Restoring Oak Habitats in Southern Oregon & Northern California

A Guide for Private Landowners

Klamath Bird Observatory

Klamath Basin Audubon Society

U.S. Department of the Interior Bureau of Land Management

Lomakatsi Restoration Project
Restoring Ecosystems, Sustaining Communities

U.S. Fish and Wildlife Service
Partners for Fish & Wildlife

Together Green
act today, shape tomorrow

Version 1.0

Rich Fairbanks

California black oak leaves and flowers

Acknowledgements

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Klamath Bird Observatory is a scientific non-profit organization that achieves bird conservation in the Pacific Northwest and throughout the migratory ranges of the birds of our region. We developed our award-winning conservation model in the ruggedly beautiful and wildlife-rich Klamath-Siskiyou Bioregion of southern Oregon and northern California, and we now apply this model more broadly to care for our shared birds throughout their annual cycles. Emphasizing high caliber science and the role of birds as indicators of the health of the land, we specialize in cost-effective bird monitoring and research projects that improve natural resource management. Also, recognizing that conservation occurs across many fronts, we nurture a conservation ethic in our communities through our outreach and educational programs. We owe our success to committed donors, volunteers, staff, and conservation partners who demonstrate that each of us can contribute to a legacy of abundant bird populations and healthy land, air, and water.

Bureau of Land Management sustains the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. The BLM's multiple-use mission, set forth in the Federal Land Policy and Management Act of 1976, mandates that we manage public land resources for a variety of uses, such as energy development, livestock grazing, recreation, and timber harvesting, while protecting a wide array of natural, cultural, and historical resources.

Lomakatsi Restoration Project is a non-profit, grassroots organization that develops and implements forest and watershed restoration projects in Oregon and northern California. Since 1995, Lomakatsi has a proven record of success implementing restoration projects across thousands of acres of forests and miles of streams. In cooperation with a broad range of partners including federal and state land management agencies, The Nature Conservancy, land trusts, private landowners, watershed councils, city and county governments, and Native American tribes, our work has set precedents on nationally recognized projects. Lomakatsi provides expertise and capacity in project development, planning, management, fine-scale ecological treatment design, monitoring, and implementation for ecosystem restoration projects. We integrate restoration practice with science delivery, education and workforce training. Lomakatsi coordinates closely with multiple funding partners and manages a diverse workforce in complex social settings supported by critical community outreach.

Klamath Basin Audubon Society provides opportunities for people of all ages to experience and appreciate our region's birds and other natural resources. We achieve this mission through educational programs, field trips, and grants that support worthy local or regional projects.

USFWS Partners for Fish and Wildlife Program works to efficiently achieve voluntary habitat restoration on private lands, through financial and technical assistance, for the benefit of Federal Trust Species.

Photographers and Affiliations

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Helpful Terms

If you encounter an unfamiliar term in **bold font** in the text, return to this page for the definition.

Annual plant—is a plant that lives for one year or less.

Conifer—are evergreen trees that bear cones and have needle-like or scale-like leaves, such as pines, firs, spruces, and cedars.

Controlled burn—refers to the controlled application of fire over a predetermined area to reduce wildland fuels and restore ecological health. These are also known as "broadcast burns" and "prescribed burns."

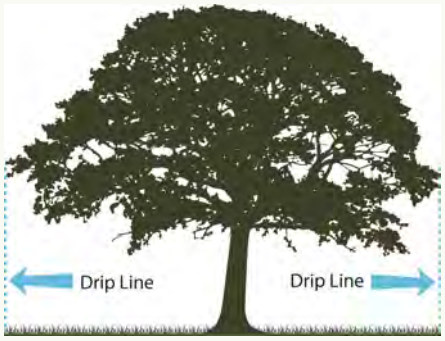
Canopy cover—the extent to which the tree canopy intercepts light from hitting the ground (for example, a forest with 100% canopy cover would have no direct sunlight reaching the ground at midday).

Canopy crown—The crown of a tree or shrub is the totality of branches, leaves, and reproductive parts that extend outward from the main trunk.

dbh—is an abbreviation for "diameter at breast height," which is a standard measure of tree size that is the diameter of the tree's trunk at the height of 1.4 meters (4.5 feet) above the ground.

Downed wood—is wood found on the forest floor in various stages of decomposition.

Drip line—or drip zone, refers to the imaginary circle on the soil around a tree that falls directly below the tree's outermost branches. All the rain water that drips off a tree would fall within this circle.



Forbs—are herbaceous (non-woody) plants other than grasses.

Girdle—refers to the process of cutting through the cambium and sapwood layers around the circumference of a tree stem to interrupt the flow of nutrients between the below- and above-ground portions of the tree, resulting in the death of the tree. See **page 27** for a photo guide to girdling.

Granary trees—are trees that Acorn Woodpeckers use as storage sites for acorns.

Ladder fuels—are tall grasses, shrubs, and living or dead trees that allow ground fires to travel upwards into forest canopies.

Perennial plant—is a plant that lives for more than two years. An annual plant lives for one year, and a biennial plant lives for two years.

Radial thinning—is the removal of competing trees within a certain radius of a valuable tree.

Residual Dry Matter (RDM)—is a standard used for assessing the level of grazing on rangeland. RDM refers to the number of pounds per acre of old herbaceous plant material left on the ground at the start of a new growing season.

Snags—are standing dead trees, usually with hollow trunks or limbs.

Sprout clump thinning—refers to the practice of thinning stems that sprouted from the base of a single tree following disturbance or the cutting of the tree. Learn more about sprout clump thinning on **page 26**.

Sudden Oak Death—is a disease in oaks and other trees caused by the non-native pathogen *Phythopthora ramorum*. Oak species show varying susceptibility to the disease, and some oak populations have been devastated recently in California and Oregon. To learn more download the document listed at the bottom of **page 19**.

Table of Contents

Summary

Private landowners own and manage roughly 60% of the land area of the United States. These private lands sustain native wildlife populations while also benefiting landowners and society. In the western United States, private lands are especially important for the conservation of oak habitats. These habitats have suffered heavy losses and most remaining oak habitats—those not converted for human use or harmed by encroaching vegetation as a result of fire suppression—occur on private lands. An exciting opportunity exists for landowners and conservation partners to work together to restore native oak systems and their diverse wildlife communities.

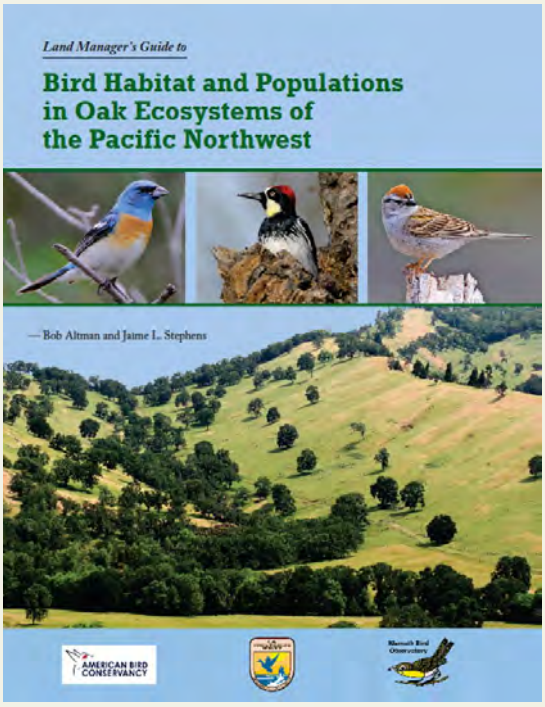
This landowner guide describes how to apply conservation practices for Oregon white oak and California black oak habitats on private lands in southern Oregon and northern California. The document first discusses the importance and history of oak habitats and then provides detailed conservation guidelines for oak habitat restoration. Also, the guide includes supplemental resources for the restoration-minded private landowner, including a list of organizations that will assist with private lands restoration as well as step-by-step instructions for monitoring birds on your land to track the return of wildlife following oak restoration activities.

Brandon Breen

A view through an oak woodland into the Rogue Valley in southern Oregon

Geographic Scope

This landowner guide specifically refers to oak habitat in Josephine, Jackson, and Klamath Counties in Oregon, and Siskiyou County in California. Although this guide is intended for guidance in the aforementioned counties, some of the restoration principles and recommendations will be relevant to those who manage oak habitats outside of this region.



Land Manager's Guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest

Consider downloading this companion volume, written by Bob Altman of American Bird Conservancy and Jaime Stephens of Klamath Bird Observatory, as a reference and source of general information about oaks and associated birds in the Pacific Northwest. This guide provides information on bird species' status, distribution, density, habitat relationships, and potential responses to oak habitat management or restoration activities. This information can be used to facilitate sound decisions to support bird conservation in the context of protection and management of the unique and threatened oak ecosystems of the Pacific Northwest. It is available for free download on the Klamath Bird Observatory website:

www.klamathbird.org/resources/support-tools

The Value of Oak Habitats

Oaks provide a diverse set of values to humans and wildlife. Oak-dominated landscapes are aesthetically pleasing—a characteristic that can lead to increased property values—and they are suitable for numerous recreational activities, such as hiking, photography, and wildlife-viewing. Oak systems provide firewood and grazing habitat, and timber is supplied by California black oak and tanoak, in particular. The presence of oaks on a landscape provides fire resilience because their thick bark and branch structure generally prevent ground fires from spreading to the forest crown.

Kate Halstead

Oak trees and habitats are considered attractive by many people

Oak habitats are also among the richest wildlife habitats in Oregon and California. For example, studies reported over 200 vertebrate species in oak woodlands in the Willamette Valley, Oregon, and over 330 species of vertebrates in oak woodlands in portions of California. Oak habitats are especially important because many of the species they harbor are not found in neighboring conifer-dominated landscapes.

Jim Livaudais

Band-tailed pigeon

A handful of characteristics help explain why oak trees are so important for wildlife. First, and foremost, is the production of acorns. Acorns can be produced in prolific numbers, and these energy-rich seeds provide nutrition at the base of the food chain; for example, many bird species rely heavily on acorns, including acorn woodpecker, western scrub jay, band-tailed pigeon, California quail, wild turkey, oak titmouse, and white-breasted nuthatch. Mammals such as western gray squirrels, Douglas squirrels, Columbian black-tailed deer, and American black bears also feed on acorns. See *Appendix I: Plants and Animals in this Guide* for a list of the scientific names of plants and animals mentioned in this document.

Eamon Engber

Roosevelt elk and Oregon white oak

Mature oak trees often contain a mixture of living and dead tree limbs, and the dead limbs provide wildlife cavities for nesting and roosting. Many oak-associated bird species build their nests in cavities, including western bluebird, oak titmouse, house wren, black-capped chickadee, and woodpeckers. Dead limbs also provide critical storage sites for acorn-caching acorn woodpeckers, as well as habitat for wildlife food items such as grubs and other insects.

Oak trees and their associated shrubs and understories support unique insect communities that provide food to birds and other wildlife. Oak leaves provide browse for Columbian black-tailed deer and elk, and oak limbs provide perches for raptors and flycatchers.

Many oaks also support Pacific mistletoe. This flowering, parasitic plant draws water and minerals from its host oak tree and produces berries important for many wildlife species, such as the western bluebird.

Many reptiles and amphibians dwell in oak habitats, including *Ensatina* salamanders, northern red-legged frogs, ring-necked snakes, Pacific tree frogs, western skinks, sharp-tailed snake, Pacific gopher snake, northwestern garter snake, and western fence lizard.

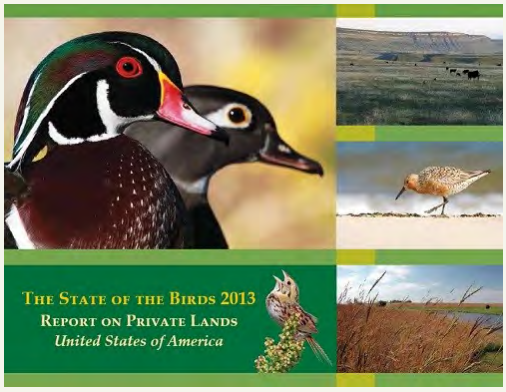
Throughout the year oaks provide habitat for birds and other wildlife. Resident species, such as bushtit, use oak habitats year-round, whereas many migratory birds, including ash-throated flycatcher and western wood-pewee, use the oak habitat during the breeding season (from May to late July). Lewis's woodpecker, however, is a short-distance migrant that uses the habitat primarily during winter. Other migratory birds that breed farther north spend winters in oak habitats in southern Oregon and northern California, or they stop here on migration to rest and refuel before traveling to destinations farther south. Our oak habitats truly support rich communities of life in every season.

Jim Livaudais

Ash-throated flycatcher

Mathew Cocking

Pacific giant salamander in California black oak leaves



Oak Habitats are Important for Birds

The State of the Birds 2013 Report on Private Lands highlights the considerable extent to which native bird populations in the United States depend on private lands. The report gives specific attention to the importance of private oak woodlands of the Pacific coast and showcases a public-private initiative in southern Oregon and northern California—the Central Umpqua-Mid Klamath Oak Habitat Conservation Project—that received the 2012 Department of the Interior Partners in Conservation Award and restored 2,000 acres of oak habitat, benefiting oak titmouse, acorn woodpecker, and black-throated gray warbler. Two local conservation groups, Lomakatsi Restoration Project and Klamath Bird Observatory, have worked with private landowners to implement and monitor restoration oak projects. This restoration initiative was funded by the Natural Resources Conservation Service Cooperative Conservation Partnership Initiative and the US Fish and Wildlife Service Partners for Fish and Wildlife Program.

A History of Change and a Future of Possibility

Historically oaks were widespread throughout the valleys and foothills of California, Oregon, and Washington. Since the start of European settlement in the mid-1800s, California has lost 33% of its oak woodlands and estimates of regional oak habitat losses in Oregon and Washington range from 50% to near total loss. Moreover, many of the remaining oak habitats tend to occur on poor soils because more productive land has largely been cleared for other uses.

A variety of factors have contributed to the loss of oak habitats. In earlier times, Native Americans set frequent fires to maintain oak savannas and woodlands in open conditions. These fires reduced competing vegetation and allowed oaks to thrive and produce large numbers of acorns, a key food source for Native people. Following European settlement, many oak woodlands and savannas were converted for agriculture or urban development. Also, decades of fire suppression during the latter half of the 1900s have allowed less fire-resistant yet faster-growing tree species, such as Douglas-fir, to encroach upon and displace oak trees. Additionally, in some cases cattle grazing has degraded oak systems by compacting soils and reducing oak regeneration. More recently, non-native invasive species—including plants, insects, and disease agents—have contributed to negative impacts in oak habitats; for example, the invasive shrub Scotch broom has altered understory and shrub communities in these habitats, and the disease **Sudden Oak Death** has devastated some oak forests in California and Oregon.

The degradation and loss of oak habitats have led to real and negative consequences for wildlife. Almost half of 49 bird species in the Pacific Northwest that are highly associated with prairie-oak habitats have experienced extirpations, range contractions, and/or regional population declines. This habitat decline has affected other wildlife too, including mammals, butterflies, and other invertebrates.

Fortunately, wildlife populations can usually bounce back if appropriate habitat conditions are in place for wildlife to live and breed. Private landowners, by referring to the guidelines in this document, can play an integral role in returning healthy, wildlife-rich oak ecosystems to the landscape, thereby leaving a valuable legacy for future generations.

The Nature Conservancy

Young citizens learn about oak habitats in the Rogue Valley

The Role of Private Landowners

In the Pacific Northwest, oak habitat in private ownership ranges from 50% to nearly 100%, depending on the region. Thus, oak habitats and their wildlife communities are heavily dependent on private landowners who choose to maintain or restore oak ecosystems. There are some oak habitats on public lands, and these tend to be at lower elevations adjacent to private lands.

Fortunately, there are many reasons why landowners may decide to undertake oak restoration. Oak woodlands and savannas have a unique aesthetic that many people find beautiful; oak trees have interesting and artistic growth forms, and oak woodlands are excellent for wildlife viewing. Restoring habitat brings satisfaction and increases a landowner's connection to the land. Additionally, it can be thrilling when new wildlife species appear in habitat created by restoration activities.

Marko Bey

Private landowner and USFWS personnel discuss an oak restoration plan

Jaime Stephens

Individuals interested in oak conservation attend a field day led by American Bird Conservancy, Klamath Bird Observatory, Lomakatsi Restoration Project, Natural Resources Conservation Service, and US Fish and Wildlife Service

Private Lands Restoration Matters

New research by Klamath Bird Observatory's Kate Halstead (pictured on right) and colleagues at Oregon State University demonstrates that even small parcels of high quality oak habitat will attract oak-associated birdlife. This is reassuring to private landowners because it means that oak restoration activities, of nearly any size, will make a difference for wildlife.

Helpful Tip: There are ways private landowners can cover costs associated with oak restoration. Conifer trees are often removed during restoration activities and the sale of these trees can offset the cost of restoration, or even generate a profit for the landowner. Numerous conservation programs exist that can provide expertise and further assist landowners with restoration costs. We provide an overview of these programs in *Appendix II—Help with Your Restoration*.

Oregon White Oak

Conservation Overview

Oregon white oak (*Quercus garryana*) has suffered substantial declines throughout its range. A major threat to this species is the encroachment of conifer trees. Encroaching conifers grow faster than oaks and eventually cover them in shade. Without access to direct sunlight, the oaks lose vitality and eventually die. Historically frequent fires reduced the number of conifers, allowing the oaks to thrive and reach maturity. With regard to the disease **Sudden Oak Death**, Oregon white oak fortunately is resistant and can persist in areas where other oaks may not be able to persist.

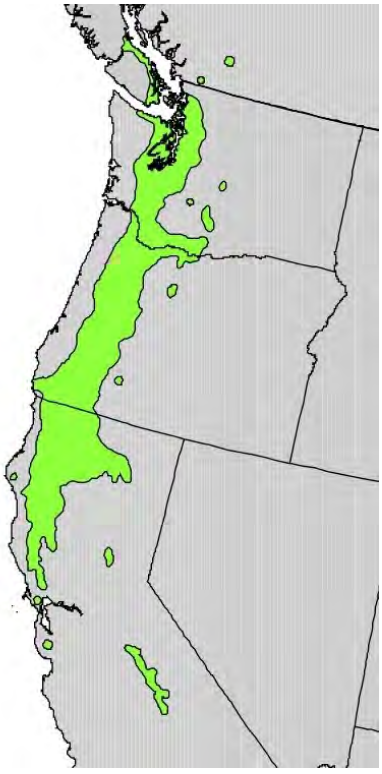
General

Oregon white oak is deciduous and the most common and widespread oak in Oregon. The heart of its range extends from southwestern British Columbia through northern California, but the species can also be found in isolated pockets in central and southern California. Trees can reach 100 feet in height on moist, productive sites, but typically attain heights between 40 and 80 feet, and can be even shorter on dry sites. These trees often occur in clumps, with multiple stems representing a single organism. Following disturbance new stems sprout from around the weakened or dead standing trunk, or from the stump if the tree had been cut down. Oregon white oaks can live to 300 or 400 years old, and a few trees may reach 500 years of age.

The thick and leathery leaves of Oregon white oak are 3 to 6 inches long and the lobes on the leaves are distinctively rounded (for comparison, the California black oak has pointy bristles on the tips of the leaf lobes). The color of their bark also helps with identification; the bark is white to grayish or light brown with broad ridges. Acorns have a shallow acorn cap, and are oval or barrel-shaped.

Jaime Stephens

Oregon white oaks tend to have noticeably whitish bark



United States Geological Survey

Range map of the Oregon white oak

Jaime Stephens

Oregon white oak leaf; notice the rounded leaf lobes

Tree Species Associations

Oregon white oak is commonly found alongside the following tree species: Douglas-fir, ponderosa pine, Oregon ash, California black oak, and Pacific madrone.

Acorn Production

Oregon white oak trees begin producing acorns around age 20 and achieve maximum acorn production around age 80. After this time, acorn production levels off. Trees with broad "mushroom-shaped" crowns produce more acorns than those with narrow "vase-shaped" crowns, and acorn production is also greater in trees with better access to water. Oregon white oaks generally have high year-to-year variation in their production of acorns, and large acorn crops may occur every two or three years.

Shade and Fire Tolerance

Oregon white oaks are shade-tolerant as seedlings but by the time they are mature they are shade-intolerant. Thus, mature oak trees require ample sunlight to survive. Oaks are adapted to frequent fire; their bark provides protection against the flames, their leaves promote low intensity burning, and they can sprout from the tree base if their above-ground portions are killed by fire. Oregon white oaks can be the dominant tree species in areas too harsh for other trees, as well as in landscapes experiencing repeated disturbance such as fires.

Jim Conrad

Oregon white oak acorns

Jim Conrad

Brewer's oak leaves are not deeply lobed

Brewer's Oak

Brewer's oak (*Quercus garryana breweri*) is a dwarf or shrubby form of Oregon white oak that occurs almost exclusively in the Siskiyou Mountains and typically grows to just a few feet in height, but may reach as high as 20 feet. Its leaves are velvety underneath and generally not as deeply lobed as those of the Oregon white oak. Brewer's oak occurs in characteristic pure, shrubby stands on shallow soils, and its primary mode of regeneration is sprouting after high-intensity fire. Brewer's oak communities represent rare, valuable habitat for migratory birds and other wildlife, and add diversity to adjacent oak woodland and grassland habitat. See management considerations for Brewer's oak on **page 35**.

Marko Bey

A Brewer's oak stand (foreground) in the Colestin Valley, Oregon

California Black Oak

Conservation Overview

California black oak (*Quercus kelloggii*), like Oregon white oak, is primarily threatened by the shade cast by encroaching conifers. California black oaks naturally occur in large pure stands or with conifers in mixed oak-conifer habitats. Loss of frequent fire has caused rapid proliferation of conifers at densities too great to sustain California black oak throughout much of its range. Additionally, **Sudden Oak Death** represents a moderate threat to this species.

General

California black oak is deciduous and has the widest distribution of all western oak species, occurring naturally from west-central Oregon to southern California and into Baja California.

California black oak is typically larger than Oregon white oak, often reaching 60 to 120 feet in height and often living from 300 to 500 years. California black oaks can be easily distinguished from Oregon white oaks by the pointed tips on the lobes of their leaves. Also, California black oak trees tend to have dark gray or black bark that further helps distinguish them from Oregon white oaks. They have the largest acorns of any western oak and their acorn cup covers about half of the acorn.

Tree Species Associations

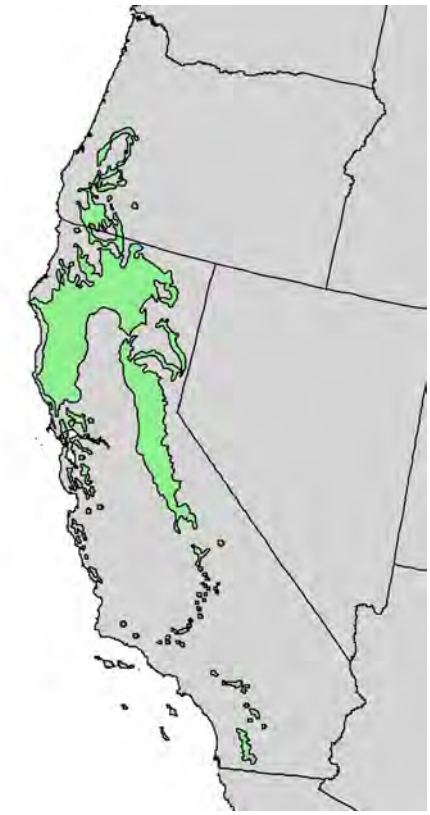
California black oaks usually occur in ponderosa pine forests, mixed-conifer forests, or pure stands. They occur alongside ponderosa pine, incense cedar, white fir, Douglas -fir, and sugar pine. California black oaks also occur in oak woodlands with other trees including Oregon white oak, canyon live oak, tanoak, and Pacific madrone.

Flickr user JKehoe *Rich Fairbanks*

California black oak leaves

Marko Bey

California black oak



United States Geological Survey

Range map of the California black oak

Acorn Production

Similar to Oregon white oaks, California black oaks begin to produce acorns around 30 years of age, but usually do not produce heavily until they are 80 years old or more. Acorns take two years to mature. Fire stimulates the germination of acorns and low- to moderate-intensity fires can improve regeneration of this species.

Shade and Fire Tolerance

California black oak is intolerant of shade for the majority of its life, although seedlings and saplings can tolerate some shade. Mature trees cannot survive in shade. This species is tolerant of fire, as its thick bark provides heat protection. When fire kills the above-ground portion of a California black oak, it survives by sprouting from the root collar, much like Oregon white oak.

Jim Conrad

California black oak acorns

Valley Oak

Valley oak (*Quercus lobata*) is a seriously threatened native deciduous tree of California whose range extends north into southern Siskiyou County, California. A large proportion of historic valley oak habitat has been cleared for farmland and urban development, and private lands hold greater than 80% of remaining valley oaks. Current threats include poor regeneration and the continued removal of mature trees.

Valley oak is long-lived, and drought– and flood-resistant. Individual valley oaks are the largest oaks in North America, although trees typically only grow between 30 and 75 feet in height. This species is dominant in valley oak woodlands as well as valley oak forests on the higher portions of floodplains. Valley oaks grow in deep, rich soils.

Valley oak forests are extremely valuable for birdlife, supporting more known breeding bird species than any other habitat in California. Trees in full sun produce the most acorns. This oak guide does not address habitat restoration for this species.

Flickr User JKehoe

Valley oak

United States Geological Survey

Range map of the valley oak

Canyon Live Oak

Conservation Overview

Canyon live oak (*Quercus chrysolepis*) faces a moderate threat from **Sudden Oak Death**, and mortality from this disease has been reported as far north as Humboldt County, CA. Canyon live oaks are occasionally overtopped by Douglas-fir, however their shade tolerance and tendency to occur on harsh sites limits conifer encroachment and competition with other tree species.

General

Canyon live oak is an evergreen tree native to California, Oregon, Nevada, Arizona, and Mexico. These trees often have twisted, complex trunks and broad, spreading crowns. On good sites they will easily grow as large as California black oak or valley oak, reaching heights greater than 100 feet. They are more typically shorter stature, and sometimes occur in a shrubby growth form.

Canyon live oak leaves do not have lobes and do not resemble classic oak leaves. These thick and leathery leaves are ½ to 2 inches long and come in two forms: one form is toothless and the other form may have some or many holly-like teeth or spines at the leaf margin. It is common for both types of leaves to be present on the same tree. Their acorns are ½ to 2" long, and about half as wide. Their mostly smooth bark has small scales and is grayish-brown and tinged with red. They may live for up to 300 years, and usually occur on dry and well-drained sites in the sun, including rocky mountain slopes and steep canyons.

Canyon live oaks can occur in pure extensive stands, shrubby chaparral habitats, or mixed forests, with species such as Douglas-fir, ponderosa pine, California black oak, Oregon white oak, tanoak, sugar pine, and Pacific madrone.

Acorn Production and Shade and Fire Tolerance

Acorn crops vary year to year, and it takes 2 years for acorns to mature. Canyon live oaks are shade-tolerant and although their bark is often thin, are quite fire resilient. After very hot, intense fires, canyon live oaks are still able to sprout from the root collar, along the tree bole, or even from a defoliated tree crown.

Mathew Cocking

Canyon live oak stems in a forest

Flickr user Ewen Roberts

Canyon live oak acorns

Jim Conrad

Canyon live oak leaves in holly-like form

United States Geological Survey

Range map of canyon live oak

Tanoak

Tanoak (*Lithocarpus densiflorus*) is an ecologically significant acorn-producing tree that shares the same family with oaks, although it is not a true oak. Tanoak is native to California and southwestern Oregon. It is a major species in mixed-evergreen forests along the Pacific Coast, where it can dominate the subcanopy or shrub layer in forests where conifers such as Douglas-fir and redwood dominate the canopy. Pacific madrone is its most common hardwood associate, and it can also be found growing alongside California black oak, chinquapin, and California bay laurel. Tanoak is sensitive to frost, drought, and fire, and therefore tends to occur closer to the coast where marine precipitation and fog are common.

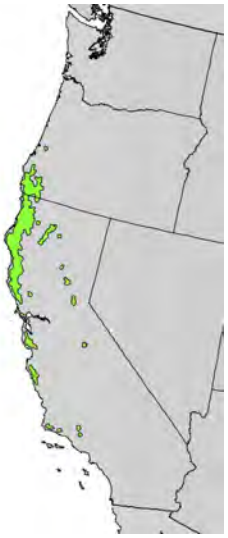
Trees are evergreen and typically grow between 60 and 100 feet tall. Tanoak can persist as a shrub in shaded forest understories, and a shrub variant (*L. d. echinoides*) occurs on serpentine and other harsh soils across the Klamath Mountains. Their stiff, leathery leaves are simple, alternate, and 3 to 5 inches long with smooth or coarsely-toothed edges. Their acorns have bristly caps.

Tanoak is threatened by **Sudden Oak Death**. In the 1800s the tanbark industry decimated this species, and in the past century it has suffered from forest management policies that favor conifers.

Mathew Cocking

Tanoak forest, Humboldt County, CA

Flickr User Bri Weldon



United States Geological Survey

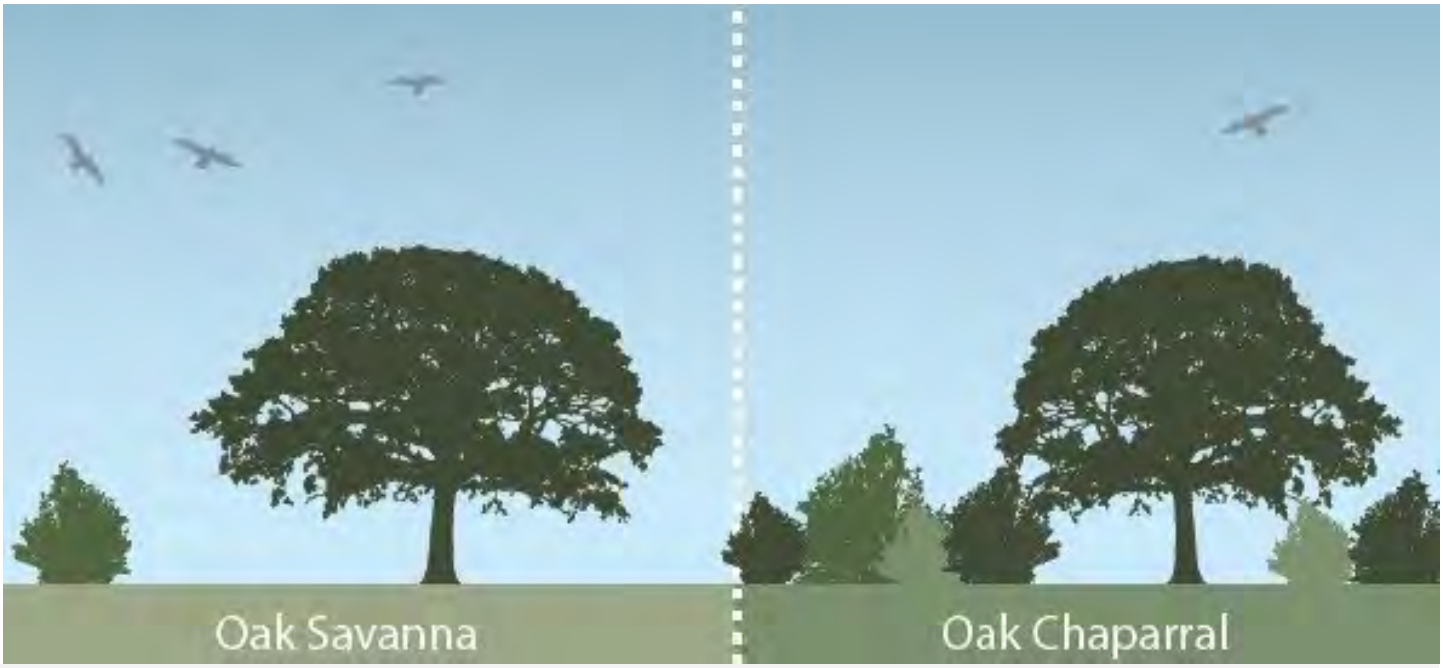
Tanoak leaves (left) and range map (right)

Chaparral Habitats and Ecology

Chaparral habitats in southern Oregon and northern California occur in areas with hot, dry summers and mild winters. These habitats are dominated by dense shrubby vegetation comprised of drought-tolerant plants with hard evergreen leaves. Infrequent fires, generally with burn-intervals between 10 and 100 years, are a natural feature of chaparral habitats.

In our region, there are unique chaparral oak habitats characterized by dense stands of *Caenothus* shrubs, usually buckbrush, and a few Oregon white oak trees. These chaparral habitats are little-studied, but believed to provide wildlife values not found elsewhere.

Chaparral photos by Jaime Stephens



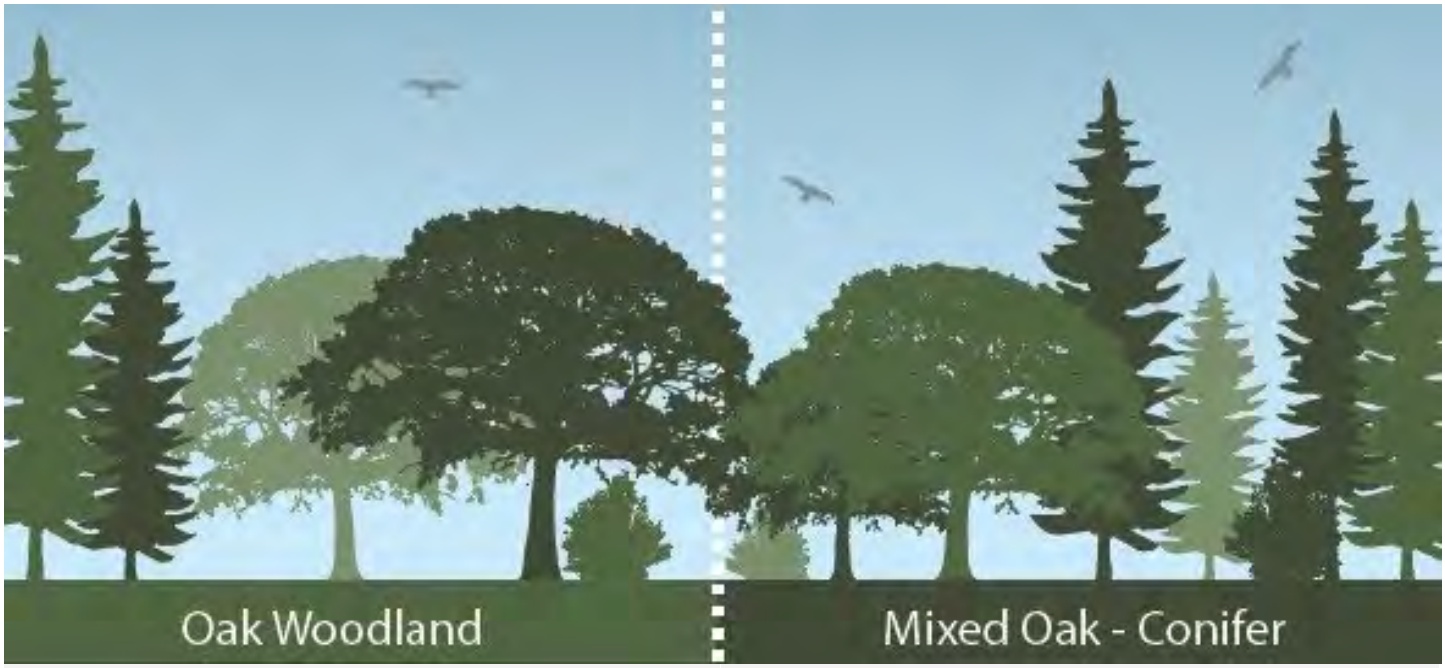
20-30% total tree canopy cover with non-oak canopy cover <5%. Native shrub cover at no more than 15%.

20-30% total tree canopy cover with non-oak canopy cover <5%. Native shrub cover 30-80%

Landowner Worksheet: Considering Oaks on Your Land

Take a moment to complete this worksheet about oaks and your land. This worksheet will direct you to the areas of this guide where your restoration efforts can produce the best results for Oregon white and California black oak habitats. Be aware that oak restoration requires work over multiple years.

_____ Look at the graphic above. Do you have oak savanna, oak chaparral, oak woodland, or mixed oak-conifer forest on your land?	All these habitat types are important for wildlife and this guide provides restoration guidelines relevant to all of them.
_____ Do you have large, old oak trees? _____ Do your oaks receive full sunlight?	Large, old oak trees provide immense wildlife value, and they need full sunlight to thrive. See **pages 22-23** to learn how to protect existing—and encourage new—large, old oaks.
_____ Do you have many standing dead trees (snags) on your land?	Snags are very important for wildlife. See **pages 28-29** to learn more about snags and how to have them on your land for wildlife.
_____ Do you have invasive shrubs or grasses in your oak habitat?	Native shrubs are better for wildlife than invasive shrubs. Learn more on **pages 30-31**.



30-60% total tree canopy cover with non-oak canopy cover <10%, favoring ponderosa pine and sugar pine. Native shrub cover should be 10-30% in variably-sized patches.

30-60% total tree canopy cover with conifer tree cover <50%, favoring med-large conifers (>15" dbh), preferably in pockets not encroaching on oaks. Native shrub cover 10-40%, in variably-sized, dense patches.

Do you have multiple age classes of oaks (seedlings, saplings, young trees, mature trees)?	"Healthy" oak habitat has multiple age classes, including seedlings and saplings. Learn more about having diverse habitat structures on your land on **pages 20-21**.
Are your oaks threatened by overtopping conifers or crowding?	Mature oaks require abundant sunlight to thrive. Faster-growing conifers can overtop and cast shade upon oaks, causing the oaks to lose vitality and eventually die. These overtopping conifers can be removed to restore healthy oak habitats. Learn more on **page 23**.
Is your habitat grazed by cattle?	Well-managed grazing can benefit oak habitats, but in other cases grazing can present challenges. Learn more on **page 36**.
Does your land experience frequent low-intensity fire?	Prescribed, low-intensity fire has many benefits for oak savanna and woodland. Learn more on **pages 32-33**.
Do your oaks have insect pests or diseases?	Oaks are subject to a variety of insect pests and diseases. Some symptoms are obvious but cause little damage, whereas others are less obvious but lethal. You may download a copy of *A Field Guide to Insects and Diseases of California Oaks* here: www.fs.fed.us/psw/publications/documents/psw_gtrl97/psw_gtr197.pdf

Desired Conditions for Your Oak Habitat

We present six desired conditions for your oak habitat. Each desired condition represents a characteristic of a healthy, functioning oak ecosystem. We present guidelines that will help you achieve each desired condition, and these guidelines can be applied to oak savanna, oak chaparral, oak woodland, and mixed oak-conifer habitats. Even if you cannot achieve all the desired conditions, every effort helps restore our region's unique oak systems.

In general, healthy oak habitat will contain (1) large, old oak trees that receive plenty of sunlight, (2) an understory of native shrubs and plants, and (3) habitat variability, characterized by variably spaced trees of different ages and shapes, and shrub and grass patches of varying sizes and spacings.

Desired Condition #1:

Diverse Habitat Structures

Significance

The diversity of wildlife in your oak habitat depends in part on the diversity of important structural components, such as saplings, young trees, old trees, snags, grassland areas, shrubby areas, and low spreading limbs. Healthy oak habitats have variability in the pattern of vegetation on the land, including clumping, open spaces, and areas of differing tree densities, rather than even tree spacing.

Brush piles on your land can aid oak and shrub regeneration by providing a refuge for seedling growth; such regeneration helps maintain a diversity of age classes. Coarse woody debris from deciduous trees, such as fallen limbs and whole trees, are used by invertebrates as well as vertebrates including reptiles and amphibians. Shrub cover is important for small animals and shrub-dependent birds. Mixed oak stands that have some conifers can attract additional wildlife compared to pure oak stands. Finally, wetland and stream or river components in oak systems, if present, are extremely valuable for wildlife.

White-breasted nuthatches are often seen moving down oak trunks and limbs, probing bark crevices for insects to eat. They store nuts and seeds under loose tree bark for winter, and benefit from the extra foraging area provided by low spreading oak limbs.

These small birds live in pairs on permanent territories. You typically find White-breasted nuthatches in oak chaparral and oak woodland.

Guidelines

(1) Aim to have multiple oak age classes represented on your land

- Maintain individuals from all existing age classes
- If oak regeneration is low or non-existent, you may need to plant acorns or oak seedlings. To learn more, read Devine and Harrington's *Planting Native Oak in the Pacific Northwest* (www.arlis.org/docs/vol1/B/547193245.pdf)

Klamath Bird Observatory

Acorn woodpecker granaries, where the birds store acorns, are valuable structural components on your land

(2) Reclaim and maintain natural openings and edges

- Consider removing trees that encroach upon natural openings
- Restore and/or maintain native shrub and herbaceous understory in these gaps as needed

(3) Consider leaving some brush piles on your land for wildlife and to protect regenerating trees and shrubs

(4) Keep trees with unique wildlife benefits

- Retain all trees with unique growth forms that provide wildlife habitat, Acorn Woodpecker **granary trees**, and **snags** or standing dead trees (for safety reasons, don't leave **snags** within falling distance of a house, garage, or barn)

Mathew Cocking

Low spreading limbs provide varied structure to the habitat

Jaime Stephens

Diverse age classes of oaks, including this new recruit in the foreground, are an indication of healthy oak habitat

Helpful Tip: When you're deciding where on your land to implement oak restoration, give priority to sites that have large, old oaks, as well as oaks of varying ages. Large, old oaks are particularly valuable as wildlife habitat. When possible, choose restoration sites that are adjacent to good quality oak habitat because doing so will increase the size of an existing oak system, rather than create a new, small, and isolated oak habitat patch. If the option to expand a habitat patch does not exist, there is still value in creating new oak habitat patches.

Desired Condition #2:

Large, Old Oak Trees

Significance

Mathew Cocking

Oregon white oak

Large, old oak trees are the cornerstones of healthy oak habitat. These dramatic figures on the landscape are critically important for wildlife. They can produce huge numbers of acorns that provide nutrition to wildlife during the fall and winter when other food sources may be scarce. Their plentiful foliage provides foraging substrates for birds and bats. Dead as well as live limbs provide nesting cavities, and fallen leaves become cover for soil invertebrates. These large trees provide substantial wildlife benefits and their acorns become the next generation of oak trees.

Threats

Mature oak trees require sunlight and will eventually die if they are in the shade of overtopping conifers. Neighboring trees also compete for resources such as soil nutrients and water. Additionally, encroaching young conifers can increase fire risks for old oaks as their regularly-spaced low branches can transfer ground fires into oak canopies, acting as **ladder fuels** and causing more extensive fire damage. Diseases and heavy mistletoe infestations can also harm oak trees.

Jim Livaudais

The Acorn woodpecker, like many birds and other animals, depends heavily on acorns. Larger, mature oak trees produce more acorns than smaller trees, and thus are critical for supporting acorn-consuming wildlife.

Acorn woodpeckers are communal breeders. Up to as many as 15 individuals from multiple generations will live together in an established territory. Only some of these individuals breed, while others help raise the young. The number of breeding individuals varies, but usually consists of one or two females and up to four males per female.

Acorn woodpeckers collect acorns during autumn and winter and store them in dead trees and telephone poles and other manmade structures. These acorn storage sites are called granaries, and one granary may contain as many as 50,000 acorns. All of the woodpeckers that live in a community are responsible for collecting and storing acorns.

You typically find acorn woodpeckers in oak savanna, oak chaparral, and oak woodland.

Restoration Tool

Remove encroaching trees and vegetation

Guidelines

(1) Keep legacy conifers and other legacy hardwoods

- Retain all legacy conifers and hardwoods; these older trees are often >24" **dbh**, but you should also consider retaining individual conifers and hardwoods on your property that are large relative to most other trees.

(2) Remove conifers and hardwoods that encroach upon large, old oaks

- Consider removing conifers (generally <24" **dbh**) and competing hardwoods within two times the **dripline** of large or vigorous oaks.
- Remove conifer trees that create deep shade over oaks, keeping in mind that conifers located on the north side of oaks cast less shade and cause less harm to the oaks.
- Take care not to damage your oaks when felling overtopping conifers; **girdle** (rather than remove) overtopping conifers likely to damage oaks if felled.
- In oak savanna and woodland you may choose to remove almost all small diameter (<12" **dbh**) conifers, whereas in mixed-oak conifer forest you should think about leaving a wide spacing (10 to 30 trees per acre) of recruitment-age conifers, generally giving preference to ponderosa pine and sugar pine, and ideally having patches of conifers away from oaks.

(3) Consider removing smaller oaks where they encroach on large, old oaks

- Retain healthy and vigorous oaks with the broadest crowns, oaks with cavities, and large oaks (usually >20" **dbh**, but consider what is large for your property).
- Identify large, vigorous oaks and consider removing smaller oaks (up to 16" **dbh**) within two times the **dripline**; some oaks may be retained as replacement trees. Oak stumps may resprout and may need to be dealt with as a maintenance issue in later years.
- Maintain multiple age classes of oaks; for example, you may retain smaller oak replacement trees between crowns of large or vigorous oaks.
- If you have many young or suppressed oaks competing with each other, consider thinning oaks in some areas and leaving other patches with the existing density. Be careful not to over thin this component; consider thinning incrementally over time without reducing the canopy >10% with each entry.
- If you have multi-stemmed oaks, keep in mind that each clump of connected stems functions as a single organism and thinning techniques may include removal of the entire clump, retention of the entire clump, or careful thinning within clumps. Retaining a mixture of single– and multi-stemmed oaks is desirable for structural diversity. Many stands naturally include both single-stem and multiple-stemmed clumps and do not require cutting of oaks to achieve greater diversity. If you have mostly multi-stemmed oaks you may want to consider thinning to achieve diversity; in which case, you will need to learn about **sprout clump thinning** on **page 26**.

Additional Considerations

- You'll want to avoid restoration actions that lead to a type transition (e.g., changing a woodland to a savanna) unless it is provable you are restoring the historical condition, or that is the goal of the treatment.
- If conifers are removed, do so during fall or winter, or during spring before leaf out; avoid using heavy equipment on wet soils.
- Whenever possible, hand crews should be used instead of heavy equipment.
- Forestry contractors must understand the goal is to preserve oaks and be able to describe practices to minimize damage to oaks. Alternately, consider extensively marking stands prior to treatment.
- Clean and inspect logging equipment entering a restoration site to prevent the introduction of non-native, invasive species.
- Removing trees through the use of equipment (e.g., dragging trees with cables) can disturb the forest floor and create favorable conditions for invasive plants. To mitigate this, spreading seeds of native understory perennial plants following forest floor disturbance is highly recommended.
- See the bottom of *Appendix II: Help with Your Restoration* for information on disposing of slash created from tree removal.

Photo Album - Large Oaks

Keith Perchemlides

Open-grown Oregon white oak in savanna.

Marko Bey

Measuring the diameter of a legacy white oak

Mathew Cocking

Conifer encroachment on oaks

Marko Bey

California black oak that lost its crown as a result of overtopping conifers

John Cymore

Conifer removal near a legacy oak

Photo Album - Thinning

Mathew Cocking

Conifers are beginning to encroach upon oaks

Keith Perchemlides

Keith Perchemlides

Before (left) and after (right) photos showing the results of thinning young oaks competing with large, old oaks

Keith Perchemlides

Keith Perchemlides

*Before (left) and after (right) photos showing **radial thinning** around a large, old oaks*

Sprout Clump Thinning

Oaks routinely re-sprout from the base following disturbance (e.g., fire), or from the stump if they have been cut down. Oaks are occasionally thinned during restoration to release large, old oaks from competition. In these cases, dealing with oak sprouts represents a maintenance issue.

In other cases, sprout clump thinning can be used on young, multi-stemmed oaks to increase structural diversity and encourage the growth of the most vigorous stems.

Here are guidelines for thinning young multiple-stemmed oaks that are already established on your property:

- Focus thinning when sprouts are relatively young and respond well to release (typically 5-15 years old)
- Plan to have remaining stems widely spaced
- Favor stems on the uphill side of a slope
- Favor smaller high quality stems over larger poor quality stems
- Retain some un-thinned oak clumps for wildlife

Keith Perchemlides

Dealing with undesirable oak re-sprouting is a maintenance issue associated with oak restoration

Jaime Stephens

An oak clump that was never thinned provides structural diversity and habitat for shrub-associated birds

Jaime Stephens

This clump of re-sprouting oaks was thinned at eight years of age, and is shown here 14 years after a wildfire

Jaime Stephens

This clump of oaks was thinned six years ago and the thinned sprouts have re-sprouted. Further maintenance might benefit this oak clump.

Special Note: Brewer's oak (**see pages 13 and 35**) can easily be mistaken for sprout clumps or young oak thickets. Brewer's oak is not the same as young oak sprouts clumps, and thinning is not recommended as the effects are unknown.

Photo Guide to Girdling

Mathew Cocking originally developed the information on this page for the Natural Resources Conservation Service.

Girdling refers to the process of cutting through the cambium and sapwood layers around the circumference of a tree stem to interrupt the flow of nutrients between the below- and above-ground portions of the tree, resulting in the death of the tree. The snags—or standing dead trees—that result from girdling provide nesting and foraging habitat for wildlife.

Girdled trees will generally die within three years. Trees should be monitored for girdle failure (i.e., the girdle did not completely sever the cambium or live foliage below the girdle was not removed). If trees do not die, they may require re-girdling or felling.

Mathew Cocking

Mathew Cocking

Step 1 (left photo): After removing branches, make shallow (<1 inch deep) horizontal cuts through the bark using an axe or chainsaw. These parallel cuts should be 4 to 8 inches apart, and should not be so deep as to compromise the structural integrity of the tree. **Step 2** (right photo): Use a flat edge shove, pry bar, axe or other wedge tool to pry bark away from outer sap wood.

Mathew Cocking

Mathew Cocking

Step 3: Continue to pry away from outer sap wood until no connective bark or cambial tissue remains between the two initial horizontal cuts. If all connective tissue is not removed, or if the girdle is not wide enough, trees are less likely to die. Do not leave any live branches below the girdle as they may prevent the death of the tree.

Desired Condition #3:

Snags and Downed Wood

Significance

Snags are standing dead trees, and these are essential for many wildlife species. Snags provide cavities for nesting, perches with good vantage points, and insects for food. Dead wood on the ground (**downed wood**), is important in soil development, provides nutrients to streams, and is essential for maintaining fungi and other microorganisms that are the foundation of woodland food webs. Downed wood also provides habitat for small mammals, reptiles, amphibians, and insects, many of which serve as prey for animals further up the food chain.

Brandon Breen

The hollowed out base of snags can provide den habitats for a variety of wildlife

Jaime Stephens

A Douglas squirrel uses a cavity in this downed wood

The house wren is one of many bird species in oak habitats that nest in cavities, especially old woodpecker holes. The male begins building its nest in a cavity and once he pairs with a female, she will complete construction of the nest.

Compared to other cavity nesters, house wrens prefer cavities closer to the ground, and they will use cavities in dead as well as living trees. They avoid nest sites more than 30 meters away from patches of woody vegetation.

You typically find house wrens in oak savanna, oak chaparral, and oak woodland.

Jim Livaudais

Restoration Tool

Retention—One of the most valuable restoration tools is keeping existing standing and downed wood in a woodland or forest stand

Girdling—See **page 27** for a photo guide to this management practice

Guidelines

(1) Retain snags and downed wood for the benefit of wildlife

- Retain **snags** if at all possible and also dead oak limbs
- Retain some large dead wood on the ground and consider leaving large trees on the ground if they are felled for other reasons

(2) Provide new snags if they are not abundant on your property

- **Girdle** conifers to create snags in areas with few or no snags; consider this method if you decide some conifers need to be removed, especially if felling them may harm oaks
- Aim to have snags of various sizes, tree species, and levels of decay

Jaime Stephens

Standing dead wood, or snags, are an important component of all oak habitats

Jim Livaudais

The oak titmouse nests in natural cavities more often than old woodpecker holes, and will even partially excavate holes in rotted wood. The female chooses the nest site after inspecting several cavities in the area. You typically see oak titmice in oak savanna, oak chaparral, and oak woodland.

Desired Condition #4:

Native Shrubs and Perennial Grasses

Significance

Native shrubs and native perennial grasses are understory components of healthy oak systems. Native plants have evolved with native wildlife communities and tend to support wildlife better than non-native species. Many oak habitats in our region have understory plant communities that contain invasive plants and have strayed from historical conditions.

Threats

Non-native species can outcompete and overwhelm native grasses, forbs, and shrubs. The introduction of non-native species, as well as the recent absence of regular fire, are responsible in large part for this departure from past conditions. Grazing can also reduce the cover of native grasses and increase soil disturbance that can lead to the establishment of non-natives. When non-native plants become dominant there can be changes in fire regimes and nutrient cycling in the soil and introduced competition can hinder the survival of oak seedlings.

Mathew Cocking

Native grasses, such as this California fescue in an oak savanna, provide food and cover for birds

Restoration Tools

- Planting native species
- Manual pulling of non-native species
- Mechanical and chemical treatments
- Prescribed fire (learn more about fire on **pages 32-33**)
- Conifer removal (increases sunlight to understory plant communities)
- Seeding of native plants following ground disturbance

Jim Livaudais

The spotted towhee is a bird of thickets and scrubby habitats. During the breeding season, Spotted Towhees flip through the leaf litter under shrubs in search of high-protein insects and arthropods. Native shrubs attract richer insect communities that feed towhees and other birds.

You can encounter spotted towhees in oak savanna, oak chaparral, oak woodland, and mixed oak-conifer, wherever there are relatively dense shrub patches.

Guidelines

(1) Consider historic conditions to determine your desired shrub cover

- Consider historic shrub cover when deciding whether to remove or plant native shrubs; consult old photos if they exist
- Generally, retain variably-sized patches of dense native vegetation if it is present in your oak woodland and does not pose a fire hazard to homes or communities

(2) Retain and/or plant native perennial grasses

- Strive for a diverse, native understory with a balance of grasses, forbs, and shrubs
- Encourage native understories by seeding grass and forbs into mineral rich ashes leftover from prescribed fire or disturbed areas following restoration thinning

(3) Remove non-native plant species if practical to do so

- Refrain from using herbicides if possible; hand-pulling plants is very effective. If hand-pulling is labor- or cost-prohibitive, minimize the application of herbicides through spot spraying
- Agencies can help you develop a plan for dealing with non-native species (see *Appendix II: Help with Your Restoration*)
- There may be situations where only a combination of herbicides, burning and/or mechanical removal will restore highly degraded areas

(4) Minimize likelihood that non-native species will establish

- Minimize ground disturbance at sites with native understories to prevent opportunities for non-native species to establish
- If restoration actions lead to ground disturbance, plan to reseed the site with native species and have the seed on hand before starting restoration

Native oak grasses and shrubs

California fescue
Roemer's fescue
California brome
Blue wildrye
Purple needlegrass
Idaho fescue
Western fescue
California oatgrass
Junegrass
Sweetcicely
Coffeeberry
Poison oak
Common snowberry
Ocean spray
Hazel
Serviceberry
Oregon-grape
Bitterbrush
Mountain mahogany
Buckbrush

Common non-native, invasive plants in oak habitats

Scotch Broom
English hawthorn
Yellow starthistle
Armenian blackberry
English holly
Himalayan blackberry
Bull thistle
French broom
St John's wort
Medusahead
Cheatgrass

Sowing Native Seeds

Following burning, a good restoration practice is to sow native grass seed into the mineral-rich ashes of some of the burn locations to restore the native grass community. Native grass can establish itself well in disturbed locations like burn spots. It may be possible to acquire native grass seed for specific locations from the US Forest Service or a local nursery in the area. Seed can be sown by hand; experimentation with amounts will produce different results. Seeding rates will vary, so check when purchasing the seed as to how much to use per location. The best time to sow native grass seeds is November through March during their dormant time, depending on elevation. Sowing native grasses not only restores herbaceous plant communities to the site, it is a good preventive measure for noxious weed mitigation.

Desired Condition #5:

Frequent, Low-intensity Fire

Significance

Restoring natural fire regimes can produce many benefits for your oak ecosystem. Restoring fire can reduce fuel loads, remove encroaching young conifers (i.e., seedling and sapling size), maintain an open understory, create understory conditions suitable for native plants, and possibly encourage oak recruitment. However, restoring fire will not be realistic in many areas due to fire use restrictions related to safety and air quality. If fire is used, it is highly recommended that fire treatments are repeated periodically (typically, every 3 to 5 years) to maintain low fuel loads and reduce the likelihood of a high-intensity wildfire that could damage or kill valuable, old oaks. Also, it should be noted that the use of **controlled burns** occurs *after* initial restoration and thinning treatments have been implemented and vegetation density has been reduced.

Jena DeJulio

Prescribed fire

Threats

High-intensity fires can harm large, old oaks. Oak habitats have historically experienced frequent low-intensity fires and thus do not naturally have high fuel loads. Oaks persist when there are frequent fires and benefit from low-intensity fires because these fires can remove species that are susceptible to fire when young, such as Douglas-fir, white fir, and other conifers; a competitive benefit for oaks. If fuel levels build up, however, high-intensity fires can burn and kill oak trees, and pose risks to persons and property.

Jim Livaudais

Western bluebirds are open-country birds that prefer areas with few shrubs—the types of habitat created by low-intensity burns in oak savanna or oak woodland. Burned areas with large trees for perches and **snags** for nest cavities are ideal.

Both parents feed the young, and these birds feed on insects during warm months and on mistletoe berries during winter.

You typically see western bluebirds in oak savanna and oak woodland.

Restoration Tools

Prescribed Burning—The controlled application of fire

Important Notice: Prior to any prescribed burning, it is critically important that a specific burn plan is developed by prescribed fire specialists and other qualified professionals. Prescribed fire methods are very site-specific. Not all methods are appropriate for every location. Prescribed fire prescriptions must be determined on a unit-by-unit or section-by-section basis. The details needed for burning will develop as on-the-ground work progresses along with knowledge of site conditions. Also, it is important that landowners are aware of liability issues surrounding the use of burning.

Guidelines

(1) Understand the liability associated with prescribed burning and reach out to professionals for guidance or assistance in implementing a burn on your property

- The use of fire requires planning, necessary permissions, experienced personnel, and communication with neighbors and other stakeholders
- Due to decades-long absences of fire in many places, mechanical fuel reduction treatments are often necessary to reduce fuel loads to safe levels prior to implementing understory burning
- Post-burn seeding of native understory plants and herbaceous vegetation is an important step to creating a healthy oak understory, use a local seed source and consult with professionals
- The frequency at which fire is needed at a site depends on how quickly woody fuel accumulates

(2) Protect important habitat components, like snags, downed wood, and large oaks, prior to burning

- Create buffer areas of bare dirt around important habitat components to prevent fire from reaching them
- Note: Seedling and sapling oaks may be top-killed by fire but will usually re-sprout
- Note: The thick bark of mature oaks protects them from low-intensity fires

(3) Observe the following common sense practices

- Keep your neighbors informed and forewarned
- Burn when moisture levels are appropriate: neither too dry or too wet
- Do not burn when weather conditions are inappropriate (e.g., too windy, or during an inversion)
- Follow fire precaution levels
- Always have a fire line (approximately 12-24 inches in width) cleared to bare mineral soil encircling the fire
- Start by igniting small test patches
- Patrol the area periodically until the fire is dead out and all the heat is gone
- Do not leave your property while there is the potential for reburning
- Check old rotten stumps and duff for residual heat
- Patrol and inspect burned areas for residual smoke in the hours and days following burning

Photo Album - Prescribed Fire

Mathew Cocking

California black oaks after a prescribed burn in winter

Mathew Cocking

After a prescribed burn in tanoak forest

John Paul

A professional implements a prescribed burn

Brewer's Oak

Management Considerations for Brewer's Oak

The main conservation issue with Brewer's oak is probably the lack of fire as a life cycle process. This species relies on sprouting more than acorn dispersal for regeneration. It is unlikely encroachment by conifers is an issue because this species occurs on shallow soils where conditions are too harsh for many trees.

As part of an overall oak management plan, careful application of prescribed fire can benefit Brewer's oak patches, as well as adjacent woodland and grassland habitat patches. Where fire risk is a major concern, contiguous Brewer's oak patches may be separated by fire breaks into large, distinct patches to retain its function as bird and wildlife habitat.

The predominant growth form of Brewer's oak is as chaparral rather than single stemmed or clumped trees. Mechanical thinning is generally not recommended within Brewer's oak patches, although mechanical thinning release treatments in adjacent oak woodlands benefit Brewer's oak patches by improving woodland plant health on a landscape scale.

Marko Bey

After a prescribed fire in Brewer's oak habitat

Desired Condition #6:

Grazing is Balanced

Significance

Grazing, when managed well, can occur in healthy oak woodlands. Too much grazing pressure, however, can increase soil erosion, compact the soil, and favor non-native grasses, shrubs, and conifers instead of native grasses and oak trees. Oak regeneration is most successful in areas that have mature oaks that produce acorns and adequate protein-rich grass, which is preferred by cattle over oak seedlings. The effects of grazing on the health of oak systems are complex and require further study.

Jaime Stephens

*An Oregon white oak savanna with high **Residual Dry Matter***

Guidelines

(1) Ensure grazing pressure from livestock is in balance with supply

- Rotate livestock away from grazing areas to provide recovery periods for grasses and forbs to regrow
- Allow palatable plants to grow to the proper height, and thus to restore nutritional reserves and regrow roots, before reintroducing grazing animals
- Meet or exceed the minimum **Residual Dry Matter (RDM)** standards for annual grasslands/hardwood rangelands in your area. Contact a local rangeland specialist to learn the minimum **RDM** on your oak savanna or woodland.

(2) Reduce the potential for grazing impacts on oaks and wildlife

- Refrain from grazing oak recruitment areas during the dormant season for grasses, or place temporary enclosures around young oak trees to protect them during this period
- To promote healthy habitat for breeding birds, rotate cattle out of woodlands during the breeding season (April 1—July 15) to prevent trampling and ensure sufficient grass cover to conceal nests from predators
- Use fencing to keep cattle away from wildlife-rich stream and riverside habitats adjacent to oak woodlands

Jim Livaudais

Western meadowlarks live in open habitats, including grasslands and oak savanna. This species is well-known due to its abundance and conspicuousness, and well-loved owing to its bright yellow undersides and melodious song.

Western meadowlarks prefer habitats with a large amount of grass cover. Females choose sites for their ground nests, which are often well-concealed by dense vegetation.

Habitats with heavy grazing can reduce the breeding success of western meadowlarks because short-cropped vegetation does not adequately conceal nests from predators. Also, trampling of eggs and nestlings by cattle may occur.

What to Expect after Restoration

Within a few years after overtopping conifers are removed, oak trees will start to show results. Growth rates of California black oaks, for example, can double following thinning. Also, released oaks can increase the number of acorns they produce and begin building larger crowns. Oaks are slow-growing, so changes in growth will be gradual. If conditions remain favorable, oaks may expand their crowns for years.

Follow-up treatments are often desirable to remove newly encroaching conifers. If fire is used it should be repeated every few years as needed, depending on the growth of competing conifers and shrubs. Invasive, non-native species may need to be controlled through repeated treatments if they persist.

As your oak habitat becomes restored, new species of wildlife are likely to appear on your land. For example, in Marin and Sonoma Counties in California, the number of birds species at restored oak habitats increased steadily over a 16-year period from an average of 8 to 27 species. In the years following restoration you can watch with pride as your oaks trees develop to support rich wildlife communities and provide a pleasing landscape aesthetic.

Mathew Cocking

Thinned black oak-conifer forest

Kraen Hussey

Oak woodland with high-vitality trees

What the Birds Tell Us

Birds are excellent indicators of the health of your oak habitat. Birds are diverse and each species depends on specific habitat features, such as cavities for nesting, shrub structure for cover, and abundant insect populations for food. An oak habitat that can support many types of birds will contain habitat components of value to other wildlife as well. By observing which birds occur on your land following oak restoration, you can bear witness to the return of ecological health to your land. Birds provide a colorful, musical, and accessible window into the functioning of your land that can increase your appreciation of your oak habitats. See *Appendix III: Monitoring Birds on Your Land* on **pages 45-53** to get started.

Jim Livaudais

Lewis's woodpecker

A Landowner Success Story

Mark and Lisbeth LaCoste underestimated the amount of work and learning that would be required of them when they relocated to a 230 acre tract of rural farm and forestland in the remote Colestin Valley of southern Oregon.

Mark and Lisbeth on their property in southern Oregon

The couple sought cost share funds for fuels reduction and pre-commercial thinning, but did not feel as though that type of treatment fully addressed the needs of their forested property.

They became interested in restoration of the oak tree component of their forests during a conversation with Marko Bey of Lomakatsi Restoration Project. Marko described the open condition of oak woodlands prior to Euro-American Settlement, when the landscape was subject to frequent low-intensity fires lit by Native Americans. These fires maintained productive plant communities, helped oaks thrive by removing competing vegetation, and made it easier for Native people to collect acorns, a staple of their diet. This conversation prompted Mark and Lisbeth to begin to look at their property in a new way.

When funding later became available for oak woodland restoration on private properties in the Colestin Valley through a cooperative agreement among Lomakatsi Restoration Project, US Fish and Wildlife Service, Natural Resources Conservation Service, and Klamath Bird Observatory, the LaCostes were excited to begin work.

Contributing to the restoration effort was rewarding in so many ways, says Mark. *We found it incredibly satisfying to engage in restoration work not only for the good of our own property, but also for the good of the surrounding community. We felt gratified as local interest in oak restoration grew and neighbors became involved in similar restoration work on their properties.*

Josh Budziak

A nice California black oak on the LaCoste property

Our biggest challenge was deciding how much involvement was right for us. When the time came for the on-the-ground work to begin we thought we could just give some general guidance and leave the details up to the professional work crews. But when we saw the initial results, we were shocked at how much the stand had opened up.

We were uncertain as to whether we wanted to proceed further but when we brought our concerns to Lomakatsi, we realized that we could specify our wishes in a very detailed way. For example we could say, "Leave a 20 foot buffer along roads so there is not a clear view from the road all the way up to our house," or "Let's keep this particular tree right

here because we like it, even though it may be crowding a single oak tree." Once we learned that we could provide specific input on treatments, we were excited to watch the additional work proceed.

Restoration Tip: To help prevent a mismatch in vision between landowners and resource professionals, it can be useful to first treat a small sample area. This will allow landowners to see actual results and make modifications before the bulk of restoration begins.

Josh Budziak

As encroaching conifers were thinned from around dominant California black oak and Oregon white oak trees, we saw new parts of our property open up that we had never previously really seen or explored. This inspired us to make walking paths and appreciate our property in a whole new way.

We feel comforted knowing that our woodlands are not only healthier, but safer in terms of fire risk and more beneficial for wildlife.

What really excites me now, says Mark, *is thinking about additional treatments that we can do, especially using prescribed fire.*

Josh Budziak

The LaCostes are planning for a prescribed underburn on 40 acres of their property under a cooperative agreement between the US Fish and Wildlife Service Partners Program and Lomakatsi Restoration Project. A certified burn plan and professional crew are needed to safely plan and execute a prescribed fire. The LaCostes are motivated by the expected restorative benefits of prescribed underburning following the recent thinning work, and feel that carefully executed burning, followed by reseeding with native bunchgrasses and forbs, can reduce the chance of noxious weed invasion and result in mixed vegetation patterns that restore forest health and habitat diversity for wildlife.

Josh Budziak

The same stand of mixed oak-conifer forest on the LaCoste property is shown, from top to bottom, in stages of "before," "during," and "after" restoration thinning. California black oaks are easily visible in the bottom photograph.

Overall they say the restoration experience has been positive and rewarding. For them, the best part was finding value in not just treating the forest to harvest resources, but in learning to become a land steward.

Actually becoming a land steward through practice, says Mark, *has been a very satisfying experience*.

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Appendix I—Plants and Animals in this Guide

Plants

Native

Oregon white oak (*Quercus garryana*)
Brewer's oak (*Quercus garryana breweri*)
California black oak (*Quercus kelloggii*)
Canyon live oak (*Quercus chrysolepis*)
Tanoak (*Lithocarpus densiflorus*)
Valley oak (*Quercus lobata*)
California redwood (*Sequoia sempervirens*)
Douglas-fir (*Pseudotsuga menziesii*)
Oregon ash (*Fraxinus latifolia*)
Pacific Madrone (*Arbutus menziesii*).
Ponderosa pine (*Pinus ponderosa*)
Incense cedar (*Calocedrus decurrens*)
White fir (*Abies concolor*)
Sugar pine (*Pinus lambertiana*)
Chinquapin (*Quercus muehlenbergii*)
Coffeeberry (*Rhamnus californica*)
Poison oak (*Toxicodendron diversilobum*)
Common snowberry (*Symphoricarpos albus*)
Ocean spray (*Holodiscus discolor*)
Hazel (*Corylus spp.)*
Serviceberry (*Amelanchier spp*.)
Oregon-grape (*Mahonia aquifolium*)
Bitterbrush (*Purshia tridentata*)
Mountain mahogany (*Cercocarpus spp*.)
Buckbrush (*Caenothus cuneatus*)
Pacific mistletoe (*Phoradendron villosum*)
California bay laurel (*Umbellularia californica*)
California fescue (*Festuca californica*)
Roemer's fescue (*Festuca roemeri*)
Idaho fescue (*Festuca idahoensis*)
Western fescue (*Festuca occidentalis*)
California brome (*Bromus carinatus*)
Blue wildrye (*Elymus glaucus*)
Purple needlegrass (*Nassella pulchra*)
California oatgrass (*Danthonia californica*)
Junegrass (*Koeleria macrantha*)
Sweetcicely (*Osmorhiza spp.)*

Non-native Invasive

English hawthorn (*Crataegus laevigata*)
Armenian blackberry (*Rubus spp*.)
Himalayan blackberry (*Rubus* armeniacus)
French broom (*Genista monspessulana*)
Scotch broom (*Cytisus scoparius*)
English holly (*Ilex aquifolium*)
Yellow starthistle (*Centaurea solstitialis*)
Bull thistle (*Cirsium vulgare*)
St John's wort (*Hypericum perforatum*)
Medusahead (*Taeniatherum caput-medusae*)
Cheatgrass (*Bromus tectorum*)

Birds

California quail (*Callipepla californica*)
Wild turkey (*Meleagris gallopavo*)
Band-tailed pigeon (*Patagioenas fasciata*)
Lewis's woodpecker (*Melanerpes lewis*)
Downy woodpecker (*Picoides pubescens*)
Acorn woodpecker (*Melanerpes formicivorus*)
White-breasted nuthatch (*Sitta carolinensis*)
Black-capped chickadee (*Poecile atricapillus*)
Oak titmouse (*Baeolophus inornatus*)
Bushtit (*Psaltriparus minimus*)
Blue-gray gnatcatcher (*Polioptila caerulea*)
Western wood-pewee (*Contopus sordidulus*)
Ash-throated flycatcher (*Myiarchus cinerascens*)
Western scrub-jay (*Aphelocoma californica*)
Western bluebird (*Sialia mexicana*)
House wren (*Troglodytes aedon*)
Bewick's wren (*Thryomanes bewickii*)
Spotted towhee (*Pipilo maculatus*)
California towhee (*Melozone crissalis*)
Lazuli bunting (*Passerina amoena*)
Black-throated gray warbler (*Dendroica nigrescens*)
Western tanager (*Piranga ludoviciana*)

Mammals

Western gray squirrels (*Sciurus griseus*)
Douglas squirrels (*Tamiasciurus douglasii*)
Columbian black-tailed deer (*Odocoileus hemionus columbianus*)
American black bears (*Ursus americanus*)
Roosevelt elk (*Cervus canadensis*)

Reptiles & Amphibians

Ensatina salamanders (*Ensatina spp.*)
Pacific giant salamander (*Dicamptodon spp*.)
Northern red-legged frogs (*Rana aurora*)
Ring-necked snakes (*Diadophus punctatus*)
Pacific tree frogs (*Pseudacris regilla*)
Western skinks (*Plestiodon skiltonianus*)
Sharp-tailed snake (*Contia tenuis*)
Pacific gopher snake (*Pituophis catenifer catenifer*)
Northwestern garter snake (*Thamnophis ordinoides*)
Western fence lizard (*Sceloporus occidentalis*)

Appendix II—Help with Your Restoration

Assistance and Professional Guidance for Private Landowners

Numerous agencies, organizations, and conservation programs can help you with your oak habitat restoration project by defraying costs, providing expertise, and offering other support services. Contact the following organizations to learn more:

USDA Natural Resources Conservation Service
US Fish and Wildlife Service
US Forest Service
Oregon Department of Forestry
Oregon Department of Fish and Wildlife
CalFire, and California Board of Forestry
California Department of Fish and Wildlife
Land Trust Alliance
Resource Conservation Districts (by county)
Lomakatsi Restoration Project
University Extension Services
Watershed Councils
Wildlife Conservation Board
National Fish and Wildlife Foundation
The Nature Conservancy
The Conservation Fund

Selling Restoration By-Products

You may decide to sell trees on your land that are harvested as a result of your oak habitat restoration project. These harvested trees may pay for some or all of the costs associated with managing your oaks. Agencies such as the Oregon Department of Forestry and university extension offices can offer assistance and resources to private landowners interested in managing their own timber sale. Before beginning, you should consult with professionals to learn about applicable forest practices laws as well as timber harvest taxes on your small operation.

Special note: In California, state law requires re-planting of conifer species for most timber harvest operations following logging. This is counter to conifer-removal and oak restoration objectives. Regulatory mechanisms in CA to waive the requirement to plant conifers after harvest are uncommon and difficult to obtain. If in California, contact a local CalFire representative, or a local private forester for more information about options under CA state law regarding commercial sale of material resulting from oak woodland restoration. This law may change in the future.

Dealing with Slash

Oak restoration activities, especially the removal of large conifers, can generate large amounts of slash (i.e., branches and other woody residue left on the forest floor after the cutting of timber). Generally, the felling of trees in thinning operations is a small portion of the total work and the disposal of slash is the bulk of it. A landowner must decide how to dispose of all this woody debris. Here, we direct you to a resource for disposing of your slash:

1. Go to the website http://www.forevergreenforestry.com/SierraCCWPP_Documents.html
2. Go halfway down the page and click “Wildland Fuel Hazard Reduction” to open up a Word document
3. Refer to section C.2: “What to Do with Thinned Materials”

Appendix III—Monitoring Birds on Your Land

Observing birds can bring pleasure and a greater understanding of your land. Birds are among the easiest wildlife to observe; they are abundant, often brightly-colored, and many of them announce their presence through distinctive songs. Furthermore, it is rewarding to see your land provide for these animals as they go about their lives.

Birds also tell us you a great deal about the condition of your land. A single parcel of healthy oak habitat can provide food and shelter for an amazing variety of birds. Some birds live year-round as residents on your land, others visit on migration to rest and refuel, and others spend either summers or winters on your land. By observing which birds occur on a parcel of land, we learn about the capacity of the land to support wildlife and the benefits of your restoration activities.

Below are some simple directions for monitoring birds on your land. If you conduct bird surveys both before and after restoration activities, you'll be able to see the benefits of restoration for wildlife.

(1) Choose a walking route on your land that will take approximately 15-30 minutes to complete.

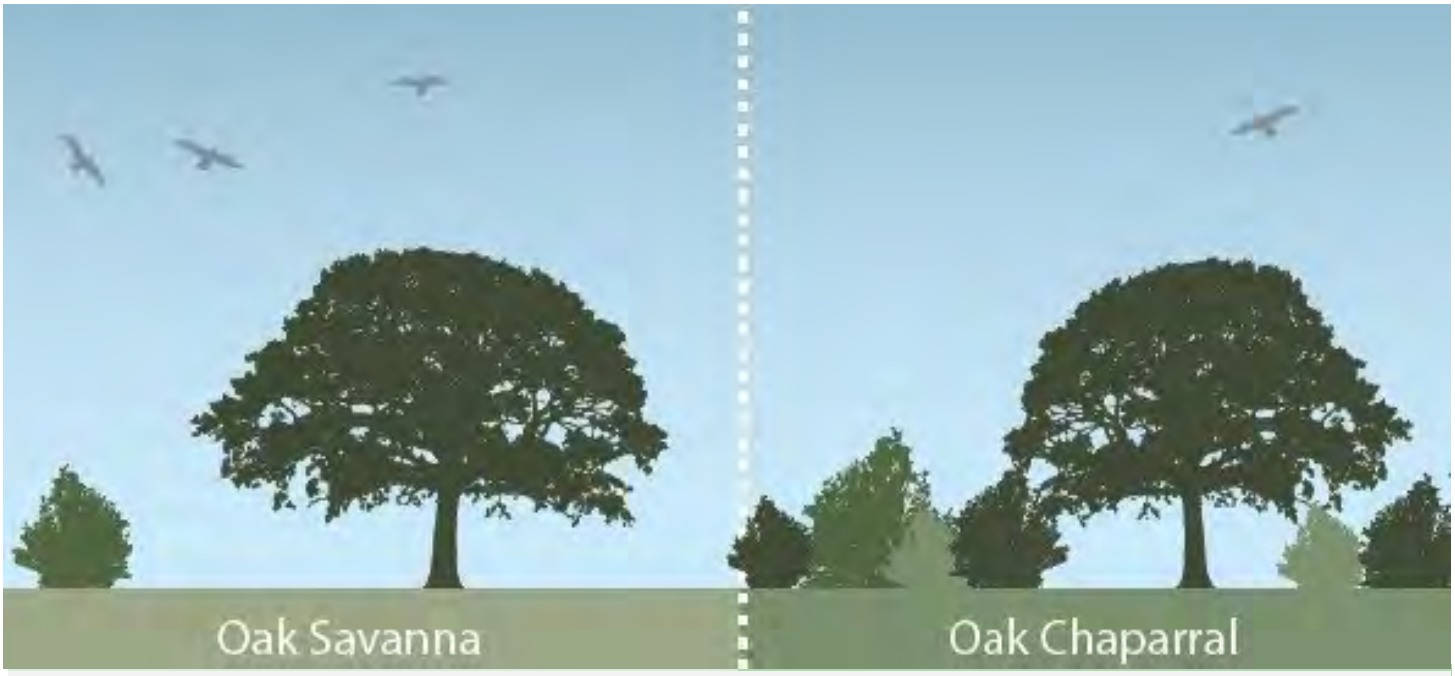
(2) Walk this route at the same time of day, preferably within 4 hours of sunrise when birds are most active, on an approximately weekly or monthly basis.

(3) On each walk, record how many of each of your four focal bird species you see or hear (see the next page to learn your focal species). Be conservative when recording numbers of birds, trying not to "double count" individual birds. You may also record additional bird species you are able to identify. See below for an example datasheet for recording your bird sightings.

(4) Use your computer to enter your bird observations into the eBird website: www.ebird.org/nw. By entering your observations you will join one of the most significant conservation programs in the world. Visit page 50 of this guide for instructions on how to use eBird.

(5) Have fun and share your knowledge of birds with friends and family. Over time, watch how your bird list changes as new species appear on your land and other birds increase in abundance.

Brandon Breen



You will survey for four bird species when you monitor birds on your land. The four species you survey depends on whether you are monitoring birds in oak savanna, oak chaparral, oak woodland, or mixed oak-conifer habitat. Some species, such as the towhees, are good indicators of multiple habitats.

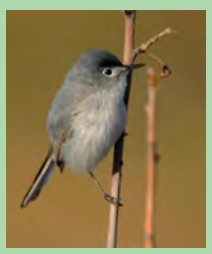
California Towhee
Time: All year
Identification: 9”, brownish overall, top of head a warmer brown, and orange on throat and under tail
Where to find: on ground near shrubs

Western Meadowlark
Time: All year
Identification: 9”, plump bird with short tail, bright yellow underneath with black V-shaped chest band, speckled brown above
Where to find: on ground, wires, fence posts

Western Bluebird
Time: All year
Identification: 7”; back, head, and wings blue; chest and sides reddish; belly light gray
Where to find: on low perches

Western Kingbird
Time: Spring and Summer
Identification: 9”, black tail and wings, gray upperparts, bright yellow belly
Where to find: on wires and exposed perches

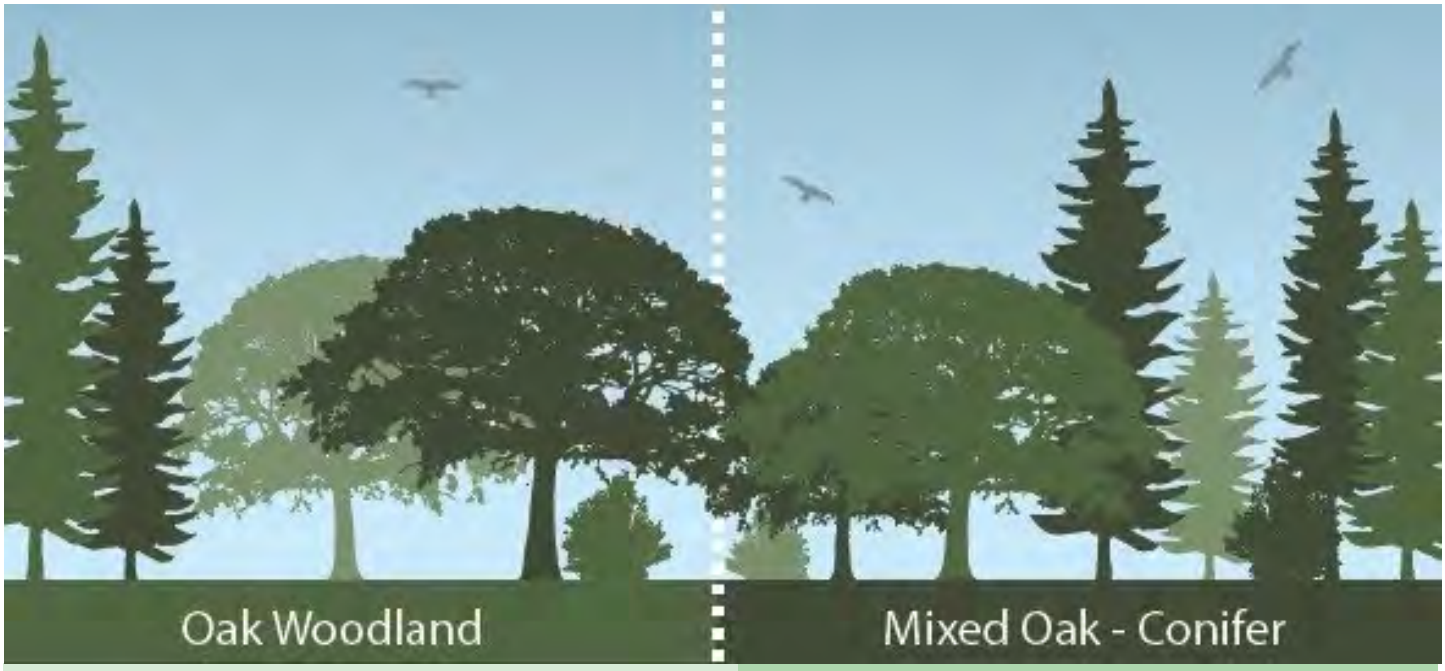
California Towhee
Time: All year
Identification: 9”, brownish overall, top of head a warmer brown, and orange on throat and under tail
Where to find: on ground near shrubs



Blue-gray Gnatcatcher
Time: Spring and Summer
Identification: 4”, blue-gray above, long tail is black with white outer edges and white below, white eye-ring
Where to find: in shrubs or trees

Bewick’s Wren
Time: All year
Identification: 5”, dark brown above, whitish below, long white eyebrow, tail flits sideways and is edged with white spots
Where to find: in shrubs

Lazuli Bunting
Time: Spring and Summer
Identification: 5”, male is bright turquoise above and on throat, with cinnamon chest, white belly, and white wing bar
Where to find: singing from shrubs or trees



Spotted Towhee
Time: All year
Identification: 8”; black head, back, and throat; reddish sides; white central belly; white spots on wings; red eyes
Where to find: on the ground near shrubs

White-breasted Nuthatch
Time: All year
Identification: 6”, white face with black cap, blue back, underneath white
Where to find: moving down trunks and large tree limbs

Acorn Woodpecker
Time: All year
Identification: 9”; black chin; yellowish throat; white cheeks and forehead; red top of head; white eyes; black body with white rump, belly, and wing patches
Where to find: in oak trees

Oak Titmouse
Time: All year
Identification: 5”, grayish brown with a short crest, lighter underneath, black eye
Where to find: in oak trees

Spotted Towhee
Time: All year
Identification: 8”; black head, back, and throat; reddish sides; white central belly; white spots on wings; red eyes
Where to find: on the ground near shrubs

Downy Woodpecker
Time: All year
Identification: 7”, center of back is white, small woodpecker with small bill, outer tail feathers are white and tend to have faint dark spots
Where to find: in trees

House Wren
Time: Spring and Summer
Identification: 5”, brown above with subtle eyebrow, little barring on belly, tail pointed upwards
Where to find: in trees and shrubs

Black-capped Chickadee
Time: All year
Identification: 5”, black cap and bib, white and gray body, lacks the white eyebrow of the similar Mountain Chickadee
Where to find: in trees

Other Birds to Watch For

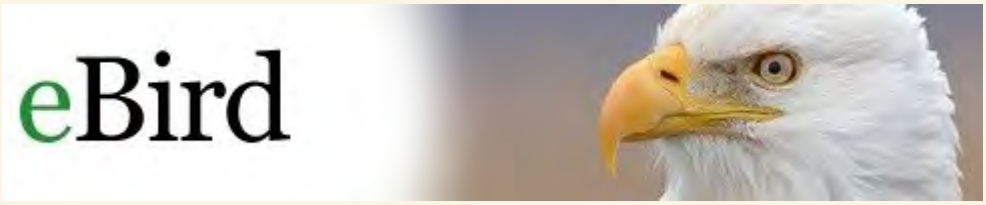
Lewis's Woodpecker
Time: Winter
Identification: 11", greenish-black head and back, gray collar and chest, dark-red face, pinkish belly
Of Note: Breeding populations of Lewis's Woodpeckers have almost disappeared from our region, but look for groups of these birds in winter
Where to find: in trees and flying above them

Black-throated Gray Warbler
Time: Spring and Summer
Identification: 5", head is black with thick white streaks, chest is black and belly white, yellow spot between eye and bill
Of Note: These small, active warblers produce buzzy songs and are associated with mixed-oak conifer forests. They are unmistakable if you catch a glimpse!
Where to find: in trees

Western Tanager
Time: Spring and Summer
Identification: 7", white bar on black or dark wings, black and yellow bird, male's head is bright red, bill is light in color
Of Note: These flashy and beautiful birds prefer mature oak woodlands and mixed oak-conifer forests with some canopy gaps. See if you can find them on your land.
Where to find: in trees

eBird Northwest

www.eBird.org/NW



What is eBird?

eBird is an online program that has revolutionized the way the birding community reports and accesses information about birds. Citizens enter their bird sightings into eBird and then can view summaries, maps, and other representations of their data, as well as the data of other birdwatchers. The information also has tremendous value for scientists and educators.

What is eBird Northwest?

eBird Northwest is a regional portal of eBird that engages communities in the Pacific Northwest.

Why is eBird Important?

Each person's bird sightings are joined with sightings from thousands of other participants around the world, and this wealth of information is used to understand, protect, and share information about bird populations.

Why is eBird Meaningful to You?

You can use eBird to manage your bird sightings while contributing to the understanding and conservation of birds. Contributing to eBird is one of the most enjoyable ways to safeguard our natural heritage.

eBird Northwest
Get Started Now!

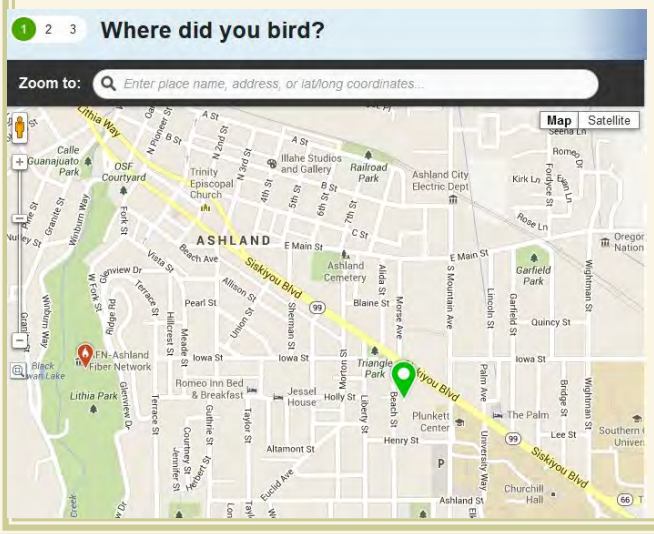
Below are steps for getting started with eBird.

(1) Get online. Go to this website:
www.eBird.org/NW

(2) Sign In or Register as a New User

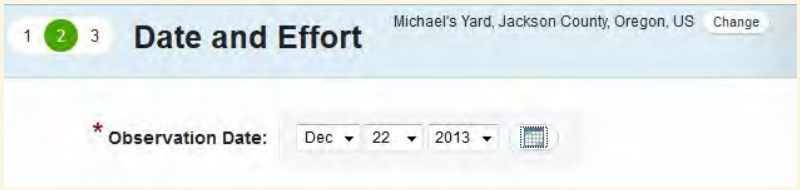
(3) Click "Find it on a Map" to Identify Your Property

(4) Put a Marker on your Property



(5) Enter Your Bird Sightings

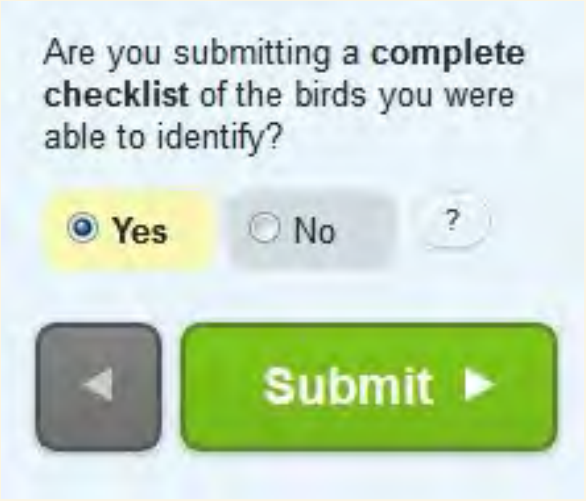
(a) Enter date and effort

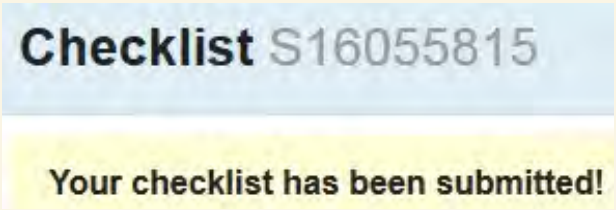


(b) Enter the bird species you saw or heard, including numbers of individuals of each species

(c) Check "yes" or "no" depending on whether you are entering all the bird species you were able to identify

(d) Click "Submit" to finish





eBird Northwest

My eBird

Manage your personal lists, observations, locations, and account settings.

Your Life List: 1 Species

Last updated 10 sec ago.

Your Stats

	Life	Year	Month
Total Species	1	1	1
Total Checklists	1	1	1
ABA Area Total Ticks	1	1	1

My Observations

Summarize My Observations
Create frequency, abundance, and other tables of my observations.

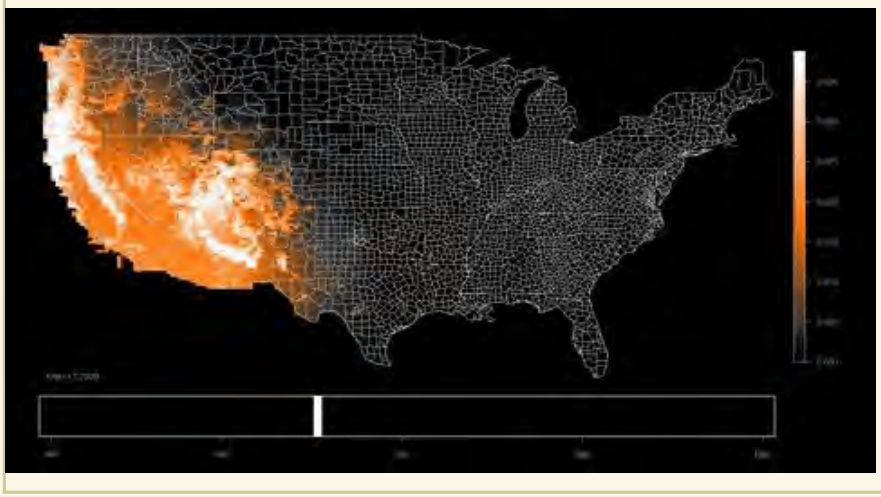
Manage My Observations
View, edit, print, share or download my observations.

My Shared Observations
Checklists that other eBird users have shared with me

Manage My Locations
Edit existing locations

(6) Explore eBird Northwest

The eBird website offers interesting content and many ways to explore your personal bird observation data, as well as data entered into eBird by other users. The "Home" tab directs you to news articles about birds and the Pacific Northwest. The "Submit Observations" tab is what you will use to submit new bird checklists. The "Explore Data" and "My eBird" tabs allow you to look at the data in dynamic and fascinating ways. Play around with the website, and enjoy!



This eBird Occurrence Map for Black-throated Gray Warbler—a bird that breeds in oak habitats in the western US—shows the predicted occurrence for this species in the lower 48 states of the US during one day in May. Areas in white are predicted to have higher densities of Black-throated Gray Warblers. This is one of many tools eBird has for displaying bird abundance and distribution data.

Private Lands Oak Restoration Project

Bird Species Checklist

Location:_____ Date: _____

Start Time: _____ End Time: _____

Distance Covered (~miles):_____ Total # of People in Party**:**_____

Observer Name(s) _____

Species Name	Number	Species Name	Number
Oak Savanna Species			
California Towhee			
Western Meadowlark			
Western Bluebird			
Western Kingbird			
Oak Chaparral Species			
Blue-gray Gnatcatcher			
Bewick's Wren			
California Towhee			
Lazuli Bunting			
Oak Woodland Species			
White-breasted Nuthatch			
Spotted Towhee			
Acorn Woodpecker			
Oak Titmouse			
Oak-Conifer Forest Species			
Downy Woodpecker			
House Wren			
Black-capped Chickadee			
Spotted Towhee			
Other Bird Species (Write-in)			

Please enter your bird observations into eBird Northwest: www.eBird.org/NW

Thank you for your participation!!

