Introduction to Conifer Release

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On sites recently reforested after a timber harvest, competing plants grow quickly. Competition for essential growth elements—sunlight, moisture, and nutrients—often depresses the vigor and survival of the desired crop trees. Competition comes from grasses, broadleaf weeds (called forbs), shrubs, or less valuable tree species.

Effective site preparation before reforesting can do much to slow the reinvasion of forest weeds (see *Successful Reforestation: An Overview*, EC 1498-E). However, follow-up vegetation control often is required. This practice commonly is referred to as **plantation release**.

This publication helps you evaluate when a conifer plantation release is needed and describes basic release treatments.

When is plantation release needed?

The level and degree of competition in forest plantations can change in just 1 or 2 years. Problems with competing vegetation often can be minimized if you detect them early and take care of them promptly.

To anticipate release needs, it's important to evaluate which brush species are on the site before the harvest. You'll want to know how the brush reacts to disturbances and to increases in light, moisture, and nutrients.

After reforestation, inspect your plantation at least twice a year. In winter, it's easy to inspect the number and condition of planted seedlings because grasses, forbs, and other vegetation are at their lowest levels. However, competition from deciduous weed species can be deceiving in winter, so it's important to visit your plantation in the summer, too, when foliage is completely leafed out. Then, you can evaluate the level of competition during the period of most rapid growth. Table 1 lists some common forest competitors.

Table 1. Common forest competitors

	Western Oregon		Eastern Oregon
Grasses and forbs	grasses thistle brackenfern	fireweed foxglove sword fern	grasses (especially sod-forming species)
Woody shrubs	salmonberry elderberry evergreen huckleberry manzanita oceanspray vine maple Scotch broom	thimbleberry salal Ceanothus hazel cascara poison-oak Himalayan blackberry	mountain-mahogany Ceanothus bitterbrush manzanita mountain maple willow
Trees	alder bigleaf maple	tanoak madrone	juniper live-oak

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Consider release treatment if one or more of these statements is true for your plantation.

a. Undesirable vegetation is taller than the planted seedlings, and the shade it creates has reduced the seedlings' current (or recent year's) growth. (To determine this, look at the crop trees' relative amount of height growth for each recent year. Then check the leader length and the distance between annual branch whorls.)

b. The crowns (branch spread) of undesirable vegetation are touching and crowding the crowns of planted conifer seedlings, causing the conifer seedlings' foliage to look sparse or unhealthy. East of the Cascades and on all but the moistest westside sites, grasses and forbs compete heavily for moisture and nutrients. Sparse foliage on planted seedlings usually indicates that they are losing the competitive struggle for space, sunlight, moisture, and nutrients. Healthy foliage is essential for rapid growth. This is where the plant's food is manufactured through the process of photosynthesis.

c. Dense grasses and forbs are creating a favorable habitat for seedling-eating animals such as mice, moles, mountain beaver, rabbits, or pocket gophers.

The combination of overtopping, competition for moisture, and animal damage can cause substantial mortality (see Figures 1 and 2.) If your plantation shows any of these conditions—or a combination of them—it's prudent to consider a plantation release treatment to protect your reforestation investment.

Photo by Eric Dinger, © Oregon State University

Figure 1. Grasses compete aggressively with planted conifers for moisture.

Photo by Eric Dinger, © Oregon State University

Figure 2. Three-year-old seedling stunted by overtopping shrubs.

Competition from grasses and forbs

We often think of western Oregon and Washington as having a wet climate with more than enough moisture for tree growth. However, summer is quite dry most years, and drought periods are common.

During the summer, competition for nutrients and moisture can become critical for newly established conifers. Moisture competition from grasses and forbs can affect growth and, ultimately, survival.

This is even more important on south-facing slopes, on sites with shallow soils, or when you plant in old fields, where well-established grass competes for moisture.

Many studies in Oregon confirm that survival and growth are improved by controlling competing grass vegetation. A southwest Oregon study showed second-year tree survival was from 0 to 22 percent with no grass control. In contrast, survival in areas with grass control was 98 percent. In locations with more rain, differences may not be quite as dramatic, but it's important not to underestimate the potential negative effect of competition from grasses and forbs.

East of the Cascades, where rainfall is generally less, competition for moisture becomes even more critical. Many eastside grasses and forbs germinate in fall and winter as small plants. Early in spring, their roots begin to grow while the soil temperature is still too cold for conifer root growth.

Grasses' competitive nature can be hard to appreciate at first, since up to 85 percent of their total mass is below ground. This gives the grasses an advantage—they can use up available moisture and nutrients early in the season, before the more slowly growing conifer seedlings can establish adequate roots.

Grass control methods

Newly established seedlings can be released from grass and weed competition by applying herbicides from an aircraft or backpack sprayer. However, if you work in hardwood plantations, be careful—hardwood species are more susceptible than conifers to some herbicides.

Hand scalping (physically removing the grass from around individual seedlings) can be done on a limited scale; however, you might need to repeat the treatment in the same year and in subsequent years.

The effectiveness of scalping is directly related to the size of the scalped area around each seedling. Scalps less than 3 feet in diameter aren't effective. Placing paper mulch around each seedling after scalping can slow the reestablishment of grasses and forbs.

Competition from woody shrubs

Shrub species often are both abundant seeders and aggressive sprouters. Increases in water, nutrients, and sunlight after harvest or other site disturbance promote their rapid development. Species that were in the stand before harvest—but appeared to be minor components—can occupy the site completely in 1 to 2 years. They are particularly effective competing with the slower-growing conifer seedlings.

Salmonberry and thimbleberry are examples of westside brush species that are aggressive sprouters. A dense stand of salmonberry has several miles of rhizomes beneath the ground and has hundreds of thousands of active buds that can sprout readily.

Ceanothus, manzanita, and Scotch broom are examples of species with hard-coated, long-lived seeds that are stored in soil and triggered to germinate after fire. Many woody shrub species can grow 10 to 15 feet tall or even taller. If they compete with seedlings or overtop them, the plantation can fail or lose a great deal of growth, requiring a release treatment.

Manzanita and bitterbrush are examples of eastside shrub competitors. These have vigorous root growth early in the season that allows them to capture moisture better than the more slowly developing conifers. Even when survival isn't endangered, competition from these shrubs can reduce conifers' height and diameter.

Competition from lower-value hardwoods

Most hardwood species native to western Oregon grow rapidly when young. Red alder is a prolific seeder and can grow as much as 1 to 3 feet or more in the first year. Bigleaf maple, tanoak, and madrone have extensive root systems and, when cut, sprout readily. Their sprout clumps can quickly occupy the site and overtop the slower growing conifers.

Different species of conifers have varying tolerances for shade (see Table 2, page 4). Consider this factor when you assess the need and degree of conifer release treatment. Early and thorough release is more critical for shade-intolerant species such as ponderosa pine, western larch, or westside Douglas-fir. More shade-tolerant species (grand fir, western hemlock, and eastside Douglas-fir) are better able to compete and grow in partially overtopping vegetation. If overtopping is severe, release treatment likely will be necessary, even with shade-tolerant species.

Table 2.—Shade tolerance of major conifer species

Westside		Eastside
western hemlock	Tolerant	Englemann spruce
western redcedar	↑	white fir
Sitka spruce	↕	grand fir
grand fir	↕	Douglas-fir
noble fir	↕	ponderosa pine
Douglas-fir	↕	lodgepole pine
incense-cedar	Intolerant	larch

Free to grow

Planted conifer seedlings require a year or two to establish their root systems. During this time of root system establishment, height growth is relatively slow. In contrast, shrubs and hardwoods often have rapid height growth right from the start, especially if they sprouted from stumps. Grasses, forbs, and shrubs also can compete aggressively for limited moisture and nutrients.

Foresters rate a plantation as "free to grow" when the crop trees reach the stage in which they can dominate the site and grow to maturity without further help. Figures 3a and 3b illustrate the free-to-grow concept.

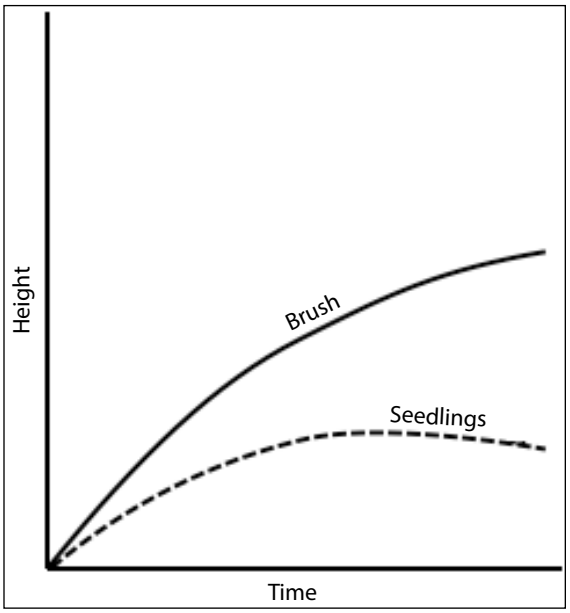

Figure 3a. No release.

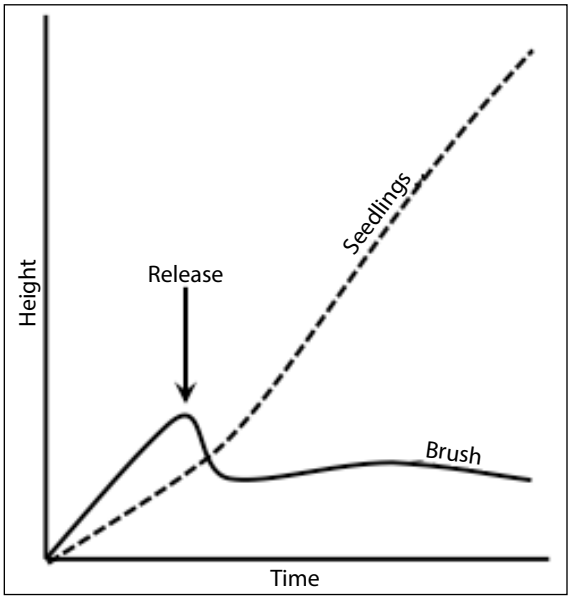

Figure 3b. With release treatment.

Release methods

Chemical control

Herbicides are commonly used to control competing vegetation in forest plantations. Herbicides including 2,4-D, triclopyr, imazapyr, hexazinone, glyphosate, and others can be used to selectively control targeted weed species when applied at the proper rate and season.

Common application methods include aerial application from a helicopter (Figure 4, page 5) and ground application using a backpack sprayer (Figure 5, page 5) or tractor-mounted sprayer. Depending on the chemical you use and the species involved, foliar treatments may be made during mid- to late summer or during the dormant season in early spring before conifer budbreak.

You can treat individual hardwood stems by the hack-and-squirt, cut-stump, basal, or thinline basal bark method using triclopyr, imazapyr, or 2,4-D.

Photo by Eric Dinger, © Oregon State University

Figure 4. Helicopters allow for precision application of herbicide over rough terrain.

Photo by Bill Schroeder, Professional Reforestation of Oregon Inc

Figure 5. Backpack sprayers can be used for broadcast or targeted spraying of competing vegetation.

For proper application method and chemical selection, see the current edition of the *Pacific Northwest Weed Management Handbook*. Always read and follow label directions.

Advantages of chemical control:

- Cost-effectiveness
- Ease of application for knowledgeable, experienced applicators

Disadvantages:

- Need for technical knowledge
- Applicator must be licensed to buy and use certain chemicals in some cases
- Use of herbicides often unpopular with neighbors and the public

Use herbicides 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. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

Manual control

Manually controlling weeds to release seedlings from competition is an alternative to herbicides in environmentally sensitive areas or when growers choose not to use chemicals. Methods include cutting with a chain saw or brush cutter, or chopping, pulling, or using a hoe to remove grasses and forbs from an area at least 3 feet square around each seedling.

Advantage of manual methods:

- Can be effective

Disadvantages:

- Typically labor intensive and time consuming
- Effects often short-lived, especially for sprouting hardwoods
- Costs of high labor demands and the need to re-treat

Mulching

Growers have tried mulching with straw, bark, or paper (Figure 6, page 6) as a way to release seedlings from grass competition. It can be expensive, but it does help control herbaceous weeds and grasses. In dry seasons, mulching can help retain spring soil moisture into the summer.

Advantages of mulching:

- Maintaining weed control without chemicals or the danger of power tools

Disadvantages:

- Cost
- Mulch may create favorable habitat for rodents, which can damage seedlings.

- Mulch can slide downhill on steep slopes or blow away in strong winds. This reduces the effectiveness of the treatment and damages seedlings.
- Mulching won't control fast-growing hardwoods or stump sprouts.

Photo by Paul Oester, © Oregon State University

Figure 6. Mulch mats and other forms of mulch can be effective for grass and herbaceous weed control but tend to be expensive.

Grazing

Some growers in southwest Oregon and east of the Cascades have introduced grazing as a form of vegetation management. Research shows that some gains in tree growth can be achieved when forage is grazed. However, this practice requires significant time and expense to regulate animals' movements in order to prevent seedling damage.

Keys to conifer release

Early control of grasses, forbs, and brush can increase the moisture, nutrients, and light available to conifer seedlings—which increases their survival and early growth (Figures 7a and 7b), reduces planting losses, lowers cost per established seedling, and results in a more uniform stand.

Getting seedlings to free-to-grow status at the earliest possible age can shorten the time needed for forest stands to reach harvestable size (rotation). Shorter rotation reduces the number of years you must pay interest on financing to cover initial expenses such as reforestation and conifer release; therefore, you'll realize investment returns sooner.

Photo by Eric Dinger, © Oregon State University

Figure 7a. Seedling was dug up after growing for two seasons with no vegetation control.

Photo by Eric Dinger, © Oregon State University

Figure 7b. Seedling was dug up after growing for two seasons with less than 20 percent weed cover. Note the increased diameter growth, more developed root system, and fuller crown.

It's important to remember that whatever method of release you use in your plantation, the objective is to control competing vegetation for a specific period with little or no damage to the planted seedlings.

Inspect your plantation

Plantation release is most effective if done before seedlings are too badly damaged. This means that you should inspect your plantation periodically.

For small areas, a walk-through that crisscrosses along a route representative of the unit might be adequate. Larger plantations might require a more systematic survey, using plot lines in a formal grid that are laid out on a map or photo.

During your inspection, note survival problems that might be developing, animal damage, crowding, and overtopping by competing vegetation. It's a good idea to document your inspection on a simple map for your management file.

Reduce animal damage

An added benefit of controlling vegetation after plantation establishment can be reduced animal damage. Populations of voles, deer mice, rabbits, and mountain beaver tend to increase when food supplies are abundant.

As well as providing food, grasses and forbs offer these animals protective cover from predators. When these plants are reduced, small mammals move to other sites where food is more abundant. The crop trees benefit from increased availability of nutrients and moisture and, as a result, grow vigorously above the level of animal damage. What's more, increased early height growth, achieved with effective vegetation control, may reduce or even eliminate the need to protect seedlings from animal damage.

How much release is enough?

It's important to remember that where timber production is the primary motive, the goal of any release treatment is to achieve free-to-grow status as early as possible, not to eradicate all competing vegetation. Over-treating wastes money and effort and can damage crop trees.

Large voids or bare spots may increase your crop trees' exposure to harsh elements such as wind, frost, and erosion. Voids can be invaded by more competitive, harder-to-kill species, thereby aggravating the problem. Open areas can encourage and concentrate animal use and damage.

Remember, too, that grasses, forbs, and woody vegetation provide valuable habitat for a variety of wildlife species. If managing for wildlife is among your goals, consider retaining some grasses and shrubs in a young plantation. While crop tree growth will be slowed somewhat, species that rely on brushier conditions (sometimes called early seral habitat) will benefit.

When planning your release treatments, it's important to choose the right method and level of release for your site and your management goals.

For further reading

OSU Extension publications

Find these and other forestry publications in the OSU Extension Catalog at http://extension.oregonstate.edu/catalog/

Enhancing Reforestation Success in the Inland Northwest (PNW 520-E)

Pacific Northwest Weed Management Handbook (revised annually)

Successful Reforestation: An Overview (EC 1498-E)

Other publications

Guide to Reforestation in Oregon. 2006. College of Forestry, Oregon State University.

Competing Vegetation in Ponderosa Pine Plantations: Ecology and Control. PSW 113, USFS General Technical Report, 1989.

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