

Restoration: Preparing the site and planting

Pre-treatment and conditioning of the site: herbicide application, clearing, mowing, mulching

Restoration sites may have much vegetation and soil worth preserving. At the other extreme, there may be sites with almost no native vegetation and the soil may be contaminated with weed seeds. Restoration sites will have weedy species. Generally some form of triage is applied to the site, dividing it into areas of vegetation and soil that will be left, modified, or removed. There is an initial removal of invasive plant species (mechanical removal, mowing, plowing, herbicide application). This activity constitutes a disturbance, and disturbances promote the germination of weeds, so the site must be protected or stabilized. This may be accomplished by applying mulch to suppress weed growth, or by the planting of a temporary cover crop (like sterile wheat). A second benefit of such treatments is the suppression of raindrop erosion of bare mineral soil.

Modification of the site: grading, surface modification, wood, gouges

Along with the activities in the previous section, surface grades may be changed to accommodate site hydrologic design, to create access roads, to form reservoirs, etc. This results in de-vegetated areas that may need protection from erosion as outlined above. Surface modification may be made to provide safe-sites for seeding, to improve soil water retention and planting qualities, while at the same time removing weeds. Addition of wood and the creation of gouges, pits, rows or other earthworks provide intermediate topographic relief. This results in resource retention in the bottoms of depressions or around the base of large and medium-sized wood. Depressions may remain moist or may even hold water for much or all of the season, depending upon the hydrology of the site.

Getting mulch and using it

Restoration sites are often bare and not at all like natural resource-conserving environments (no shade, little OM, no canopy layer to stop wind and re-radiation). Heavy (> 6") applications of mulch have a number of benefits. Mulch suppresses weed germination and growth. Soil moisture under a heavy mulch layer lasts much longer than under bare soil or soil with a weed crop. Mulch seems to have a conditioning affect on the soil under it, probably because it forms a supporting environment for soil micro-biota.

Free arborist's mulch is available in the Puget Sound region. Landscapers must pay to landfill chipped trees and shrubs, and so are willing to bring it to a restoration site so long as there is an economic advantage to do so. Arborist's

mulch must be inspected! It should not be accepted if it contains English ivy, blackberry roots, or chips of woody species that are prone to root from cuttings (poplar, willow). Woody mulch is desired. Mulch that is primarily leaves or needles will not provide a good mulch layer and will decompose quickly.

Logistics of getting plant materials and other things to the site

If you are going to do a restoration project you will probably either grow your own plant material or order it from a nursery. If you have to transport it to site yourself, it should always be moved in a covered vehicle or trailer. Transpiration losses in open vehicles will quickly stress or kill un-protected plants. At a site, material should be grouped, generally placed in shady areas if available (or covered with shade cloth), and protected from herbivory. It should be watered regularly if it is not going into the ground immediately.

Inspecting plant material

Even if you grew it yourself, plant material should be inspected before it is committed to a restoration planting. Here are some general things to look for:

1. Pull container plants out of pots. Look at root systems. Pot-bound plants with girdling roots should be rejected.
2. Woody species with kinks in their main roots will not grow well.
3. Plants that are too leggy will not perform well after planting.
4. Plants with poor vigor or evidence of disease should not be accepted.
5. Young plant material generally "wants to grow" more than old material. Plant young material (2-1, 1-1).
6. Reject bruised or damaged plant material.
7. Reject the wrong species. Willow whips all look alike. Seedlings of conifers are hard to differentiate. Get some kind of verification that you are planting what you specified.

Sorting species and assigning them to planting places; spacing

Plant species are generally put into the ground in specific groupings that are assumed to do well together, and assumed to respond positively to specific anticipated environments. So there must be an initial allocation of available plants to groups. This is often done by physically sorting plants in a marshalling area and sending a selected, pre-mixed group of species to a particular location on the site.

In order to achieve the correct mix, some decisions must be made about spacing and grouping. There are many sources that suggest standard spacing for restoration plants. For instance, trees may be planted on 6' centers, shrubs on 4' centers, and herbaceous species on 12-18" centers. If you have an area

that is 500 square feet in area, you would need to specify 14 trees for that area (500 sq. ft. divided by 36 sq. ft. per tree = 13.9 trees).

Polygons and Flagging

Large projects often utilize polygons to direct the planting of species mixes. Polygons are actually marked out on the ground with stakes and colored plastic tape. Each polygon has a measured area. Rather than specify the exact location for each plant that goes into a polygon, numbers of each species to be planted are tabulated, and the planters are allowed some flexibility in distributing or grouping species (e.g., polygon 245X, which has an area of 500 m² will contain 14 *Alnus rubra*, 11 *Sambucus racemosa*, 10 *Oemleria cerasiformis*, 10 *Rubus parviflorus*, 111 *Berberis nervosa* and 111 *Polystichum munitum* plants.)

The use of flags (colored plastic tape on stiff metal wire) is useful when directing volunteers or un-trained installation workers. Bundles or buckets of plant material are color coded (red tape, blue tape, yellow tape), and flags are placed in the ground either to delimit the area where a species should be planted, or to indicate the exact location to plant. Plants in red bundles are planted where there are red flags, blue bundles where there are blue flags, etc.

The day of the plant: mounting the offensive

The day or days before the planting, preparations should begin. Plants that have been transported to the restoration site should be well-watered and kept under good conditions on the day or days prior to the installation. Crates, trailers, tractors, and other needed items should be brought to the site. Flags, polygon markings and other directional signage should be in place. If mulching is to be done, mulch stockpiles should be placed where they will be useful. If there is no water on site, it may need to be cached in barrels or a water trailer may need to be obtained.

On the planting day, pre-mixed plant material should be taken to where it is easily accessible for installation (to the polygons, to the area where it will be planted, to the correct rows if planting is to be in rows). Equipment (shovels, wheelbarrows, mulch forks, hoses) should be brought to the site. As installation progresses, it should be followed by mulching and watering.

If volunteers take part in the installation, they need to have training in safety, equipment use, plant identification and planting technique. Volunteers also need water, gloves, sunscreen, first-aid kits, hats, snacks, a place to go to the bathroom, and they may need transportation.

The planting day requires that someone knowledgeable about the design of the restoration, restoration techniques, and plant material be in charge. This person must be able to direct the planters and make mid-course changes as conditions warrant. As the installation comes to a finish, they must make sure that the project is neatly tied up (all plants planted, all areas that need mulch will have it, all watering will be done that day before sunset, everything that needs to be removed from the site will be picked up and secured).

How to plant

For container plants, remove root mass from container, tease out roots from the rootball surface, cut sections if rootbound, remove at least outer soil. Dig a wide, not deep hole, place root mass on mound in center, plant high, add back native soil and firm around roots. Do not amend. You may create a reservoir (but not a depression) around plant with soil.

For small plants such as plugs, sets, divisions, liners, or bare root material, you may open a hole in the ground with a dibble, shovel, re-bar. Place plant in opening and firm soil around it (you may do this by stepping on soil). If soil is generally dry, hard and poor, this approach will not work. The soil must be sufficiently friable and moist to provide plants with an acceptable planting bed.

You may plant through turf for many species; prairie species have evolved with turf-forming competitors. You may need trial-and-error to find out which species work this way.

If using live stakes, soil must be moist and have the prospect of staying moist through winter and spring. You should not have to drive live stakes with a hammer; we have re-bar tools for making pilot holes, but soft soil is better. Use 2-3 foot whips and put them in the ground for half their length.

Watering in

On planting day, newly planted material must be watered in, no matter what the weather or forecast. Watering immediately forms a closer contact between roots and soil, as well as providing necessary moisture and decreasing the impact of transplantation shock.

Shade, protection from herbivores, protection from wind, micro-site modification in harsh climates

Plants in a restoration project may not experience the same environmental conditions that would occur in a natural setting. Shade-loving plants may be planted before there is adequate shade. A forest of new little saplings may

attract hordes of rodents. Lack of canopy protection may result in temperature extremes.

Shade. Shade may be provided by building shade-cloth structures, by planting nurse-plants, by using tree shelters, by planting next to boulders or snags, or by sequenced planting (wait until a woody canopy has formed, then interplant).

Herbivores. Herbivore protection can be secured by using fencing (chicken wire or hardware cloth), tree shelters, netting, chemical repellants, watchdogs. At the Auburn Downs racetrack, the bases of tree seedlings were painted with a mix of melted beeswax and cayenne pepper to discourage rodent gnawing.

Wind. Wind can desiccate, and it can also cause abrasion if it blows sand and ice crystals. Wind damage can be minimized by using snow fences, woody vegetation shelter belts, depressions or gouges, or by planting behind rocks, logs, or other obstructions.

Micro-sites. Plants generally do better in harsh environments if they are in a depression or behind a log or boulder. All of these solutions create moister habitats, often with better soil conditions.