Chaparral/Scrub

General Distribution

While not an oak woodland community, chaparral/ scrub is included here due to the various species of shrub oaks it contains. It is also the second most common land cover in the County, covering approximately 107,000 acres or 21% of the County (BDR, 2005). This community is dominated by woody shrubs, with less than 10% cover of trees, and generally occurs in settings that are too hot, dry, rocky, and steep to support tree-dominated habitats (Holland 1986). They occur especially on south and southwest-facing slopes. The three most common chaparral/ scrub types present are chamise chaparral, leather oak–white leaf manzanita–chamise (a serpentine chaparral), and scrub interior live

oak–scrub oak (*mixed chaparral*). The mixed chaparrals and serpentine chaparrals sub-groups are discussed below.

Dominant Plants

Mixed Chaparral/Scrub

Of the five types of mixed chaparral/ scrub that are mapped, three are classified as evergreen sclerophyllous chaparral. The two remaining types are deciduous (deer brush) or microphyllous (coyote brush–California sagebrush [*Artemisia californica*]) and are both very small in extent in the County. The sclerophyllous chaparral types are dominated by various species of shrubby oaks: interior live oak (*Quercus wislizenii*), leather oak (*Quercus durata*) and scrub oak or manzanitas, and others. Associate species are highly variable depending on type and physical site characteristics. Mixed chaparral occurs on more mesic sites than chamise-dominated chaparral. Oak dominated chaparral is found primarily in the east of the County, where it occurs in dense stands, especially along the crest of Blue Ridge, and forms a total of 2% of the total land cover of the County. This type forms 6% of the land cover in the Berryessa area, and from 2%–6% in five other evaluation areas. It transitions to interior live oak forest on more mesic sites. Manzanita-dominated chaparral occurs in a variety of settings, mostly in the western portion of the County, and also forms a total of 2% of the total land cover.

Serpentine Chaparral

Four types of serpentine chaparral are recognized on the ICE map, and together they form almost 10% of the total land cover of the County. Serpentine chaparral grows on infertile soils derived from serpentinite rock that have a unique mineral composition with high concentrations of iron and magnesium and low concentration of nutrients such as nitrogen and calcium (Kruckeberg 1984). These harsh soils support a distinctive flora, including many endemic species: Ten percent of California‘s endemic plants are confined to serpentine soils (Skinner and Pavlik 1994). The dominant shrubs of serpentine chaparral are usually leather oak, chamise (*Adenostoma fasciculatum*), or white leaf manzanita (*Arctostaphylos viscida*). Species composition is related to aspect, mineral content, and soil moisture levels, and the transition between chaparral types can be subtle. The ground layer is usually sparse. Serpentine chaparral is found mainly in the north central portion of the County, especially in the Knoxville area, where they form more than 30% of the total land cover, and also in the hills east of Pope Valley (23% land cover of the Pope Valley Evaluation Area), Central Interior Valleys (19% land cover) and Berryessa area (11% land cover). Small amounts are also found in the Eastern Mountains (4%) and the Western Mountains (2%).

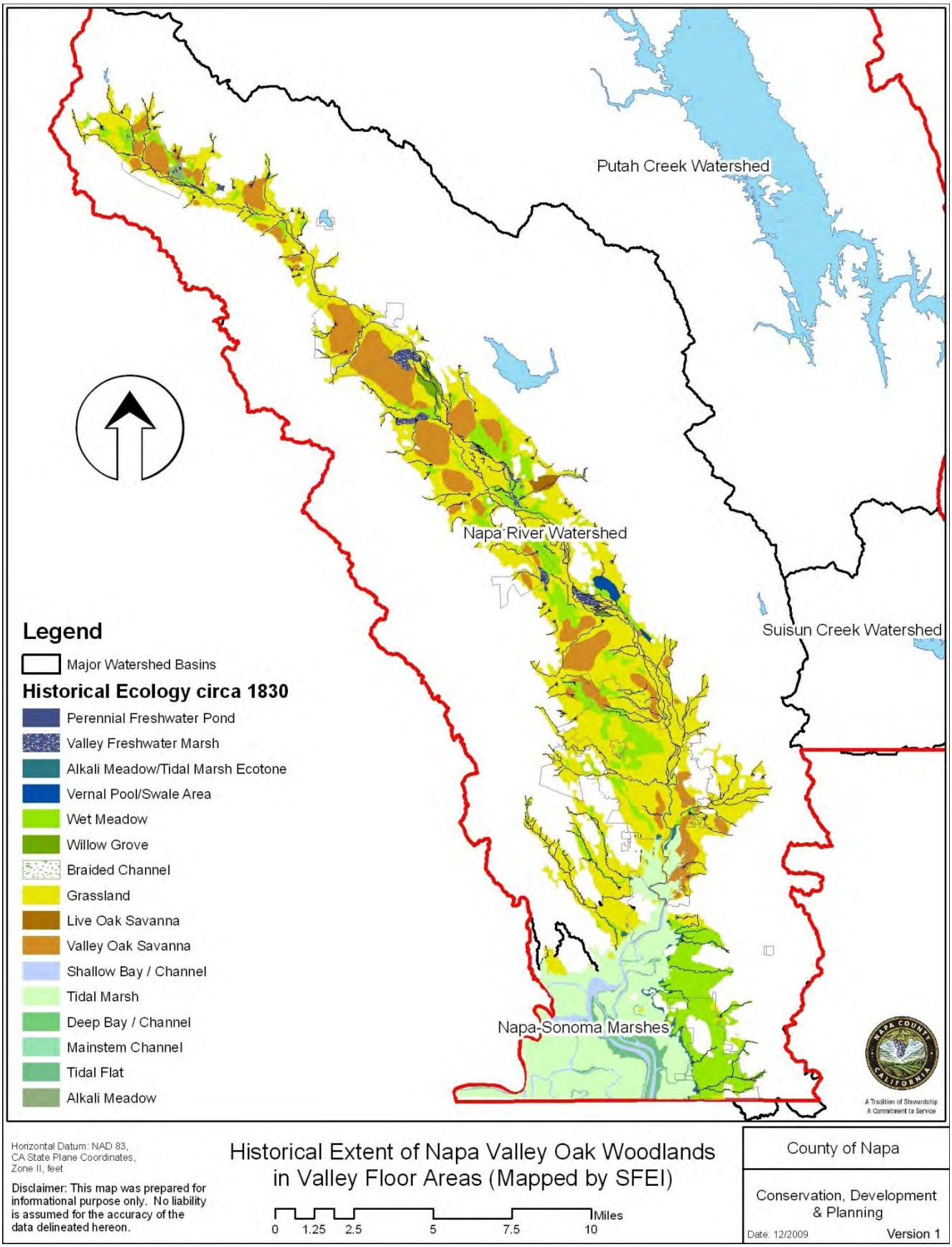
Common Wildlife

Many species are primarily associated with chaparral, including reptiles such as western rattlesnake (*Crotalis viridis*), California mountain kingsnake (*Lampropeltis zonata*); mammals such as desert cottontail (*Sylvilagus bachmanii*) Sonoma chipmunk (*Tamias sonomae*); and birds such as wrentit (*Chamea fasciata*), California thrasher (*Toxostoma redivivum*), rufous-crowned sparrow (*Aimophila ruficeps*), California quail (*Callipepla californica*), Bewick's wren (*Thryomanes bewickii*), and sage sparrow (*Amphispiza belli*). Most of these species are resident and are rarely found outside of this habitat. Other species that occur in chaparral are also found in a variety of woodlands and other habitats including many mammals.

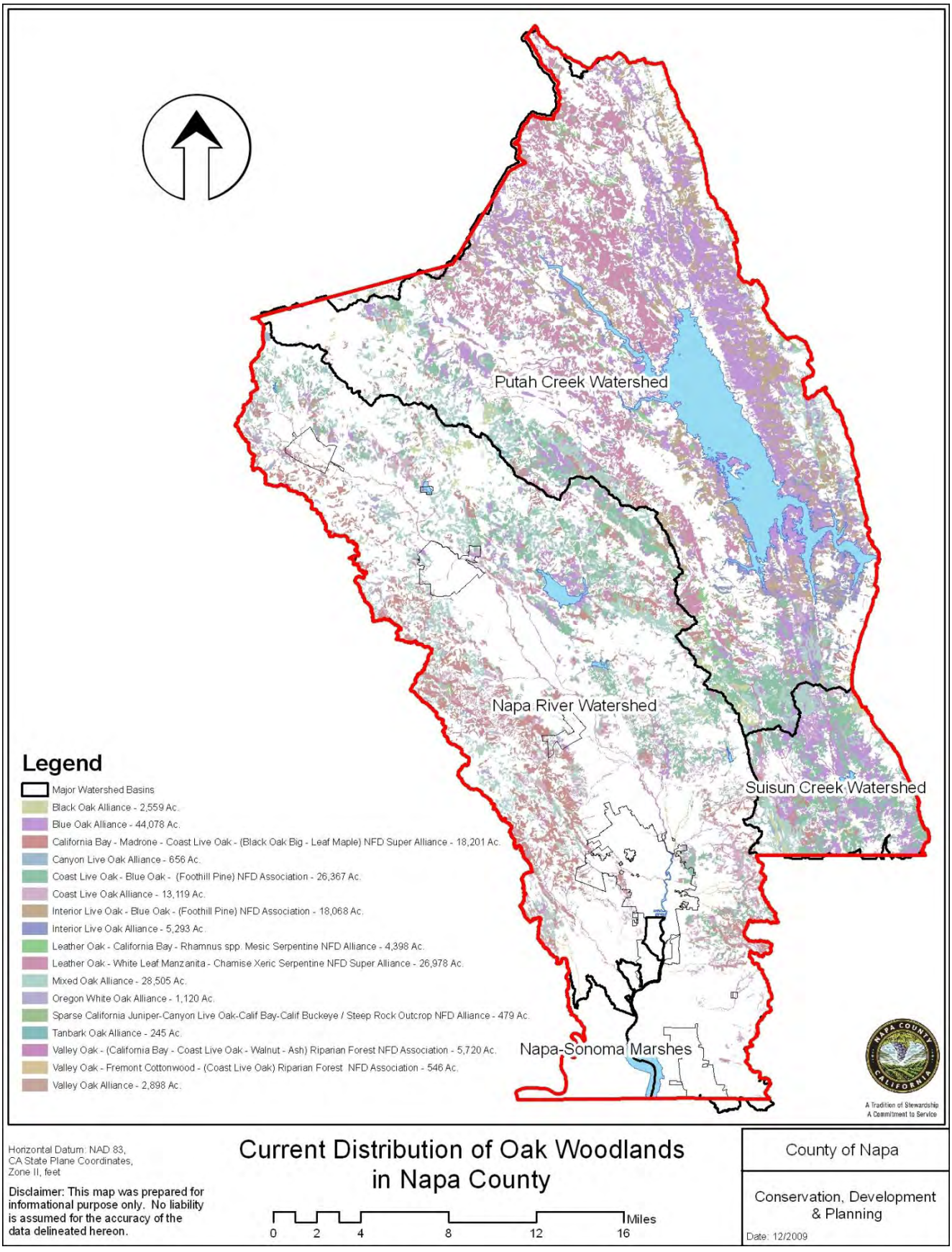
Special-Status Species

A total of 34 special-status plants are associated with chaparral, often with micro-habitats such as openings, rocky outcrops, or swales within this habitat type. Of these, 20 are also found in serpentine chaparral.[xxviii]

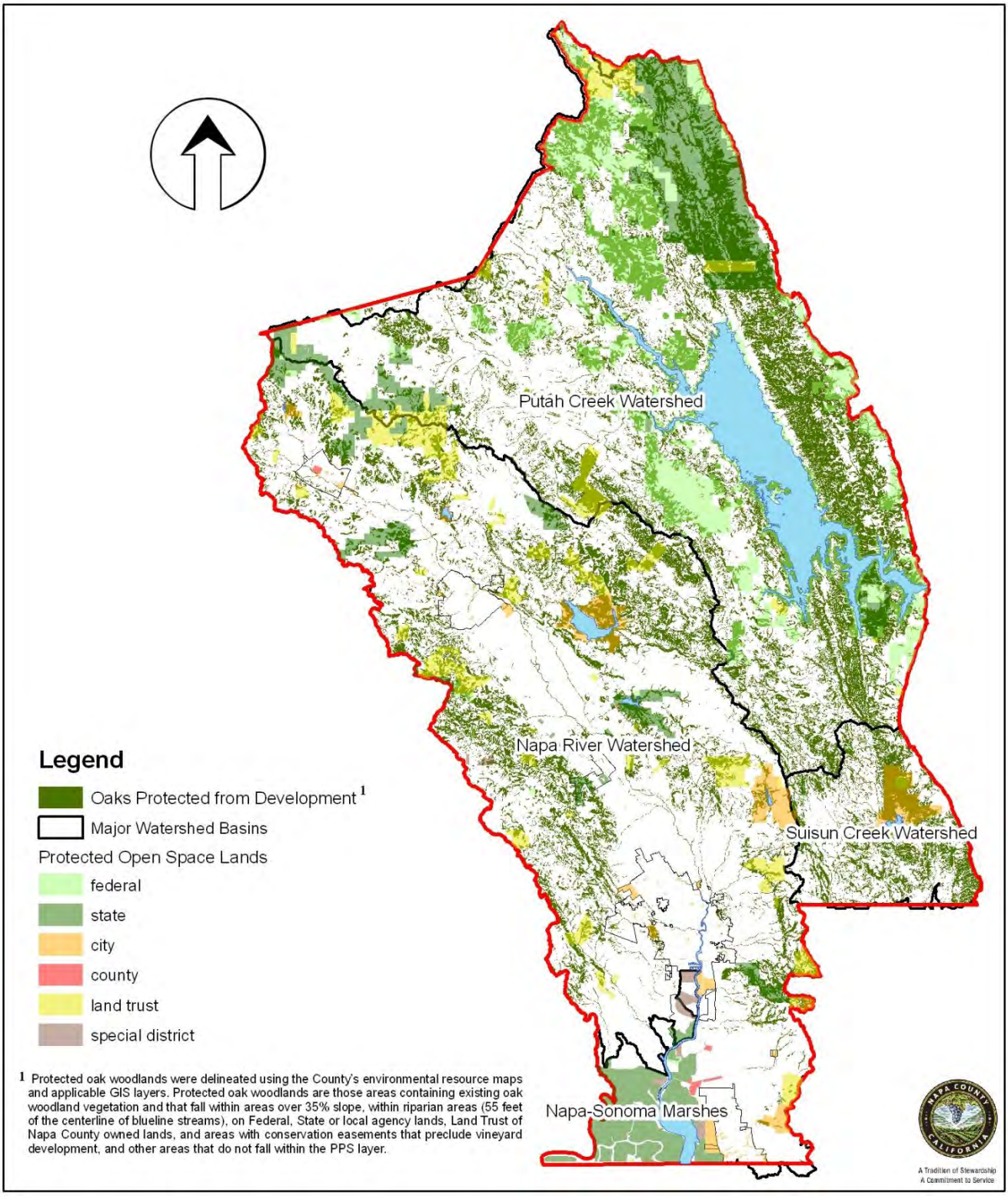
Appendix B - 1


Putah Creek Watershed
Napa River Watershed
Suisun Creek Watershed
Napa-Sonoma Marshes
Legend
Major Watershed Basins
Historical Ecology circa 1830
Perennial Freshwater Pond
Valley Freshwater Marsh
Alkali Meadow/Tidal Marsh Ecotone
Vernal Pool/Swale Area
Wet Meadow
Willow Grove
Braided Channel
Grassland
Live Oak Savanna
Valley Oak Savanna
Shallow Bay / Channel
Tidal Marsh
Deep Bay / Channel
Mainstem Channel
Tidal Flat
Alkali Meadow
A Tradition of Stewardship
A Commitment to Service
Horizontal Datum: NAD 83,
CA State Plane Coordinates,
Zone II, feet
Disclaimer: This map was prepared for informational purpose only. No liability is assumed for the accuracy of the data delineated hereon.
Historical Extent of Napa Valley Oak Woodlands in Valley Floor Areas (Mapped by SFEI)
0 1.25 2.5 5 7.5 10 Miles
County of Napa
Conservation, Development & Planning
Date: 12/2009
Version 1

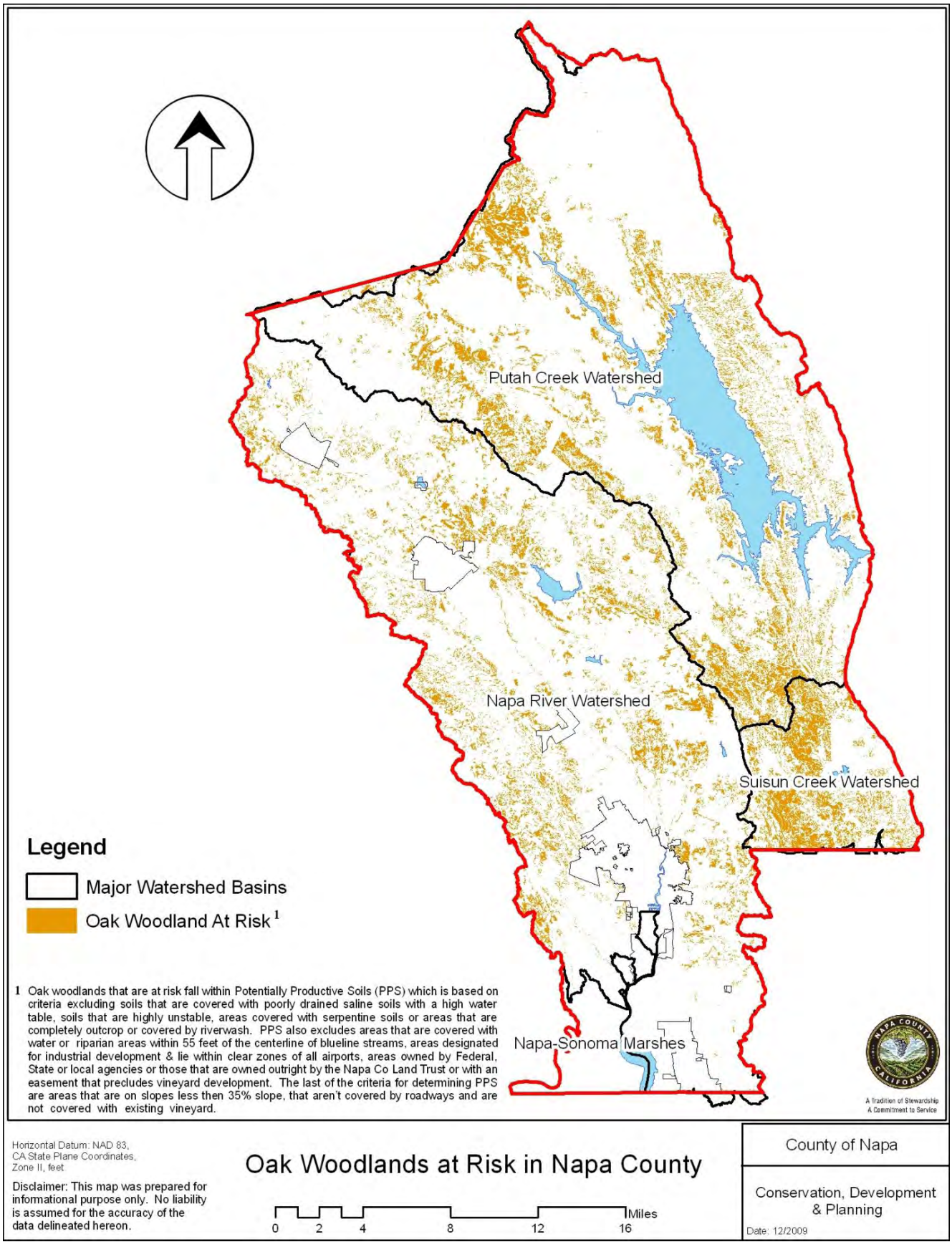
Appendix B - 2


Putah Creek Watershed
Napa River Watershed
Suisun Creek Watershed
Napa-Sonoma Marshes
Legend
Major Watershed Basins
Black Oak Alliance - 2,559 Ac.
Blue Oak Alliance - 44,078 Ac.
California Bay - Madrone - Coast Live Oak - (Black Oak Big - Leaf Maple) NFD Super Alliance - 18,201 Ac.
Canyon Live Oak Alliance - 656 Ac.
Coast Live Oak - Blue Oak - (Foothill Pine) NFD Association - 26,367 Ac.
Coast Live Oak Alliance - 13,119 Ac.
Interior Live Oak - Blue Oak - (Foothill Pine) NFD Association - 18,068 Ac.
Interior Live Oak Alliance - 5,293 Ac.
Leather Oak - California Bay - Rhamnus spp. Mesic Serpentine NFD Alliance - 4,398 Ac.
Leather Oak - White Leaf Manzanita - Chamise Xeric Serpentine NFD Super Alliance - 26,978 Ac.
Mixed Oak Alliance - 28,505 Ac.
Oregon White Oak Alliance - 1,120 Ac.
Sparse California Juniper-Canyon Live Oak-Calif Bay-Calif Buckeye / Steep Rock Outcrop NFD Alliance - 479 Ac.
Tanbark Oak Alliance - 245 Ac.
Valley Oak - (California Bay - Coast Live Oak - Walnut - Ash) Riparian Forest NFD Association - 5,720 Ac.
Valley Oak - Fremont Cottonwood - (Coast Live Oak) Riparian Forest NFD Association - 546 Ac.
Valley Oak Alliance - 2,898 Ac.
A Tradition of Stewardship
A Commitment to Service
Horizontal Datum: NAD 83,
CA State Plane Coordinates,
Zone II, feet
Disclaimer: This map was prepared for informational purpose only. No liability is assumed for the accuracy of the data delineated hereon.
Current Distribution of Oak Woodlands in Napa County
0 2 4 8 12 16 Miles
County of Napa
Conservation, Development & Planning
Date: 12/2009

Appendix B - 3


Putah Creek Watershed
Napa River Watershed
Suisun Creek Watershed
Napa-Sonoma Marshes
Legend
Oaks Protected from Development 1
Major Watershed Basins
Protected Open Space Lands
federal
state
city
county
land trust
special district
1 Protected oak woodlands were delineated using the County's environmental resource maps and applicable GIS layers. Protected oak woodlands are those areas containing existing oak woodland vegetation and that fall within areas over 35% slope, within riparian areas (55 feet of the centerline of blueline streams), on Federal, State or local agency lands, Land Trust of Napa County owned lands, and areas with conservation easements that preclude vineyard development, and other areas that do not fall within the PPS layer.
A Tradition of Stewardship
A Commitment to Service
Horizontal Datum: NAD 83,
CA State Plane Coordinates,
Zone II, feet
Disclaimer: This map was prepared for informational purpose only. No liability is assumed for the accuracy of the data delineated hereon.
Protected Oak Woodlands in Napa County
0 2 4 8 12 16 Miles
County of Napa
Conservation, Development & Planning
Date: 12/2009

Appendix B - 4


Putah Creek Watershed
Napa River Watershed
Suisun Creek Watershed
Napa-Sonoma Marshes
Legend
Major Watershed Basins
Oak Woodland At Risk 1
1 Oak woodlands that are at risk fall within Potentially Productive Soils (PPS) which is based on criteria excluding soils that are covered with poorly drained saline soils with a high water table, soils that are highly unstable, areas covered with serpentine soils or areas that are completely outcrop or covered by riverwash. PPS also excludes areas that are covered with water or riparian areas within 55 feet of the centerline of blueline streams, areas designated for industrial development & lie within clear zones of all airports, areas owned by Federal, State or local agencies or those that are owned outright by the Napa Co Land Trust or with an easement that precludes vineyard development. The last of the criteria for determining PPS are areas that are on slopes less then 35% slope, that aren't covered by roadways and are not covered with existing vineyard.
A Tradition of Stewardship
A Commitment to Service
Horizontal Datum: NAD 83,
CA State Plane Coordinates,
Zone II, feet
Disclaimer: This map was prepared for informational purpose only. No liability is assumed for the accuracy of the data delineated hereon.
Oak Woodlands at Risk in Napa County
0 2 4 8 12 16 Miles
County of Napa
Conservation, Development & Planning
Date: 12/2009

Appendix C

Oak Woodland Conservation and Restoration Evaluation Criteria

These criteria will assist willing landowners, public agencies, nonprofit organizations and other project partners in identifying priority areas with the highest oak woodland resource values. The evaluation system uses criteria to assess a broad range of oak woodland resource values, such as stand composition and distribution, tree cover and density, plant and wildlife habitat availability (including special status species), historical and cultural significance, and recreational opportunities. In addition, the system factors in the threat of loss and potential management constraints, and complements countywide conservation and watershed planning efforts.

Priority Conservation & Restoration Criteria

The evaluation system to establish priorities uses a three (3) layered approach to assign an overall priority to a parcel which can be tailored to the specific landowner or funding source requirements. The three-layers considered in the ranking system are:

(1) **resource value** - an aggregate assessment of the natural resource values associated with a given oak woodland (most important layer in the prioritization system);
(2) **risk category** - an assessment of the likelihood that the resource will be lost or seriously degraded over various time horizons if no conservation actions are instituted; and
(3) **management constraints** – a measure reflecting the level of land management inputs needed to maintain the resource value (e.g.-control invasive species, promote oak regeneration).

The evaluation system is designed to provide flexibility and can be modified over time by adding criteria or adjusting thresholds for priority rankings as needed to address changing resource needs. Specific weighting has not been assigned to the various criteria, as their relative importance may change over time based on the locations and types of conservation projects that are implemented and their effectiveness. The County's Geographic Information System (GIS) provides data on oak woodland species, density and distribution, which can be supplemented by field and other site specific information in areas where the scope and resolution of GIS data may be limited.

1. Resource Values

Conservation ranking is based on maintaining existing oak woodlands having high resource values that are already present. Enhancement ranking criteria is based on a combination of both current resource values and the potential resource values in the enhanced/restored state. Resource value criteria are grouped into four general categories:

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

The four categories make-up a checklist of twenty-one (21) criteria used to measure resource value. The County will use the checklist to summarize the priority ranking. Since the information available for assessing the various criteria may vary in type and quality, the sources of data used and their overall data quality should be noted in conjunction with the priority ranking. Uncertainty associated with the data should be considered in the overall effort to establish priorities and in comparisons between ranked areas or projects.

Stand Composition, Integrity, and Functionality:	Criteria 1-7
Habitat for Plant and Wildlife Species:	Criteria 8-13
Landscape Function:	Criteria 14-17
Human Interactions:	Criteria 18-21

Stand Composition, Integrity, and Functionality

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

Priority for Conservation and Enhancement	Stand Composition (Oak Species Present)
High	**Valley oak** – This species may have experienced the greatest loss in its historical range within the county, especially on the valley floor. It has also been eliminated from much of its historic range statewide. Valley floor and riparian valley oak stands have especially high priority. **Black oak** – This species is very uncommon in the county. **Canyon live oak** – This species is relatively uncommon in the county. **Oregon White Oak –** This species is uncommon as mapable stands in the county. **Tanbark Oak –** This species is uncommon or rare as mapable stands in the county.
Moderate	**Blue Oak –** This is a more common species in the county and over much of its range in the state. **Coast Live Oak –** This is a more common species in the county **Interior live oak –** This is a more common species in the county and over much of its range in the state. **Mixed oak–** Most oak woodlands in the county are mixed oak woodland with more than one co-dominant species.
Low	**Scrub oak/Leather Oak** – These species are currently relatively common statewide and in portions of the county.

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

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

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

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

Criterion 3: Tree Cover and Density. Many of the benefits and services provided by oaks woodlands are directly related to the amount of tree canopy cover on the site. Most of the benefits related to air quality (such as carbon sequestration and particulate interception), for example, are directly proportional to total canopy cover. The amount of flood protection and erosion protection provided by oak woodlands is also directly related to canopy cover. The relationship between canopy cover and wildlife habitat is more complex. Some species prefer closed canopy woodlands, whereas others are more apt to utilize openings within the woodlands or edges between woodlands and other habitat types. Hence, sites with less than 100 percent canopy cover may support greater biodiversity overall. One of the goals of the plan is to maximize the total amount of conserved oak woodland canopy cover, while recognizing the importance of including a variety of canopy cover levels within conserved and restored woodlands. Napa County will consider the level of canopy cover present on adjacent conserved lands when evaluating overall canopy cover.

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

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

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

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

Criterion 4: Stand Size and Connectivity. An overarching goal in conserving and enhancing woodlands is to maintain oak woodlands as functional ecosystems. The functionality of the oak woodland ecosystem is related to its size, its connectivity with other oak woodlands or other native habitats, and its interface with less compatible adjacent land uses. Larger oak woodland stands are more likely to provide the scale needed to allow for ecosystem processes to function, and therefore generally have greater conservation value than smaller areas (if all other factors are equal). The overall biodiversity of a stand tends to increase with size, since a larger variety of habitat features are more likely to exist in a larger area. Also, some species that require relatively large home ranges are likely to occur only in sufficiently large habitat areas. Small stands with a limited number of trees may not have sufficient genetic variation to provide for long term stability, and are more likely to be threatened by impacts such as fire, disease, or long-term climate variation. In assessing the overall size of an oak woodland ecosystem, Napa County will consider the landscape context. Oak woodlands and habitat elements commonly do not end at parcel boundaries, so Napa County will consider the overall size of the woodland area of which a specific parcel is a part. Therefore a relatively small woodland area can have a high conservation value if it is adjacent to other conserved lands, especially if it forms a linkage between conserved habitats.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Populations in the main portion of a species‘ range also need to be conserved to provide a complete complement of genetic resources for the species. Genetic traits found in these main populations, however, are likely to be present in many individuals and may therefore be at low risk of being lost. The conservation priority ranking for this criterion is therefore lowest for these populations. The highest priority ranking for this criterion are assigned to populations that may contain unique genetic traits that are found in relatively few extant individuals and are therefore at a high risk of being lost.

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

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

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

Habitat for Plant and Wildlife Species

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

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

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

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

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

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

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

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

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

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

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

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

Criterion 11: Contribution to Maintaining Native Plant and Animal Population.

Among areas that serve as habitat for various native species, some areas may be especially critical for various reasons, including:

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

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

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

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

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

• Habitat used for breeding or foraging during certain seasons. Hence, in addition to considering whether species utilize a given patch of habitat, we also need to consider how that patch of habitat contributes to the overall viability of a species or group of species within the county.

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

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

• Vegetation-related features such as old growth trees, dead trees (snags), large downed wood (coarse woody debris), and trees that shade riparian areas

• Aquatic features such as riparian areas, vernal pools, and ponds

• Physical features such as serpentine soils, burrows, high water tables, rock outcrops and caverns

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

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

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

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

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

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

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

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

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

	management.

Landscape Function

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Human Interactions

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

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

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

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

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

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

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

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

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

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

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

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

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

2. Risk Categories

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

Example of Risk Categorization

	Likelihood of Loss (Absent Intervention)		
Time Frame	High	Moderate	Low
Near-term (< 5 yrs.)			X
Mid-term (5-20 yrs.)		X	
Long-term (> 20 yrs.)		X	

Current zoning, General Plan designations and urban spheres of influence will be used to help assess likelihood of loss due to urban conversion. Losses due to other activities and processes (change to intensive agriculture, alterations in historic water tables, tree mortality without regeneration) will be estimated from other available information (i.e.-soils, slopes, setbacks, others).

The highest overall risk is assigned to high resource value woodlands that have a high likelihood of being lost in the near term. This category would include lands that contain Sensitive Biotic Species and fall within Potentially Productive Soils.[1] Woodlands with a relatively high long-term risk but low near-term risk may be the more cost efficient targets for funding. Parcels with very low to no intrinsic risk may not be high priority even if they have a high resource value. This category would include lands with existing conservation easements (which address oaks), lands owned in public trust, and lands that are non-developable due to terrain or other factors, provided these lands are managed in a sustainable fashion. Woodlands would need to be both fully protected and permanently managed in a sustainable fashion in order to be considered at no significant risk. Reassessment of risk categorization on a regular basis would also be necessary.

[1] High Risk/High Value: Sensitive Biotic species that fall within Potentially Productive Soils. Sensitive species include Blue Oak Alliance, California Bay – Madrone – Coast Live Oak – (Black Oak Big Leaf Maple) NFD Super Alliance, Tanbark Oak Alliance, Valley Oak Alliance, Valley Oak – (California Bay – Coast Live Oak - Walnut - Ash) Riparian Forest NFD Association, Valley Oak – Fremont Cottonwood – (Coast Live Oak) Riparian Forest NFD Association, Oregon White Oak Alliance, Leather Oak – White Leaf Manzanita – Chamise Xeric Serpentine NFD Super Alliance and Leather Oak – California Bay – Rhamnus spp. Mesic Serpentine Chaparral NFD Alliance types per UC Davis' Information Center for the Environment GIS database. Potentially Productive Soils (PPS) is based on criteria excluding soils that are covered with poorly drained saline soils with a high water table, soils that are highly unstable, areas covered with serpentine soils or areas that are completely outcrop or covered by riverwash. PPS also excludes areas that are covered with water or within riparian areas within 55 ft of the centerline of blueline streams, areas designated for industrial development & lie within clear zones of all airports, areas owned by Federal, State or local agencies or those that are owned outright by the Napa Co Land Trust or with an easement that precludes vineyard development, areas that are on slopes less then 35% slope, that aren't covered by roadways and are not covered with existing vineyard (see Map/Appendix B-4)

3. Management Constraints

Woodland management constraints can be considered a factor that contributes to the risk of resource loss/degradation. In addition, management can be considered as a separate factor that interacts with the cost-effectiveness of conservation and restoration projects. Woodlands that are conserved need to be managed in a way that retains or improves their resource value if they are to continue to provide benefits and services. If properties are currently being managed in a sustainable fashion to protect or enhance resource values, no change in management will be necessary. Future management savings will be greatest for sites where sustainability is achieved through few or no major management inputs.

In contrast, lands that require a major change in management to attain sustainability may be more expensive to maintain over the long term, particularly if the necessary management changes will be expensive or difficult to implement. For example, good quality riparian oak woodlands on favorable soils typically have good rates of natural regeneration when left in a natural state with little or no active management. In contrast, a riparian oak woodland that has been heavily cleared, compacted, and colonized by invasive species would require significant changes in management, including some intensive inputs (such as eradication of invasives, restoration and near to mid-term maintenance) to attain long-term sustainability.

For lands where restoration is an objective, ease of restoration is considered a management factor for the near and/or mid-term. Sites requiring relatively small inputs to achieve restoration and those having a higher probability of success have higher priority overall. Current land uses need to be evaluated for their compatibility with the protection and enhancement of oak woodland resources. It may also be necessary to consider land uses on adjacent properties to determine if they will affect the management potential of the targeted property. For example, the need to clear vegetation for fire protection around residences may affect the management of the adjacent oak woodland. (Note: consult the Firewise Program for additional information, as oaks are a listed Firewise tree: http://www.napafirewise.org/) Activities upstream from a conserved riparian woodland, such as dredging, excessive erosion or polluted irrigation runoff, could impact the value of aquatic habitat (i.e., resource value) of the downstream woodland.

Management Constraints

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

Oak Woodland Evaluation Criteria - Checklist

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

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

Appendix D

Sustainable Best Management Practices (BMPs) for Oak Woodlands

The following recommendations for Best Management Practices (BMPs) are summarized from various publications on oak woodland protection, maintenance, and restoration, as well as contributions by local and other experts.

The information/guidelines for building around oaks and oaks in the home garden can be found in the Integrated Hardwood Range Management Program's (IHRMP) publication, Living Among the Oaks. Information on BMPs for disturbance around oaks and protecting trees from construction impacts can be found in the UC Cooperative Extension's (UCCE) handout, Disturbance Around Oaks (Frost, 2001) and the California Department of Forestry's(CDF) Tree Notes, Protecting Trees from Construction Impacts (Sanborn, 1989). Information on care of oak trees is also available through the California Oak Foundation.

Information on Best BMPs for the maintenance, restoration, and rehabilitation of oak woodlands are from Regenerating Rangeland Oaks in California, University of California Agriculture & Natural Resources Publication 21601 (McCreary, 2001). Additional information can be found in How to Grow California Oaks (http://danr.ucop.edu/ihrmp/oak04.htm) and How to Collect, Store, and Plant Acorns (http://www.californiaoaks.org/ExtAssets/HowTo Acorns'07.pdf).

Qualified professionals and interested persons are encouraged to consult these published resources and other current sources for additional information, including the local Napa County NRCS office, Napa County RCD, UCCE Advisor, the IHRMP and others.

1. **The following are general guidelines or best management practices for tree protection during construction activities, from some of the above sources:**
    - The root protection zone (RPZ) is roughly one-third larger than the drip line (or outermost edge of the foliage based on the longest branch).
    - Install high visibility fencing around the RPZ of any tree or cluster of trees with overlapping canopy that are identified on an approved grading plan as needing protection. The fencing should be four-feet high and bright orange with steel t-posts spaced 8 feet apart.
    - Do not grade, cut, fill or trench within the RPZ.
    - Do not store oil, gasoline, chemicals, construction materials, or equipment within the RPZ.
    - Do not store soil within the RPZ.
    - Do not allow concrete, plaster, or paint washout within the RPZ.
    - Do not irrigate within the RPZ or allow irrigation to filter into the RPZ.
    - Plant only drought tolerant species within the RPZ.

2. **The following are general guidelines for protecting oak trees in gardens and yards.**
    - Avoid summer irrigation.
    - The zone within six feet of the trunk of the tree should be disturbed as little as possible. The base of the tree should be kept dry.
    - Limit plantings beneath oak trees to drought-tolerant species not requiring summer irrigation.
    - Landscape beneath oak trees with non-living plant materials such as wood chips.
    - Refer to Living Among the Oaks or contact the Master Gardener Program (through the UCCE office) for more information on oaks in the home garden.

3. The following are general guidelines or best management practices for Maintenance, Restoration, and Rehabilitation of Oak Woodlands

a. Acorn Collection and Storage Procedures

- Collect acorns in the fall, several weeks after the first ones have started to drop and when those remaining on the tree can be easily dislodged from the acorn cap by a gentle twisting.
- If possible, collect acorns directly from the branches of trees, rather than the ground.
- If acorns are collected from the ground, place them in a bucket of water for several hours, and discard any floaters.
- Stratify acorns from the black oak group (e.g., black oak, interior live oak) by soaking them in water for 24 hours and then storing them in a cooler/refrigerator for 30-90 days before sowing.
- Store acorns in a cooler or refrigerator in loosely sealed plastic bags, but do not store acorns from the white oak group (e.g., valley oak, blue oak, Oregon white oak) for more than 1 or 2 months before planting to ensure greatest viability.
- If acorns start to germinate during storage, remove and plant as soon as possible.
- If mold develops during storage, and acorns and radicles are discolored/slimy, discard acorns.

b. Methods for Sowing Acorns of Rangeland Oaks in the Field

- Sow acorns in the fall/early winter, as soon as soil has been moistened several inches down.
- If possible, pregerminate acorns before planting and outplant when radicles are ¼ inch to ½ inch (1/2 cm to 1 cm) long.
- Cover acorns with ½ to 1 inch (1 to 2 ½ cm) of soil.
- If acorn depredation is suspected as a serious problem (high populations of rodents are present), plant deeper, up to 2 inches (5cm).
- If acorns begin to germinate during storage, outplant as soon as possible. Use a screwdriver/pencil to make a hole in the soil; plant with the radicle pointing down..
- If radicles become too long, tangled, and unwieldy to permit planting, clip them back to ½ inch (1 cm) and outplant.
- If acorn planting spots have above ground protection (treeshelters), and acorns have not been pre-germinated, plant two or three acorns per spot and thin to the best seedling after 1 year.
- Keep planting spots free of weeds for at least 3 years after planting.

c. Procedures for Planting Rangeland Oaks

- Plant oak seedlings early in the growing season, soon after the first fall rains have saturated the soil; do not plant after early March unless irrigation is planned.
- Make sure seedlings are not frozen, allowed to dry out, or physically damaged before, during, or after planting.
- Plant seedlings at proper depth, making sure they are not J-rooted, and eliminate air pockets in soil adjacent to seedling roots
- In hard, compacted soils, break up soil (using a shovel, auger or posthole digger) through the compacted zone prior to planting to promote deeper rooting. If planting holes are augered, make sure that the sides of the holes are not glazed.
- Select microsites for planting that afford some natural protection and provide the most favorable growing conditions.
- Plant in a natural pattern, avoiding straight, evenly spaced rows.

d. Weed Control Procedures

- Select method of weed control (herbicides, physical weed removal, or mulching) based on environmental, fiscal, and philosophical considerations.
- Maintain a weed-free circle that is 4 feet (1.2m) in diameter around individual seedlings or acorns for at least 2 to 3 years after planting; if using herbicides to control weeds, remove weeds in circle with a diameter of 6 feet (1.8m)
- Initiate annual weed control by early spring to ensure that weeds do not become established and deplete soil moisture before oak roots can penetrate downward.
- Visit planting sites at least twice annually to remove both early- and late-season weeds that may have grown through mulch.
- If using post-emergent herbicides, make sure that chemicals do not come in contact with foliage or the expanding buds of seedlings.
- After weed control is discontinued, visit plantings regularly to make sure vole populations and damage to seedlings have not increased. If increases are observed, remove thatch.

e. Methods of Protecting Trees from Animals

- Fences and large cages are effective only if livestock and deer are the only animals of concern. Fences require a large initial investment and result in fenced areas being removed from livestock production. Fences and cages must be maintained regularly.
- Screen cylinders provide adequate short-term protection against insects, rodents, and deer but are ineffective against livestock, insects, or small rodents. Shoots that grow through the sides of tubes are vulnerable to browsing.
- Tree-shelters have proven very effective in protecting rangeland oak seedlings from a wide range of animals and stimulating rapid, above-ground growth. While relatively expensive they can greatly reduce time required for seedlings to grow to sapling stage.
- Habitat modification can reduce damage from grasshoppers and some rodents, but it is ineffective for larger ranging animals, such as deer. Care must be taken to monitor the re-growth of vegetation or animals will quickly reoccupy site.

f. Procedures for Tree-shelter Installation

- Select tree-shelter size based on the browsing height of animals that are a threat.
- Install shelters so they are upright and secure them to stakes using plastic ratchet clips or wire; make sure seedlings are not damaged when shelters are secured to posts.
- When tree-shelters are used, plant in an aesthetic, ~~"~~natural" arrangement rather than in regular, evenly spaced rows.
- Utilize stakes that are durable enough to last the length of time tree-shelters will be in place and drive them at least 1 foot(31 cm) into the ground before planting seedlings.
- Make sure tops of stakes are lower than tops of shelters to prevent access by rodents that can climb stakes and damage seedling shoots from rubbing against stakes.
- To prevent seedling desiccation, install shelters with the base buried in the ground.
- To prevent bird access, install plastic shelters with the base buried in the ground.
- If tree-shelters are placed in pastures grazed by livestock, secure them to metal posts using wire and thread flexible wire through the top instead of using plastic netting.

g. Tree-shelter Maintenance Procedures

- Visit shelters at least once each year to make sure they are upright, attached to the stake, buried in the ground, and functioning properly.

- Keep a 4-foot (1.2 m) diameter or larger circle around shelters free of weeds for at least 2 years after planting, and remove weeds that grow inside shelters.
- Replace flexible netting that has blown off shelter tops.
- Replace stakes that have rotted or broken.
- Leave shelters in place for at least 3 years after seedlings have grown out the tops, longer if shelters are still intact and and are effectively protecting seedlings.
- Remove shelters if they are restricting growth or abrading seedlings; to remove solid shelters, slice down the sides with a razor or knife, being careful not to damage the seedling inside.

h. Fertilization, Irrigation, and Top Pruning

- Place .74-ounce (21-g), slow release fertilizer tablets (20-10-5) 3 to 4 inches (7.5 to 10 cm) below planted acorns or seedlings.
- Irrigation is not necessary in many situations if there is timely/thorough weed control.
- If irrigation is needed for established and the terrain is steep or percolation of water through soil is slow, construct earthen irrigation basins.
- Provide irrigation in the form of infrequent, deep irrigations rather that frequent, shallow irrigations; time irrigations to extend the rainy season.
- Always control competing vegetation, even where supplemental irrigation is provided.
- Top-prune seedlings at the time of planting if they are too tall and are out of balance with root systems; prune small, liner stock back to a 6-inch (15 cm) top.

4. Natural Resources Conservation Service(NRCS) Conservation-BMPs

The following are USDA-NRCS conservation practices which are relevant to achieving protection, enhancement, and sustainable management of oak woodlands in Napa County, especially on grazed rangelands, managed watershed lands, and along waterways. A full, detailed description of the practices and consultation on the appropriate application of land treatments are available at the Napa NRCS office. Electronic copies can also be accessed at http://efotg.nrcs.usda.gov/

Conservation Cover (NRCS Practice 327) Definition: Establish and maintain perennial vegetation, including native oak savannah grassland species, to protect soil and water resources.
Purposes: Reduce soil erosion, improve water quality, and create or enhance wildlife habitat.

Prescribed Burning (NRCS Practice 338) Definition: Applying controlled fire to predetermined areas.
Purposes: Control undesirable vegetation, reduce wildfire hazard, improve wildlife habitat, and facilitate distribution of grazing animals.

Critical Area Planting (NRCS Practice 342) Definition: Planting vegetation, including trees, native shrubs, and herbaceous plant materials on erodible or eroding areas. Purposes: Stabilize soil, reduce damage from downstream sediment runoff, and improve wildlife habitat and visual resources.

Fence (NRCS Practice 382) Definition: Construct a barrier to livestock or wildlife.
Purposes: Control livestock or wildlife access to sensitive vegetation, eroding areas, or stream channels/banks. Create management units to optimize management of grazed lands, or to facilitate control of noxious weeds.

Fuel Break (NRCS Practice 383) Definition: A strip or block of land on which vegetation and plant debris have been reduced to diminish the risk of fire crossing the area. Purposes: Control and reduce the spread of fire.

Forest Slash Treatment (NRCS Practice 384) Definition: Treating woody residues to achieve management objectives. Purposes: Reduce hazardous fuels, insect and disease risk, increase access to grazing animals, improve soil organic matter, and improve natural or artificial plant regeneration.

Riparian Forest Buffer (NRCS Practice 391) Definition: Establish trees adjacent to and up-gradient from water bodies. Purposes: Create shade to reduce water temperature, provide riparian habitat and corridors for wildlife, reduce excess sediment or other pollutants in surface runoff, and reduce excess nutrients and other chemicals in groundwater flow.

Mulching (NRCS Practice 484) Definition: Applying plant residues or other suitable materials to the soil surface. Purposes: Reduce soil erosion, retain soil moisture near plantings, improve water quality, and create or enhance wildlife habitat.

Tree/Shrub Site Preparation (NRCS Practice 490) Definition: Treatment of areas to improve conditions for establishing trees or shrubs. Purposes: Encourage natural regeneration or permit artificial establishment of desired woody plants.

Prescribed Grazing/Annual Rangeland (NRCS Practice 528/528A) Definition: Controlling grazing through fencing or herding so that each grazing area receives alternating, appropriate periods of grazing and rest. Purposes: Improve or maintain the health of desired vegetation, maintain or improve water quality, reduce accelerated soil erosion. (Note: associated practices such as spring development and wells may sometimes be incorporated into grazing plans to accomplish conservation objectives).

Range Planting (NRCS Practice 550) Definition: Establish adapted perennial vegetation such as trees, shrubs, forbs, and grasses. Purposes: Restore the plant community similar to its historic climax or desired community, improve livestock forage, improve cover for wildlife, and improve water quality.

Tree and Shrub Establishment (NRCS Practice 612) Definition: Establish woody plants, (generally native species) by planting or seeding. Purposes: Provide woody plants for conservation purposes such as erosion control, watershed, or wildlife habitat.

Watering Facility (NRCS Practice 614) Definition: Install a tank or trough to provide livestock or wildlife access to water. Purposes: Protect and enhance vegetative cover by proper distribution of grazing, enhance erosion control, and protect streams and ponds from contamination.

Underground Outlet (NRCS Practice 620) Definition: Install an underground conduit to convey surface water to a suitable protected outlet. Purposes: To dispose of excess water to prevent erosion or flood damage. Designs should include appropriate dispersal outlets to reduce the likelihood of concentrated flows causing downstream impacts.

Restoration of Rare and Declining Habitats (NRCS Practice 643) Definition: Restoring and conserving rare or declining native vegetated communities and associated wildlife. Purposes: Restore native habitats degraded by human activities, provide habitat for rare or declining wildlife species by restoring native plant communities, increase native plant community diversity, manage or conserve declining native habitats, and to control noxious invasive plant species.

Wetland Wildlife Habitat Management (NRCS Practice 644) Definition: Retain, develop or manage wetland habitat for wetland wildlife. Purposes: Maintain, develop, or improve wetland habitat for dependent or associated plants and animals.

Upland Wildlife Habitat Management (NRCS Practice 645) Definition: Creating, restoring, maintaining, or enhancing areas for food, cover, and water for wildlife that use upland habitat.
Purposes: Provide food, cover, and water to benefit desired wildlife species and maintain viable populations.

Forest Stand Improvement/Competing Vegetation Control (NRCS Practice 666D)
Definition: Herbicide or mechanical removal of brush competing with desired tree species. Purposes: Improve wildlife habitat and hydrologic conditions, initiate forest stand regeneration.

Appendix E

Submittal Guidelines:

Napa County Voluntary Oak Woodland Management Plan and WCB Oak Woodland Conservation Program

The Oak Woodlands Conservation Program is administered by the Wildlife Conservation Board (WCB) and offers landowners, conservation organizations, counties and cities the opportunity to obtain funding for projects to conserve and restore California's oak woodlands. While the program is statewide in nature, it provides opportunities to address oak woodland issues on a regional priority basis.

This voluntary state Program is designed to provide incentives for local efforts to achieve oak woodland protection. More importantly this program provides a mechanism to bring farmers, ranchers, other landowners, and conservationists together in a way that allows for both sustainable ranch and farming operations and healthy oak woodlands. The Napa County Voluntary Oak Woodland Management Plan provides the framework for certification of local efforts so they are eligible for submittal and funding consideration by the WCB.

Proposals developed in partnership with landowners, non-profit organizations, local, regional, and state resource specialists bring a diversity of skills, expertise, and ideas to the table, and often the ability to leverage funding that might not otherwise be available for a project.

STEP ONE (1) : Contact the Wildlife Conservation Board (WCB)

First contact the WCB for an Oak Woodland Conservation Program Application and Guidelines at: www.wcb.ca.gov/ Oaks/ index.html or call (916) 445-8448 with any questions prior to completing an application package.

STEP TWO (2) : Applications for **conservation easements** and restoration

Applications for conservation easements, restoration or other long term conservation methods should be developed with the help of an eligible participant such as a non-profit organization/ land trust. These organizations have the expertise to work with property owners to develop customized land conservation easements, and assist with the completion of the Oak Woodland Conservation and Restoration Evaluation Criteria (Appendix C) of the Napa County Voluntary Oak Woodland Management Plan. Contact information for these groups/ agencies is available at the Napa County CDPD and at their websites.

Applications for **public outreach** and education

Applications for public education and outreach and technical assistance should be designed and implemented in partnership with local entities such as the Resource Conservation District, NRCS, non-profit organizations, farming/ ranching organizations, landowners, Napa County

CDPD, and others. Contact information for these groups/ agencies is available at the Napa County CDPD and at their websites.

STEP THREE (3) : Napa County Certification

Submit the completed WCB application and Oak Woodland Conservation and Restoration Evaluation Criteria (Appendix C) of the Napa County Voluntary Oak Woodland Management Plan to the Napa County Conservation, Development & Planning Department for review and certification by the Planning Director.

Submit applications to:

County of Napa

Director-Conservation, Development & Planning Dept.
1195 Third Street Suite 210
Napa, California 94559

STEP FOUR (4) : Application Submittal

Once an application proposal has been completed and certified by the Napa County CDPD Director, submit it to the WCB for consideration.

Mail completed applications to:

Executive Director, Wildlife Conservation Board
1807 13th Street, Suite 103
Sacramento, California 95811

While applications are accepted on a year-round basis, the WCB generally meets four times a year. Typically, Board meetings are held in February, May, August and November. All applications that comply with the program requirements and meet program eligibility criteria will be scheduled for Board consideration if sufficient money exists to fund the request. Applicants will be notified as to when the project will be considered by the Board. The Board must approve any project to be funded.

Appendix F

RESOLUTION NO. 2010-137

A RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF NAPA, STATE OF CALIFORNIA ADOPTING THE NAPA COUNTY VOLUNTARY OAK WOODLAND MANAGEMENT PLAN

WHEREAS, the purpose of the Napa County Voluntary Oak Woodland Management Plan is to encourage voluntary oak woodland conservation in Napa County and to provide a framework for the conservation of oak woodlands throughout the county; and

WHEREAS, the Oak Woodlands Conservation Act of 2001 as enacted by State Fish and Game Code commencing with Section 1360, directed the State Wildlife Conservation Board (–WCB") to establish and implement the Oak Woodland Conservation Program grant program;

WHEREAS, the WCB Oak Woodland Conservation Program requires that for landowners, local government entities, districts and conservation organizations to participate in the program, that the County adopt by resolution an Oak Woodlands Management Program pursuant to California Fish and Game Code Section 1366; and

WHEREAS, the Napa County 2008 General Plan Update provides goals and policies in support of oak woodland protection and enhancement and an implementation action item providing direction for the development and adoption of a Voluntary Oak Woodland Management Plan; and

WHEREAS, the County of Napa has developed a Voluntary Oak Woodland Management Plan consistent with the General Plan direction and California Fish and Game Code Section 1366 that will allow landowners, local government entities, districts and conservation organizations an opportunity to obtain funding from the WCB Oak Woodland Conservation program; and

WHEREAS, the County of Napa recognizes that the Napa County Voluntary Oak Woodland Management Plan is an important step in informing landowners, farmers, ranchers, land developers, and the general public about the significance of oak woodlands and encouraging their voluntary participation and responsible stewardship in the recognition and protection of oak woodlands; and

WHEREAS, the WCB Oak Woodland Conservation Program requires, pursuant to State Fish and Game Code Section 1366(f) that the County certify that grant proposals are consistent with the Napa County Voluntary Oak Woodland Management Plan prior to submittal to the State Wildlife Conservation Board for consideration; and

WHEREAS, on October 6, 2010, the Napa County Conservation, Development and Planning Commission held a duly noticed public hearing on the Napa County Voluntary Oak Woodlands Management Plan. After closing the public hearing, the Planning Commission recommended that the Board of Supervisors adopt the Napa County Voluntary Oak Woodlands Management Plan without any substantive revisions; and

WHEREAS, the Board of Supervisors has considered a staff report and background information and held a public hearing regarding the Napa County Voluntary Oak Woodlands Management Plan and oak woodlands in the unincorporated areas of Napa County;

NOW, THEREFORE, BE IT RESOLVED by the Board of Supervisors of the County of Napa as follows:

1. The above recitals are true and correct.

2. The Board recognizes the economic value of oak woodlands to landowners and the community at large, and supports farming, ranching and grazing operations that are compatible with oak woodland conservation.

3. The Board recognizes the natural resource values of oak woodlands including the critical role oak woodlands play relative to the health and function of local watersheds, soil and water retention, wildlife habitat, open space and others.

4. The Board supports landowners that participate in the Wildlife Conservation Board's Voluntary Oak Woodlands Conservation Program, and agrees to certify that individual proposals are consistent with the Napa County Voluntary Oak Woodlands Management Plan, pursuant to Section 1366 (f) of the California Fish and Game Code.

5. The Board supports and encourages education and outreach efforts designed to demonstrate the economic, social and ecological values associated with oak woodland.

6. The Board shall review and update the Napa County Voluntary Oak Woodlands Management Plan, as needed.

7. The Board hereby finds that the Napa County Voluntary Oak Woodlands Management Plan would not have a significant effect in the environment and is exempt from the California Environmental Quality Act pursuant to 14 CCR Section 15307 (Class 7 – Actions by Regulatory Agencies for Protection of Natural Resources).

8. The Board hereby adopts the Napa County Voluntary Oak Woodlands Management Plan

9. This Resolution shall become effective immediately upon adoption.

THE FOREGOING RESOLUTION WAS DULY AND REGULARLY ADOPTED by the Board of Supervisors of the County of Napa, State of California, at a regular meeting of said Board held on the 26th day of October, 2010, by the following vote:

AYES: SUPERVISORS WAGENKNECHT, CALDWELL, DODD, DILLON

NOES: SUPERVISORS NONE

ABSENT: SUPERVISORS LUCE

DIANE DILLON, Chair
Napa County Board of Supervisors

ATTEST: GLADYS I. COIL
Clerk of the Board of Supervisors
By: Gladys I. Coil

APPROVED AS TO FORM
Office of County Counsel
By: *Laura J. Anderson (e-signature)*
Deputy County Counsel
Date: October 11, 2010

Approved by the Napa County Board of Supervisors
Date: 10-26-2010
Processed by: Maria Jan McLaughlin
Deputy Clerk of the Board

Acorns to Oaks:

Partnerships for Re-Oaking the Napa Valley

NAPA COUNTY RCD Resource Conservation District

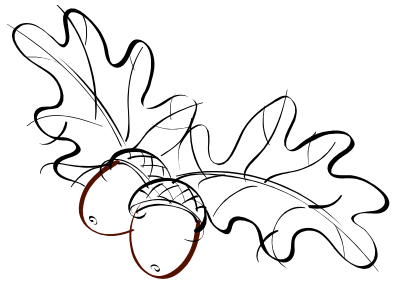
Friends of the Napa River

Oaks define our landscape

Oaks have a long relationship with fire

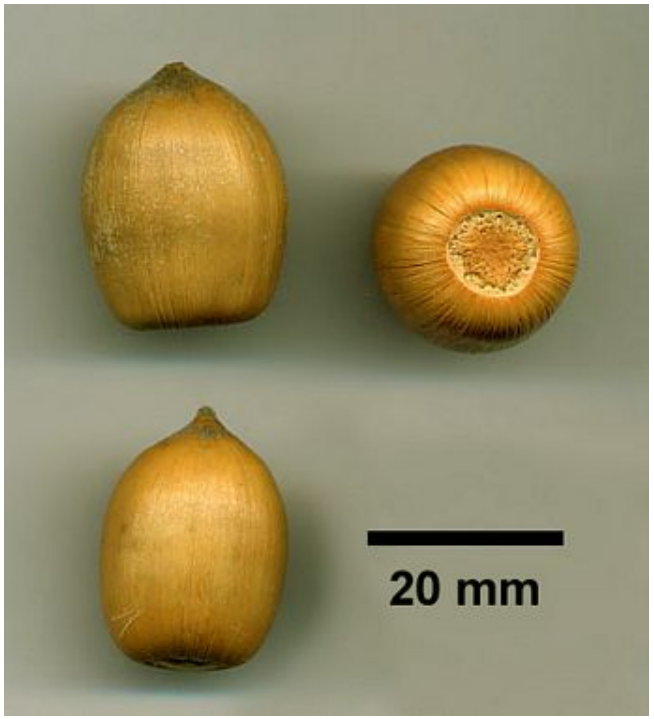
Oak Species in Napa Watershed

- Black Oak
- Coast Live Oak
- Interior Live Oak
- Valley Oak
- Blue Oak
- Canyon Oak
- Scrub Oak
- Oregon Oak



Tanbark oak - ***Notholithocarpus densiflorus***

Not an oak, but in the same family with oaks, beeches and chestnuts (Fagacea)




Valley Oak


Scrub Oak


Coast Live Oak


Blue Oak


Black Oak

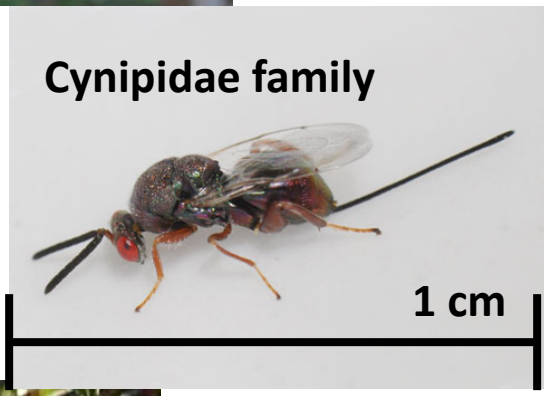
Live Oak

Valley Oak

Why are oaks important?

Oaks are biodiversity hotspots

Oak Galls --
Over 100 species of gall wasps!




Copyright Eric Preston

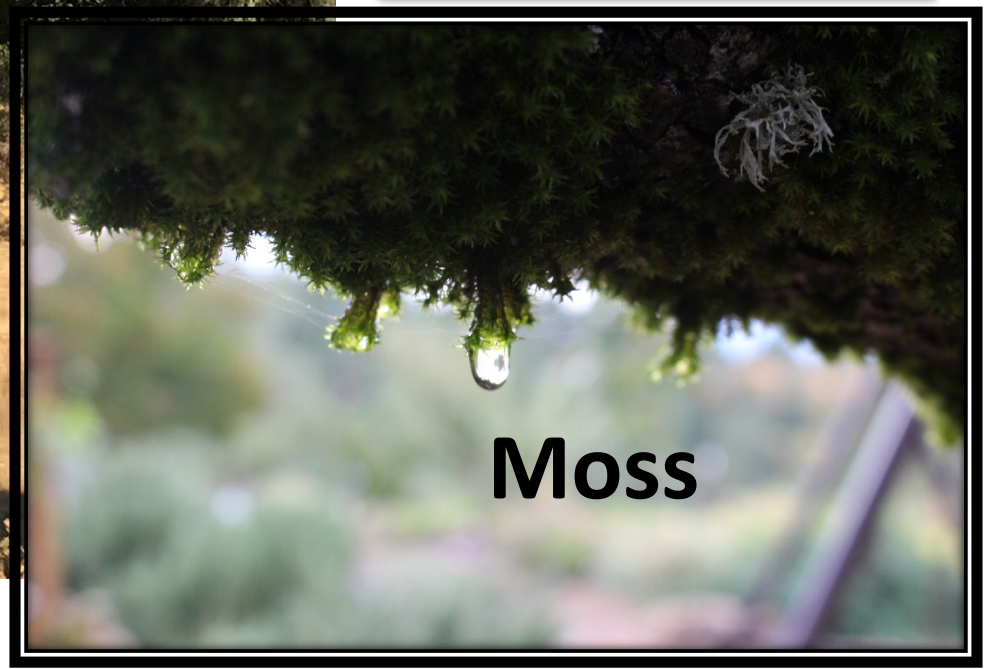
Biodiversity Value

- FOOD - Acorns are a key resource for deer, squirrels, turkeys, jays, quail, bears

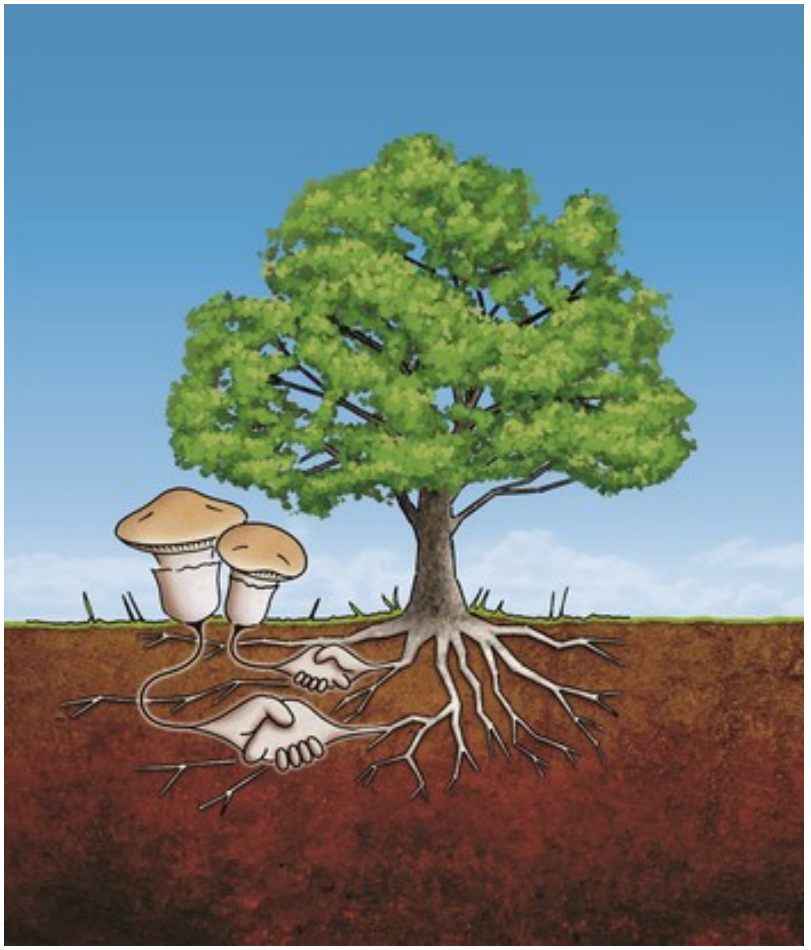
- HABITAT - California's oak woodlands provide habitat for nearly half of the 632 terrestrial vertebrates species found in the state. Standing dead trees provide an important habitat resource for raptors, bats, salamanders, and lizards.

- PROTECTION - Migrating birds and bats seek refuge in its boughs, amphibians and insects scurry along the deep cavities of its bark, and the diverse understory plants that blanket the ground below make California a “biodiversity hotspot”.

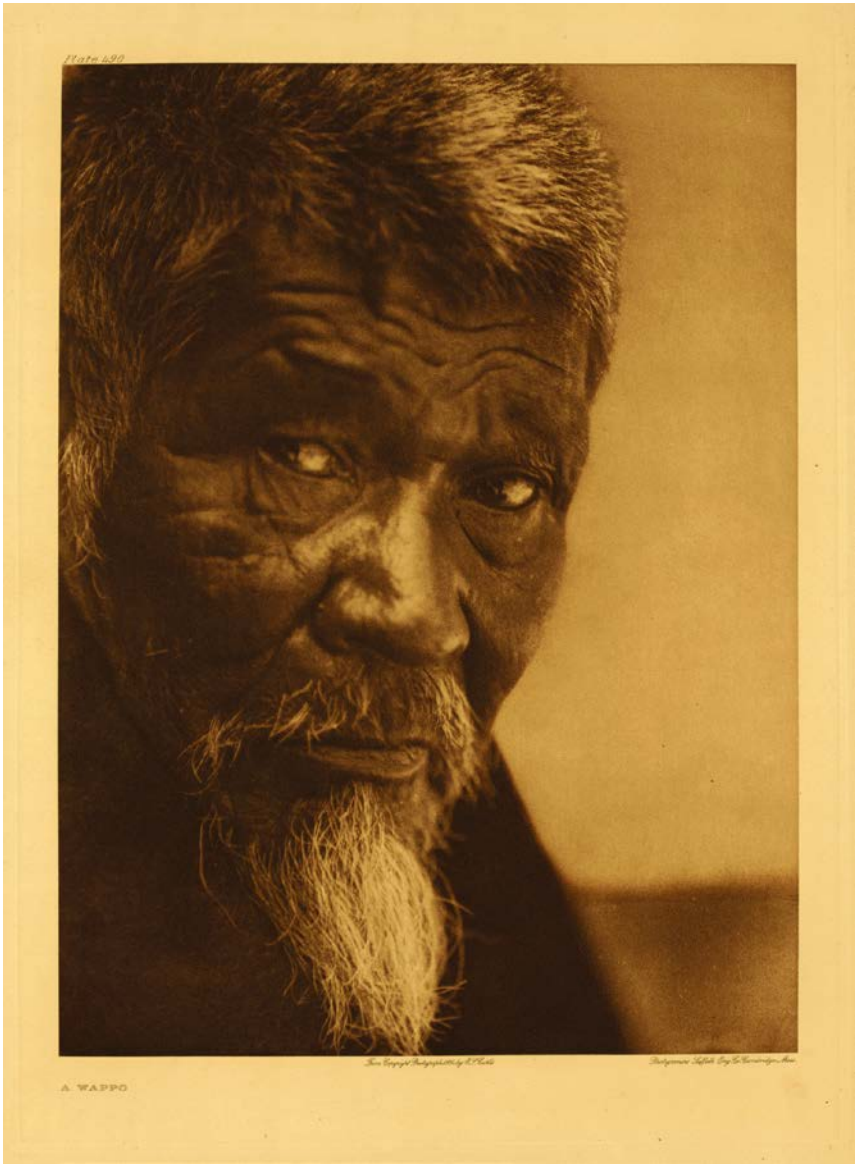
Lichen

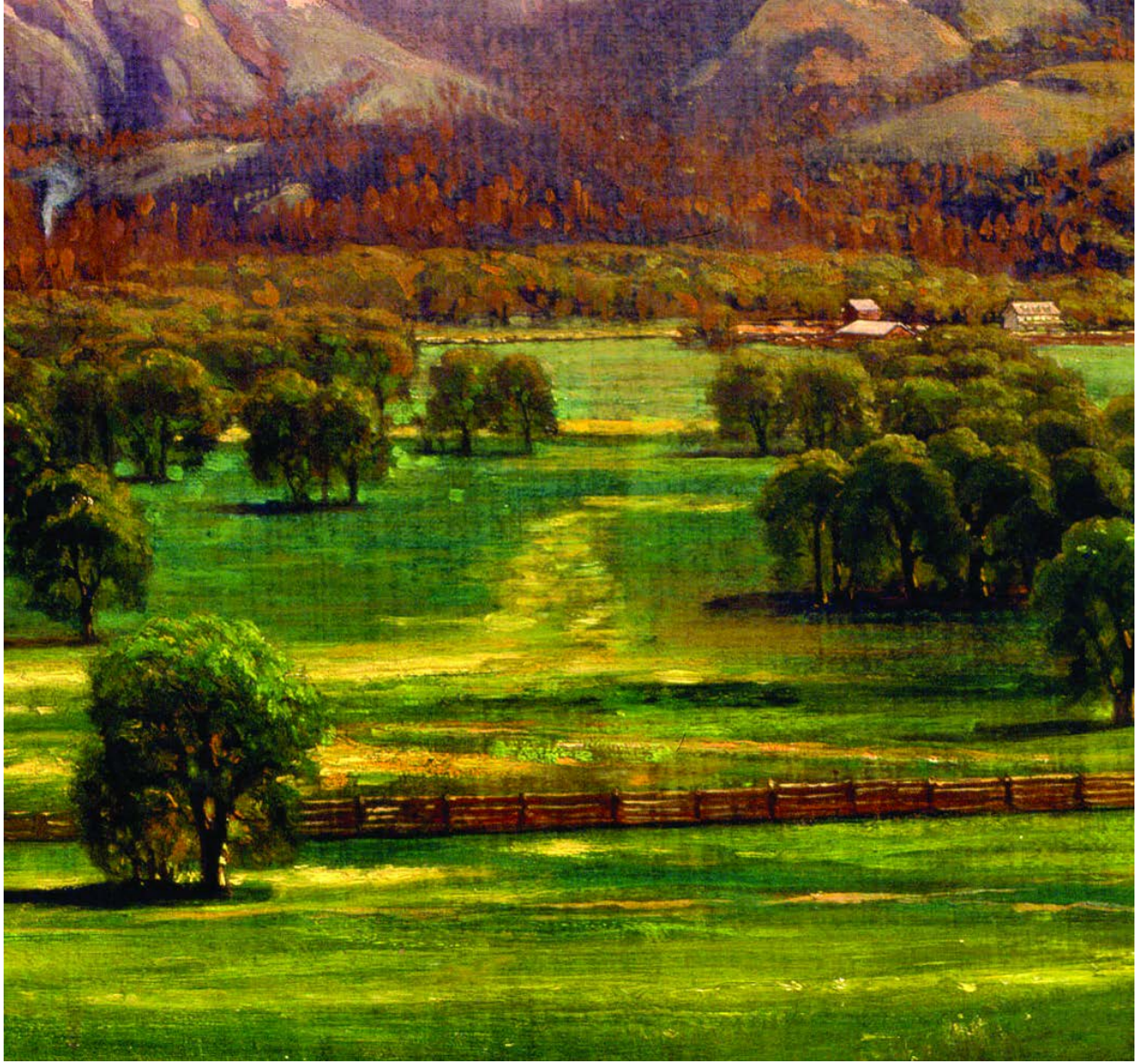


The fungus among us



Humans depend on oaks too





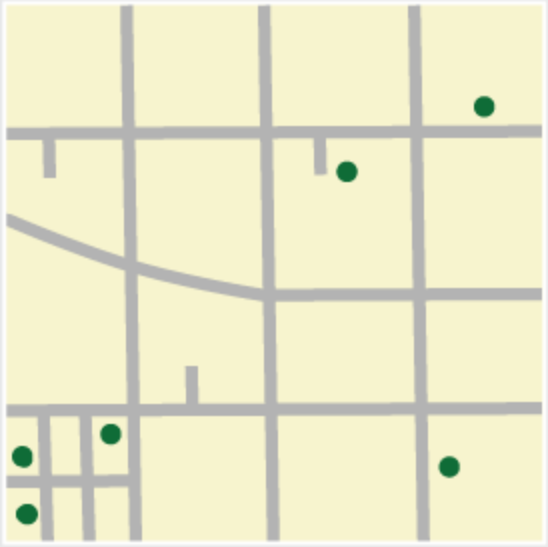
“The magnificent oaks are one great secret of Napa's beauty. Their rustling leaves and finely formed tops are the glory of the landscape scenery, and they everywhere, single and in groups, are scattered over the valleys.”
Smith and Elliot 1878

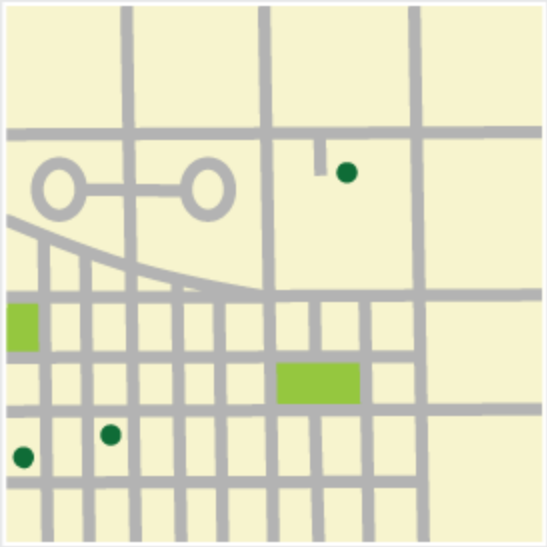
Land use changes led to changes in oak abundance

- **Pre 1769** – Wappo managed Napa Valley, including oaks
- **1769 - early 1800's** – Spanish used Napa for grazing cattle and horses
- **Mid 1800's** to present – Pioneers settled in Valley; as population density grew, fire suppression, agriculture, residential and industrial development transformed the watershed

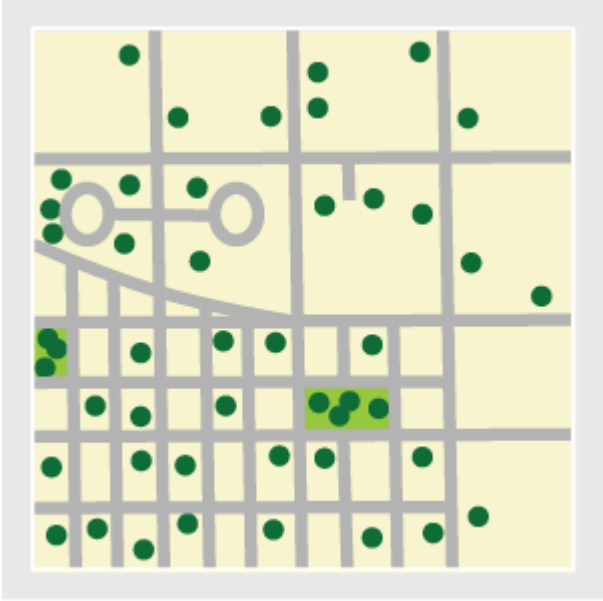
Napa Valley's Iconic Valley Oaks

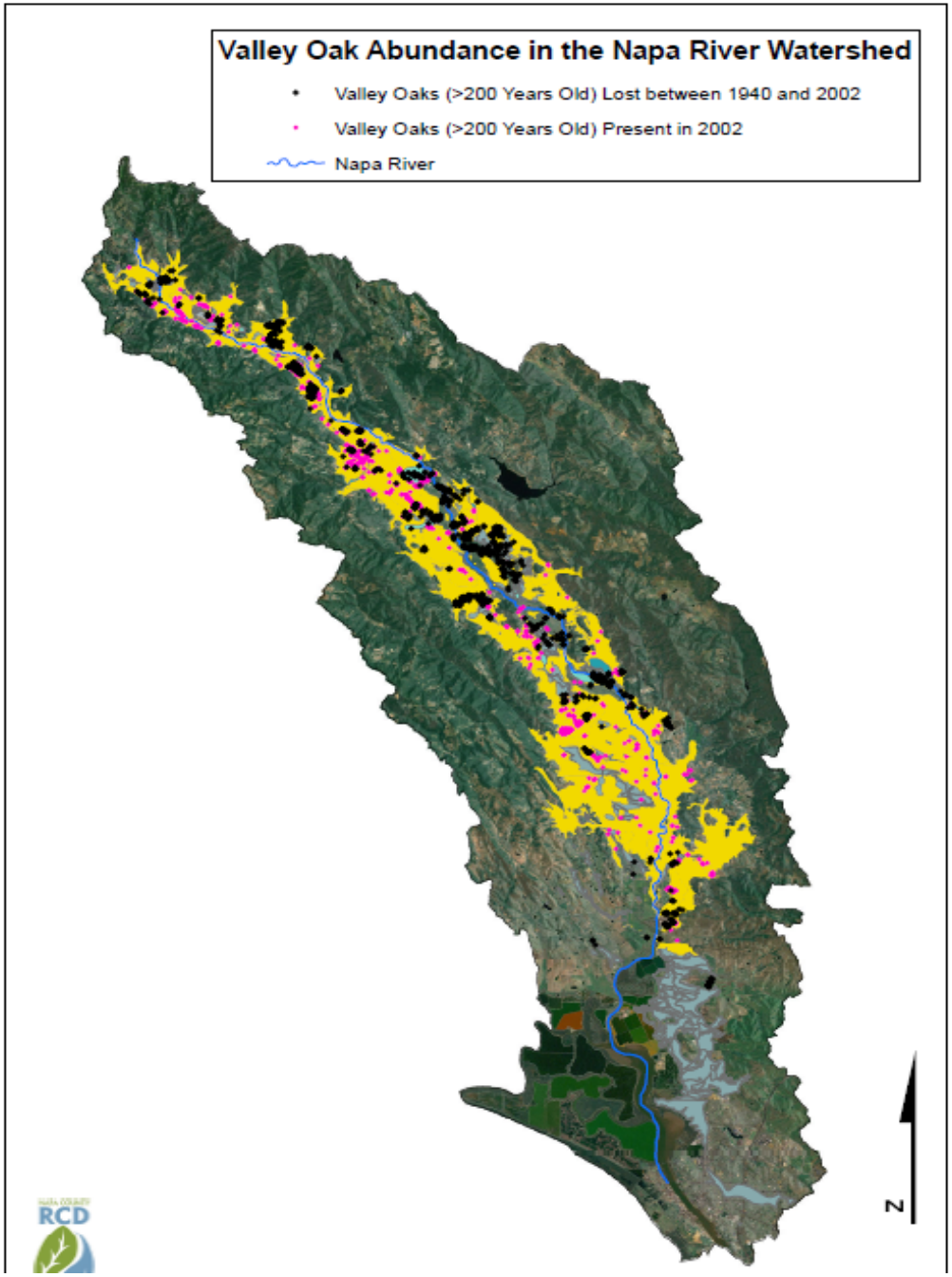
1800 1940 2012





2050?




Valley Oak Abundance in the Napa River Watershed
Valley Oaks (>200 Years Old) Lost between 1940 and 2002
Valley Oaks (>200 Years Old) Present in 2002
Napa River
N
RCD

The Mystery of Seven Big Trees. Driving along Highway 29, one passes roadside plantings of oleander, bottlebrush, eucalyptus, and other introduced species, along with occasional groups of native oaks. One of the most striking is a series of giant valley oaks just north of Oak Knoll Road. The trees are so well-aligned to the road, with similar size and spacing, that at first glance they seem like the other roadside plantings. But the size of the trees—trunks 41 to 49 inches in diameter—suggests that they must be at least 150 to 250 years old. The trees sprouted from acorns before significant clearing, when there were thousands of trees in the valley. It is likely that this linear grove is actually a slice of the original savanna, the fortuitous few that happened to find themselves between road and field as their neighbors were cut down. Scattered through the valley, these just-missed trees perforate the new Napa landscape with the native landscape of centuries past. Beyond their historic significance, these and other surviving trees are living links to the past landscape, contributing viable genetics and ecosystem functions, that could serve as nodes for future restoration of valley oak populations. *Photographs (above and below left) by Susan Schwartzenberg in November 2008; photograph (below right) by Robin Grossinger in June 2003.*

Linear Groves. In a few places, Napa Valley roadsides also demonstrate impressive regeneration of young trees descended from the original matriarchs. At the most well-developed sites, mixed-age oak communities can be found in thin lines along highway right-of-ways or farm roads. Local farmers have preserved mature trees and allowed their acorns, likely planted by scrub jays and squirrels, to develop in these narrow but productive corridors of ecological opportunity. As Jepson noted a century ago, these "linear groves," with songbirds flitting above and the potential for wind pollination across fields, represent viable habitats within the rectilinear framework of highly managed landscapes. *Photograph (above) by Ruth Askevold in November 2008; photograph (below) by Susan Schwartzenberg in November 2008.*

What are current threats to our oak trees?

Agriculture, vineyard conversion

Residential and Urban Development

Climate Change

Grazing: wildlife, livestock

Disease (sudden oak death) and introduced pests

Fire: catastrophic or change in frequency

Logging/firewood collection

Competition

Lack of regeneration due to: low acorn yield, poor seed-bed conditions, herbivory, water stress, genetic isolation

Disturbance to soil under dripline, summer water, disruption of mycorrhiza relationship

General lack of appreciation for the value and importance of oaks

Value of Preserving Oaks

- Global warming/carbon sequestration
- Wildlife habitat: food and shelter for 100's of species: mammals, insects, birds, reptiles
- Improve air and water quality
- Prevent soil erosion
- Shade
- Cultural/historical heritage
- Food!

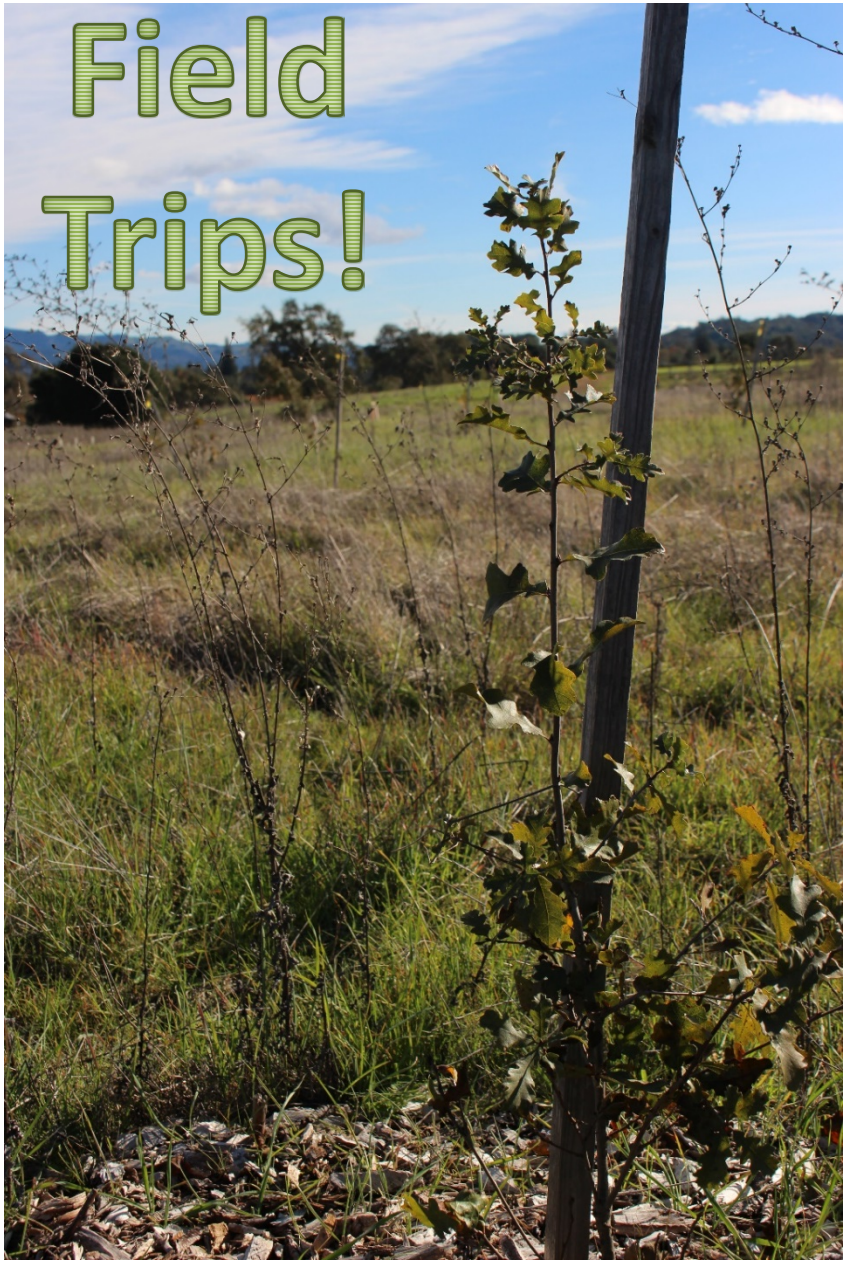
Acorns to Oaks

2012-2013 school year

- 6 student groups collect acorns and plant sprouts
- 6 landowners provide acorn collection and planting sites
- Napa County RCD, NRCS, Friends of Napa River provide technical support and field trip coordination, and education


VOLLEYBALL
JOE
BOXER
Hello!
Yun
Hello!
Theresa

Field Trips!



Oak classroom


NAPA HIGH SCHOOL
EST. 1891


LEADERSHIP TEAM
BOBCATS
2015-17


Thank you
NAPA COUNTY
RCD
Resource
Conservation
District
Friends of the
Napa River

Contact: Shari Gardner sg@fonr.org

Eric McKee Eric@naparcd.org

A few Oak resources:

- www.californiaoaks.org
- Napa County Voluntary Oak Woodland Management Plan http://www.countyofnapa.org
- Oak Woodlands Conservation Program www.wcb.ca.gov/
- Watershed Information Center and Conservancy of Napa County (WICC) google earth maps: http://www.napawatersheds.org/app_folders/view/256
- University of California Agricultural Extension "Ask the Expert" http://groups.ucanr.org/oakplan
- California Native Plant Society www.cnps.org
- Urban Forestry Ecosystems Institute www.ufei.calpoly.edu

Acorns to Oaks: Partnerships for re-oaking the Napa Valley
Presentation notes

Oaks define our landscape. These oak woodlands are one of the defining features of Napa County's scenery, and provide numerous recreational and ecological benefits. In addition to more common species of oaks, Napa County contains many of California's remaining valley oaks, which make up only one percent of the state's oak population, but almost six percent of Napa County's oaks.

Oak woodland is the most common land cover in the County, occurring on over 167,000 acres or roughly 33% of the County's area. It occurs throughout the County across a broad range of elevations, on gentle to steep slopes. Oaks are most common in the Southern Interior Valleys of Napa County, where it constitutes almost 70% of the land cover.

Oaks can be grouped in an oak woodland, mixed in with other trees in a mixed conifer forest, or mixed with chaparral on our drier slopes….

scattered through a grassland/savanna…

Oaks make up an important part of our riparian corridors: roots strengthening banks, canopy providing cooling shade & habitat, and feeding the river and streams

Oaks and fire

Most Oaks are considered stress-tolerant –
-they live a very long time (250-500+ years),
- live in harsh environments,
- have a strong relationship with mycorrhizal fungi,
- are drought tolerant.
- have evolved with fire and have thick bark in fire areas and can crown sprout.

Oak Species in Napa Watershed

There are some 25 species of oaks (including common natural hybrid species) in California.
These oaks are common in Napa County:
Black oak – *Quecus kelloggii* – best tasting acorn
Coast live oak - *Quercus agrifolia* tolerant to salt spray
Interior live oa*k* – *Quercus wislizeni*
Valley oak – *Quercus lobata (California endemic) biggest oak and oldest – up to 600 years*
Blue oak – *Quercus douglasii (California endemic)* can be drought deciduous
Oregon oak – *Quercus garryana*
Canyon oak – *Quercus chrysolepis*
Scrub oak – *Quercus berberidifolia*
Tanoaks are actually a member of the chestnut family. *Notholithocarpus densiflorus*

Tanbark oaks, or Tanoaks are not an oak tree – they are in the same Family: Fagacea, but do not have the same Genus. Including them here, because their nuts are very similar to the acorns of an oak, and

they are an important species in our mixed conifer forests. Tanoaks were heavily logged to tan hides in the mid-late 1800's. They are one of the species most seriously affected by "sudden oak death" (Phytophthora ramorum), with high mortality reported over much of the species' range.

Oak leaf examples

Coast Live and Valley Oaks

The two species we have primarily focused on replanting in the Napa Valley are the Coast live oak and the California Valley oak.

Coast live oaks are an evergreen tree. Dark green with compact canopies, their leaves have sharp "teeth" around the margin making them prickly. Their inland cousin is the Interior live oak. Coast live oak populations have taken a hit from Sudden Oak Death.

Valley Oaks are endemic to California, Valley oaks can grow to massive sizes (up to 9' diameter, 100' tall!) and their branches droop in graceful peduncles. They thrive in deep rich soils with good access to farmland…. Our valleys, that we have cleared for agriculture, homes, cities, parking lots… until less than 5% of our valley oaks remained!

Why important? Biodiversity!

Oak woodlands are the most diverse terrestrial/land-based ecosystems in California, supporting well over 320 vertebrate species (including more than 120 mammal, 147 bird, and 60 reptile/amphibian species), 1,100 plant species, 370 fungal species, and 5,000 arthropods species (insects and mites).

Gall wasps

Over 100 species of gall WASPS – additional galls made by mites, and others

Any place you find oaks, you'll find galls. Gall formation is often triggered by tiny wasps the size of fruit flies. A wasp lays an egg on a plant. The egg hatches and the larva begins to chew, releasing a chemical that triggers the plant to produce a specific type of gall, And people shouldn't worry about the tiny wasps that trigger the whole process. They don't sting people, they do have a stinger, but it's used only for the purposes of piercing the plant tissue and laying eggs.

Oak galls were used by California Indians as an eyewash and dye. Some of America's most historic documents, including the Declaration of Independence and Constitution, were written with ink made with galls from Turkey

Oak apples are among the larger galls. They look like potatoes clinging to the tree. Each can have 10 or more larvae inside. The developing larvae attract weevils, moths and other insects looking for food. And those insects, in turn, draw lizards, birds and spiders seeking sustenance. Some larger wasps and ants feed on the honeydew secreted by the gall larvae, and will try to protect the gall from predators.

Small, but fascinating and important part of ecology: how amazing that a tiny little bug larvae can trigger a giant oak to build a specialized house for it!

Acorn Woodpeckers

Acorn woodpeckers live communally in a clan of 2-16 individuals. Work together to gather and protect food stores, brood and raise young. Can live for 17 years.

-Eat acorns, also eat flying ants, beetles, wasps, etc., drill sap wells and drink mineral rich sap from trees.

-Store up to 50,000 acorns in granaries: drill individual holes in dead tree limbs or trunks, telephone poles, side of house or barn

-Woodpeckers move acorns as they dry into smaller holes. Guard their stores against raids by other birds, rodents.

-Their nest cavities may later be used by Western screech owls, American kestrels, oak titmice, western bluebirds, woodrats, gray squirrels, gopher snakes, arboreal salamanders and feral honeybees.

Acorns as wildlife food

Acorns drop at just the right time for animals to fatten up for winter. Rodents, large mammals such as pigs, bears, and deer also consume large amounts of acorns; they may constitute up to 25% of the diet of deer in the autumn.[3] Deer with access to large quantities of acorns in the fall have healthier fawns in the spring.

Jays and squirrels bury acorns away from the parent tree to store them for a food source, a practice known as 'scatter-hoarding'. A jay caches up to 5,000 acorns each year! Many of these stored acorns are left uneaten, and happen to be buried at just the right depth, to grow into new oaks.

Biodiversity Value

- FOOD - Acorns are a key resource for deer, squirrels, turkeys, jays, quail, bears
- HABITAT - California's oak woodlands provide habitat for nearly half of the 632 terrestrial vertebrates species found in the state. Standing dead trees provide an important habitat resource for raptors, bats, salamanders, and lizards.
- PROTECTION - Migrating birds and bats seek refuge in its boughs, amphibians and insects scurry along the deep cavities of its bark, and the diverse understory plants that blanket the ground below make California a "biodiversity hotspot". 5000 insects and 1000 other invertebrate species (spiders, slugs, etc.) make their homes in and around oaks

Lichen

Oaks provide a structure to support Lichen and moss

Lichen:
- Lichen is composed of a fungus, an algae, and cyanobacteria: the fungus provides structure & captures water and minerals; the algae provides food through phtosynthesis
- Lichen is an indicator of air quality, thriving in clean air, and dying off in the presence of air pollution.
- Lichen's great surface area captures dust that blows inland from the sea carrying nutrients and salts, which in turn feed the tree when the lichen falls to the ground and decomposes

Moss

The Fungus among us

Fungi form mutually beneficial partnerships with trees, receiving carbon from the trees while helping trees acquire nutrients.

thin-rooted trees, including oaks, relies on fungi called ectomycorrhizas, which are capable of producing wide-spreading strands—hyphae—to bring in nutrients.

Mycorrhizal fungi allow the plant to withstand more stress

Mycorrhizal roots increase drought tolerance by both finer root like structures, (more soil volume is exploited), and increased desiccation tolerance (plant roots are thicker and more resistant to desiccation damage). That is, mycorrhizal roots develop more stress tolerant structures from the beginning. Sounds contradictory, but the plants roots become tougher as the attached fungal hyphae become more numerous and replace root hairs.

"Earthworms help open up the ground while they are dissevering through the ground eating most any material in their way, the fungi and to a lesser degree the bacteria open the ground up at least a hundred fold more. Sowbugs, nematodes, mites, springtails, millipedes, etc. also help spread the fungi and bacteria. And they all get eaten by birds and other larger animals which further spread the micro-organisms." http://www.laspilitas.com/advanced/advroots.htm

This Graphic is from: http://www.healthfreedoms.org/fungi-and-roots-direct-where-trees-search-for-nutrients/

Humans Depend on acorns, too

The Wappo Native Americans were the sole inhabitants of the Napa Valley until the late 1700's. Their cultural practices included hunting and the selective gathering of plants, including acorns from several oak species, which were made into flour and comprised an important part of their diet.

A Long History of Oak Management:

The local Wappo People called June "burn-the-valley-moon" and used fire as a tool to manage oak savannahs and woodlands. Fire improved soil fertility by fixing nitrogen in the soil, kept vegetation under trees down so acorns would be easier to harvest, and helped control insect populations which feed on acorns.

While knocking acorns out of the Oaks with long poles, Native People also pruned the trees; removing diseased or weak branches and increasing acorn production.

Acorns as food

Oaks grow around the world, and everywhere that oaks grow, people eat acorns. Acorns provide

Nutrient rich: 18% fat, 6% protein, 68% carbohydrate, plus minerals and fiber, good source of vitamins A & C, many essential amino acids

Can still buy acorn flour in Korean markets… or make your own

Acorns have a lot of tannins which are a natural preservative, but toxic to humans (impair our ability to absorb nutrients), but tannins are water soluble, so can be leached out by soaking the ground (increase surface area) acorn meal in water.

"The magnificent oaks are one great secret of Napa's beauty. Their rustling leaves and finely formed tops are the glory of the landscape scenery, and they everywhere, single and in groups, are scattered over the valleys." ***Smith and Elliot 1878***

Early settlers, surveyors, visitors to the valley commented on the oaks and the beauty they contributed to the landscape

The shade of the mighty oak is appreciated on a hot summer day

Early settlers and surveyors commented on the Napa Valley's park-like setting and its majestic oaks. Houses were built in their shade and for a time, crops were grown around the majestic oaks

Land use changes led to changes in oak abundance

Dramatic shift in land use though the 1800's. Eradicated species like the Grizzly and the tule elk.

Brought new species: some grasses, weeds, trees, that take over (INVASIVES)

Channelized the Napa River and its tributaries. Large scale logging of redwoods for shingles, tan oaks for leather industry (tanning hides), and valley oaks and others for firewood to fuel steam trains, cooking, heating homes and San Francisco

Oak trajectories:

Valley oak population on valley floor shrank dramatically: here – as in most of California, valley oaks live in the places we like to build our homes, grow crops and put our roads, parking lots, etc. The trajectory is not good for our endemic valley oak….

BUT, we can turn the tide and bring oaks back into our landscape, if we choose to, with education, restoration and appreciation

Oaks in our landscape today: Oaks and vineyards… maybe room for more oaks? Need to better understand the oak/mycelium relationship to avoid oak fungus rot

Oaks in Vineyards. Oaks and vineyards… maybe room for more oaks? Need to better understand the oak/mycelium relationship to avoid oak fungus rot

Current Threats to our oaks:

- **Ag, urban and residential development:** Since the mid-1940s, 1.2 million acres of oak woodland habitat have been converted to urban and agricultural uses and another 10 million acres are at risk. An additional 14,000 acres are estimated to be lost each year to residential development and woodcutting.
- **Climate Change** hotter, drier, unpredictable weather, higher winds…
- **Grazing**: oak trees can resprout after browsing, but heavy grazing removes new oaks and compaction from livestock affects ability of shallow roots to absorb water. Grazing also encourages invasive grasses which destroy the critical relationship with fungal mycelium

- **Disease, SOD**: Sudden Oak Death is a tree disease caused by the plant pathogen *Phytophthora ramorum*. *Phytophthora*, aka water molds, are water-loving and produce plentiful spores in moist, humid conditions. The disease kills some oak species and has had devastating effects on forests in California and Oregon, Since the mid 1990s, *P. ramorum* has caused substantial mortality in tanoak trees and several oak tree species (coast live oak, California black oak, Shreve oak, and canyon live oak), as well as twig and foliar diseases in numerous other plant species, including California bay laurel, Douglas-fir, and coast redwood. Over the last fifteen years, more than a million oak and tanoak trees have died from Sudden Oak Death (SOD) and at least another million trees are currently infected.
- **Fire:** Oaks tend to have thick bark, and can stumps-sprout, but hot fires can kill them, reseeding after a fire with nonnative grasses destroys the mycorrhizal network; and fire suppression leads to spread of firs which shade oaks out.
- **Competition**: fast growing non-natives, and natives that grow taller like pines and firs will out compete oaks
- **Disturbance:** the area beneath the drip line is very sensitive to disturbance. Oaks can have very deep taproots, but the shallow roots are critical to the health of the tree. These roots have a complicated relationship with fungal mycelium, which helps the oaks absorb water and nutrients. Compaction, sogginess from summer water, disturbance to the soil destroys these roots and that relationship.
- **Appreciation**: If oaks were more appreciated, we would plant them along our roads and sidewalks (instead of non-native – lower value trees), in our yards, in our parks and parking lots, along the edges of our farms…

Value of Preserving Oaks

- Global warming/carbon sequestration
    -
- Wildlife habitat: food and shelter for 100's of species: mammals, insects, birds, reptiles
    - -Oak woodlands are the most diverse terrestrial/land-based ecosystems in California, supporting well over 320 vertebrate species (including more than 120 mammal, 147 bird, and 60 reptile/amphibian species), 1,100 plant species, 370 fungal species, and 5,000 arthropods species (insects and mites).
- Improve air and water quality
- Prevent soil erosion
- Shade
- Cultural/historical heritage
- Food!

Acorns to Oaks: began in 2012-2013 school year

- 6 student groups collect acorns and plant sprouts
- 6 landowners provide acorn collection and planting sites
- Napa County RCD, NRCS, Friends of Napa River provide technical support and field trip coordination, and education
- Efforts have grown: plan to plant 5,000 oaks by the end of 2018

Field trips: Oak planting field trips are hands-on. Remind students to wear sturdy, closed-toed shoes, long sleeves and long pants recommended, sunscreen, hat, and bring a water bottle! Keep an eye out for ticks/snakes/poison oak.

1. Select acorns that are heavy, have no holes, and do not rattle: 2-3/hole
2. Prep ground: clear vegetation 2 ft diameter,
3. Dig small hole, plant acorn pointy side down or on its side,
4. Cover the hole and mark it with stake and seedling protection (screen, tube, etc.)
5. Spread mulch around the open ground. Mulch helps hold the moisture in the soil, encourages fungal connections, adds nutrients.

Oak Classroom: There are lots of different aspects of oak communities to choose from for class and field study, including:

- Photosynthesis, carbon cycle, nitrogen cycle,
- Surveying a forest
- Art: form and function
- Cooking/nutritional value
- Seeds/roots/germination
- Study factors affecting germination and growth rates
- Biodiversity
- Distribution: historic and/or present
- Climate change/carbon sequestration

Taking a group of children (of any age) out among the oaks presents opportunities for lesson, observation, inspiration. Highly recommend!

Resources:

Contact: Shari Gardner sg@fonr.org

Eric McKee Eric@naparcd.org

A few Oak resources:

- www.californiaoaks.org
- Napa County Voluntary Oak Woodland Management Plan http://www.countyofnapa.org
- Oak Woodlands Conservation Program www.wcb.ca.gov/
- Watershed Information Center and Conservancy of Napa County (WICC) google earth maps: http://www.napawatersheds.org/app_folders/view/256
- University of California Agricultural Extension "Ask the Expert" http://groups.ucanr.org/oakplan
- California Native Plant Society www.cnps.org
- Urban Forestry Ecosystems Institute www.ufei.calpoly.edu
- Gall wasp video https://ww2.kqed.org/science/2014/11/18/what-gall-the-crazy-cribs-of-parasitic-wasps/
- Carbon calculator: https://www.fs.usda.gov/ccrc/tools/tree-carbon-calculator-ctcc

A few of Shari's very favorite oak books:

Oaks of California by Bruce Pavlik, Pamela Muick, Sharon Johnson & Marjorie Popper

Secrets of the Oak Woodlands: Plants & Animals Among California's Oaks by Kate Marianchild

The Life of an Oak – an Intimate Portraitby Glenn Keator

Napa Valley Historical Ecology Atlas by Robin Grossinger – see chapter on oaks!