

A guide for western Oregon landowners



Oregon Forest
Resources Institute

ESTABLISHING AND MANAGING FOREST TREES IN WESTERN OREGON



Contents

Western Oregon's varied landscape	3
Common trees of western Oregon	7
Establishing tree plantings	18
Protecting new plantings from competing vegetation and animals	25
Tending your trees	28
When trees need to be removed	31
Putting it all together: Forest management planning	34
Where to get help	35

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More detailed information on identifying Oregon's trees can be found in *Trees to Know in Oregon*, available for purchase at local Oregon State University Extension offices or at catalog.extension.oregonstate.edu/ec1450.

To order copies of this report, or for further information, contact Oregon Forest Resources Institute at 971-673-2944 or visit OregonForests.org.



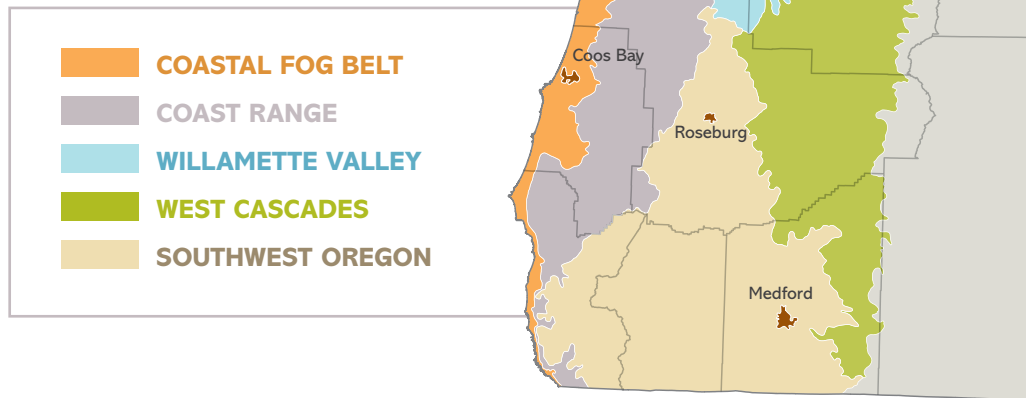
Introduction

Oregon is a state of staggering geographic diversity. A traveler can experience, in a day's drive, fog-drenched coastline, emerald-green forests, fruitful valley bottoms, glaciated volcanoes and vast desert expanses. Overlaid on this varied topography is a patchwork of different landowners, including state and federal public lands, industrial forestry companies and family forest landowners. Your property may seem like a small part of this puzzle, but Oregon's family forestland comprises almost 3.6 million acres, or 12 percent of the state's total forestland. This goes a long way toward providing the wildlife habitat, clean water, wood products, and other goods and services Oregonians rely on.

In this publication we'll focus on the reforestation process of planning, planting and caring for a young forest. We'll help you understand your land's place in this varied landscape, and how you can best plant and tend to trees in your woods to ensure they remain healthy and productive. Although forests are found throughout Oregon, this publication is focused on Oregon forests that lie west of the Cascades crest.

Western Oregon's varied landscape

Generally speaking, Oregon can be divided into its dry east side and wet west side. However, even within the moist western portion of the state, there is a great deal of geographic variability. Topography and climate interact to create several different regions, each with its own dominant forest type. It's important to know which region your forestland is within, because not every tree species will survive and thrive in all parts of western Oregon. How you choose to manage property will be affected by the unique environment and inherent capabilities of your land. In this publication, we'll break western Oregon into five ecoregions.



COASTAL FOG BELT

The coastal fog belt is a narrow band that hugs Oregon's coastline. This ecoregion is defined by a temperate climate, caused by its proximity to the ocean. Winters here are mild and wet, and summer temperatures are tempered by foggy conditions. These factors are favorable to moisture-dependent tree

species, especially Sitka spruce and western hemlock. In fact, forests in this ecoregion are usually referred to as spruce-hemlock forests. Soils here tend to be very deep and fine-textured. The mild climate, plentiful rainfall and fertile soil result in some of the world's most productive forests.

Beyond the ever-present Sitka spruce and western hemlock, other important tree species include red alder, shore pine, bigleaf maple and western redcedar, with the addition of tanoak, Oregon-myrtle and Port-Orford-cedar on the south coast. Douglas-fir and grand fir are also present here, but historically they were not found growing in pure stands.

Forests in the coastal fog belt region are highly productive, but the moist conditions can perpetuate disease issues when trees from outside the area are planted here. Also, because sites are so productive, understory vegetation such as huckleberry, salmonberry and vine maple can grow quickly and dominate a site after trees are harvested. Consequently, you will often need to control shrubs and other competing vegetation when you're planting trees after a harvest or disturbance in this region.



COAST RANGE

The Coast Range of Oregon runs from the Oregon-Washington border south to the Middle Fork of the Coquille River. This ecoregion lies just inland from the coastal fog belt region. Soils here are mostly derived from sedimentary materials as well as some volcanic rocks uplifted from the ancient ocean floor and are, generally speaking, deep and well drained in valley bottoms, becoming shallower and rockier as the slope increases. The climate in the Coast Range is mild and moist like the coastal fog belt, but moisture and temperature extremes are greater here because this region is farther from the coast. Because summers here are dry (only 5% to 10% of annual precipitation occurs in the summer), trees need to be able to survive droughty conditions. This is especially true on harsh sites such as south-facing slopes and steep, rocky hillsides with shallow soil.

Coast Range forests are dominated by coniferous trees, including Douglas-fir, western hemlock, grand fir and western redcedar. Of these, Douglas-fir is the most common and is widely planted as a commercial species. Hardwoods tend to be found in areas with more moisture such as stream sides and valley

bottoms. In valley bottoms you'll likely find black cottonwood and Oregon white oak, with red alder and bigleaf maple growing farther upland. At the southern end of the Coast Range in the Umpqua and Coquille watersheds, you're also likely to see California-laurel (also known as Oregon-myrtle) and tanoak.



WEST CASCADES

The forests on the west slope of the Cascade Range are similar in many respects to those found in the Coast Range. Soils (while volcanically derived rather than coming from the sedimentary deposits dominating the coastal fog belt and Coast Range) are generally well drained. They are deep in the valley bottoms and toe slopes, getting shallower and rockier as slope steepness increases. The climate, however, is

somewhat drier with greater temperature extremes than the Coast Range.

Douglas-fir, western hemlock and grand fir are all common species in the west Cascades, and incense-cedar can be found in the southern part. Hardwoods such as bigleaf maple and red alder are less common than in the Coast Range, and are generally limited to riparian areas. Western redcedar also favors sites with more moisture, such as valley floors and along streams.

WILLAMETTE VALLEY

The Willamette Valley sits in a rain shadow caused by the Coast Range. Consequently, total precipitation is lower here than in forests closer to the coast. The Willamette Valley has a Mediterranean climate with less coastal influence, resulting in colder winters with hotter summers. However, while the climate does influence the forests of the Willamette Valley, soils have a greater influence on which trees thrive here.

Soils below 400 feet of elevation are often poorly drained clays and silts originating from river alluvium and lake sediments. This sediment was deposited at the end of the last Ice Age (15,000 to 12,800 years ago), when advances and retreats of glaciers repeatedly blocked the Columbia River near present-day Missoula, Montana. Periodic collapses of the ice dam released cataclysmic floods causing the Columbia River to flow at a volume 10 times the flows of all the Earth's present-day rivers combined. These flood waters backed up into the Willamette Valley to about Eugene, forming Lake Allison. The lake would only last for a few weeks until the floodwaters were able to drain into the Pacific Ocean, but the process is estimated to have repeated itself about every 50 years for some 2,000 years.

The soils formed by glacial silts and clays deposited on the valley floor by Lake Allison are generally poorly drained. They are more suited to herbaceous plants than forests, and historically were part of a large swath of prairies and savannas.

Trees here included Oregon white oak, Oregon ash and the native strain of ponderosa pine commonly known as "valley pine."

There once were also extensive hardwood gallery forests growing along the Willamette River and its major tributaries. The floodplain soils are generally coarse and well drained, and although prone to winter flooding they support a wide variety of trees and shrubs.



The foothills of the Willamette Valley consist of a variety of soil types that developed from different geologies. They range dramatically in depth and drainage, with some behaving like the poorly drained lowland soils and some more like the Coast Range and west Cascades soils. The trees and forests we see growing on these sites generally reflect the diversity of soil types and/or some fire history.

Historically, Native Americans maintained open conditions by burning the prairies of the valley floor, as well as the savannas and oak woodlands extending into the foothills. This practice stopped after European settlement in the 1800s. Much of the valley floor was converted to agriculture, while savannas of oak and pine gradually changed into oak woodlands. Later, many of these oak woodlands were invaded by Douglas-fir and grand fir due to fire-exclusion.



SOUTHWEST OREGON

Interior southern Oregon, beginning in the Umpqua Valley and continuing south to the California border, contains some of the most biologically diverse forests in the Pacific Northwest. This ecoregion is at an intersection of several geologic formations, producing many different soil conditions, and it experiences a wide range of microclimates. Generally speaking, the climate is Mediterranean, similar to that of the Willamette Valley, but with somewhat colder winters and particularly hotter summers. Also, total precipitation is much lower than other regions of western Oregon. Foothill soils are relatively shallow and rocky, while valley-bottom soils range from poorly drained to well-drained clay soils.

Forest trees found in the Siskiyou region of southwest Oregon tend to tolerate the hot, dry summers well. In fact, moisture plays a very large role in determining which trees will be found on a particular site. The driest sites are home to Oregon white oak, California black oak, Pacific madrone and ponderosa pine, with ponderosa pine playing a much larger role here than in the Willamette Valley. Intermediate sites (sites that aren't very dry or very wet) support incense-cedar, Douglas-fir, grand fir, sugar pine and western white pine. Very wet sites such as springs, seeps and stream banks may also host Port-Orford-cedar and western hemlock, which both require some water during the growing season. Evergreen hardwoods are also quite common in the woods of southern Oregon, where you'll find California laurel, pacific madrone, golden chinkapin and tanoak.

Riparian areas that are poorly drained or that flood are home to a different set of hardwoods. Here, black cottonwood, white or red alders and Oregon ash dominate. These species are tolerant of very wet conditions, and take advantage of the abundant moisture that's available year-round.



Common trees of western Oregon

Look around. From almost any vantage point you will see trees. That sea of green we call “the forest” often comprises different species of trees, each with its own likes and dislikes (known as tolerances) for where it can grow. Tree species are commonly separated into two types: conifers and hardwoods (also called broadleaf). Conifers often have needles for leaves, produce their seeds in cones and are almost always evergreen. Hardwood trees have flattened leaves,

produce their seeds in a wide variety of berries, nuts and samaras (a winged nut containing a seed), and are generally deciduous, losing their leaves each fall. There are always exceptions – such as the madrone and chinkapin, which are evergreen hardwood trees, and the western larch, which is a deciduous conifer (and not native to western Oregon). This section contains a list and descriptions of the most common native tree species of western Oregon.

CONIFERS

GRAND FIR (*Abies grandis*)

Character: Thin-barked, shade-tolerant conifer that can grow up to 250 feet tall and 6 feet in diameter. Maximum life span of 250 to 300 years.

Distribution: Common on cool, moist sites across all regions in western Oregon. Often found as a relatively fast-growing understory tree growing in the shade of other species.

Uses: Grand fir is used for a variety of wood products, although it is not as highly prized as Douglas-fir. It is also a popular Christmas tree.



NOBLE FIR (*Abies procera*)

Character: Foliage is blue-toned. This tree boasts unique cones with “whiskers” that separate the seeds from cone scales. It can reach 200 feet tall and 5 feet in diameter.

Distribution: Common at middle to upper elevations in the entire Cascade Range. Grows at higher elevations in the Siskiyou. Appears very sparingly in the Coast Range from Marys Peak north. If left to grow for timber, noble fir will only become timber-size on moist, well-drained sites above about 1,000 feet in elevation. At lower elevations, it tends to suffer from root rot and other ailments, which can shorten its life and deform it.

Uses: Noble fir has very strong wood for its weight and is one of the most popular Christmas tree species grown in Oregon. It is also planted as an ornamental tree because of its blue color, symmetrical growth pattern and unusual cones.





INCENSE-CEDAR (*Calocedrus decurrens*)

Character: Sun-loving conifer that grows up to 110 feet tall and 5 feet in diameter. Its woody cones are shaped like a duck's bill when unopened, and like a flying goose when opened.

Distribution: Southern Willamette Valley and southern Oregon, on drier sites.

Uses: Known as pencil cedar because of its historic use for pencils, the aromatic wood of this species is used for a wide variety of wood products. The tree often develops heart rot at older ages and becomes excellent habitat for cavity-nesting birds.



PORT-ORFORD-CEDAR (*Chamaecyparis lawsoniana*)

Character: Similar in form and size to western redcedar but with slightly bluer foliage. Can grow up to 200 feet tall and 6 feet in diameter. This species is very susceptible to an introduced root rot that has decimated the species in its native range, but root-rot-resistant seedlings are now available.

Distribution: Southern Oregon and along the coast from Reedsport south. The tree is a major part of southern Oregon coastal woods but is only found on moist sites in interior southern Oregon.

Uses: Port-Orford-cedar produces strong, rot-resistant, light-colored wood that is used for a variety of niche products. Boughs are valuable as greenery for wreaths and floral arrangements. Typically, strong markets exist locally for both logs and boughs.



SITKA SPRUCE (*Picea sitchensis*)

Character: Large tree with wide-buttressed base. Commonly grows to 180 feet tall and 5 feet in diameter, although it can exceed 200 feet tall with diameters reaching 16 feet.

Distribution: Limited to the coastal fog belt, where it is a major forest component along with western hemlock.

Uses: Sitka spruce is used for lumber, pulp and plywood cores. Old-growth spruce is straight-grained and light, but smaller second-growth trees are coarser in structure. Can tolerate direct ocean salt spray better than hemlock.

KNOBCONE PINE (*Pinus attenuata*)

Character: A smaller pine, reaching up to 80 feet tall and 2 feet in diameter. Knobcone pine is known for its distinctive cones that are rock-hard with knob-like projections, thus giving it its name. This tree is dependent on fire, as the cones will only open and release their seeds after exposure to heat from a fire (known as serotiny). Without fire, this species will eventually be replaced by other species that are more shade-tolerant.

Distribution: Prefers to grow on hot, dry sites that are 1,000 to 2,000 feet in elevation, in southwest Oregon and down through California, in areas that are frequented by wildfire.

Uses: Because it is a small, shrubby tree that often has multiple tops, knobcone pine is occasionally used for firewood. It often grows in following a fire, paving the way for new forests ahead.



JEFFREY PINE (*Pinus jeffreyi*)

Character: Can reach 140 feet tall and 4 feet in diameter. Can easily be confused with ponderosa pine.

Distribution: Grows in a very limited range in southwest Oregon, stretching down into California. Can tolerate a wide variety of soils and fluctuating temperatures. Is one of the few species that grows well on the serpentine soils characteristic of the Siskiyou region, which are toxic to most plants.

Uses: Jeffrey pine is used in the same ways as ponderosa pine – for light construction, furniture, millwork and other specialty items. Because it is so similar to ponderosa pine, it is frequently sold as such.



SUGAR PINE (*Pinus lambertiana*)

Character: The tallest of all pines, reaching up to 200 feet in height and 7 feet in diameter. John Muir called it “the priests of pine.” This species is susceptible to white pine blister rust, but resistant seedlings have been developed.

Distribution: Found in southern Oregon on mid-elevation, well-drained, sunny sites.

Uses: Sugar pine wood exhibits exceptional wood properties and is a commercial species. Although early growth rates are slower than other conifer species, its growth remains steady as the tree ages.





WESTERN WHITE PINE (*Pinus monticola*)

Character: Relatively fast-growing tree with a beautiful straight trunk, growing up to 180 feet tall and 4 feet in diameter. Like sugar pine, this species is susceptible to white pine blister rust, but resistant seedlings are available. Grows in stands mixed with other conifers.

Distribution: Found in mid- to high-elevation forests in the west Cascades.

Uses: White pine wood is very straight-grained and free of resin, which makes it valuable for millwork, although log markets for this species are very limited. This species is one of the most frost-resistant trees native to western Oregon, so it can be used to reforest areas previously ravaged by cold winters. Also grown for Christmas trees and boughs.



PONDEROSA PINE (*Pinus ponderosa*)

Character: Grows on a wide variety of soils and under varying moisture conditions, reaching up to 180 feet tall and 6 feet in diameter. Can live to be 500 years old. “Valley pine” (ponderosa pines from the Willamette Valley) are genetically different from those found in southern and eastern Oregon, so make sure you’re using a local seed source when you plant it.

Distribution: Capable of growing on most low- to mid-elevation sites in the Willamette Valley and southern Oregon.

Uses: Well-suited as lumber for light construction, furniture, millwork and other specialty items. Markets exist in southern Oregon, but currently there are not enough natural stands to create a market for its wood in the Willamette Valley. Potentially a valuable tree for use in riparian plantings, poorly drained sites or where drought in the summer is an issue. Has a deep root system, which makes it well suited to urban uses (such as parks, away from roads and sidewalks), and for mixing with grazing in agroforestry applications.



DOUGLAS-FIR (*Pseudotsuga menziesii*)

Character: Sun-loving conifer capable of living hundreds of years, reaching more than 250 feet tall and 10 feet in diameter.

Distribution: Widely grown everywhere in western Oregon where sufficient soil drainage and sunlight are present. This tree is so prevalent in the Pacific Northwest that ecologists refer to it as the Douglas-fir region.

Uses: Known worldwide as the premier structural wood, Douglas-fir is used for a wide variety of building products. Millions of Douglas-fir Christmas trees are also exported from Oregon each year. Older Douglas-fir are important as homes for nesting birds, and decadent (older mature) trees and snags are a key source of cavities for woodpeckers and other birds.

COAST REDWOOD (*Sequoia sempervirens*)

Character: Long-living, giant conifer capable of reaching up to 370 feet tall and 23 feet in diameter in its native range. A fast-growing species, coast redwood can reach more than 3 feet in diameter and more than 100 feet in height in 50 to 60 years. It is shade-tolerant and likes moist, well-drained areas, but does not tolerate hard frosts. Unlike most conifers, redwood can regenerate from sprouts after a disturbance such as a timber harvest or fire.

Distribution: Found in northern California and the extreme southern end of the Oregon coast. Coast redwood has been planted throughout Oregon as an ornamental tree, and some woodland owners are experimenting by reforesting cool, foggy, moist areas with this species.

Uses: Redwoods produce decay-resistant lumber that is prized for decking, siding and outdoor furniture.



WESTERN REDCEDAR (*Thuja plicata*)

Character: Long-lived, shade-tolerant conifer that grows up to 200 feet tall and 10 feet in diameter. Its swollen base makes it the broadest of all trees in western Oregon, capable of reaching 20 feet in diameter.

Distribution: Moist sites along streams and near springs or other wet areas. It's a major species in the coastal fog belt, but is also found in most regions of western Oregon.

Uses: Wood from western redcedar is prized for decks, siding and shake roofs because of its rot resistance. Downed western redcedar logs are an important structural component along streams, serving as an excellent source of large woody debris for healthy stream structure and fish habitat.



WESTERN HEMLOCK (*Tsuga heterophylla*)

Character: Shade-tolerant conifer that can reach up to 200 feet tall and 4 feet in diameter.

Distribution: A major species in the coastal fog belt, which is also found in the Coast Range, west Cascades and valley fringes on moist sites (generally more than 60 inches of annual rainfall). On these sites, this tree is the dominant tree species in old-growth forests.

Uses: Hemlock wood is prized for trim products, windows and doors. Older trees are prone to rot, creating cavities that serve as excellent bird habitat.



BROADLEAF TREES (HARDWOODS)

**BIGLEAF MAPLE** (*Acer macrophyllum*)

Character: Shade-tolerant broadleaf tree that grows up to 100 feet tall and 4 feet in diameter.

Distribution: Widely distributed throughout western Oregon. Capable of growing on a wide variety of sites and soils, and regenerating in the shade of other species.

Uses: Wood used for furniture, cabinets and other uses. Maple is an excellent habitat tree due to its palatable foliage, good seed production and nesting possibilities.

**WHITE ALDER** (*Alnus rhombifolia*)

Character: Broadleaf tree that grows up to 80 feet tall and 2 feet in diameter. Short-lived species that is intolerant of shade and drought. White alder also fixes nitrogen from the atmosphere and is an excellent recycler of nutrients.

Distribution: Interior valleys from the Willamette Valley south, where it occurs on wet sites along rivers and streams near valley floors. Prefers sites with moving water.

Uses: Similar to red alder, but is not commonly managed for timber production. Important riparian tree for some Willamette Valley streams.

**RED ALDER** (*Alnus rubra*)

Character: Fast-growing tree that can be up to 120 feet tall and 3 feet in diameter. Short-lived species that is intolerant of shade and drought. Red alder also fixes nitrogen from the atmosphere and is an excellent recycler of nutrients.

Distribution: Common along stream courses in the coastal fog belt, Coast Range and west Cascades below 2,500 feet elevation. On moist sites it will grow across the landscape.

Uses: Broadly acclaimed for a variety of high-value wood products such as cabinets and furniture. Because it is immune to a root rot that kills Douglas-fir, it can be planted in root-rot pockets within Douglas-fir stands to prevent perpetuating the disease. Important riparian species for wildlife habitat.

PACIFIC MADRONE (*Arbutus menziesii*)

Character: Evergreen broadleaf tree that grows up to 100 feet tall and 6 feet in diameter. Smooth bark with a distinctive reddish-brown color that flakes off in scales or strips, often revealing bright green underneath.

Distribution: Grows widely across western Oregon on well-drained, sunny sites.

Uses: Wood is hard and valuable for woodworking but tends to check as it dries. Excellent firewood. The tree's red-orange berries are a popular food source for birds in the fall. Pollinators feed on the flower clusters in spring.



GOLDEN CHINKAPIN (*Chrysolepsis chrysophylla*)

Character: Evergreen broadleaf tree that grows up to 150 feet tall and 6 feet in diameter. At higher elevations it may grow as a shrub. It has intermediate shade tolerance.

Distribution: Common in southern Oregon. Scattered on well-drained, usually rocky soils in the foothill forests of the southern Willamette Valley below 500 feet.

Uses: On good sites, chinkapin can develop tall straight trunks that yield beautiful, hard lumber, but commercial use is limited by the scattered distribution of large trees. The tree's burr-covered fruit contains two triangular nuts popular with chipmunks and squirrels.



OREGON ASH (*Fraxinus latifolia*)

Character: Shade-tolerant broadleaf tree that seldom grows taller than 80 feet and 3 feet in diameter. Bright-yellow fall foliage.

Distribution: Tolerance to standing water allows this tree to grow on the most poorly drained valley soils, where no other tree species will grow. Common along watercourses and swales throughout western Oregon.

Uses: Wood is prized for flooring, cabinetry and other high-value wood products, but trees grow slowly and there is not a well-developed local market.





TANOAK (*Notholithocarpus densiflorus*)

Character: Tall evergreen hardwood that can reach 100 feet tall and 3 feet in diameter, but can also grow in a shrubby form. Affected by the introduced pathogen *Phytophthora ramorum*, which causes Sudden Oak Death. The disease is currently limited to tanoaks growing in California and southern Curry County. Vigorous stump sprouts often compete with planted conifers following harvest.

Distribution: Found on a variety of sites in the southern Coast Range and throughout southern Oregon.

Uses: Wood has been used for furniture and flooring, although it is most commonly used for pulp or firewood.



BLACK COTTONWOOD (*Populus trichocarpa*)

Character: The tallest and often broadest hardwood tree, growing up to 200 feet tall and more than 6 feet in diameter. Although fast-growing, this sun-loving tree does not have a long lifespan, with trees rarely living more than 100 years.

Distribution: Restricted to watercourses throughout the Willamette Valley floor and foothills. Particularly well suited to well-drained, gravelly soils near streams. Tolerant of flooding.

Uses: Wood historically used for paper, but also can be used for plywood and lumber. Leaves and shoots highly prized as food for many wildlife species.



OREGON WHITE OAK (*Quercus garryana*)

Character: Slow-growing, drought-hardy, shade-intolerant tree that can reach up to 80 feet tall and 3 feet in diameter. Tolerates a wide range of soil conditions. Capable of living up to 500 years, this species needs disturbance from fire or grazing to remain competitive on sites where Douglas-fir is also present.

Distribution: Interior valleys and their foothills, from California to Washington.

Uses: Wood is used for wine barrels, flooring, furniture and other products. Excellent firewood species. Excellent wildlife habitat species, producing acorns, nesting cavities and other habitat features.



CALIFORNIA BLACK OAK (*Quercus kelloggii*)

Character: Slow-growing and short-lived tree that can reach up to 80 feet tall and 3 feet in diameter. This tree will sprout vigorously from the stump if cut.

Distribution: Southern Oregon is at the northern end of black oak's native range. It thrives on dry, sunny sites, especially on lower hills and broad valley bottoms.

Uses: Can be sawn into lumber or peeled for veneer to be used in various finished wood products, although there are limited markets.



OREGON-MYRTLE OR CALIFORNIA-LAUREL (*Umbellularia californica*)

Character: Large evergreen tree capable of exceeding 100 feet in height and 5 feet in diameter. When grown in the open, trees have very broad crowns. When grown in a dense stand, trunks can be clear and straight. On harsh sites, it can grow as a tangled shrub. Vigorous stump sprouter.

Distribution: Broadly distributed throughout southern Oregon, from the coast to the Rogue Valley.

Uses: Wood is prized for its beauty and machinability. Leaves are highly aromatic and have been used as a replacement for bay leaves in cooking.



NON-NATIVE SPECIES OF WESTERN OREGON

The mild climate of western Oregon makes it possible to grow a range of non-native tree species. When choosing non-native species, however, you need to be careful to select trees that will thrive in your local growing conditions. It is not adequate for a planted tree just to survive the average weather conditions. To thrive, it will have to survive environmental extremes. Colder-climate trees sometimes have problems with drought and heat. Warmer-climate trees have trouble with the occasional cold blasts of arctic air. Take note that forest landowners wishing to use non-native tree species for reforestation must obtain approval from

the Oregon Department of Forestry.

Over the past 150 years, several hundred species of non-native trees have been trial-planted in western Oregon. For example, more than 35 species of eucalyptus have been tested, and not a single species was deemed well suited to Oregon's climatic cycles. Before planting an exotic species, ask around to see if it has already been tested here. In general, it is best to stick with native species that are well adapted to your site's conditions. Below are a few of the most common species that have been trial-planted in Oregon.



TRUE FIRS (*Abies spp.*). Many species of true firs have been tried in western Oregon. The most common is noble fir (*Abies procera*), which is one of the most popular Christmas tree species grown in Oregon. There are several other true firs such as Nordmann (*Abies nordmanniana*), Turkish (*Abies bornmuelleriana*) and Fraser (*Abies fraseri*) fir that are grown for Christmas trees. None of these species are currently recommended for forest plantings.



BLACK WALNUT (*Juglans nigra*). Black walnut plantings in western Oregon date back to white settlement in the mid-1800s. Many fine specimen trees exist on old farmsteads, and during the ensuing decades new plantings have been established on farms throughout the state. Growing much faster than its Midwestern cousins, the successful trees in the Willamette Valley appear to be hybrids between black walnut (*Juglans nigra*) and the Hinds walnut (*Juglans hindsii*) native to the Sacramento Valley in California. Walnut trees need full sunlight and prefer deep, well-drained soils.

SCOTS (*Pinus sylvestris*), **LODGEPOLE** (*Pinus contorta*) and other pines non-native to western Oregon. Many species have been tried, but most become infested with insects and diseases within a few decades. Many different varieties have been planted in home landscapes, but none are currently recommended for forest plantings. A type of lodgepole pine known locally as shore pine is native to the Oregon coast, where it does well in poor-quality dune soils and can tolerate high winds and salt spray. A hybrid between knobcone (*Pinus attenuata*) and Monterey (*Pinus radiata*) pine called KMX has been tested extensively during the past few decades with limited success, often developing a host of pests and diseases.



BLACK LOCUST (*Robinia pseudoacacia*). Native to the Appalachian Mountains, this species has been planted extensively throughout the country. Early homesteaders favored this tree for its rapid growth rates and ability to produce rot-resistant fence posts. A nitrogen fixer, black locust has also been used to reclaim old mining sites. This tree likes moist, well-drained soils and will not do well in overly wet or droughty sites. Prolific suckering can make black locust a weedy tree if not managed.



SIERRA REDWOOD/GIANT SEQUOIA (*Sequoiadendron giganteum*). Giant, long-living conifer native to the Sierra Nevada Mountains in California. Grows extremely fast, with a pleasant, Christmas-tree shape, but needs lots of room as it may reach several feet in diameter and well over 150 feet tall. Avoid poorly drained areas. Its value as a timber species is doubtful, yet it can grow to become a magnificent specimen tree.



Establishing tree plantings

The forests of the Pacific Northwest are some of the most productive tree-growing areas on the planet. With careful thought and planning, you should be able to grow a healthy stand of trees that achieves your goals as a landowner. In this section, we'll outline the various decisions to make in the planting process. While every project is different, the same decisions will have to be made whether you plant one tree or 10,000 trees.

Additionally, if you're planting seedlings after a timber harvest, make sure you're aware of the reforestation requirements, including the minimum required number of trees per acre, as outlined in the Oregon Forest Practices Act. See page 23 for more information.

Tree-planting decisions

- Which species should I plant?
- How will I prepare the site for planting?
- Where do I get seedlings?
- How much space do my trees need?
- How do I plant my trees?

WHICH SPECIES SHOULD I PLANT?

You should choose which species to plant based on your objectives as a landowner and the characteristics of the specific site where the trees will be planted.

Where specific tree species grow and thrive is no accident. In the wild, trees may grow where they are for a variety of reasons. Often they are where they are because they compete better for that shady space near

the stream, or can withstand the hot, dry summer drought on a clay hillside, or simply grow faster than other species on a particular site.

To ensure success with growing trees, select a tree species that will thrive in the place it is planted. Simply surviving is not enough. Start by choosing species that are native to your region. Planting non-native trees can result in poor growth as well as insect and disease problems.

Next you need to understand the conditions a tree will experience on your property. It often helps if you can observe the property over a year, especially through the winter and spring. Here are some things to consider.

- 1. Water:** After a prolonged rainy period, does the property flood or stay soggy? Getting trees to grow in wet ground can be frustrating and often futile. Some tests you can use:
 - Dig a few planting holes and see how far down the water table sits.
 - Observe how long it takes the water to drain in test holes.
- 2. Frost:** Pay particular attention to areas that may have frost forming in late April through May. Conifer trees begin to break buds in this time period, and if a late frost hits, new buds may be damaged. Frost may be more prevalent in landscape depressions with poor air flow.

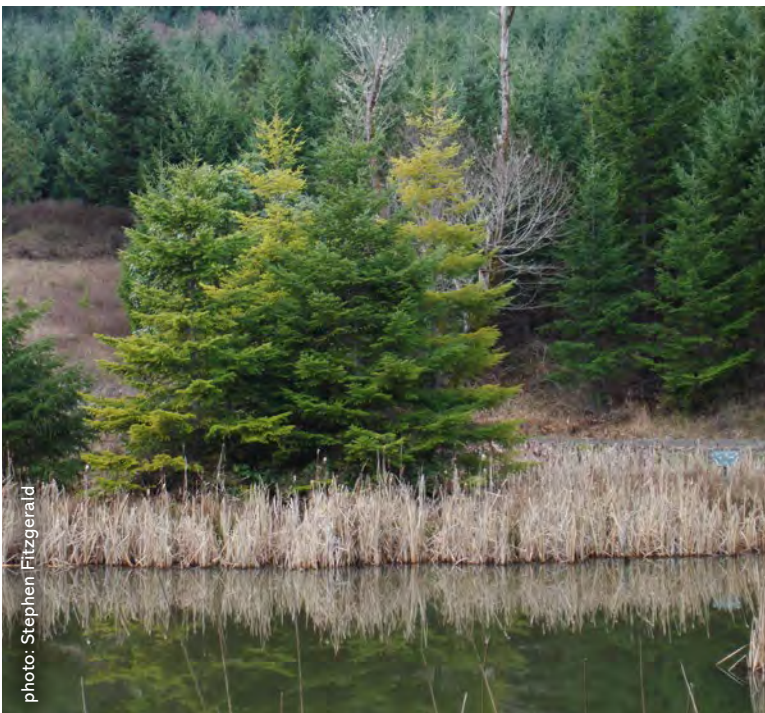


photo: Stephen Fitzgerald

Special care must be taken when planting trees on sites with high water tables.

3. Sunlight: Is the area open to full sun, or is it shaded by other plants for most or all of the day? Most trees like open areas, yet some will survive where shade is present.

4. Past vegetation:

- If an open area never had any trees and no stumps exist, it may not be well suited for growing trees.
- Take a closer look at the soil conditions to see if there are any factors that would limit or inhibit tree growth.
- Talk with neighbors or others who may know some of the history of the area. Did trees grow there at one time? What species grew well?
- Observe what species of trees seem to do well on similar properties near the area you want to plant.

5. Slope and aspect: Some tree species are better adapted to drier south-facing slopes, while others prefer cooler and moister north aspects. Choose trees adapted to warm, dry conditions for south-facing slopes, and those preferring cool, moist conditions for north aspects.

6. Soil: It's common for landowners to have a variety of soil types within a particular parcel. Researching your soils can help determine which sites will have characteristics that could limit planting success. Soils have been mapped for most parcels in western Oregon by the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service. This information is available on a county-by-county basis, indicates the forest productivity of each soil type, and suggests tree species commonly associated with each soil type (see your local NRCS office or use the online Web Soil Survey tool at websoilsurvey.nrcs.usda.gov).



Douglas-fir can tolerate only small amounts of shade.



This Willamette Valley property contains several different soil series (shown here by their series numbers).

Finally, remember that you'll want to plant trees that match your objectives for owning forestland and are capable of growing and thriving there. For example, if you're interested in a financial return through timber harvest, you may be best served by a plantation of Douglas-fir. Alternatively, if your interests lie more in providing habitat for a wide range of wildlife, you might consider planting a diverse mix of hardwoods and conifers. Your planting will be successful only when the species you choose match your desires as a landowner and the specific characteristics of the site.

Once you have a good feel for what the site conditions are, you can choose species that fit those sites. Below is a table showing tolerances of common native species to various site conditions. Listed along the top row are factors that impact how well trees will perform.

Growth: This gives you a feel for how tall a tree can grow each year in a good location. When you're planting, think ahead and allow room for your trees to grow. Too often landowners will plant more trees than the site can handle after only a few years.

Native ecoregions: These are the ecoregions in western Oregon where this species has historically grown.

- CFB** Coastal fog belt
- CR** Coast Range
- WV** Willamette Valley
- WC** West Cascades
- SW** Southwest Oregon

Low light: Most trees prefer full sunlight, and some won't be able to survive in a low-light environment. Trees with ratings of 4 or 5 will tolerate some shade, while trees with a 1 or 2 rating need full sun.

Animals: This relates to damage from big game such as deer and elk, which can eat and browse certain trees to the ground if hungry. If large animals are around,

Performance of major native tree species of western Oregon

SPECIES	Native Ecoregions	Growth*	TOLERANCE TO:**				
			Low Light	Animals	Wet Soil	Drought	Frost
CONIFERS							
Douglas-fir	All	3-4	2	2	2	3	4
Grand fir	All	3-4	4	4	3	2	3
Noble fir	CR, WC	1-2	2	3	1	2	4
W. hemlock	All	2-3	5	3	3	1	1
Sitka spruce	CFB	3-4	3	5	2	2	1
W. redcedar	All	2-3	5	1	4	1	2
Port-Orford-cedar	CFB, SW	2-3	4	2	4	1	2
Incense-cedar	SW, WC	1-2	2	3	2	5	3
Jeffrey pine	SW, WC	1-2	1	3	1	5	4
Knobcone pine	SW, WC	1-2	1	5	1	3	1
Ponderosa pine	WV, SW	2-3	1	4	5	5	5
Sugar pine	SW	2	2	4	2	2	4
W. white pine	SW	2-3	2	4	4	2	5
HARDWOODS							
Oregon white oak	WV, SW	0.5-1	1	4	4	5	5
Calif. black oak	SW	0.5-1	1	4	1	5	5
Bigleaf maple	All	2-3	4	1	3	3	5
Red alder	All	3-4	1	2	3	1	2
White alder	WV, SW	2-3	1	2	4	1	2
Black cottonwood	All	1-2	1	1	4	1	5
Oregon ash	All	1-3	3	2	5	2	5
Golden chinkapin	CR, SW	1-3	3	5	3	4	5
Pacific madrone	All	1-2	2	4	2	5	3
Oregon-myrtle	SW	1-2	4	4	5	3	5
Tanoak	CR, SW	0.5-1	4	5	2	3	3

* Height growth per year in feet of planted seedlings during good growing years. Resprouting hardwoods (especially California black oak, tanoak and Oregon-myrtle) could exhibit much faster height growth.

** Tolerance ranges from 1, which means species are very susceptible to this factor, to 5, which means species are not susceptible to this factor.

planting a species with a rating of 1 is like planting lunch if you don't protect the trees.

Wet soil: Almost all species prefer deep, well-drained soil. Trees need water, but not too much. On sites that seem to stay wet or soggy, look for species with 4 or 5 ratings. And if it's too wet or flooded for long periods, don't be surprised if no tree species thrive. Some areas are just destined to be wetland marshes.

Drought: Annual rainfall is variable from year to year, but also varies depending on where in the state you're located. If you're planting trees in a low-rainfall area with rocky soils, look for a species with a 4 or 5 rating.

Frost: Some areas are prone to spring frosts that may continually kill new growth on plants. Valley bottoms are particularly susceptible to this problem. Again, some trees (those with 4 or 5 ratings) may tolerate this factor better.

HOW WILL I PREPARE THE SITE FOR PLANTING?

Lacking a nearby seed source, planting trees is the only way to establish a forest. Natural regeneration and seeding will sometimes work, but the results are much less guaranteed than planting seedlings. Regardless of whether natural seeding or planting is selected, effective seedling establishment requires good site preparation.

Site preparation has three major objectives: reduce the amount of vegetation competing with seedlings; reduce habitat for animals that browse or girdle seedlings; and create planting sites. Be aware that you have several options, and that it's much easier to control competing vegetation before you plant seedlings.

Site preparation can be accomplished in a variety of ways, each with advantages and disadvantages. For example, a tractor or bulldozer is good for clearing excessive brush and slash, but can have the adverse effect of removing topsoil and compacting the soil; burning has many costs and restrictions and can be difficult to keep under control; hand-scalping is short-lived and expensive; mulch mats are expensive

and provide cover for rodents; and herbicides are often effective but can be expensive.

Use chemicals safely

- Read the label and follow the instructions. The label is the law!
- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use. Don't chew gum or smoke while using chemicals.
- Know your legal responsibility. You may be liable for injury or damage resulting from chemical use.

WHERE DO I GET SEEDLINGS?

A number of private tree nurseries can supply seedlings grown from the seed of parent trees native to the same elevation and geographical zone as your property (known as seed zones). Planting seedlings from the appropriate seed zone will ensure they will tolerate the climate and soil type on your property.



Seed zone maps for a variety of native tree species can be viewed in the Oregon Department of Forestry's "Sources of Native Forest Nursery Seedlings" guide, available at oregon.gov/odf/Working/Pages/Replanting.aspx.

The type of seedlings produced, referred to as stock-type, is a general indication of seedling size, age and root mass. Trees are started from seeds at a nursery and can be grown in greenhouse containers or outside in prepared beds for one, two or (rarely) three years.

Common seedling stock-types



Container

Grown for one year in a container, usually in a controlled environment such as a greenhouse. Good for dry, rocky sites because of abundant fine roots and easy planting. Not desirable where deer browse or competing vegetation will be severe. Also known as a “plug” seedling.



2-0

Grown for two years in an outdoor seedbed. Inexpensive bareroot option.



1-1

Grown for one year in a seedbed, transplanted to a wider spacing and then grown for another year. A bit larger than 2-0 seedlings at a slightly higher cost.



Plug-1

Grown for one year in a container, transplanted to a bed and then grown for another year. More resilient to deer browsing and competing brush.

Above is a table describing some of the stock-types commonly used in reforestation.

You should start contacting nurseries one to two years before the winter you want to plant, so you can reserve trees in advance. You can locate a commercial nursery

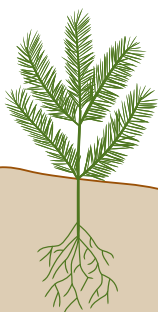
using the Oregon Department of Forestry’s “Sources of Native Forest Nursery Seedlings.” You can access this and other information about replanting at oregon.gov/odf/Working/Pages/Replanting.aspx.

It’s also possible to find surplus seedlings locally from timber companies and land management agencies. While quality seedlings can be acquired this way, you’ll often have to wait until the end of the planting season for these trees to be available. You’ll also want to confirm that the surplus seedlings are appropriate for your seed zone and elevation, and the stock-type is well suited for your specific site. Surplus seedlings can be located by asking around locally or checking the Forest Seedling Network, where nurseries and landowners list seedlings for sale, at forestseedlingnetwork.com.

HOW MANY TREES SHOULD I PLANT?

Before purchasing seedlings from a nursery, you first need to know what spacing you’ll use when you plant your seedlings. Commercial timber producers space trees according to species and projected thinning intervals. In western Oregon, Douglas-fir is commonly planted at 10 x 10 to 12 x 12 spacing (in feet). The table on the next page indicates the number of trees per acre that need to be ordered for the most common planting intervals utilized in western Oregon.

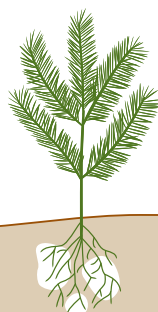
The right choice for your property will depend on some tradeoffs, your effort and maybe even a little bit of luck. If good spring planting conditions and effective management exist, a high survival rate is probable (80% seedling survival or better). In this situation, a 12 x 12 spacing will be adequate to provide a well-stocked stand, whereas a 10 x 10 spacing would require thinning earlier on in the stand’s life.



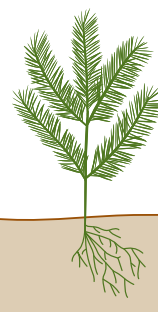
Too deep



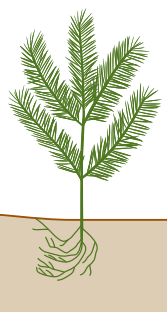
Too shallow



Air pockets



“L” rooted



“J” rooted

Spacing and number of trees per acre (TPA)

SPACING (FEET)	TREES PER ACRE
6 x 6	1,210
8 x 8	681
10 x 10	436
12 x 12	302
14 x 14	222

To calculate other spacing, use the following equation:

$$\text{TPA} = 43,560 \text{ sq.ft./per acre} \div \text{desired spacing sq.ft.}$$

Example: You want to space your trees out on a 12 ft. x 10 ft. grid.

$$43,560 \div 120 \text{ (12 ft. x 10 ft. spacing)} = 363 \text{ TPA}$$

On the other hand, if rough spring weather conditions and management challenges exist, you may experience a lower seedling survival rate. In this case, the 12 x 12 spacing may lead to the stand being severely understocked, making the 10 x 10 spacing more ideal to local conditions.

The planting pattern doesn't need to be a perfect square. Good planting spots – those free of competing vegetation and perhaps shaded if on a hot, south-facing slope – are more important than precise spacing. Planting more trees per acre is a hedge against potential losses to drought and animal damage. Higher planting densities will provide more thinning options, if that's part of your plan. Remember, trees compete with grasses and shrubs for light, moisture and nutrients when they're young. Higher planting densities can shorten the time it takes for your trees to dominate the other vegetation. However, trees will also compete with each other as they grow larger, so

Oregon Forest Practices Act

The Oregon Forest Practices Act sets standards for any commercial activity involving the establishment, management and harvesting of trees on Oregon's forestlands. The Act requires private, state, county and city landowners to notify the Oregon Department of Forestry prior to implementing a variety of forest management activities. There is no minimum property size exemption from the notification requirement.

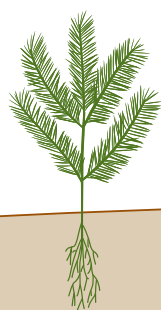
The following activities require notification:

- site preparation for reforestation
- applying chemicals and using petroleum products
- precommercial thinning
- harvesting
- slash disposal
- road construction

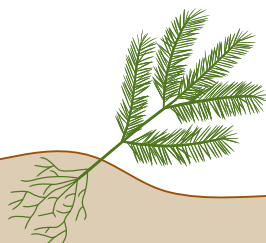
The following activities do not require notification:

- tree planting
- routine road maintenance
- personal-use firewood cutting
- collecting tree boughs, cones and similar minor forest products
- establishment, management and harvest of Christmas trees
- hardwood plantations harvested on rotations of 12 or fewer years
- agricultural tree crops, including nuts, fruits, seeds and nursery stock
- ornamental, street or park trees within an urbanized area

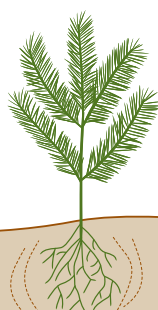
Notifications are filed online using the Oregon Department of Forestry's Forest Activity Electronic Reporting and Notification System (FERNS). Contact your nearest Oregon Department of Forestry stewardship forester for information. To find contact information for your local stewardship forester, visit KnowYourForest.org/assistance-map.



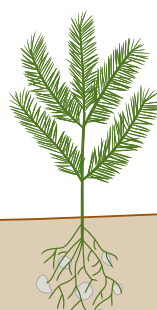
Compacted roots



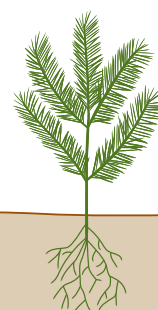
Not vertical



Too loose



Poor soil



Properly planted tree



A landowner planting a seedling.

denser plantings will require earlier and perhaps more frequent thinning to retain the necessary light, moisture and nutrient balance. In western Oregon, spacings of 10 x 10 to 12 x 12 are most common in commercial plantings of Douglas-fir.

HOW DO I PLANT MY TREES?

Once you've decided on species and spacing and have ordered seedlings, you can finally put some trees in the ground! Tree planting can be a do-it-yourself project, but remember that it can take an experienced

tree planter a full day of hard work to plant 500 trees. If you're planting a larger area, you may want to hire a crew to do the actual planting. If you do take on the task yourself, you'll want to follow these guidelines.

Timing: The best time to plant seedlings in western Oregon is from December through early March. Seedlings are dormant during these months and are better able to withstand handling and transplanting.

Temperature: Seedlings out of the ground are perishable and must remain cool (between 34°F and 40°F) and moist. They must be handled gently, kept out of direct sunlight and not allowed to freeze. Most of the larger forest landowners have large walk-in coolers to store seedlings before they're planted. You can keep smaller quantities cool by wrapping the planting bags in space blankets with blocks of ice and storing them in a cool, dark, well-ventilated place such as a garage.

Tools: Specially designed long-bladed shovels, spades, hoedads, dibbles and augers are used to plant seedlings. For smaller projects, a common gardening shovel will suffice, but for larger jobs consider purchasing or borrowing proper tree-planting tools.



Specialized tree-planting tools, from left: long-handled planting spade, hoedad, tree planting bag, short-handled planting spade.

Technique: Planting holes should be deep enough to accommodate roots without the roots being crammed into the hole. Gently tamp the soil with your boot to eliminate air pockets, but be careful not to compact the soil too much.

Protecting new plantings from competing vegetation and animals

Young trees are susceptible to the environment. They need care and protection until they're able to care for themselves. While seedlings may survive and grow with no intervention, your objectives are usually better served by helping the trees out a little, particularly

in the beginning. A modest investment of time and money can significantly increase seedling survival and growth compared to a more hands-off approach. In this section, we'll cover ways you can protect your trees from competing vegetation and animal damage.

VEGETATION CONTROL

Until the roots of the newly planted seedling are established in its new environment, a seedling is very vulnerable to competition from vegetation, especially grasses and invasive plants, which can retard growth and cause significant seedling mortality. During the annual summer drought, the grass will snatch and steal moisture from a newly planted seedling. This competition is a leading cause of seedling mortality and planting failure.

Experiments by Oregon State University researchers have demonstrated significant increases in tree seedling survival and growth by reducing vegetative competition up to about 10 feet in every direction from each planted tree. Such a large vegetation-free area around each seedling might be undesirable if your property is being managed for multiple objectives, such as wildlife habitat or recreation. Just be aware that the larger the area around the seedling kept free from competing vegetation, the greater the chance for seedling survival – and likely faster growth and greater stem height and volume. In general, reducing competing vegetation in a 4-foot circle (2-foot radius) around seedlings will improve survival.

The following are among several methods you can use to release your trees from competing vegetation.

Chemical control

A number of herbicides are registered for use in forests for site preparation or to release trees from competing vegetation. They can be applied from the ground or from the air to selectively control woody and non-woody plants. Backpack sprayers are commonly utilized for herbicide application. Used properly, herbicides can be the cheapest, safest and most effective way to control weeds and other unwanted competing vegetation.



Grasses, shrubs and resprouting hardwoods can compete with your planted seedlings for water, sunlight and nutrients.



This Douglas-fir seedling was sprayed too late in the spring, and buds were damaged. Herbicide label directions must be followed to ensure safe, effective results.



This row of grass was missed when spraying weeds with a tractor.



Commercially available mulch mats can reduce competition from non-woody plants.

For the proper application technique and chemical choice, see the current edition of the Pacific Northwest Weed Management Handbook at pnwhandbooks.org/weed. Always read and follow the herbicide label directions. The label is the law! Also note that chemical applications in forestry situations fall under the Oregon Forest Practices Act and require the landowner to notify the Oregon Department of Forestry when chemicals are used in both site preparation and in helping previously planted seedlings overcome vegetative competition.

Advantages:

- low cost
- ease of application
- long-term control is possible
- relatively safe

Disadvantages:

- need some technical knowledge
- herbicide use can be unpopular with some of the public

Manual control

Manually controlling weeds to relieve seedlings from competition can be an alternative to herbicides in environmentally sensitive areas or where chemical use is undesirable. Methods include cutting vegetation with a chainsaw or chopping, pulling or using a hoe to remove grasses and forbs from an area at least 4 feet square/circle around each seedling (2-foot radius).

Advantages:

- avoid possible negative environmental effects that some believe are associated with chemical use
- little skill or experience needed

Disadvantages:

- labor-intensive
- release may be short-lived as hardwood trees and shrubs vigorously resprout
- work can be hazardous, especially on steep terrain

Grazing

Grazing livestock such as sheep or cattle can help reduce competition from woody plants, but care must be taken to manage grazing intensity so they don't damage your planted trees.

Advantages:

- can be low in cost if you already own livestock
- safe, with little labor needed

Disadvantages:

- expensive if hiring a contract grazer
- need to fence areas and provide water and supplementary feed to manage animals
- strong potential for seedling damage

Mulching

Some landowners have tried mulching with straw, bark, plastic mulch mats or paper to suppress grass and other vegetation, to reduce competition with seedlings. It's usually quite expensive and labor-intensive, but it does help control

herbaceous weeds and grasses. In dry seasons, mulching can help retain spring soil moisture into the summer. Mulching won't control fast-growing hardwoods or stump sprouts.

Advantages:

- safer than manually removing unwanted vegetation
- no perceived negative effects as there are with herbicide use

Disadvantages:

- expensive and labor-intensive
- mulch can create habitat favorable to rodents, which cause seedling damage
- difficult to keep mulch in place on steep slopes and in windy conditions

ANIMAL DAMAGE CONTROL

Following planting, you may need to consider protecting seedlings from animal damage, particularly if large populations of deer, elk, voles, rabbits, gophers or mountain beavers are present. Animals can adversely affect tree survival, growth and form, especially in the first few years after planting.

Deer and elk will browse the new growth of seedlings until they grow out of reach. This browsing will result in stunted growth and a bushy-looking tree, perhaps with multiple tops. Deer and elk will also rub the stems of larger trees, which can strip off the bark and cause damage or tree mortality. Damage from deer and elk is usually greatest when these animals concentrate in an area, so providing hunting or other pressures can help reduce damage. Protective plastic tubes and deer-repellent sprays are also available. While both measures provide only temporary relief from browse, they may be sufficient to allow seedlings to grow tall enough to be safely out of reach of the animals.

Rodents such as voles, pocket gophers, mountain beavers and squirrels can all cause damage to small seedlings, usually by removing bark (girdling) or sometimes by clipping off the entire stem at ground level. Identifying the culprit in these cases can be difficult, so you might want to check with your local Oregon State University Extension forestry agent for help. Rodent damage can be prevented somewhat by using protective plastic tubes, but it is best to try reducing rodent populations by limiting the amount of quality habitat (grass) and maintaining a strong predator population. In extreme cases, gophers and mountain beavers can be controlled using bait and traps.



Rigid seedling protector tubes can provide some protection from deer and elk browse.



photo: Norma Kline

Above: Bears use their claws and teeth to remove or strip bark from the bole of a tree. Below: Squirrels can debark and girdle pole-sized trees.



Tending your trees

Some have interpreted the adage “It’s not nice to fool with Mother Nature” to mean trees don’t need to be managed, because nature will take care of them. While that may be true of ecosystems in wilderness areas, there are many factors that make this strategy a challenging one for small-acreage woodland owners in western Oregon. Large-scale insect and disease epidemics, wildfires and mass blowdown of trees might be acceptable conditions in a wilderness area, but they don’t meet the objectives for most small-acreage owners, particularly if a dwelling is involved.

Private forest landowners use a variety of management techniques to ensure their forests remain healthy and are able to achieve their intended objectives.

A healthy forest generally does not mean a forest without any death or damage to trees from insects, disease or animals. Tree death in the forest is a natural process, so it becomes a matter of managing the amount of death, rather than trying to prevent it altogether. Having some dead trees (snags) large enough to produce cavities for woodpeckers and other cavity-nesting birds is an important wildlife objective, and a good reason not to remove all trees that die. On the other hand, if an infestation of bark beetles begins to kill multiple trees, delaying or refusing to sanitize or salvage trees may allow the attack to spread, causing widespread mortality.

Deciding when to intervene and which tools to use is what foresters call “silviculture.” Silviculture is both a science and an art, and covers the management or treatment of forests from young to old while considering specific objectives. There are certainly scientific principles that can explain how trees and forests will respond to various treatments. Deciding when to apply which treatments and how to apply them depends as much upon landowner objectives as anything else. This forms the art of silviculture. You may need the help of a professional forester, and possibly a wildlife biologist, to better understand these dynamics in your forest.

THINNING

One of the most important tools used by forest landowners and managers is thinning. Thinning



Dead and dying trees often need to be removed when they pose a risk to people and property.

means removing some trees so the remaining trees get a bigger share of light, nutrients, water and growing space – resources that are necessary for trees to thrive and grow. As trees grow larger, they also require increased resources and therefore more space to stay healthy.

Many forest landowners often ask as their trees grow larger, “What’s the best spacing for my trees?” The answer is: It depends! It depends on the tree species, their size (diameter) and your personal forest management objectives.

There are several ways to determine the best density for different species, ages and sizes of trees, according to your personal management objectives. The most common way to determine optimal density is by using a stand density table. These tables come in several formats, but they all provide information about three interdependent factors: stand density, tree size and level of competition. These tables are used to guide management actions by estimating current levels or predicting future levels of one of these factors, based on the other two. To learn more about stand density tables and how to utilize them for different western Oregon tree species, read *Competition and Density in Woodland Stands (EM 9206)*, available for free download at <https://catalog.extension.oregonstate.edu/em9206>.

Long-term research regarding Douglas-fir growth and mortality shows there is a zone where the trees are utilizing most of the resources of the site but the competition between trees is not so intense as to cause

mortality. Based on this research and experience, foresters have developed the “D-plus” (D+) rule for spacing trees for thinning.

The D+ rule tells you that the average spacing (in feet) of trees left after a thinning is equal to the average diameter at breast height (DBH) of the trees in the stand (in inches) plus some constant. The constant is based on the tree size and species, and site productivity for a particular stand of trees. Make note that the average DBH (in inches) is expressed as feet in the D+ rule calculation.

To apply the D+ rule, obtain the average DBH of the trees in the stand (in inches). Expressed in feet, that average DBH becomes the “D” in “D+.” Next, choose the constant factor, a number typically between 1 and 8, selected according to the tree species, stand age and local site conditions. Add those two numbers, D plus the constant (such as D+5), to find your target spacing in feet.

When applying the D+ rule to thinning, it tells you the average spacing (in feet) of trees left after thinning to

allow for future growth, based on the size of the leave trees. For example, if you want the average diameter of trees left in a stand to be 12 inches DBH and you follow a D+5 rule, the average spacing of the remaining trees will be 17 feet.

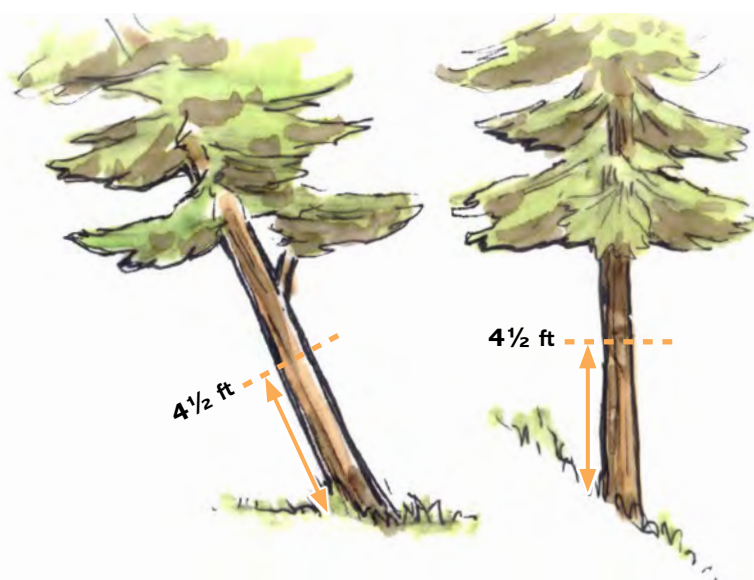
The D+ rule can also help you decide when to thin by using a smaller constant value. For example, if you have a stand of trees with an average of 12-foot spacing, and you apply a D+2 thinning guideline, you would need to thin by the time trees reach an average size of 10 inches DBH.

This does not mean the trees need to be perfectly spaced, as variation will exist in order to accommodate differences that exist in the stand (like tree vigor and quality, and original planting spacing). In western Oregon, it’s common for stands to be thinned following a D+4 or D+5 rule in early years when the trees are smaller, then followed up with heavier thinnings, such as D+6, in later years when the trees are larger. This is a rough guide only, and you should consult with your local Oregon Department of Forestry stewardship forester for specific guides used in your area.



A landowner measuring the DBH of a tree using a Woodland Stick.

Measuring trees with an angle or on slope



Diameter at breast height, or DBH, is the standard reference point for measuring the diameter of a tree. This measurement is taken 4.5 feet above the ground on the uphill side of the tree using a logger’s tape, Woodland Stick or any other instrument designed to convert circumference into diameter.

TENDING TREES



The stand on the left was planted at an 8 x 8 spacing and left untouched, while the stand on the right was thinned to a 12 x 12 spacing. Note the smaller diameter and increased mortality in the 8 x 8 stand. Trees in the 12 x 12 stand had room to grow and are consequently much healthier.

PRUNING

Pruning is another technique commonly used by forest landowners. Removing lower branches while the tree is growing into adulthood achieves several important objectives. Access to the forest is improved for hiking, grazing animals or other uses. Pruning also reduces the chance that fires will climb up into the crowns and develop into a crown fire. Finally, pruning can provide significant improvements in wood quality, particularly for high-value hardwood species such as walnut, alder and oak. Before you prune, make sure you understand the basic techniques and timing, because a poor pruning job can lead to stem decay and other problems. For more information, see catalog.extension.oregonstate.edu/ec1576.

FERTILIZING

Some forest landowners consider fertilizing their trees. Forest trees commonly have a mat of beneficial fungi on their roots, called mycorrhizae, that helps them extract nutrients and moisture from the soil much more efficiently than garden plants. Therefore, it is generally a rare situation where soils in western Oregon are so nutrient-poor that survival of planted trees is an issue. On some sites, particularly if they've been degraded by farming or other prior land uses, some nutrient additions may help. You'll need to get professional help sampling your soil and/or trees to assess the need for nutrient additions.



Pruning can provide improvements, but is a very labor-intensive process. Right: Ensure no damage to branch collar with proper pruning.

When trees need to be removed

Trees may need to be removed for a host of reasons. Tree diseases, danger of falling, harvest for potential income and creating room for expansion are common reasons. Based on your objectives, the situation or scale of the removal will also determine if it's going to be a large expense or an income-producing task.

The following is a checklist of items to consider if you wish or need to have trees removed. The focus here is on urban to “slightly rural” situations.

EXTENT OF REMOVAL: Is this a single tree that threatens to crash onto a house, or is it a five-acre thinning project? Within some city boundaries, any tree removal may need authorization of some sort, and this varies from city to city. Tree removal in the case of a harvest on rural property will be governed by the Oregon Department of Forestry (ODF), and you must file a “Notification of Operation” application with your local ODF office.

Why are permits needed? First, lumber mills need to receive a copy or reference to an Oregon Department of Forestry notification application with each load of logs they receive. This helps thwart timber theft, as each load can be traced to a landowner and location. Second, there may be a number of environmental protection concerns that need to be addressed before and during harvest.

PROPERTY LOCATION, JURISDICTION AND PERMITS: Is the property within a city or urban growth boundary, or is it rural? The regulations you follow will largely be determined by the extent of tree removal and the jurisdiction. If you're unsure of exactly how your property is classified, check with your county assessor or planning department. As a general guide, consider the following course of action:

- Find out if your property is within city, urban growth area or rural boundaries.
- Contact your local Oregon Department of Forestry stewardship forester to help determine which rules may apply to your situation. Within some cities and some urban growth areas, the Oregon Department of Forestry will have jurisdiction. The stewardship forester can provide information regarding who else should be contacted.



Professional loggers and arborists can fall trees safely and efficiently.

PROPERTY BOUNDARIES: Trees on one side of a property line often look exactly like those across a line. If you're unsure exactly where the property line runs and who owns which trees, a property survey performed by a licensed land surveyor may be justified. Tag or mark all property lines. If an outside party is removing the trees, make them aware of the marked boundary.



When you plan to remove trees near a property boundary, lines need to be clearly marked.

TAXES: Anytime there's money to be spent or made, taxes may be due. In the case of timber harvest revenue, a number of taxes may be possible. The names of these possible taxes are:

- Forest products harvest tax: This tax is paid on timber harvested from any land in Oregon. The first 25,000 board feet (MBF) is exempt.
- Property tax: If your property is in the Small Tract Forestland Option, you will pay a severance tax on harvested timber. This is a tax paid in exchange for a lower annual property tax, and is based on the volume of the harvested timber on a property in this tax program.
- Federal and state income taxes: Income and expenses incurred in tree harvests involve some unique tax treatments, including long-term capital gains, depletion, Section 631 and a host of other considerations. These are best understood before starting a logging operation or setting up a contract. It's a good idea to seek professional assistance beforehand, from a tax adviser and/or a professional forester.

FINDING HELP: Again, the situation will determine the type of help needed. If you need a hazard tree removed near a home, you need an arborist (see the certified arborist list at the International Society of

INSURANCE: The firm or individual you hire should have coverage for the types of risks encountered in the job. For example, when removing a hazard tree near a home, the insurance should cover any potential damage to the home, as well as injury to workers or people on the property. Loggers should carry a number of insurance policies, including a Loggers Broad Form policy.

OBTAINING BIDS AND REFERRALS: Prices and quality of work vary. As with any contractor you may hire, obtain multiple bids and ask for references. Memberships in professional associations and additional training can also provide some assurance of work quality. In the area of tree service, look for bonding and insurance notations, and professional designations such as "Certified Arborist," "National Arborist Association" or "International Society of Arboriculture."

- For loggers, you'll need to find someone interested in small jobs. Look for references such as "Certified Oregon Professional Logger" or "Associated Oregon Loggers." Having a contract in place that identifies the scope and cost of the project ahead of time is highly recommended.



Arboriculture). These are people with training and insurance to cover taking trees down, often piece by piece, near homes. If proximity to houses is not a factor, then a logging professional (see the Oregon Pro-Logger directory at Associated Oregon Loggers) is likely to be the person or organization to call.

Oregon Forest Industry Directory

Need to hire a logger? Arborist? Tree-planting contractor? Forester? Check out the Oregon Forest Industry Directory, a free online resource to help woodland owners find contact information for forestry service providers. There are a variety of ways to search for help, and the information can be narrowed down to your region or county.

Start your search at orforestdirectory.com.



How do I know what questions to ask when hiring a forestry professional?

For many forestry services, there are a lot of professionals available to help small woodland owners reach their goals. It can be overwhelming choosing the person or company that is the best fit for both the landowner and the job at hand. The publications listed below can help guide you when choosing a logger, tree-planting contractor, chemical applicator, consulting forester or accountant/tax preparer for your family forest. Use the questions provided in each publication to help guide your conversation and assist with your final decision when choosing a forestry service provider.

Available for download from catalog.extension.oregonstate.edu:

- Choosing the Right Service Provider for your Family Forest: Logging Contractor (EM 9170)
- Choosing the Right Tree-Planting Contractor for your Family Forest (EM 9201)
- Choosing the Right Service Provider for your Family Forest: Chemical Applicator (EM 9171)
- Choosing the Right Service Provider for your Family Forest: Consulting Forester (EM 9241)
- Choosing the Right Service Provider for your Family Forest: Accountant or Tax Preparer (EM 9169)



- Remember that trees can have significant value, especially if you're selling a large number of conifers or a particularly desirable hardwood such as black walnut. Make sure you seek out multiple bids from reputable operators to ensure that you're fairly compensated for high-value trees.

WRITTEN CONTRACTS: To avoid complications, it's important to have a signed and written contract with any forestry service provider who may work with you on your land. This includes loggers, arborists, chemical applicators, tree planters and consulting foresters. A well-written contract is enforceable and serves to protect both parties. Avoid oral or handshake agreements. For more information on contracts, and to see samples, download *Contracts for Woodland Owners* (EC 1192) at catalog.extension.oregonstate.edu/ec1192.

AFTER LOGGING: Logging and tree removal is messy. Trees have lots of branches, and the equipment used to remove and transport logs may be large. As you discuss your project with your contractor, make sure both of you are clear about the details of cleanup and removal of material. In many urban areas, burning the



When done safely, burning is an efficient way to dispose of logging debris. Check first to make sure burning is allowed in your area.

material may not be permitted, so you may be limited to chipping, grinding, removal or letting debris decay on-site. Removing slash is often required by the Oregon Department of Forestry to reduce fire hazards.

Where to get help

Once you decide to establish or manage trees, the question becomes where you can get the information and expertise necessary to complete the project. Oregon has a very good system available to help landowners who want to undertake forestry projects. Here are some sources of help to consider.

Consulting foresters

Consultants offer individual assistance and will act on your behalf for a fee. In addition to getting their names from your local Oregon State University Extension forestry agent or Oregon Department of Forestry stewardship forester, you can also locate them online. Their professional organization is the Association of Consulting Foresters. Information is available online at acf-foresters.org.

Oregon Department of Forestry

Stewardship foresters located throughout Oregon are available to assist forest landowners with technical forestry questions and provide planning assistance for woodland projects. Call your local state forestry office, or access information online at oregon.gov/ODF/Pages/index.aspx.

Oregon Small Woodlands Association

The Oregon Small Woodlands Association is a member-based association that represents small woodland owners in Oregon. This organization provides members opportunities to get together with others who have similar interests, and to collaborate on a variety of common issues. Information is available online at oswa.org/blog.

Oregon State University Extension Service — Forestry and Natural Resources

Offices in each county provide a variety of educational materials on forest tree establishment and management. Extension foresters and trained Master Woodland Manager volunteers offer frequent workshops and tours for woodland owners. You can phone your local county office, or access information online at extension.oregonstate.edu.

Oregon Tree Farm System

The Oregon Tree Farm System (OTFS) is the local chapter of the American Tree Farm System. OTFS administers the Tree Farm certification and Outstanding Tree Farmer of the Year programs for family forest landowners. Information is available online at otfs.org.

Oregon Forest Resources Institute (OFRI)

OFRI is dedicated to advancing public understanding of forests, forest management, forest products, and encouraging sound forestry through landowner education. OFRI's landowner education program offers a variety of publications, workshops, tours, webinars and resources. Find out more about Oregon forests at OregonForests.org.



Partnership for Forestry Education

KnowYourForest.org

KnowYourForest.org is a one-stop shop for information. In addition to contact information for the professionals and organizations mentioned, you'll also find videos, publications and instructions on a wide variety of forest topics. The website is hosted by the Partnership for Forestry Education, an innovative partnership of government, nonprofit and private organizations dedicated to providing educational resources to Oregon forest landowners, managers and operators. Learn more at KnowYourForest.org.





ABOUT THE OREGON FOREST RESOURCES INSTITUTE

The Oregon Legislature created the Oregon Forest Resources Institute (OFRI) in 1991 to advance public understanding of forests, forest management and forest products, and to encourage sound forestry through landowner education. A 13-member board of directors governs OFRI. It is funded by a portion of the forest products harvest tax.



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