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*Establishing  
& managing*  
**ponderosa pine**



*in the Willamette Valley*

**OREGON STATE UNIVERSITY**  

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**EXTENSION SERVICE**

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*Rick Fletcher examines a 2-year-old planting of Willamette Valley pine near Elkton, OR.*



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# An overview of Willamette Valley ponderosas

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Many people are surprised to learn that ponderosa pine (*Pinus ponderosa*), a common tree east of the Cascade Mountains, also is native to the Willamette Valley in western Oregon. No one is quite sure how ponderosa got into the Willamette Valley, but the local race is genetically different from those growing east of the Cascades.

This management guide will describe what is known about this unique race of ponderosa pine, how to establish, manage, and protect it on rural and urban sites in the Willamette Valley, and how to harvest and market ponderosa pine timber.



Figure 1.—An old-growth ponderosa pine logging operation near Lebanon, OR in 1912.

## History of ponderosa pine in the Willamette Valley

The year was 1852, and white settlement of the Willamette Valley was well underway. The town of Monroe was just getting its start with a new water-powered sawmill. The mill's records indicate that it cut ponderosa pine exclusively for several years until the supply ran out.

Other reports and studies of ponderosa pine in the Valley picture ponderosa in scattered pure stands or mixed in groves with Douglas-fir, ash, and oak. Two studies using pollen counts in deep cores from Valley bogs track pines' presence for the last 7,000 to 10,000 years. The hypothesis is that lodgepole was the dominant pine until about 7,000 years ago when a major climate shift removed lodgepole and brought in ponderosa. Pollen counts covering these 7,000 years indicate that ponderosa pine,

while widespread across the Valley, has never been the dominant vegetation type.

Undoubtedly there is some connection between indigenous peoples' practice of burning and the distribution of pine in the Valley at time of white settlement. Ponderosa pine is very common in other fire-impacted landscapes and is quite tolerant of ground fires, especially when the trees are mature. The frequent ground fires set by native peoples very likely resulted in the widely spaced groves of "yellow pines" (ponderosas), surrounded by grass prairie, which confronted early settlers.

Surveyors, botanists, and historians in the 1850s recorded yellow pines in oak woodlands, on areas subject to flooding, and on foothill slopes and ridges where they were widely spaced and mixed with oak and Douglas-fir. These open stands have been called savannahs.



Figure 2.—Old-growth ponderosa pine on private forestland near Brownsville, OR.

Willamette Valley ponderosa's genetic difference from ponderosa east of the Cascades was the focus of a pine-race study begun in 1928 by Thornton Munger and T.J. Starker. The study featured seed sources from throughout the western United States, planted on six field sites. Included were seven sources east of the Cascades and three westside sources. The latter included Peoria (south of Corvallis, along the Willamette River); El Dorado, California, in the Sierras south of Sacramento; and Steilacoom, Washington, near Olympia.

The latest measurement of the study, completed by Roy Silen, found that after 65 years, only the westside sources were still alive and actively growing at the Willamette Valley test site on McDonald Forest, near Corvallis. Trees from eastside sources all appeared poorly adapted for the weather and pest conditions in the Willamette Valley. The bottom line is that one should not plant ponderosa pine trees from eastside seed sources in the Willamette Valley. While the trees may survive 15 to 20 years, they aren't likely to reach mature size and may become carriers for all sorts of pine pests.

Another lesson from the Willamette Valley test site is that even the trees from westside sources that were still living were not doing very well. This might be expected because the McDonald Forest site was not on a soil and exposure common for pine in the Willamette Valley.

Concern about the dwindling supply of native Willamette Valley ponderosa pines, and the realization that the local source could not be replaced with eastside sources, led to the formation of the Willamette Valley Ponderosa Pine Conservation Association, in 1996.

A group of local foresters, landowners, and scientists had been studying the local pines for 15 years and had begun propagating local parent sources. The Association seeks to further this work in restoring ponderosa pine to the Willamette Valley through research, education, and increased availability of seed from the local race of pines. To date, more than 900 native stands have been mapped, and about 150 individual sources have been grafted into a seed orchard near St. Paul, Oregon.

The Association's work will be complete when landowners can buy native planting stock readily and when research has shown how best to plant and grow this tree.



Figure 3.—Principals in the Willamette Valley Ponderosa Pine Conservation Association admire the Robert H. Mealey gene conservation planting of Willamette Valley ponderosas at the State of Oregon seed orchard near St. Paul, OR.

## Ponderosa pine growing sites in the Willamette Valley

Ponderosas grow on a wide variety of both rural and urban sites throughout the Willamette Valley. Native groves are in Beaverton, in parks and on the grounds of such prominent businesses as Nike. Scattered trees and small groves are found on neglected bottomland farm sites the whole length of the Valley. Along riverbanks, it often is associated with black cottonwood, ash, or bigleaf maple. In the foothills, ponderosas occupy the harshest of forest sites, where Douglas-fir and other species cannot dominate. On sites suitable for other conifers, ponderosa may grow for some time but eventually is shaded out by the taller, more dominant species. Commonly, ponderosas are found in association with Oregon white oak and many times in thick patches of poison-oak.

Native ponderosas are commonly found on three general soil types:

1. Poorly drained, heavy clay soils on the Valley bottom or in the low foothills
2. Shallow, rocky clay soils in the Valley foothills
3. Well-drained, sandy soils in the flood plain of the Willamette River and its tributaries

These soil types represent the low end of growth potential for ponderosa pine. It grows better on soils with good drainage and depth.

## Benefits of planting Valley ponderosa pine

Willamette Valley ponderosa pine plantings can meet a number of objectives that include producing valuable wood, filling the need for a stately conifer in an urban setting, and restoring woodland and riparian habitat.

### Wood production

Wood from Willamette Valley ponderosa pine was an important building material for the settlers in the Valley in the 1840s and 1850s. Next to Douglas-fir, ponderosa pine has been the most widely used species



Figure 4.—Ponderosa pine replaces Douglas-fir on a typical, wet Willamette Valley site.

for wood products in Oregon during the past 150 years. Most of it has come from eastern and southern Oregon; however, new plantings in the Willamette Valley have the potential to once again fuel a ponderosa-pine-based wood industry later in this century. Excellent growth rates and good wood quality will make maturing plantings in the Willamette Valley an attractive option for wood purchasers in the future.

### Ornamental trees

Most native conifers in the Willamette Valley are poorly suited to urban uses. Not so, however, with ponderosa pine. Its deep rooting structure, tolerance of drought and



Figure 5.—Ten-year-old Valley ponderosa agro-forest on Rising Oak Ranch near Lebanon, OR. Spacing is 9 feet between trees and 18 feet between rows.

flooding, and stately form make it an ideal choice for parks, schools, factories, and other urban locations where a large conifer is desired. Many fine specimens are in urban areas such as Eugene (Figure 6) and Beaverton.

### Habitat restoration

Habitat restoration is the order of the day for streams, rivers, and oak savannahs throughout the Willamette Valley.

Ponderosa grew historically in much of this habitat, so it is only natural that it would be a key species to reestablish. On the dry knobs and prairies, ponderosa is being intermingled with oaks and firs. In riparian areas or wet clay soils, it is planted alone or mixed with ash, maple, oak, and cottonwood.

One of the main features it offers for these habitat plantings is a long-lived conifer that will provide nesting, shade, and other habitat features while living and large woody debris for a healthy riparian system after it dies.



*Figure 6.—Mature ponderosa pines thrive on city streets in Eugene, OR.*



*Figure 7.—Ponderosa pine planted in a riparian restoration project near Brownsville, OR.*

# Managing a new ponderosa pine plantation

H. Dew and B. Kelpsas

Attention to the details of site preparation, stock type selection, and plantation maintenance is probably more critical in establishing Valley ponderosa pine than any other species planted west of the Cascades. This is because of the tough sites that ponderosa pine is expected to occupy.

No other tree is asked to survive and grow in conditions as adverse as these. From rocky, dry, and poison-oak-infested south slopes to marshy, heavy clay that cracks wide open in summer, sites that won't grow another commercial tree are typically where this durable species is planted.

For more information on site preparation and general reforestation topics, refer to OSU Extension publications EC 1188, "Site Preparation: An Introduction for Woodland Owners"; EC 1498, "Successful Reforestation: An Overview"; EC 1504, "The Care and Planting of Tree Seedlings on Your Woodland"; EC 1196, "Selecting and Buying Quality Seedlings"; and PNW 33, "Plant Your Trees Right" (see page 39).

## Site selection

Many times the search is for a tree that will grow on a site where a planting has already failed. It is true that ponderosa pine will grow in a flood-prone area, but is this really the place to grow trees at all? Often, the best sites are reserved for more profitable species such as Douglas-fir or western redcedar, as well they should be, but ponderosa will do very well on some good sites and may be the best choice for them. If you have questions about your site's suitability for growing ponderosa pine, contact your local office of the OSU Extension Service or Oregon Department of Forestry.



Figure 8.—Pine shelterwood unit near Brownsville, OR, cleared of debris and ready for planting.

## Site preparation

Site preparation is the most important step in reforestation with any species. Improper site preparation results in poor growth and a much higher risk of plantation failure. More tree-planting failures can be attributed to poor site preparation than to any other cause.

At the very least, make sure the site is free of weeds and grass for the first few years. Competing vegetation places moisture stress on newly planted trees with poorly established roots and is a primary cause of plantation failure. Whether you use herbicides, mulch mats, or hoeing, you must control vegetation to ensure the seedlings' survival and growth. An adequate

Figure 9.—One-year-old container seedling at Kintigh's Nursery, Springfield, OR.



weed-free space around each tree generally is thought to be a radius of about 2 to 3 feet for the first 3 years.

The secondary cause of plantation failure is girdling damage caused by rodents that use the grass for cover (see Chapter 7). Vegetation control is the best way to prevent rodent damage.

### Site preparation sprays

The best feature of site preparation sprays compared to herbicide applications after planting is that they involve little risk to seedlings you will plant later. You also have more flexibility in timing sprays when weather is favorable.

In applying any herbicide, follow the instructions on the label regardless of what is said elsewhere, including in this publication. The herbicide label is the legal guide to how that chemical may be used. Also, you must notify the Oregon Department of Forestry any time you plan to apply an

herbicide on forestland, and you might also have to be licensed by the Oregon Department of Agriculture. In addition, you must report any pesticide use on your forestland annually to the Oregon Department of Forestry.

Table 1 lists the most common herbicides used for site preparation in ponderosa plantings.

Glyphosate and products like imazapyr work well on most species but are weaker on blackberries. Products such as metsulfuron and triclopyr often are added to spray mixes to improve blackberry control. These commonly are applied in midsummer or fall before planting. Evergreen weed species such as Scotch broom, snowbrush, manzanita, and madrone are best treated with triclopyr, imazapyr, or 2,4-D from spring through summer.

Herbaceous weeds also can be controlled for the following growing season by adding sulfometuron to the fall site-preparation mix. Pine seedlings planted the following spring can develop in relatively weed-free environments. Table 1 gives more detail on target vegetation.

### Planting considerations

The two stock types are containerized and bareroot. Both come in many different sizes; generally, the biggest are best. Containerized seedlings have many advantages. One of the best is that timed-release fertilizer can be incorporated into the planting medium to give the tree a boost the first year after planting. This is a great benefit on some of the poor sites where ponderosa is expected to grow. Also, containerized trees generally are easy to plant and suffer less transplant shock than bareroot seedlings.

The disadvantages to using containerized trees are (a) their high cost relative to size and (b) the seedlings' vulnerability to animal browsing, because they tend to have more lush growth. Sometimes container seedlings must have tubelike tree protectors, which can be as expensive as the seedlings to purchase and install.

Bareroot seedlings can be cheaper to purchase, but are often hard to find due

**Table 1. Forest herbicides and target vegetation for site preparation**

Chemical name	Target vegetation
glyphosate	Deciduous brush, grasses, forbs, bracken fern
imazapyr	Maples, madrone, deciduous brush and trees
atrazine	Annual grasses, grass and forb germinants
2,4-D	Alder, madrone, manzanita, thistles, and forbs
metsulfuron	Blackberries ( <i>Rubus</i> spp.), ferns, deciduous brush
triclopyr	Blackberries, Scotch broom, evergreen brush
sulfometuron	Grasses and forbs; suppresses blackberries
clopyralid	Thistles, some forbs, elderberry
hexazinone	Established grasses and forbs



to the current shortages of seed and the unwillingness of many purchasers to wait two seasons for their seedlings versus one for container seedlings.

Seed sources are particularly important. Be sure to ask whether the parent seed was truly Willamette Valley ponderosa pine seed. Seed from eastside sources will not grow well on the westside, as many plantations have proved.

Whether the seed comes from the north or the south Valley doesn't seem to make a large difference. Getting a source that is close to your plantation site is, however, highly desirable.

Until the Willamette Valley ponderosa pine seed orchard at St. Paul begins to produce seed, infrequent wild crops are still the only source for local nurseries, so seedling availability may be an issue for the next 5 years or so. When the orchard begins to produce seed, it will be the best available.

### Use pesticides safely!

- **Wear** protective clothing and safety devices as recommended on the label. **Bathe or shower** after each use.
- **Read the pesticide label**—even if you've used the pesticide before. Precisely follow label instructions (and any other instructions you have).
- **Be cautious** when you apply pesticides. Know your legal responsibilities as a pesticide applicator. **You may be liable** for injury or damage resulting from your pesticide use.



*Figure 10.—Mixed plantings of ponderosa pine and Douglas-fir might be a good idea on sites where there is a question about which species is better suited.*

Plantation spacing depends on management goals. Plant in a way that gives you the most flexibility for future management decisions:

- Will you manage for an uneven-age or an even-age stand?
- Do you want a mixed-species stand?
- What is the site's carrying capacity?
- Will the stand be thinned later?

Discuss these questions with your OSU Extension forester or a forestry consultant *before* planting. Common spacing for newly planted ponderosa pine plantings is about 10 to 12 feet apart.

### Vegetation management around newly planted ponderosa pines

No matter which type of stock you choose to plant, controlling competing vegetation around newly planted trees is essential for good survival and growth. Strategies to manage competing vegetation involve physical removal through scalping or tilling, treated paper or other mats that smother competing weeds, and herbicides. For more information on weed control, refer to the current edition of the "Pacific Northwest Weed Management Handbook" (see page 39).



Figure 11.—  
Blackberry  
competition has left  
this ponderosa pine  
seedling deformed and  
weak.

Scalping or tilling to control vegetation can be effective if you are persistent and if you remove the vegetation in a way that does not damage the tree seedlings' tops or roots.

Scalping works best before the trees are planted. Tillage can work before planting and up until the tree roots begin to invade the scalped area.

One disadvantage of tillage is that it tends to leave competing weeds closest to the trees. Treated paper or other mats can be effective around newly planted trees if

they are properly installed and maintained. Their main drawbacks are high cost and the fact that they sometimes provide cover for mice, which will girdle the young trees.

Ponderosa pine is more sensitive than Douglas-fir to many herbicides used in forestry. In addition, various surfactants

and oils that are added to spray mixtures can increase the risk of pine damage.

Take care when using herbicides over seedlings, to avoid injury or death. In many cases, vegetation management around pine involves balancing seedling injury with weed control.

Two spraying strategies for controlling weeds around newly planted ponderosas are:

- Directed spraying, and
- Broadcast release applications

### Directed spraying

Directed spraying uses herbicides in a spray directed around seedlings but not contacting them. Spot spraying with backpack sprayers is an example. Using a spray shield is another technique. The risk of injury is limited to seedlings that are sprayed or are overdosed through the soil. This method also allows you to use non-selective herbicides and a much wider effective spraying window of time.

Herbaceous weeds can be controlled effectively at any time with spot applications of glyphosate around seedlings. Since glyphosate has no soil activity, overdosing through the root system is not a risk. Often, glyphosate can be mixed with soil-active herbicides to give longer lasting pre-emergent activity. Using this treatment with spring residual soil-active products such as sulfometuron, atrazine, or hexazinone requires precise sprayer calibration and application in order to avoid damaging seedlings through the soil. Be very careful to keep glyphosate off the foliage, however; it is toxic to the plant.

Blackberries and Scotch broom are often problems on Valley sites. Both are treated effectively with directed foliar spot applications of triclopyr. Unfortunately, pine is extremely sensitive to any triclopyr spray drift, and triclopyr ester is volatile at warmer temperatures, so take care.

Blackberries are best treated in fall after conifer budset. Scotch broom can be treated any time during the growing season, but applications before conifer budbreak or after budset in the fall may be safer for trees.

**Table 2. Common forest herbicides and Valley pine tolerance for release applications**

Chemical name	Pine tolerance <sup>1</sup>	Use over pine?
atrazine	excellent	yes
imazapyr	marginal <sup>2</sup>	site prep only
metsulfuron	poor	site prep only
triclopyr	poor	no – only as directed spray
2,4-D	poor to fair	possible but risky
sulfometuron	good	yes
glyphosate <sup>3</sup>	fair to good	yes
clopyralid	excellent	yes
hexazinone	excellent	yes

<sup>1</sup> Herbicide injury is variable and is highly dependent on rate, timing, and tree condition.

<sup>2</sup> Imazapyr products can reduce shoot growth the next growing season.

<sup>3</sup> Some glyphosate products contain surfactant, which increases the risk of damaging pine.

Other evergreen species such as madrone, manzanita, and snowbrush also can be treated with a directed spray of triclopyr, 2,4-D, or imazapyr. However, these products can damage pine and should be used only as a site preparation or spot treatment. Larger weeds that cannot be efficiently controlled with a foliar spray from a backpack unit may be treated individually with a basal-bark application of triclopyr in an oil carrier.

Deciduous plants such as poison-oak, deerbrush, hazel, and bracken fern are sensitive to mid- to late summer foliar applications of glyphosate and/or imazapyr in water. Avoid spraying over pine, even though it has some tolerance to glyphosate (see the section on broadcast release applications, below). Maples and other hardwoods or brush often can be treated with a hack-and-squirt application using imazapyr, glyphosate, or triclopyr amine.

### Broadcast release applications

Another strategy for vegetation control uses herbicides selectively over seedlings in a calibrated broadcast treatment. Application methods include helicopter, backpack waving wand, meter jet, and backpack with flat-fan spray tips.

This strategy might give the most complete weed control, but it also carries the greatest risk of damaging pine seedlings. In addition, not all herbicides can be used selectively over pine. Table 2 shows pine tolerance to foliar-applied herbicides.

Broadcast release treatments for herbaceous weeds can be made selectively over newly planted or established pine with atrazine, sulfometuron, or hexazinone in spring before conifer budbreak.

Atrazine is least likely to injure pine but also has limited ability to control established vegetation. Ponderosa pine is extremely tolerant to hexazinone, which is a good choice on sites that have perennial grasses and forbs. Sulfometuron gives intermediate vegetation control; higher rates can affect seedling development temporarily on some sites.

Tank-mixes of these herbicides are effective and can help reduce per-acre costs. Note that all these products are soil active, so

precise calibration is important to avoid overdosing seedlings.

Glyphosate products that contain no surfactant can be applied at reduced rates in spring before budbreak over established (second-year) seedlings. In western Oregon, sulfometuron also can be used over pine in spring or fall to suppress blackberries. Mixtures of sulfometuron and glyphosate as fall blackberry treatments may be a reasonable substitute for damaging triclopyr applications.

Thistles and some broadleaf plants are sensitive to clopyralid. Applications can be made at any time because clopyralid has little activity on pine or other conifers at any growth stage. Clopyralid has been a good addition to atrazine, sulfometuron, or hexazinone during spring weed control programs and makes a good substitute for the more injurious 2,4-D.



Figures 12a and 12b—A newly established ponderosa pine plantation near Lebanon, OR (top) and after five growing seasons (above).

Release applications of 2,4-D over pine have been made but usually cause some injury. Damage can range from mild to severe depending on weather, seedling growth stage, and spray adjuvants, among other variables.

Avoid adding oils or surfactants to spray mixes to improve selectivity. Spring treatments target madrone, manzanita, alder, and forbs. Since 2,4-D is the only herbicide for broadcast release pine programs on evergreen brush, some conifer injury may be acceptable. Applications in early spring before candle elongation or in fall after budset can help reduce risk of injury.

Unlike evergreen brush, deciduous brush species such as poison-oak, hazel, and deerbrush often are treated selectively over pine with glyphosate products. Typical release treatments are timed after budset in late summer or fall to reduce risk of damage.

Conifers still can be injured, however, especially if a surfactant is added or is in the formulation. The type of surfactant used with glyphosate over pine can have a very large impact on damage. Carefully screen new surfactant additions in small trials before using them in a full program. You also might want to consult with someone in the agricultural pesticides industry for recommendations on surfactants.

Because Valley sites often contain numerous plant competitors, no one herbicide will do the job in all cases. Combinations of these strategies probably will be the most effective on vegetation and least injurious to pines. Herbicide labels change frequently, so read and carefully follow the label on the product in hand.