

The Care and Planting of Tree Seedlings on Your Woodland

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In some forest situations, seedlings readily spring up from seeds produced by nearby trees, reducing (or even eliminating) the need to plant trees. Often, though, conditions aren't right for this natural regeneration to happen quickly, or with the desired kinds of trees. Therefore, planting tree seedlings by hand usually is required.

A tree planting project has several steps, all of which are important to overall success. After preparing the site for planting (see EC 1188, *Site Preparation: An Introduction for the Woodland Owner*) and purchasing seedlings best suited to your area (see EC 1196, *Selecting and Buying Quality Seedlings*), the next step is to provide proper care for those seedlings from the time they leave the nursery until they are planted. It is critical to protect seedlings from extremes in *moisture* and *temperature* as well as from *physical damage*. Poor care and handling can result in reduced seedling survival and growth.

Almost anyone can learn to plant tree seedlings that survive and grow. And while common sense or a green thumb go a long way in planting trees correctly, there's a science to it as well. If you heed some of the "how to's" born of experience and research, you'll be more successful.

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The first part of this publication deals with the care and handling of seedlings; the second part with proper planting, including timing, tree spacing, planting spot selection, tools, and techniques. Other steps to ensure a successful tree planting project include protecting planted seedlings from animal damage and competition from grass and shrubs. These subjects are covered in other Extension publications; see “For more information,” page 11.

Seedling care

Proper timing

Trees usually are dug and lifted from nursery beds in the winter when they are dormant (January–March) and then stored in coolers to maintain dormancy. When trees are dormant, they are most resistant to stresses from handling and planting. If seedlings are planted in fall or late spring, they are not fully dormant and are more susceptible to stresses from handling, so take extra care if planting trees at these times.

Moisture

Lack of moisture (desiccation) kills root tips from which new roots grow and interferes with the tree’s ability to make food. Seedlings usually are packed in a special bag or box designed to maintain moisture and prevent seedlings from drying out. After receiving seedlings from the nursery, be sure to repair any holes or tears in the packaging, and keep bags or boxes tightly closed at all times.

Cooler temperatures help to maintain moisture, but seedling roots can dry out even while properly stored—especially if stored for any length of time. Check to make sure roots are moist when you get seedlings from the nursery, and check for adequate moisture during storage.

Temperature

Ideal storage temperatures are from 34 to 36°F. Do everything possible to maintain these ideal temperatures from the time the seedlings leave the nursery until they

are planted. The risk of damage to seedlings increases when temperatures reach 40°F or above.

Some nurseries freeze seedlings for long-term storage, but freezing and thawing are done under carefully controlled conditions. Try to keep your trees from freezing, which can damage plant cells.

Even though seedlings are dormant, they still carry on a process called *respiration*. This process gives off heat. As temperature increases (40°F or more), respiration increases, as does the heat given off. Respiration also uses carbohydrates (food) stored in the seedling, thus depleting food reserves needed for survival and growth.

Carefully stack seedling bags or boxes to allow air circulation and cooling. Stacking more than three high can increase seedling temperatures and physical damage.

Care during transportation and storage

When transporting seedlings, keep them cool. If possible, transport them at night or during the cooler times of the day, or have them shipped in a refrigerated truck. If you transport them yourself, use an insulated van or pickup with a canopy, or cover trees with a special thermal “space blanket,” available at forestry supply dealers. Avoid transporting trees uncovered or with a dark tarp, which can cause added heating. Be aware of heat in the bed of a pickup caused by the exhaust system; insulating the area or elevating the seedling bags may provide needed protection.

Plant seedlings as soon as possible, within 3 or 4 days if they are stored at temperatures above 42°F.

If you must store seedlings, keep them cool and moist. Check with local state forestry offices, nurseries, large timberland owners, or other businesses that may have cold storage facilities available. A basement, garage, or other *cool*, shaded location is acceptable for periods of less than a week. You can make a temporary storage cooler of plywood, Styrofoam insulation, and some blocks of ice.

Proper handling at the planting site

Handle seedling bags or boxes carefully; avoid dropping or throwing them. Likewise, handle seedlings carefully and as little as possible. Keep seedlings in a cool, shaded area; you may have to move them during the day to keep them in the shade.

It usually is cumbersome to carry around the container the seedlings came in from the nursery. Remove a manageable number of seedlings from the storage container (reclose the container), dip them in water, and place them in a planting bag or bucket (Figure 1). Avoid overfilling the planting bag. Stuffing seedlings into bags damages roots and may cause you to drop trees when you try to remove them from the bag.

The container should protect seedling roots from drying. It is a good idea to cover roots with damp moss, damp sawdust, or even a wet rag (keep it wet!). Dipping roots in water is particularly beneficial on windy days. Don't leave seedling roots sitting in water for more than a minute.

Avoid exposing roots to the air or touching roots when planting. To minimize root exposure and drying, don't remove a tree from the bag until you've dug the hole and are ready to place the seedling in the hole.



Figure 1.—Tree planting bag.

Planting seedlings that grow

The goal of tree planting is to plant *seedlings that grow*. That's the whole point. If you go to the trouble of planting trees, you want them to survive and grow well.

Planting at the right time

The correct time to plant seedlings is when the seedlings are dormant and the site is favorable for proper planting. The planting season varies by region in Oregon. Sometimes, weather or site conditions are not appropriate at the time seedlings are dormant.

In the Cascades or in eastern Oregon, planting is best accomplished either in early to late spring, after snow melts and the soil thaws, or in the fall, after the soil is moistened by fall rains (to a depth of at least 1 foot) and before snow or freezing weather arrives. Fall planting is less common because seedling survival can be poor.

At lower elevations west of the Cascades, conditions often are suitable for planting throughout winter and early spring. Plant from early January through the end of March, avoiding times of frozen or dry soil, snow, and hot or dry weather. Especially avoid dry, windy days. Cool, wet days are ideal.

Consider talking to a local forester if you're unsure of when to plant your trees.

Using the right spacing

The Oregon Forest Practices Act requires you to plant seedlings where harvests have reduced the number of trees below specified stocking levels. Reforestation must begin within 12 months of completing the harvest operation. Depending on site productivity, a minimum of 100 to 200 seedlings per acre must be established. Seedlings must be “free to grow” (that is, healthy, above competing vegetation, and well distributed across the area) within 6 years.

Unless lots of seedlings are springing up naturally, you probably don’t want to plant fewer than the minimum. However, you may want to plant more than the minimum requirement. It hedges your bet against unanticipated mortality (survival of planted seedlings rarely is 100 percent) and keeps your options open for thinning later on.

West of the Cascades, planting 300 to 400 trees per acre is common; on the east side, 200 to 300 trees per acre are common planting densities. For Christmas trees, 5- to 6-foot spacing commonly is used (about 1,500 trees per acre).

See Table 1 for correct spacing to get a desired number of trees per acre.

Choosing the right spot

If you’re planting seedlings on forestland, you may have slash and stumps to contend with, even if you’ve prepared the site for planting. Perfectly spacing each tree

Characteristics of a good planting spot

- An area with mineral soil exposed
- Away from animal holes and game trails
- Away from concentrations of resprouting brush
- A protected, shaded area next to a stump or log

Table 1.—Trees per acre and spacing required.

Trees per acre	Spacing (feet)
681	8 x 8
436	10 x 10
302	12 x 12
222	14 x 14
170	16 x 16

from other trees is neither practical nor necessary. Instead, take advantage of cleared spots and protected spots. If your desired spacing from the adjacent tree puts you in the middle of a log, stump, slash pile, or brush, shift 1 or 2 feet to one side or the other to an open spot, where you can more easily operate your shovel to dig an adequate hole.

Planting a tree next to a log or stump, in fact, protects seedlings from the elements. Such a sheltered spot is called a “favorable microsite.” Choosing such microsites is especially important on dry or exposed sites, and can improve survival considerably. On dry, south-facing slopes, try to plant trees on the north side of stumps and debris (Figure 2). Avoid planting in decaying wood because it dries out.

Regardless of your site, you’ll miss fewer planting spots if you work your way across the land systematically (Figure 3). Begin along the boundary of the area to be planted (for example, along an adjacent stand of timber, trees planted in earlier years, or a property line). Following the boundary, plant a single row of trees, with each tree the desired distance from the tree behind it and the boundary. When you reach another edge, double back and plant along your earlier line of trees, offsetting from them at the desired spacing.

If you’re growing Christmas trees, you probably have a well-prepared field that is free of debris and stumps. You’ll be able to maintain fairly precise spacing, creating a gridlike pattern of trees.

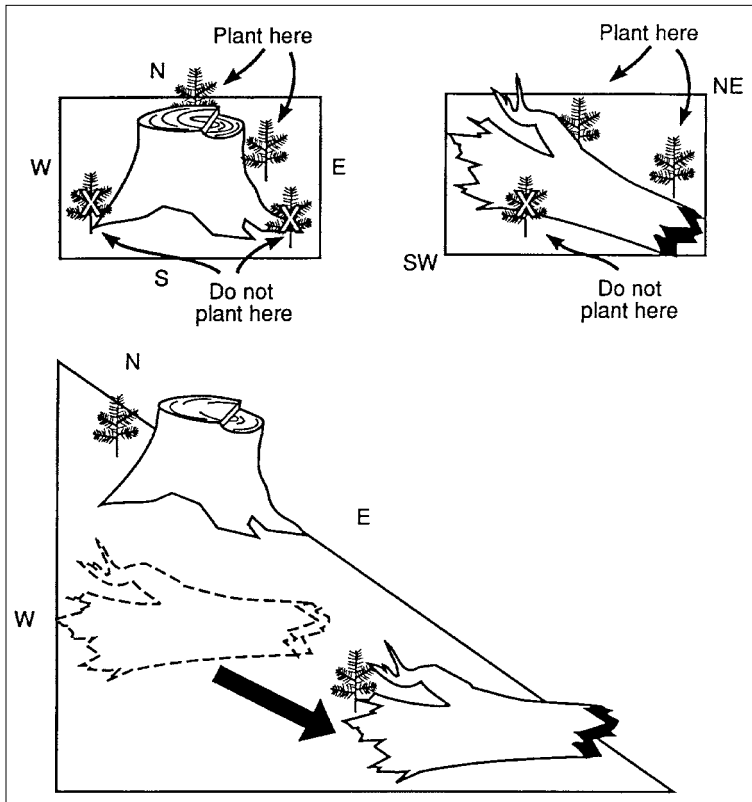


Figure 2.—Planting in a microsite in the shade (Source: *Reforestation Practices in Southwestern Oregon and Northern California*, Oregon State University Forest Research Lab).

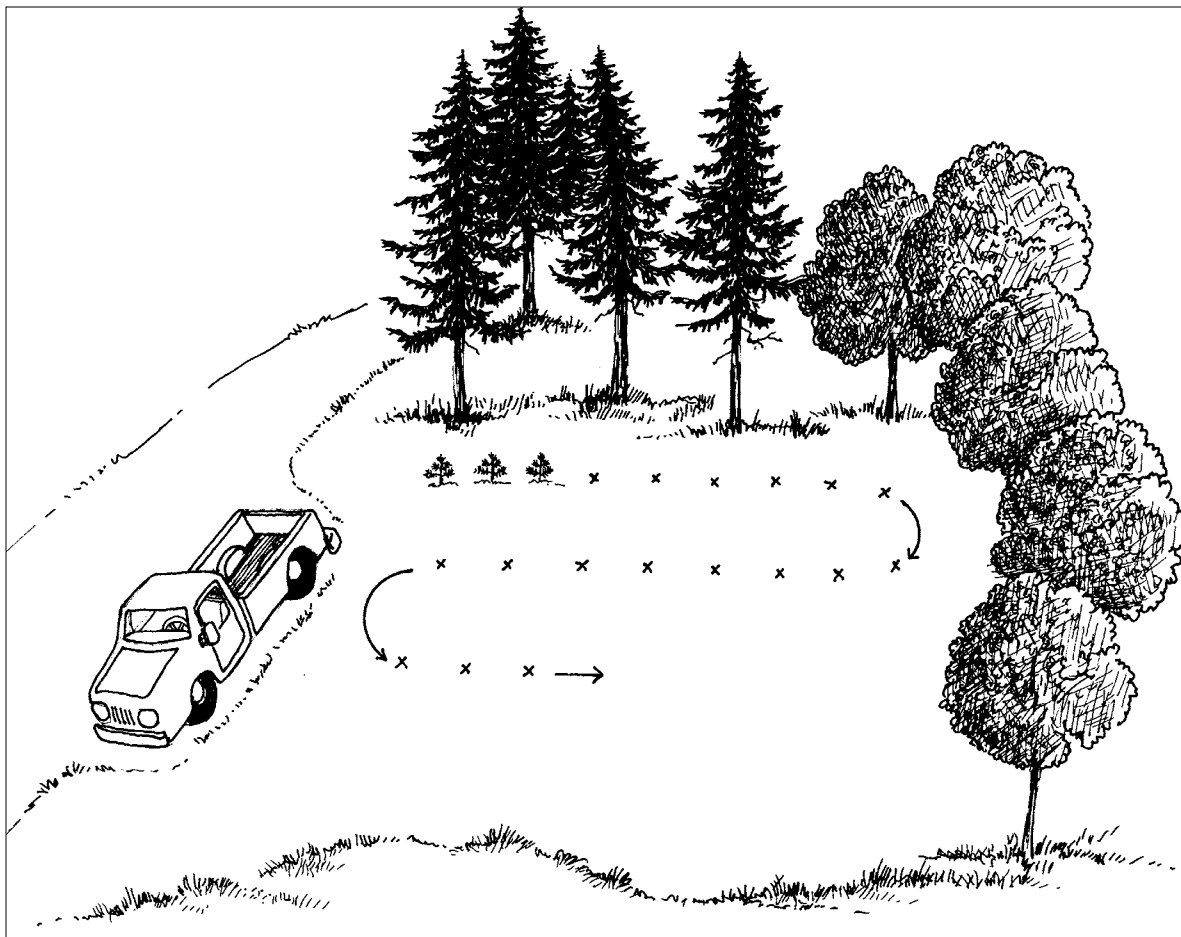


Figure 3.—Plant seedlings in a systematic fashion to ensure no areas are missed.

Using the right tool

If you're planting just a few trees, you can get by with a common garden shovel. Professional planters find that special shovels (Figure 4) make planting easier. They are reinforced for rugged field use, often have a footpad to reduce leg strain, and have minimal blade angle for ease in digging a straight hole (which is important—more on that later). If you're planting several acres or more, consider borrowing or buying one of these shovels. They may cost \$50 or more, but will make the job easier.

Other tools also are used (Figure 5). Planting hoes, or hoedads, are useful for clearing sod from around a planting spot ("scalping") but require skill to get a deep, straight planting hole. Dibbles occasionally are used for planting container-grown seedlings ("plugs"), but when used in clay soils, they can compress the soil around the hole and hinder root development. Planting bars sometimes are used, but they can cause soil compaction as well. Power-driven augers also are used to drill planting holes; they work well in loamy, sandy, or pumice soils but not as well in rocky or clay soils or where there's a lot of logging debris or brush.

Mechanical planters can plant tree seedlings efficiently, but the terrain must be flat and free of stumps and debris—a rarity on forest sites but more common on sites used for Christmas tree production.



Figure 4.—Tree planting shovel.



Figure 5.—Other planting tools.

Using the right technique

With all of those “preliminaries” out of the way, here’s where the action is: digging holes and putting trees in the ground. We’ll discuss planting seedlings with a shovel. The technique varies with other tools, but the goal is the same: creating a large enough opening in the ground so that seedlings are positioned naturally and ready to grow.

At your selected planting spot, use your shovel or hands to clear away anything—sticks, rocks, snow, or the like—that’s in your way. Clear away a spot about a foot in diameter. Sometimes, there’s very little to clear.

Hold the shovel with the back away from you (that is, backwards from the way you normally hold a shovel). With the shovel handle more or less straight up, insert the shovel blade in the center of the planting spot. Sink the shovel blade, kicking and putting your weight on the top of the blade (Figure 6), until the blade is about one-third buried. Push the handle away from you (Figure 7), loosening up the soil. Reposition the shovel to the original place, still holding the handle approximately vertical, and sink the shovel blade about two-thirds of the way down. Again, push the shovel handle away from you to further loosen the soil. After repositioning the shovel again, sink it to the hilt.

This process is especially important if you are using a regular shovel because you want to make the hole deep enough to accommodate the seedling’s root system. Failure to make the planting hole deep enough is a common (and serious) problem.

Now comes the benefit of all the soil loosening. Push the handle away from you again. Then, pull it back *toward* you, keeping the tip of the blade at the bottom of the hole. Repeat this push-pull action a few times. Finally, with a little pull toward you—keeping the tip of the shovel at the bottom of the hole—you create a somewhat rectangular hole (Figure 8).

After the planting hole is open, carefully remove a tree from your bag. Grasp the tree above the roots (avoid handling the roots), hold it above the hole, and with a gentle downward flip, place the roots in the hole



Figure 6.—Shovel sunk one-third into the soil.



Figure 7.—Shovel being pushed away from tree planter to open the hole.



Figure 8.—Planting hole being opened up, ready for the seedling.



Figure 9.—Tree seedling placed in planting hole.



Figure 10.—Ponderosa pine seedling planted correctly in a microsite and ready to grow!

(Figure 9). The roots should hang down naturally, just as they do when you hold the tree up in the air. Hold the tree so the roots are fully below the ground surface and all of the lower limbs are above ground.

Still holding the seedling, remove the shovel carefully to avoid scraping the tree. Step on the previously loosened dirt to firm up the soil around the roots. It's important to eliminate air pockets. Replace any soil that's been scattered around the hole and tamp it in. In very rocky soil, you may even need to find a little extra soil to completely fill the dip. The tree should then be standing upright, roots completely covered by soil, branches all above ground—poised to grow (Figure 10). This procedure may seem awkward at first, but don't be discouraged.

Watch out for these common mistakes

Planting speed comes with experience. If you try to plant quickly before you've developed the skill to do so, you'll plant trees poorly, and poorly planted trees grow poorly. If you work at planting correctly, you'll get faster *and* learn to avoid these common mistakes (see Figure 11).

- **Crooked roots**—When the planting hole isn't deep enough, the roots don't hang down naturally during planting. As a result, roots are curled up in the bottom of the hole and don't grow normally. Variations on the theme include J-roots (roots go down and up again), L-roots (roots go down and sweep to one side of the hole), accordion roots, and the like. **Prevention:** Dig the hole slightly deeper than the roots are long.
- **Improper planting depth**—Trees do not survive and grow well if they are planted either too shallow or too deep. Planting too shallow leads to loose trees that fall over. Planting seedlings too deep exposes the bark to soil diseases. **Prevention:** Ensure that the tree is planted so that the soil surface is midway between the top of the roots and the first limbs (often the stem of the seedling changes color at this point—from brown or yellowish below ground to green above ground). Plant hardwood trees an inch deeper than the nursery soil line.
- **Loose trees** result from not tamping the soil down adequately. The result is air pockets, and some of the roots die. **Prevention:** Tamp (but don't stomp) the soil down with your boot before you move on to the next planting spot. Three or four steps with your boot is adequate; you want to just firm the soil, not compact it.
- **Damaged bark** occurs when a planting tool or boot heel gets too close to the seedling during tamping. **Prevention:** Avoid stepping on the tree while tamping the soil after planting.

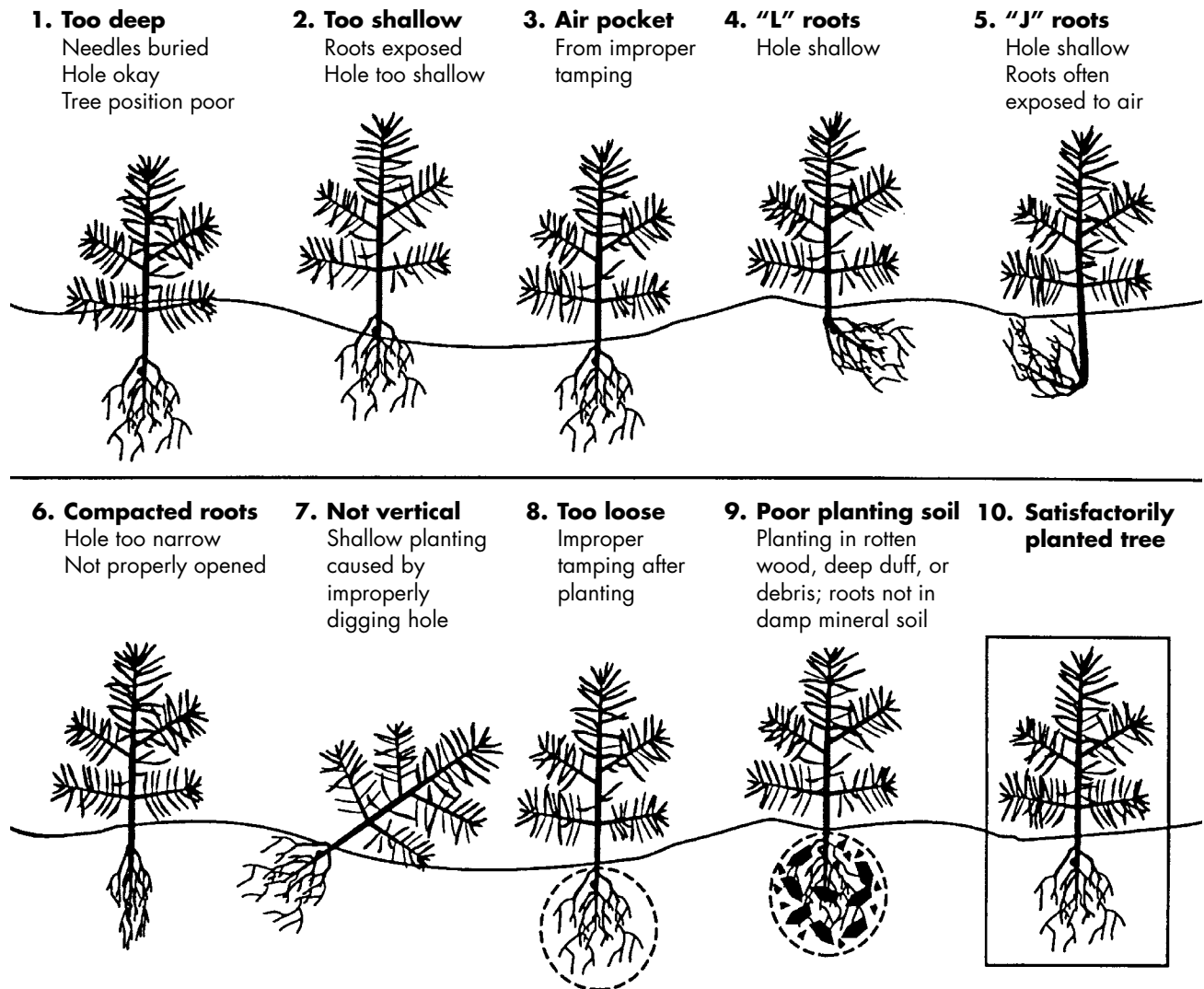


Figure 11.—Common planting mistakes (Source: *Reforestation Practices in Southwestern Oregon and Northern California*, Oregon State University Forest Research Lab).

Where to get help

Contractors can plant your trees for you. Usually for about the price of each seedling, you can hire out your planting. For some people this makes a lot of sense. Do you have the time, tools, and strength to do the planting yourself? If you have more than a couple of acres, it may take you weeks to complete the planting. Pros can plant 1,000 or more trees a day; most of us would do well to plant 100–200 per day.

If you choose to hire a tree planting contractor, do it before planting season to avoid some of the rush. Clearly say what you want done—how many trees, number of acres, any special measures you want taken—and when. Ask several contractors

for a bid. Get a written contract. Visit the site while the crew is planting to ensure they understand the unit boundaries and to check on their tree handling, spacing, planting quality, etc.

You may find that hiring a consulting forester makes sense for you; he or she is a professional forester who can represent your interests during the planting operation and handle some of the paperwork.

Your local OSU Extension forester may offer workshops on reforestation. If you take such a class, you'll get acquainted with some of the principles and language of reforestation and will feel better able to oversee your tree planting project.



Figure 12.—Scalped area.

Contact your local ODF stewardship forester or OSU Extension forester for lists of available contractors, sample contracts, or information on classes.

Some financial assistance may be available for tree planting. Financial benefits may include cost-sharing, special property tax assessments, and tax credits. Contact your local ODF stewardship forester or OSU Extension forester for information. Also, see EC 1119, *Incentive Programs for Resource Management and Conservation*. Make these contacts *before* you begin preparing the site for planting.

Common questions and answers

Should I trim the roots on my seedlings to make them easier to plant?

Usually not; roots normally are trimmed by nurseries before you get them. You even may be able to specify the root length desired. If the root mass includes a few long, stringy roots, you can cut them carefully with pruning shears before planting. **Never** tear roots with your hands; this damages them.

Should I put any special additives in the water when I dip seedlings before planting?

Water alone is best. While some additive products may offer short-term benefits, others have been found to be detrimental in the long run. The greatest benefit comes from just plain water.

Should I “scalp” before planting?

Scalping—removing sod and vegetation to create a 1-foot diameter planting spot—usually is done before planting. The purpose is to remove organic material (needles, duff, branches) and vegetation so planting is easier and organic material doesn’t get into the planting hole.

Sometimes a larger area (at least 3 to 4 feet in diameter) is scalped, especially if competitive plants closely surround the planting spot (Figure 12). This cleared spot can be made during or after the planting operation using a hazel hoe or hoedad.

Scalping can increase the amount of soil moisture available to seedling roots and can reduce rodent habitat (and damage) as well. However, its effects are short lived due to rapid regrowth of grass and weeds; following up and reclearing the circle around each seedling is important to maintain the benefits of scalping. In general, scalping is labor intensive and expensive and is only marginally effective for controlling competing vegetation.

Will it help to fertilize my new seedlings?

On most sites, lack of soil moisture and light (not soil fertility) limit seedling survival and growth. Fertilizer is almost never necessary for seedling survival. Although applying fertilizer to the planting hole may temporarily increase seedling growth on some poorer sites, it can burn roots as well. Fertilizing helps weeds grow, too, so it must be accompanied by excellent weed control.

How about “shade cards”?

Shade cards generally are not necessary unless the site is hot, dry, and south-facing. On these sites, giving the seedlings some shade can increase seedling survival. Like planting next to a log or stump, putting up a shade card (Figure 13) on the south side of a newly planted seedling can prevent heat damage to the seedling stem.

Can I protect my seedlings from animals?

Lots of animals—including voles, rabbits, mountain beavers, pocket gophers, deer, and elk—feed on seedlings. You can reduce damage to young seedlings by using the following techniques.

- Weed control, which reduces rodent habitat and populations and also increases seedling growth
- Physical barriers around the seedlings
- Repellents that keep animals away
- Direct reduction of certain animal populations (for example, trapping mountain beavers)

These measures are most effective when taken before or soon after planting. OSU Extension publications are available on protecting seedlings from specific animals.

What kind of growth can I expect from newly planted seedlings?

Growth rates vary by geographic region (western vs. eastern Oregon), site, and tree species. Expect it to take a few years for seedlings to get over planting shock and hit their stride. Seedlings may grow only 2 to 6 inches per year for the first few years following planting. After 3 to 5 years, they grow faster as they become better established. For example, Douglas-fir seedlings may grow 1 to 3 feet a year, and ponderosa pine in central and eastern Oregon may grow 8 inches to 1.5 feet a year once established. These growth rates assume good weed control at the time of planting.

Do I have to control brush after I plant?

Yes. Brush control generally improves survival and often improves growth. It is rare that weed control is *not* necessary. Weed competition can kill 60, 80, or even 100 percent of planted seedlings, especially on dry sites. Studies have shown improved growth due to control of competing vegetation on a variety of reforestation areas—including coastal areas where lack of moisture is not commonly thought to be a problem. Seedling growth increases where weed control removes most (70–90 percent) of the competing vegetation. Invasion of weeds can happen quickly in some areas, so be alert and remember that your seedlings must be “free to grow” within 6 years.

Summary

Use the checklist on page 12 to improve your seedling care and handling.

Remember, the effects of poor seedling handling and care are cumulative. Short exposures to stress may seem unimportant, but can add up to a significant loss in survival and growth.

Following up on your planting project is very important and can have a big impact on seedling survival and growth. Walk through your plantation several times during the first year and at least once a year until age 5. Look for problems such as dead trees, weed or brush development, and animal damage. Catch problems early and take steps to remedy them.

Trees, animals, and weeds have been around together for a long time. If you tend your young trees carefully while they’re getting established, they’ll soon get along just fine on their own and will live to become an essential and ongoing part of a healthy, productive forest ecosystem.



Figure 13.—Shade card.

For more information

Successful Reforestation: An Overview, EC 1498.

Site Preparation: An Introduction for the Woodland Owner, EC 1188.

Selecting and Buying Quality Seedlings, EC 1196.

Introduction to Conifer Release, EC 1388.

Incentive Programs for Resource Management and Conservation, EC 1119.

A variety of publications on protecting young trees from animal damage also are available from the OSU Extension Service.

Checklist

- Handle seedlings gently and as little as possible.
- Keep seedlings cool (34–36°F) and protect them from freezing temperatures or temperatures above 40°F.
- At the field site, store seedlings in the shade or under a reflective space blanket. Don't use canvas or dark-color coverings. Minimize field storage.
- Protect seedlings from drying out (especially the roots) by reducing exposure to drying air and by adding water when needed during storage as well as just before planting.
- Use bags or boxes that are constructed or coated to prevent water loss. Keep them securely closed. Use tape to repair rips and tears.
- Dip seedlings in water for 1 minute before you place them in the planting bag to provide added protection to the root system.
- Handle seedlings gently and avoid touching roots.

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