

Chapter 5. Outplanting

5.1 Care During Outplanting

Nursery plants are in a period of high risk from when they leave the protected environment of the nursery to when they are outplanted. It is important to remember that nursery plants are alive and perishable, and therefore should be treated with utmost care at all times. Stressful injuries incurred between harvesting and outplanting, however, are often not evident until several weeks or even months after planting. Because all types of abuse or exposure are cumulative, it is helpful to think of native plant quality as a checking account. Immediately before harvesting, plants are their maximum quality (100%), but all subsequent stresses are withdrawals from the account (Figure 5.1). It is impossible to make a deposit—nothing can be done to increase plant quality after leaving the nursery.

Temperature stress is important because warm seedlings use stored energy that could be used for growth after outplanting. It's best to keep seedlings cool, shaded, and out

of the wind right up until the moment you outplant them. On the outplanting site, temporarily store seedlings in a snow bank, a cooler, or at least in deep shade. Don't set them in full sun. Be careful with tarps. Placing most types of tarps on top of seedlings to shade them from sun actually makes them warmer than being in direct sunlight. If you use a tarp, select one made of reflective material and suspend it at least 3 feet above the seedlings so air will circulate between the tarp and the seedlings. Remove only as many plants as you can install in an hour or two.

5.2 Outplanting Windows

Years of experience have proven that, in general, the best time to outplant most native plant nursery stock is when they are dormant and least susceptible to the stresses of harvest, storage, shipping, and planting. The outplanting window is defined as the period of time during which environmental conditions on the site most favor survival and growth of nursery stock, and it varies considerably across the country (Table 5.1). Therefore, you should give some thought to what factors would be most limiting where you will be outplanting your plants. Although soil moisture and temperature are the usual constraints on most sites (Figure 1.1A), other environmental or biological factors can also limit plant survival and growth. For example, animal predation by rabbits and deer can be the most limiting factors to outplanting success.

Although good quality, nursery plants can be outplanted almost any time of year, the primary outplanting windows are in spring or fall in more northerly latitudes, as well as throughout the winter months in the southeastern United States. Fall-planted seedlings should go into the ground when enough soil moisture is available to support them, provided seedlings will have 6 to 8 weeks or so to grow roots before winter weather begins. That root growth makes them less likely to frost-heave and suffer from winter desiccation. Fall-planted seedlings have an extra advantage of beginning root growth in the spring before you could typically outplant. This extension of the growing season improves first year survival and growth.

In spring, seedlings should be outplanted when the ground has dried enough to dig a proper hole. If the soil is too wet you may cause serious soil compaction and restrict seedling root growth. Here's an easy way to see if your soil is too wet: dig a hole, then shovel the soil back into the hole—if the soil doesn't fit easily back into the hole, it's too wet. The earlier you can plant, the better; early spring planting allows seedlings to take full advantage of the growing season and available water.

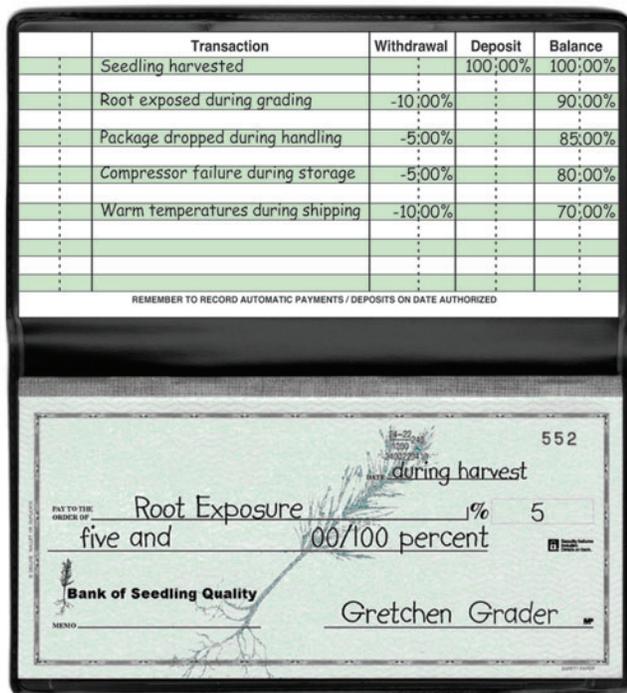


Figure 5.1—Think of native plant quality as a checking account in which all types of abuse or stress are withdrawals. Note that all stresses are cumulative and no deposits can be made—it is impossible to increase plant quality after you harvest them.

Table 5.1—If site conditions are favorable, container plants can be outplanted year-round. Here are some potential outplanting windows; not every potential window is presented.

Region	Potential outplanting windows	Outplanting conditions
Great Lakes states	April and May	Typical spring outplanting
Rocky Mountains (higher elevations)	June and July	Good soil moisture and warmer soil temperatures; spring access prohibited by snow
Southwestern U.S.	August	Coincides with summer rains
Northern California	September and October	Adequate soil moisture exists and spring outplanting is hampered by poor access
Southeastern U.S.	November through February	Outplanting conditions favorable throughout winter
Pacific Northwest (coastal)	February through March	Typical spring outplanting

5.3 Outplanting Tools and Techniques

Your plants will have the greatest chance of surviving and growing if you select the best possible location for outplanting. Be sure to consider the natural habitat of your plant—does it occur on well-drained, upland sites or wetter bottom sites? Although a planting location may seem exactly the same, there are “microsites” where conditions are better. Exposure to afternoon sun can generate severe moisture stress, especially before the plant has had time to extend new roots out into the soil. So, look for places with natural shade such as the north and east sides of downed logs, stumps, or large rocks. Slight soil depressions where rainfall can accumulate are good planting sites for upland species, but don’t plant them in low areas where water will stand for any amount of time. Compacted soil is detrimental because all the large pores spaces for water and air exchange have been squeezed out, so avoid ruts or other areas where vehicles have traveled.

Nursery stock can be outplanted with a variety of different tools but the objective is to safely and efficiently dig a hole deep enough to allow proper root placement without soil compaction. Planting bars or dibbles require the least effort but, because no soil is actually removed, they compact the soil to the sides and bottom of the hole. In

clay soils, this compaction seriously reduces new root growth. Planting bars and dibbles are popular, however, when installing wetland plants. For upland plants, the best all-around planting tool is a shovel. Root plugs on nursery stock used for reforestation or restoration are longer and narrower than plant materials used for landscaping and gardening, so specialized planting tools have been developed. Planting shovels are tile spades that have blades that are long enough to match the depth of the plant root system (Figure 5.2A). Padded foot rests and reinforced blades make it much easier to penetrate the soil and lever back and forth to create the hole.

Whatever outplanting tool is used, the hole should be dug deep enough to so that it is deeper than the full length of the root plug. Once the hole is excavated to the proper depth, hold the plant vertically slightly below ground level and gradually backfill mineral soil by hand around the root plug (Figure 5.2B), gently tamping to remove air pockets. This ensures good root-to-soil contact that enables plants to access water and nutrients. A well-planted seedling is not outplanted too deep or too shallow; no foliage is buried; the orientation is straight, especially on steep ground; planting holes are backfilled with mineral soil, (avoiding grass, sticks, rocks, or snow) that is gently tamped to remove air pockets (Figure 5.3).

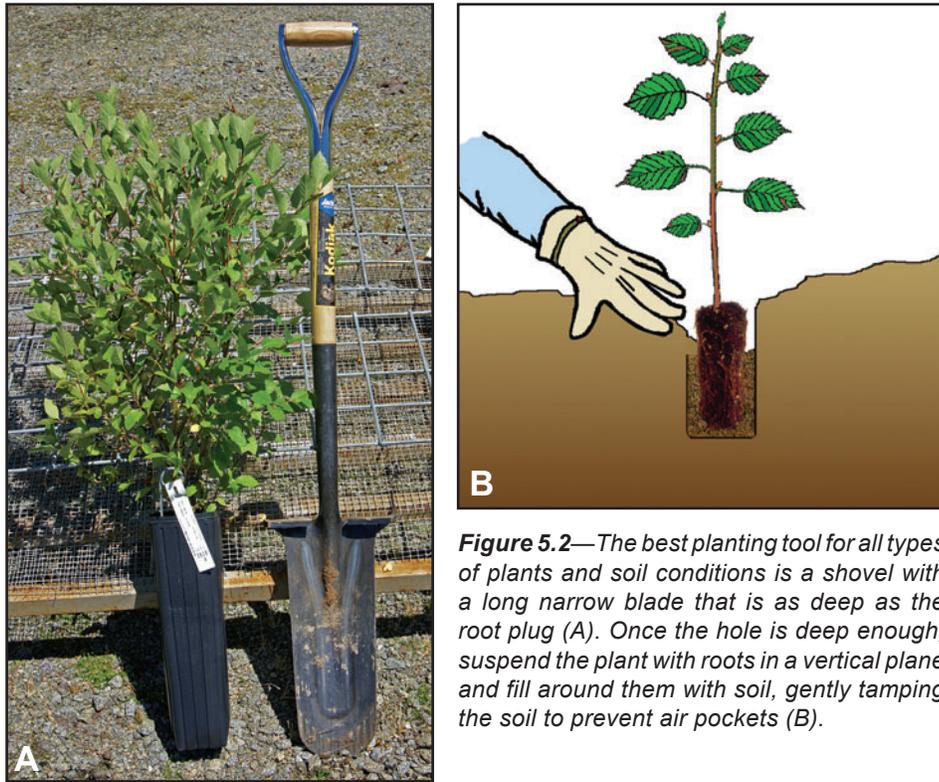


Figure 5.2—The best planting tool for all types of plants and soil conditions is a shovel with a long narrow blade that is as deep as the root plug (A). Once the hole is deep enough, suspend the plant with roots in a vertical plane and fill around them with soil, gently tamping the soil to prevent air pockets (B).

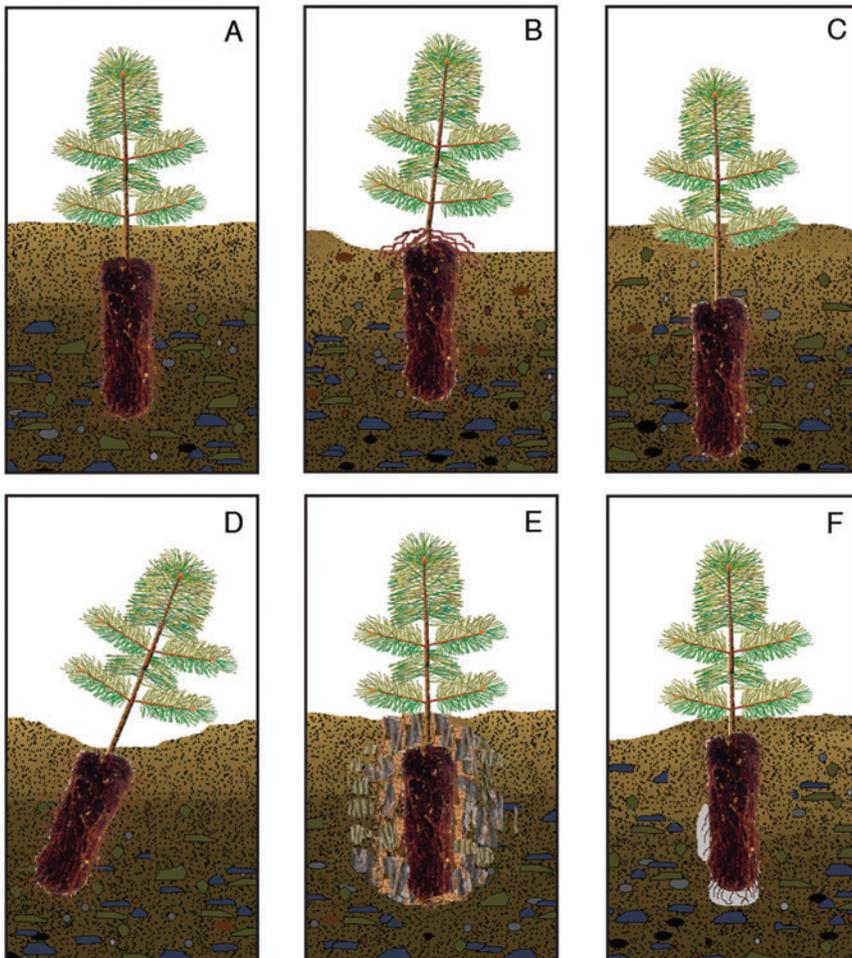


Figure 5.3—Nursery stock should be planted properly (A). Common problems include planting too shallow (B), planting too deep (C), improper vertical placement (D), filling the hole with debris (E), or poor compaction that leaves air pockets around the root plug (F).

The following 10 steps will help you get your plants in the ground properly:

1. Protect seedlings from sunlight, wind, and high temperatures. Carrying plants inside a white 5-gallon bucket with their roots wrapped in moist cloth is a good way to handle plants on the outplanting site.
2. On forested lands, plant on the north or east sides of stumps and logs if possible. Forest floor litter should be scraped (scalped) away to expose mineral soil, but replaced around the seedling after planting. At any planting site, scalp dense weedy vegetation. Scalps should be at least 30 inches square and expose mineral soil (Figure 5.4A)
3. Dig a hole large enough for the root plug. We don't recommend dibbles except for wetland plants. Spades, shovels, and hoedads work well for upland plants. Placing the plug into a slit made by rocking a spade or shovel is not recommended because rocking may compact the soil and hamper root growth.
4. Keep foreign matter (leaves, sticks, duff, rocks, snow, and so on) out of the planting hole.
5. If you add fertilizer to the outplanting hole, place it deeper than, or to the side of, the root plug so the roots are not in immediate contact. Allow roots to grow to the fertilizer. Adding fertilizer to a dibble hole next to the plant avoids this problem and reduces the chance that weeds will intercept the fertilizer.
6. After the hole is ready, remove only one seedling from the storage container. This prevents unnecessary exposure of the roots of remaining plants. If roots appear dry, dip them in a bucket of cool water for a couple of seconds to remoisten them.
7. Place your plant near the center of the hole, with the top of the root plug about 0.5 to 1 inch below the soil line. Planting too deep is better than too shallow as long as you don't bury any foliage.
8. As you fill the hole, gently firm the soil around the roots. Leave no air spaces. Be sure to use moist soil to fill the hole, but don't use heavy pressure that will compact the soil.
9. Watering plants, if practical, immediately after outplanting is probably the single best thing you can do because it not only provides moisture but gently settles soil particles around the roots (Figure 5.4B).
10. Surround the plant with a protective fabric or organic mulch to reflect sunlight, retard moisture loss, and discourage weed growth (Figure 5.4C). On exposed sites, shade cards held upright with stakes can greatly reduce sunscald and moisture loss. Broad shingles or commercially available plastic cards should be placed on the south and southwest sides of outplanted seedlings.

5.4 Care After Outplanting

Now that the plants are in the ground, you can promote greater survival and growth by addressing four important factors: water, fertilization, weeds, and animals.

5.4.1 Water

Native plants are resilient and well-adapted to their environment. If grown well, properly hardened, and outplanted correctly in the absence of weeds, most species should survive and grow well without supplemental water. They will, however, respond if provided additional water after outplanting, especially during hot weather. If you decide to water plants after outplanting, remember that how often you need to water will depend on the soil and weather. Sandy soils don't retain moisture well so you'll have to water more often. On the other hand, clay soils hold moisture very well so you may not need to water for 2 or 3 weeks after a thorough watering. Water long enough to thoroughly moisten the root zone and encourage deep rooting (Figure 5.4B). If you are installing a windbreak of native trees and shrubs, a drip irrigation line is the most efficient way to water seedlings because it delivers moisture directly to each plant in a controlled and consistent manner—less water is wasted to run-off or evaporation. Stop watering about 1 month before the first frost.

5.4.2 Fertilization

Controlled-release fertilizers can be applied at the time of outplanting, either in the hole, in a dibble hole next to the plant, or around the base of the plant. In general, placing the fertilizer in a dibble hole alongside the plant makes the most sense because it reduces the possibility of fertilizer burn to roots and prevents nutrients from being “stolen” by competing vegetation. If you are watering your plants, it would be easy to dissolve soluble fertilizers in the solution (see Section 3.3.3.2.2, Fertigation); liquid fertilization ensures quick uptake and prevents possible fertilizer burn.

5.4.3 Weeds

Native plants grow better when weeds are controlled because weeds out-compete desired plants for water and nutrients. Good weed control greatly reduces the need for adding extra water and fertilizer. For reforestation, when outplanting on recently harvested sites, weeds generally aren't a major problem, although resprouting brush can limit seedling survival and growth. Planting former agricultural land is probably the worst-case scenario for weeds; maintain at least a 3 feet by 3 feet weed-free square around each plant for at least the first 2 to 3 years;

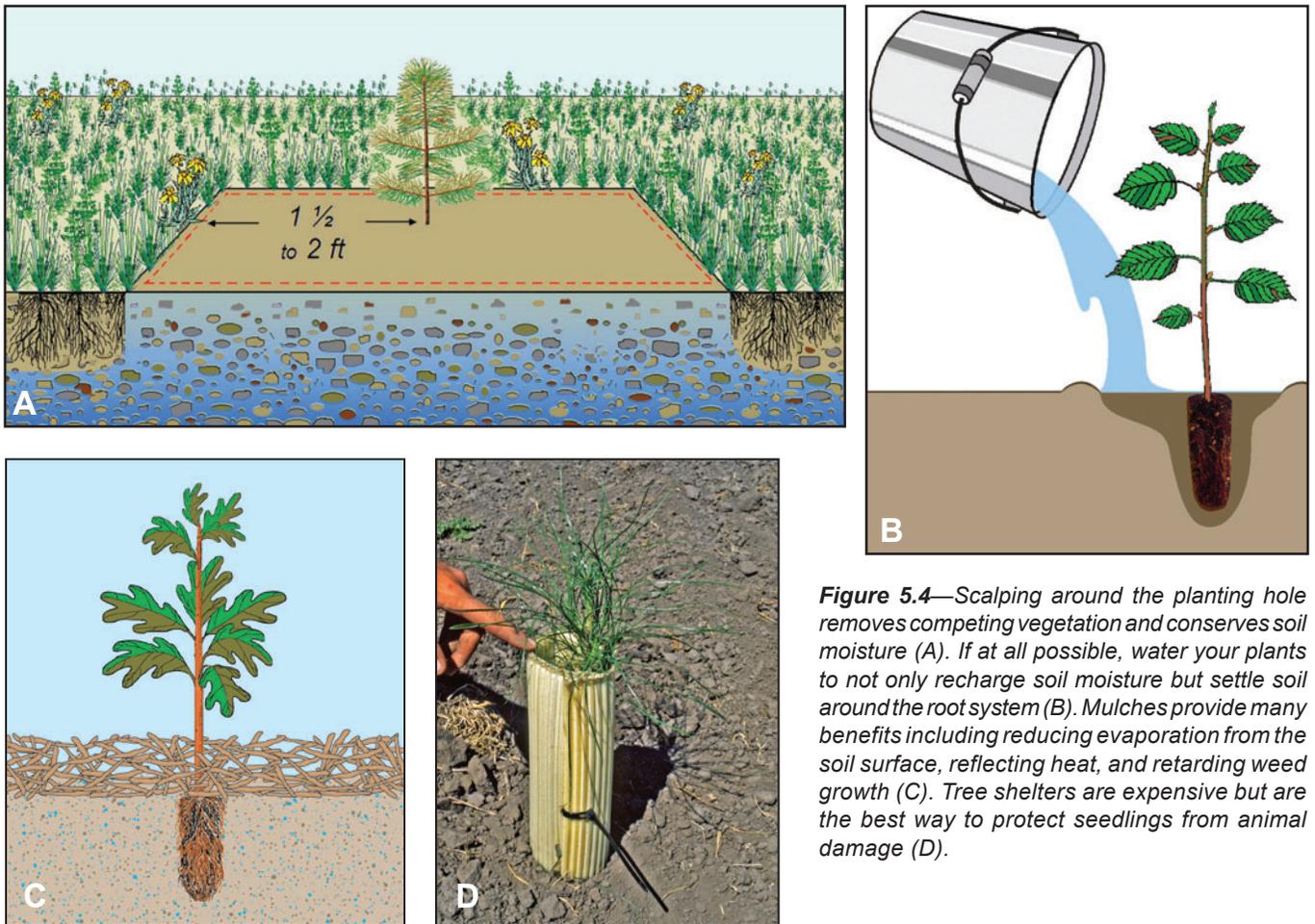


Figure 5.4—Scalping around the planting hole removes competing vegetation and conserves soil moisture (A). If at all possible, water your plants to not only recharge soil moisture but settle soil around the root system (B). Mulches provide many benefits including reducing evaporation from the soil surface, reflecting heat, and retarding weed growth (C). Tree shelters are expensive but are the best way to protect seedlings from animal damage (D).

the longer the better (Figure 5.4A). Weed-free zones can be accomplished with hand weeding, herbicides, or fabric weed barriers. Maintaining shade and mulches (Figure 5.4C) may also increase seedling survival and growth. Using a pre-emergent herbicide immediately after outplanting can control weeds, especially annual weeds. Because pre-emergent herbicides can often be sprayed over the top of desired species, the application is much easier to perform; using herbicides on established weeds is more difficult because desired plants must be shielded from the spray. Before you use any herbicides, contact your local state forester, university county extension agent, or Natural Resources Conservation Service (NRCS) representative for information on the products currently available for your species. Always follow label directions to protect yourself, others, and the environment.

5.4.4 Animal Damage

Many critters eat native plants. Mice, moles, gophers, deer, elk, rabbits, and porcupines are just a few of the animals that can be troublesome. Solid plastic tubes or plastic mesh cylinders (Figure 5.4D) are products specifically made

to reduce browse damage. If you plan to mow weeds around your plants, these tubes also protect against accidental damage, or “mower blight.” Populations of small rodents can also be reduced by natural predators like hawks and owls. Placing some wooden fence posts or larger “snags” around the outplanting site offers predatory birds a place to sit and hunt. Remember that populations of small rodents are cyclic, so not observing a problem one year does not guarantee the same result in subsequent years. Rodenticides are also available, but great care should be taken not to accidentally poison non-target species like dogs, cats, hawks, and owls. Fencing works well for deer and elk but can be extremely expensive. A variety of spray-on repellents are available—they generally reduce, but don’t eliminate, browsing. For best results, they should be reapplied frequently to cover new foliage.

5.5 Additional Reading

Landis, T.D.; Dumroese, R.K.; Haase, D.L. 2010. The container tree nursery manual. Volume 7, Seedling processing, storage, and outplanting. Agric. Handb. 674. Washington, DC: U.S. Department of Agriculture, Forest Service. 200 p.