

Forest Steward Field Guide





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you're doing good

Green Tukwila Partnership	
Why the Green Tukwila Partnership?	3
Green Tukwila Forest Stewards Program	4

The Four-Phase Approach	5
Tree-age Analysis	6
Getting Started: Planning for Your Site	6

Best Management Practices	8
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Phase 1: Invasive Control	8
Manual and Mechanical Methods	8
Weed-Specific Methods	11
Mulch	14



Phase 2: Planting and Installation	16
Why plant in the fall?	16
Plant Selection and Installation	17
Planting Calendar by Stock Type	28

Phase 3: Plant Establishment	29
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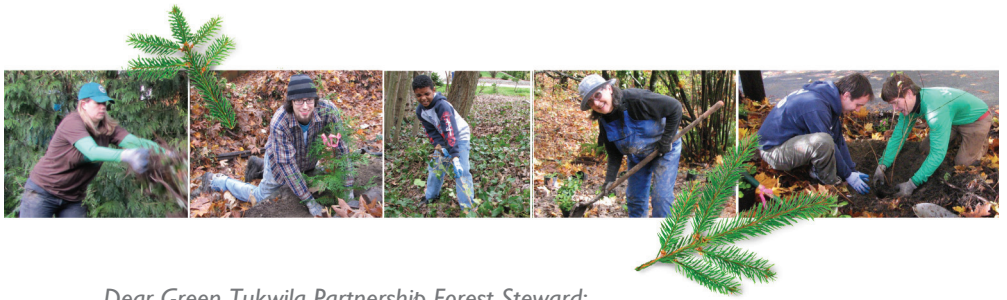


Phase 4: Monitor and Maintain	30
Long-term Monitoring	30
Monitoring Protocols for Exotic Pests	30
Planting Calendar by Stock Type	28



Reporting Forms and Volunteer Events	32
Reporting Forms (<i>important</i>)	32
Volunteer Events	32
Volunteer Event: Ten Essentials	33
Volunteer Event Welcome/Introduction	33
Creating a Tool List for Your Event	35
Working with Students	37

Field Tools	
Appendix A: Soil Quality	38
Appendix B: Mulch Calculation	40
Appendix C: Native and Invasive Plant Chart	41
Appendix D: Target Forest Types	44
Appendix E: Additional Field References and Tools	44



Dear Green Tukwila Partnership Forest Steward:

We welcome you to the Green Tukwila Partnership! The Forest Steward Program is an opportunity to join hundreds of stewards in nine cities across the region in one of the largest community-based urban forest and natural area restoration efforts in the country.

This endeavor results in extraordinary benefits to the community as well as to the environment. Stewards and community volunteers like you play an integral role in the success of this effort. Without volunteers, our goal would be unachievable. We hope that through this program, we can assist you in making your incredible efforts even more successful.

While the thought of tackling the invasive plants at your site may seem daunting at times, remember that you have support from Green Tukwila Partnership staff. As part of the Forest Steward program you will quickly realize you are not alone. The Forest Steward Field Guide in your hands contains the basic yet essential information you will need to develop and implement site restoration plans and a system for tracking progress. As a Forest Steward, you will have opportunities to expand your restoration knowledge and skills by attending specialized training sessions in restoration practices, volunteer management, monitoring, and more. In addition, Stewards at each site are eligible to receive materials, plants, and crew assistance for your restoration projects through the Green Tukwila Partnership.

Thank you for taking the lead to restore, maintain, and steward our urban forests and natural areas. Your commitment makes our amazing city an even better place to live. We look forward to many great years of cooperation and success!

Sincerely,

The Green Tukwila Partnership

Why the Green Tukwila Partnership?

In 2016, the City of Tukwila and Forterra formed a partnership to evaluate the condition of Tukwila's forested parks and natural areas, and develop a plan to help make Tukwila's vision of a sustainable, healthy forest a reality. Tukwila joins 8 other cities including Seattle, Tacoma, Kirkland, Kent, Everett, Snoqualmie, Puyallup and Redmond. With this network of Green Cities comes great collaboration. The Green Tukwila Partnership will both benefit from and contribute to this robust network of resources and expertise.



Our Vision: Healthy Forested Parks and Natural Areas Supported by an Engaged Community

The Green Tukwila Partnership's vision is to have healthy forested parks and natural areas supported by an aware and engaged community in which individuals, neighborhoods, non-profits, businesses, and city government are all working together to protect and maintain their valuable public resources. The envisioned program will be dedicated to restoring and maintaining forested areas while fostering appreciation and understanding of the long-term benefits that urban forests and natural areas provide to the City of Tukwila.

The 20-Year Plan

The Green Tukwila Partnership created a 20-Year Stewardship Plan to restore 138 acres of forested parks and natural areas and guide the program's vision, outcomes, and goals. Specifically, it is anticipated that during the next 20 years, the following outcomes will occur:

- Improvements in the diversity and health of the city's natural areas — all 138 acres enrolled in restoration and actively managed during the life of the program.
- Quality-of-life enhancement through the public's use and enjoyment of an improved urban forest.
- Positive economic effects and enhancement of the ecosystem services and social and physical health benefits that healthy natural areas provide (clean air, clean water, stormwater retention, wildlife habitat, access to recreation, community building, etc.).
- A sustainable, robust, and active Forest Steward Program with volunteers who have a high ownership stake in, and appreciation for, the city's urban natural areas.

The Green Tukwila Partnership 20-Year Stewardship Plan can be found at www.greentukwila.org

Green Tukwila Partnership Forest Stewards Program

The most important element for success is a concerned and committed community. Stewards serve as the backbone to Green Tukwila Partnership by building a community of stewardship around these public natural areas to safeguard their future.

Benefits of Green Tukwila Partnership Support (as resources allow)

- Training opportunities for continuing education and for sharing ideas and information with other Stewards
- Access to plants and materials
- Access to tools
- Paid crews when available, and where and when needed
- Volunteer networking among groups working with Green Tukwila Partnership and other Green Cities
- Direct communication with the City and access to technical resources and expertise to help meet site-specific needs
- Staff dedicated to helping Stewards recruit volunteers and accomplish their site goals
- Assistance and training to monitor each project's progress to ensure proper maintenance

Forest Steward Duties

As a Green Tukwila Partnership Forest Steward, it is your responsibility to carry out the following duties and/or delegate them within your group:

- Attend initial Steward orientation
- Serve as key contact person for Green Tukwila Partnership
- Coordinate with Green Tukwila Partnership staff to develop site restoration plans and annual goals
- Coordinate volunteer restoration events and activities at your site (minimum of three annually).
- Communicate! Complete and send Green Tukwila Partnership event notifications, resource requests, work logs, and sign-in sheets to document restoration activities and the progress you've made



THE FOUR-PHASE APPROACH

We recommend a four-phase restoration approach to site stewardship:

Phase	Tasks	Average Labor Investment
1	Invasive removal	700 hours/acre
2	Secondary invasive removal and planting	100 hours/acre
3	Continued invasive removal, watering, and mulching	40 hours/year for up to three years
4	Stewardship and maintenance	5 hours/acre annually



Phase 1 focuses on removing invasive plants for the first time. In areas with high levels of invasive coverage, it may take more than one year to complete initial invasive removal.



Phase 2 requires follow-up invasive plant removal (weeding), as well as planting of native trees, shrubs, and groundcovers.



Phase 3 repeats invasive plant removal (weeding), if needed, and focuses on plant establishment. Sites are weeded, mulched, and watered as needed. Some sites may stay in Phase 3 for up to three years.

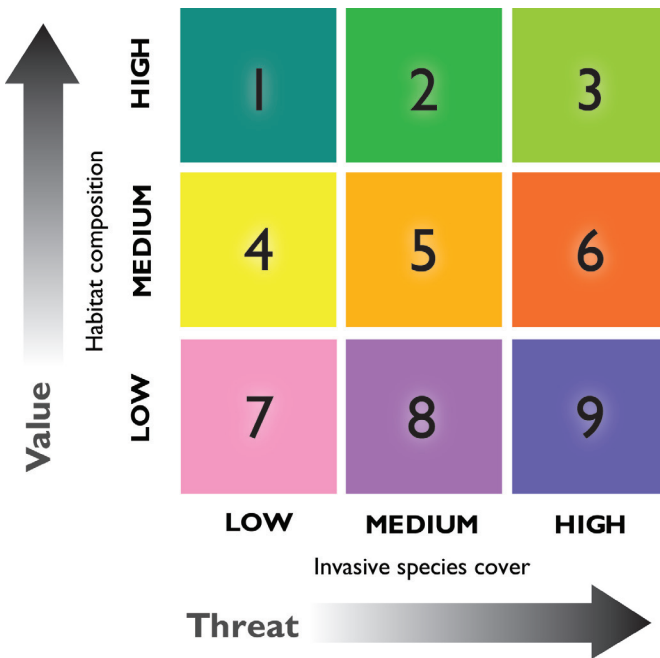


Phase 4 is long-term site stewardship, including monitoring by crews and volunteers to provide information for long-term site maintenance. This may be as simple as neighborhood volunteers patrolling park trails each year to find invasive plants or to address other site needs as they arise. Phase 4 is the shared end goal for restoration sites. But once a site is in Phase 4 it isn't done! Maintenance and monitoring will help it stay in Phase 4 forever.

While most areas will need all four phases of restoration, some areas with low levels of invasive plants may only need a quick initial Phase 1 sweep to prepare the site for the next phase. If a healthy native plant community already exists, the site may graduate to Phase 3 or 4, depending on the conditions. Characterizing restoration sites in each of the four phases aids in the monitoring and development of site-specific management strategies.

Tree-iage Analysis

In the Green Cities Network, an approach called the tree-iage model has been developed to assess habitat conditions and identify priority areas. Each of the nine categories in the tree-iage model requires a different restoration strategy. This model will be used on Green Tukwila Partnership sites to help prioritize restoration efforts. In looking at all natural areas included in the Green Tukwila Partnership 20-Year Stewardship Plan, priority is given to high-value habitats and then moves toward medium- and finally low-value areas. The tree-iage analysis is just one factor to consider when evaluating your site and establishing priorities. You may also need to consider other important factors such as safety, access, and visibility, or sites where there is already an active group dedicated to stewarding a site.



Getting Started: Planning for Your Site

Now that you have selected a site, there are five key ideas to remember:

1. Site visit
2. Restore
3. Report
4. Celebrate
5. Continue

1. Schedule a **site visit** with Green Tukwila Partnership staff. We will help your group establish a site plan to guide your work that identifies specific goals for each project year. Some parks may already have an established management plan to help guide restoration activities, in which case staff will help you interpret that plan. (Note that no volunteers are allowed on slopes greater than 40%. If the site you want to work on contains slopes this steep, you will be working with City staff to create a plan for those areas.)

Your site visit will cover the following topics:

- The history of any prior restoration work at your site
- An estimate of the approximate number of volunteer hours you can expect to spend in the upcoming year
- An estimate of an appropriately sized area to begin your restoration project
- A review of maps of your site, if available, in order to evaluate and “tree-iage” the best area of focus for your volunteer group. (See “Tree-iage” Analysis above. Maps are available to stewards by request)
- Information about how to set site goals and choose a restoration strategy using the City-approved Best Management Practices (BMPs) that apply to the site
- Information about how to set a timeline for volunteer work parties

2. Host lots of work parties as you begin to implement the site plan. Be sure to request work party dates by sending an Event Request Form to the Green Tukwila Partnership Project Manager no less than 2 week in advance if you need any additional tools or materials for your event. This will ensure that you can get your event posted on the online calendar and have your tools and materials ready for the work party. (www.greentukwila.org)

3. For each event you host, be sure to submit a work log and a volunteer sign-in sheet together on a monthly basis to the Green Tukwila Partnership Project Manager, as well as your individual work hours. Timely submission of work logs and volunteer sign-in sheets is important to tracking and reporting our progress, and demonstrating this progress is key to attracting the financial, political, and volunteer support necessary to keep the program sustainable in the future.

4. Celebrate your group’s accomplishments!

5. Continue this process annually.

Best Management Practices (BMPs)

The BMPs described in the Four-Phase Approach are a compilation of best practices collected by both volunteers and restoration professionals with a wide range of experience in restoration. BMPs are updated and revised as new methods are tested and deemed successful. Your feedback on these methods is essential! Please don't hesitate to share your experiences with us.

Phase I: Invasive Control



Manual and Mechanical Methods

The ongoing control of invasive vines, such as English ivy and clematis, is important to any restoration site. Creating “life-saver” rings on trees infested with ivy and clematis (see BMPs for English Ivy on page 12) is a great way to get started. It is also a rewarding experience for volunteers and may help to build momentum on your project as you get it underway. (Please remember, City must be notified before you begin working in any new site.)

Manual removal techniques can be very effective against invasive shrubs, vines, and herb layer weeds, such as Himalayan and evergreen blackberry.

Volunteers are **restricted from using power tools** on City of Tukwila properties, including all City parks. Mowing, chainsaw work, and brush-cutting must be performed by City staff or paid crews. Additionally, weedy trees often require treatment with herbicide or power tools, which must be done by paid crews.

Weed Pulling and Cutting with Hand Tools

- Hand pulling is appropriate for small herbaceous plants and some vines.
- Hand tools are most appropriate for shrubs and some vines.
- Be sure to maintain a safe distance of at least ten feet between volunteers using tools.
- Work carefully to minimize soil disturbance.
- Avoid pulling non-target plants.

- Use tools of an appropriate size for the job to avoid stress on both hands and tools. Stem-cutting tools include hand pruners for stems of less than one inch, loppers for stems of one to two inches, and handsaws for stems of more than one inch. Root-removal tools include hand-tillers for herbaceous plants and large picks, shovels, and Weed Wrenches™ for shrub or tree roots and rhizomes.

Weed Waste Disposal and Composting on Site

It is important to have a plan for the disposal of your weed waste before you begin to remove plants. Depending on the site and work plan developed with Green Tukwila Partnership staff, weed debris will either be hauled away to be composted off site, or composted on site. Please work with staff to determine if composting on site is appropriate at your restoration site.

Woody Debris

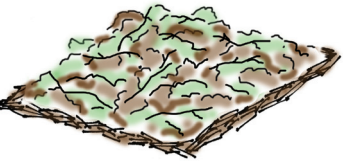
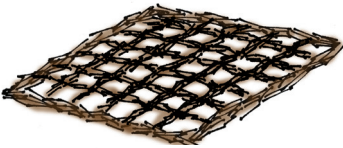
When clearing an area for planting, you may find it easier first to remove dead branches and small logs from the ground. Be sure to set these aside separate from the invasive plant material being removed. The woody debris should then be replaced, either after all the clearing and mulching is complete, or after the site has been planted. It may also be used for building a compost pile. Logs and other coarse, woody debris are important components of healthy Pacific Northwest ecosystems. Additional logs and branches can be introduced if areas undergoing restoration have little or no naturally occurring coarse, woody debris available. Make sure that only invasive plant material goes into your compost pile, so that leaves and sticks can decompose and contribute to healthy soils, and resist the urge to “rake the forest floor clean.” This will also save you from having to make more compost piles than you really need.



Building an On-site Composting Pile

Composting on site is cost effective, helps to leave organic material and nutrients on site, and provides excellent habitat for wildlife. Create compost piles out of sight from walking trails as much as possible.

Step 1: Find an area free of native plants and remove all invasive plants and roots. It is very important that the area is thoroughly cleared before you build your compost piles. If there is no good space, you can start by clearing a small patch of invasive plants to make room for the compost pile.



Step 2: Lay out a frame of branches that will define your compost area. The area of the pile should not be more than 40 square feet. (The sides of the frame should not be much longer than you are tall.) If you are using cardboard, lay the cardboard down first, then put the frame of branches on top of the cardboard edges.

Step 3: Fill in your frame with dead branches and sticks found on site. Place them in both directions to form a grid. This helps prevent the composting weeds from having direct contact with the soil.

Step 4: Put pulled weeds on top of the pile. Stack ivy in smaller bundles and contain all debris inside the frame. Do not make the pile higher than three feet tall, and do not let the pile spill over beyond your frame.

Step 5: Check piles throughout the year and turn or maintain them as needed to ensure that the ivy or blackberry does not re-sprout.

- Reproductive parts, such as seed heads and roots, should be collected separately and placed on top of composting piles so they do not sprout or root in the soil.
- Do not compost these weeds on site: Knotweed, Purple Loosestrife, Garlic Mustard, Tansy Ragwort, Yellow Archangel, and Giant Hogweed, Poison Hemlock and Water Hemlock and certain other noxious weeds are capable of re-sprouting from plant fragments and should not be touched or disturbed by volunteers (see page). Please leave it for paid crews and notify the Green Tukwila Partnership staff if you find it on your site.

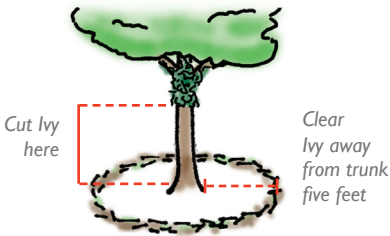
Weed-Specific Methods

For additional help with identification of invasive plants, as well as additional resources about removal and disposal methods, see the King County Noxious Weed website: <http://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds.aspx>

English Ivy

<http://www.kingcounty.gov/> search: english ivy

- Creating “life-saver” or “survival rings” should be top priority to save existing trees and reduce the ivy seed source. Start by cutting vines at shoulder height, then again at the base of the tree. Remove all ivy from where you cut at shoulder height down. Be careful not to damage the outer bark of the tree when removing ivy vines. Grub out the roots in a radius that is at least five feet away from the tree. Do not attempt to pull vines above out of the tree; they will die and decompose on their own, and pulling them down from high branches can be dangerous and possibly damage the tree.
- Remove dense ground patches of ivy by clipping edges of swaths, then continue clipping, digging, and rolling the tangled mat up into an ivy log.
- Take care to cut around or gently lift ivy mats over existing native plants.
- Clear ivy at least ten feet beyond the proposed planting area to create an ivy-free buffer.



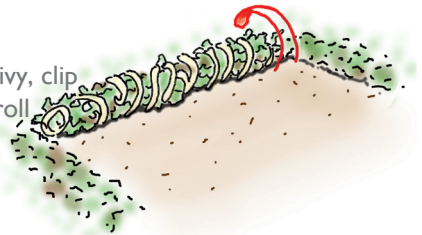
“Lifesaver” Tree Ring – Cut ivy at shoulder height and again at base of tree. Do not attempt to pull vines out of tree. Roll ivy back away from tree in logs like those illustrated. Clear at least five feet back from



each tree trunk.

Ivy Bundle – For small clumps of ivy, pull all vines out, wrap into a tight bundle, and dispose on compost pile or hang on a branch where it will not come into contact with the ground.

Ivy Log – For large contiguous swaths of ivy, clip edges of five- to ten-foot-wide sections, roll into a log, clip root connections at end of roll, and roll on top of compost pile to decompose or haul away depending on the site.



Himalayan and Evergreen Blackberry

<http://www.kingcounty.gov> search: blackberry

- Cut and grub root balls. (It may be necessary to repeat for two to three growing seasons before planting.)
- For sites that provide important bird habitat, it is recommended to only remove one-fourth of the blackberry infestation each year, especially if there is little alternative habitat nearby. You may want to consider refraining from large blackberry removal projects during nesting season (mid-March to the end of June).



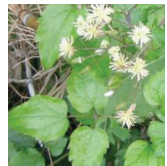
Blackberry Canes, *left above* – Use caution when cutting and carrying these stiff, prickly canes. Long sleeves and leather gloves are a necessity. Locate a clearing beyond trail-view corridors and stack the canes to compost over time. It is helpful to leave about a foot of cane sticking out of the ground to remind you where to come back and dig out the root.

Blackberry Root Balls, *right above* – Blackberries have large clumps of root balls in the first 6-18 inches of soil. Below the balls the roots can grow up to three-feet deep. Roots should be dug out entirely and placed on top of a stack of canes.

Clematis

<http://www.kingcounty.gov> search: old man's beard

- Cut vine at the base in early summer before seed production and grub out roots. Stems may be pulled more effectively in winter when brittle. In the winter clematis vines lose their leaves and may appear to be dead, but beware! They are usually still alive and should be removed if roots are established in the ground.



Knotweed

<http://www.kingcounty.gov> search: knotweed

- Chemical treatment is the most effective way to eradicate knotweed. It must be performed by Green Tukwila Partnership staff or paid crews during dry periods from July to September. With growing demand for knotweed removal, please be patient as crews are directed to your site.
- Hand removal of knotweed is impractical and could actually exacerbate the problem.
- Volunteers are highly discouraged from removing or tampering with knotweed patches as disturbance promotes growth and dispersal.



- If knotweed is present at your site, please record/map its location and report it to Green Tukwila Partnership staff. Be sure to include the park name, the site name, the date reported, the estimated square footage of the knotweed patch and the estimated number of stems.

Cherry or English Laurel, Portuguese Laurel, English Holly and English Hawthorn (other woody invasive shrubs and trees)

<http://www.kingcounty.gov> search: english laurel, portuguese laurel or english holly

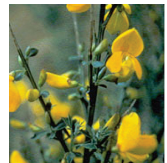
- Do not cut down an invasive tree **without removing its roots**. This will cause it to send up suckers that grow into many more trees, greatly multiplying the problem. Any tree that cannot be entirely removed should be left for paid crews.
- If invasive trees are getting in the way of other invasive removal at your site, you can “limb up” trees—removing the lower branches—to get safe access to the ground surrounding the trees. Dispose of limbs appropriately. This will also make it easy for crews to come through for cut stump treatment.
- Small, young plants may be hand pulled or taken out with a Weed Wrench™.
- Do not leave freshly cut or pulled holly stems or branches in direct contact with the soil, as the cuttings can easily re-root. Make sure they are left to dry out on top of a compost pile or hauled off site.
- Notify staff: Large plants require herbicide (only to be performed by staff or paid crews). Contact the Green Tukwila Partnership Project Manager if your site needs treatment. We may not be able to send out a crew right away, so please do not cut down the invasive trees prior to treatment by crews. This makes it more difficult to find and effectively treat the invasive trees. Herbicide application is seasonally and weather sensitive. With a growing demand for removal, please be patient.



Scotch Broom

<http://www.kingcounty.gov> search: scotch broom

- Hand-pull small plants and Weed Wrench™ or excavate larger plants when soil is moist in spring. Another option is to cut plants in early summer, just as flowering begins; then cut again at least once in late summer. For large stands, sheet mulching and diligent monitoring may be necessary.



Field Bindweed (Morning Glory)

<http://www.kingcounty.gov> search: *morning glory*

- Hand pull at least three times per year (early growing season, mid-summer, and late summer) for at least three growing seasons.
- Flag site and monitor.
- Shade is the best way to eradicate bindweed; therefore, plant conifers and other native shade plants for long-term success.
- If keeping up with all the bindweed takes more time than you have available, you may need to prioritize clearing all the bindweed from the native plants first, or at least, clipping bindweed away from the base of plants that are trying to establish.



Other Noxious Weeds (various)

Purple Loosestrife, Garlic Mustard, Tansy Ragwort, Yellow Archangel, and Giant Hogweed, Poison Hemlock and Water Hemlock should be removed by professional crews or under the supervision of staff. They should be collect in garbage bags and disposed of in a landfill. Please inform Green Tukwila Partnership staff if you encounter these or any other unusual weeds that are not listed in this guide.

Erosion Control

When invasive plants are removed from gentle and steep slopes, these areas can benefit from some erosion control.

- Plant the right plants for slopes. Use Appendix C (pg. 41) to identify what plants to install for slope stabilization.
- Mulch heavily.
- Stake or lay burlap on slopes.
- Lay coarse, woody debris perpendicular to slope.
- Work with the Green Tukwila Partnership staff to identify other options if the above methods do not fit your site, or if you need help getting started.
- Volunteers are not permitted to work on slopes without prior approval and planning with Green Tukwila Partnership staff. Depending on the location and grade of a slope permits and paid crews may be needed for these steep areas.

Mulch

Mulch is a general term to describe a ground-covering material placed around a plant. Mulches retain soil moisture and block growth of weeds around desirable plants. They also prevent soil erosion and can be used to moderate soil temperature. Several organic and synthetic mulches are available, including wood-chip mulch, compost, and burlap.

Wood Chips

Wood-chip mulch is very useful in establishing plantings that will receive no supplemental water and do not have long-term maintenance funds. Apply a four-inch layer of wood-chip mulch to at least the drip-line of all new plantings. Where possible, mulch between all plants to suppress weeds. Wood chips may be available through the City of Tukwila or a local arborist. Do not use bark mulch, which contains a higher wax content than wood-chip mulch and may lead to the formation of hydrophobic soils. It is important to ask your sources about the contents of the wood chips to minimize possible contamination by weeds or chemicals in the wood used.

Sheet Mulch

Sheet mulching is the preferred mulch method in planting areas that have previously been severely infested with invasive plants (especially blackberry) and are in full sun. Sheet mulching combines the use of burlap and wood chips. Place at least two layers of burlap on the ground between all plants. Make sure burlap overlaps so that there are no openings for weeds to grow through. Follow up by applying six to eight inches of wood-chip mulch across the site.

Compost

Compost is not generally used on Green Tukwila Partnership restoration sites due to cost, and is reserved for severely nutrient-poor soils. Compost is organic mulch that has a finer texture and is more nutrient rich than wood-chip mulch. Compost should only be used as a top dressing to sites that have extremely nutrient-poor soil due to topsoil removal or landslide. Apply one to two inches of compost across the site before planting. Follow up after planting by applying six to eight inches of wood-chip mulch to suppress weeds.



Phase 2: Planting and Installation



Why plant in the fall?

The following section was provided by Sound Native Plants.

Plants installed in the fall usually outperform those installed in the late winter or spring. Planting projects should be scheduled for early October to mid-December for best results.

More root growth before the growing season

It can take several months for roots to sufficiently grow beyond the planting hole to start absorbing moisture and nutrients from the native soil. Fall soil is warm and aerated and many plants actively grow roots during this time. Some species will continue root growth through our mild winters, and most begin their most vigorous root-growth period in the late winter or early spring. Only fall transplants have this critical time for root extension before spring top growth takes off. Plants installed in the spring may barely recover from transplant shock before the heavy demands of growth and summer drought are upon them.

Ideal planting weather

The cool, cloudy days and frequent precipitation of fall and winter provide ideal transplanting conditions. Until sufficient roots develop, newly installed plants will undergo transplant stress that can be exacerbated by warm, sunny days. Fall and winter weather allows for reduced transpiration and provides ample moisture for the roots while the plants recover from transplant shock. However, plants should not be installed when the soil or container is frozen since frozen ground will keep plants from thawing out.

Lower maintenance and irrigation requirements

Fall plantings enjoy advantages that are especially important for projects that will receive minimal maintenance and irrigation. The earlier plants go into the ground in the fall, the more time they have to recover from transplant shock, adapt to the site, and expand their root systems before the growing season. They will require less water and grow more vigorously than if they are planted in the spring. In climates where the ground is frequently frozen several inches deep, it may make sense to delay planting until spring, but in western Washington we usually have perfect winters for plant establishment.

Plant Selection and Installation

Work with Green Tukwila Partnership staff to develop plant palettes. There are many factors to consider when choosing a plant palette: aspect, slope position, soil moisture, soil texture, sunlight, existing vegetation, access to water, and human impact. It is a great experience to walk your site and analyze its characteristics. The information about analyzing soil quality in Appendix A (pg. 38) and the native plant list in Appendix C (pg. 41) will help you identify plants that will work with your site's soil, meet different ecosystem needs, and fill specific niches.

Plants for Steep Slopes and Erosion Control

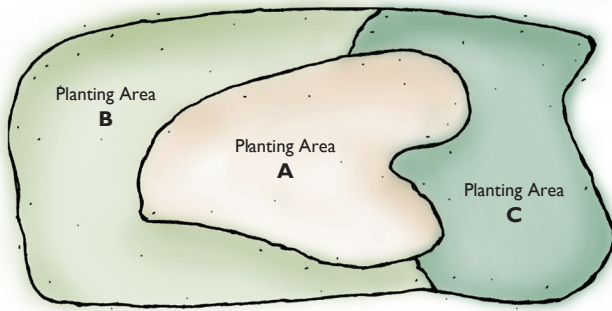
The best strategy for stabilizing a slope with plants is to establish vegetation at multiple levels – plant a mixture of trees, shrubs, and ground covers. A multi-level canopy will do the best job of intercepting and slowing precipitation before it hits the ground, thus reducing surface erosion. Multiple vegetation types also provide both deep and spreading roots, which stabilize the entire soil profile.

If maintaining a view is important, work with Green Tukwila Partnership staff to develop plant palette and installation plan. Some strategies might include planting trees at the edges of the view, spacing them widely, or pruning selectively, but don't leave them out – you can't beat a mature tree for its root system.

See a complete list of recommended plants in Appendix C. The native plants recommended for steep slopes are marked with an icon (s) and are rapid growers that stabilize soil quickly.

Selecting Planting Areas

Planting areas are distinct plant communities that require different restoration approaches. Sites overwhelmed by invasive plants will require more intensive planting and maintenance than those that already have some native canopy cover and a healthy shrub and groundcover layer. Divide your project site into the following three types of planting areas (next page). You can use the graph pages in the back of this guide (p. 47) or a separate piece of paper.



- Type A: Establish Plant Community – These are areas of completely bare ground, likely due to the clearing of an invasive plant community.
- Type B: Enhance Plant Community – Areas where there are some native plants, but additional density and/or species diversity is required to meet canopy cover and habitat goals.
- Type C: No Planting – Areas that are fully occupied by a diversity of native species that provide multiple layers of canopy cover or otherwise currently meet management objectives.

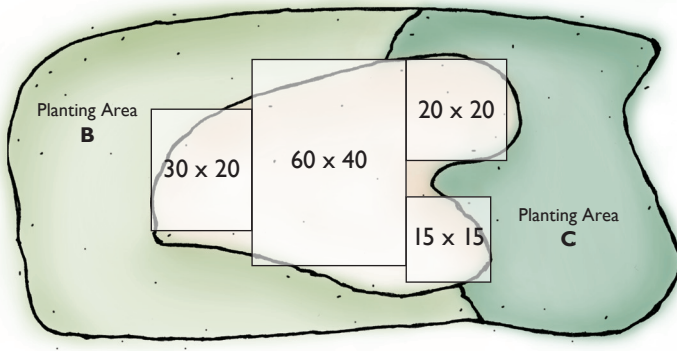
Posting the Planting Area

Delineating the above planting areas is a helpful first step before you begin to take measurements and identify where to distribute plants when they are delivered. Visual clues in the habitat will help you determine boundaries or “edges” between planting areas. Type A areas are the easiest to mark with clear boundaries between bare or chip-mulched soil and the start of other plant communities – posting edges is not necessary in these areas. Where boundaries are less clear, define planting area boundaries by flagging edges at head height.

Flagging is strictly for purposes of site measurement and designating areas for planting day. It is especially helpful when you have volunteers helping with planting. All flagging or stakes used for such purposes should be removed immediately after plants are installed and site has been mapped. Pin flags or flagging tape tied loosely on the plant may be left on site to make them easier to find for weeding, watering, and monitoring survivorship.

Measuring Planting Areas

Planting-area estimates are required in order to determine plant quantities for orders. Plants do not grow in perfect geometric patterns, so planting area shapes are often irregular. Depending on the shape of the area, divide it into a series of squares or circles, calculate the area of each shape in square feet, and add the totals together to get an estimate of the entire area. (See example on pg. 19.) If the entire area approximates a regular shape – i.e., roughly circular or rectangular– estimate the area of just the one large shape.



Formulas for Calculating Area

Use these formulas to calculate the area of squares, rectangles and circles.

square or rectangle: length \times width

Example: Planting Area A (above): $(30 \times 20) + (60 \times 40) + (20 \times 20) + (15 \times 15) = 3,625$ sq. ft.

circle: $3.14 \times \text{radius}^2$

Example: A circle with a radius of 12 feet: $3.14 \times (12 \times 12) = 452$ sq. ft.

Spacing

Spacing refers to the amount of distance between installed plants. Spacing objectives are determined by management goals related to canopy cover and plant competition. Planting natives densely will utilize site resources, including water, nutrients, and light, and limit opportunities for invasive species. Spacing will ultimately determine how many plants you need to order.

Type A and Type B planting areas (shown on page 18) have different spacing protocols. The general idea for both types of sites is for new plants to occupy as much of the site as possible without creating excessive competition with native plants. Type A sites are fairly straightforward because you are working with a blank slate. Type B sites require evaluating current plant density and approximating the number of additional plants you would need to fully occupy the site.

The spacing table on page 20 was created by Sound Native Plants. Organized into plant type and desired plant density, the table indicates the spacing – how far apart each plant should be from another – and the square footage that each plant will occupy based on that spacing. (See the caveat on herbaceous plants on pg. 20.) For most sites a “sparse” to “average” plant density is recommended. Site conditions and other considerations should be taken into account when ordering plants. Areas with sandy soils or without water access should be planted at higher density, given expected plant mortality.

Formula for Calculating Plants Needed

Planting Area ÷ Square Footage per Plant = Number of Plants Needed

Example: 3625 sq. ft. ÷ 324 sq. ft. per tree = 11 trees (sparsely spaced trees, 18 feet on center)

Plant and Stock Type	Desired Plant Density	Spacing	Divide Square Footage by
Trees	Dense	10 feet o.c.*	100 square feet
	Average	12-15 feet o.c.	144-225 square ft.
	Sparse	18 feet o.c.	324 square feet
Shrubs	Dense	4 feet o.c.	16 square feet
	Average	6 feet o.c.	36 square feet
	Sparse	8 feet o.c.	64 square feet
Live Stakes	Dense	1 foot o.c.	1 square foot
	Average	2 feet o.c.	4 square feet
	Sparse	3 feet o.c.	9 square feet
Emergents <i>plant in clumps of 4, multiply the final number x 4</i>	Dense	clumps 1 foot o.c.	1 square feet
	Average	clumps 2 feet o.c.	4 square feet
	Sparse	clumps 3 feet o.c.	9 square feet
Ground Cover <i>4-inch pots in groups of 3</i>	Dense	1 foot o.c.	1 square foot
	Average	1.5 feet o.c.	2.25 square feet
	Sparse	2 feet o.c.	4 square feet
Ground Cover <i>1-gallon pot</i>	Dense	2 feet o.c.	4 square feet
	Average	3 feet o.c.	9 square feet
	Sparse	4 feet o.c.	16 square feet

* o.c. = on center

Note: Ground cover (herbaceous layer) figures have been adjusted down from Sound Native Plants' suggestions to account for the presence of trees and shrubs. For four-inch pots, multiply the final plant number by three as each group of three plants should receive four square feet of space. (Sound Native Plants (2004), www.soundnativeplants.com)

Sample Spacing Plan for Planting Area A Sites (All New Plantings)

Suppose you want to create a sparsely mixed conifer/deciduous canopy on a Type A site. First, you would need to calculate the total number of trees needed. Second, you would need to figure out what percentage of your total square footage (3,625 sq. ft.) you would like each species to occupy. Let's assume we want 30% cedar, 50% maple, and 20% alder.

Number of trees needed: 3,625 sq. ft. ÷ 324 sq. ft. per tree = 11 trees

Cedars needed = 11 × 0.3 (30%) = 3

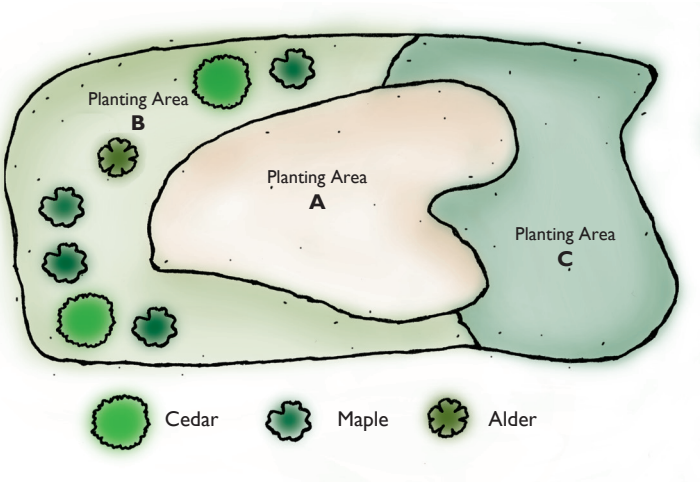
Maples needed = 11 × 0.5 (50%) = 6

Alders needed = 11 × 0.2 (20%) = 2

Follow the same steps for each canopy layer to occupy the site fully. Do not be terribly concerned about overloading each canopy layer. Density protects the integrity of a project on two levels: 1) the site is fully occupied by natives, which exclude opportunities for invasive plants to take over, and 2) it is a form of insurance for poor plant survival. In restoration, plants are cheap relative to the costs of invasive species removal. It takes substantially less effort to thin a few excess native trees or shrubs than it does to clear ivy or blackberry from the same area. Finally, it is also extremely unlikely that you will have 100% survival, so overplanting is better than underplanting.

Adjustments for Planting Area B Sites (Moderate Number of New Plantings Needed)

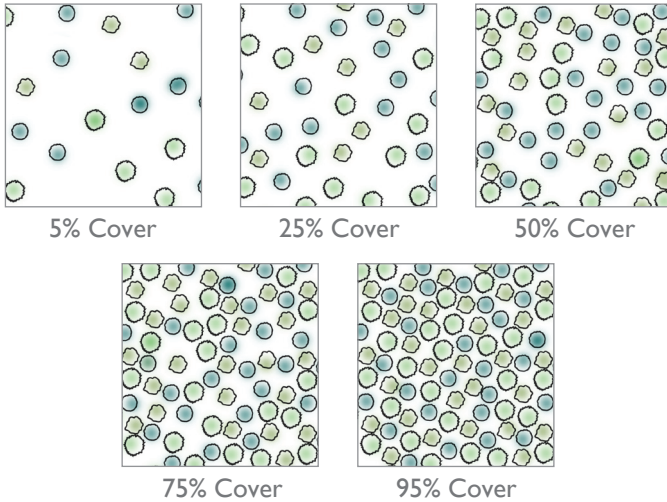
If you are working on a Type B site, enhancing plant community, you will need to estimate the current site occupancy and then adjust the quantity of new plants needed accordingly. The simplest way to do this is to count stems and divide by the site's square footage. Don't worry about getting a perfect count; this process is both an art and a science and there are no perfect answers. As an example, see the following diagram. Let's assume Planting Area B is also 3,625 square feet.



The site is currently occupied by two cedars, four maples, and one alder. Assuming we have the same density goal as our Type A site, we can follow the same steps as above, and then simply subtract the number of plants already occupying the site from the total amount of plants needed to determine how many new plants you need to install.

- Cedars Needed = $3 - 2 = 1$
- Maples Needed = $6 - 4 = 2$
- Alders Needed = $2 - 1 = 1$

Tree stem counts are simple, shrub counts are a little more complicated, and ground cover counts are challenging. If you already have dense ground cover, or plants are in clumps too close to identify individuals, estimate a percent cover, then work your way back to occupancy. The following diagrams illustrate five levels of cover. Use these illustrations to help you estimate; again, this is somewhat subjective, so don't worry about making it perfect. If you have 70% native ground cover and your goal is 100%, you need to occupy 30% of your site with additional ground cover.



Ground Cover Plants Needed: 3,625 sq. ft. ÷ 4 sq. ft./plant = 906 plants

In order to account for current occupancy, multiply the number needed for full occupancy by the percent of bare ground on your site.

Bare Ground Percent (100%) – Current Percent Cover (70%) = 30%

Ground Cover Plants Needed: 906 plants × 0.3 (30%) = 270 plants

This may seem like a lot of work, but if you are an experienced gardener or landscape technician, or have performed the above process many times, it gets much, much easier. An experienced restoration specialist can walk to a site, estimate area and percent cover, and calculate plants needed in less than an hour. While you work your sites, practice the following technique:

- Think of objects whose approximate area you already know. For example, a car is approximately 50 square feet, an average bedroom is 130 square feet, and a story of an average house is about 1,000 square feet.
- Estimate stem density and eyeball percent cover in comparison to those known areas.
- After you practice a bit, run through the above steps and see how close your educated guess came to your measured results.

Over time, your skills will improve dramatically and you will need significantly less time to develop planting plans. Remember, restoration is an art and a science; there are no perfect answers!

Plant Order

With the plant palette, stock types, and spacing settled, as well as planting areas delineated and measured, you are ready to combine these elements and work with Green Tukwila Partnership staff to develop a plant order. A plant request form will be sent out to all active Stewards/Steward Teams to receive a limited number of plants as resources are available. These plants will most likely come from a local native plant grower. There are several other ways to acquire additional plants for your restoration site.

- Use plant salvages if there are opportunities in your area.
- Use live stakes.
- Write grants or have a fund raiser.
- Contact nurseries for donations.

Plant Inspection

Visually inspect nursery stock when it is delivered. It is extremely difficult to communicate or negotiate regarding poor stock after the delivery truck has left. Plants require special care and the nursery is generally not responsible for the fate of stock after it has been received. Signing a plant delivery order implies that you have received the stock and certified that it is acceptable. Upon delivery, count and examine the health of all varieties of plants received. Pull some plants from containers to examine the root ball. Occasionally plants are delivered in containers larger than required for root and plant needs. If you pull a four-inch-pot-size plant from a gallon container and most of the soil immediately falls off, make a note and communicate this to both the delivery driver and the person who ordered the plants.

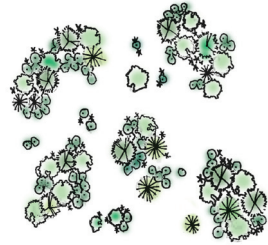
Staging

Allow adequate time in your work plans for plant staging. Staging is the distribution of plants across a site in preparation for planting. One-time volunteers and new crew members may not be familiar with each plant species or its ecological niche, so it is very important to have plants placed where they will be planted prior to the planting event. Small patch plantings of 50-100 plants may be placed by an individual within an hour. Larger, more elaborate plantings can take several hours and will require the help of a crew to stage. On delivery, place plants in groups by species, preferably in clumps of ten for easy distribution and accounting across the site.

Restoration plantings are staged to meet several management objectives such as wildlife habit, aesthetics, slope stability, and recreation. The general aesthetic is naturalistic, defined by a randomly placed assemblage of multiple canopy layers. Species are selected to suit site-specific soils, aspect, and existing plant communities. The three plant staging techniques are acceptable and are most frequently used: clump-gap mosaic, thicket, and row irrigation.

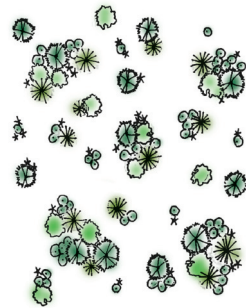
Clump-Gap Mosaic

The microsite is the specific location within a site that a plant will be placed. Plant palettes are selected to meet general site conditions; however, within each site there is variability in soils, sunlight, and moisture availability. The clump-gap mosaic planting pattern was developed in order to address these microsite issues. The basic pattern is that three to five plants of each species are “clumped” with several other groups of three to five plants of other species. Between these clumps are gaps where individuals of the different species are randomly placed with wider spacing. This layout ensures that each species will be distributed across the site and in association with several different suites of species as well as alone. It provides several unique niche opportunities for each species and lends a random and naturalistic aesthetic to the planting.

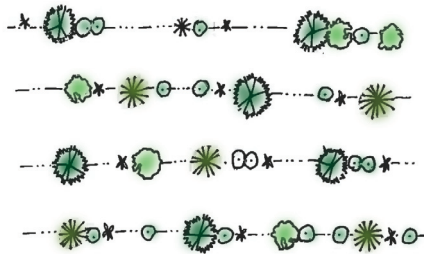


Thicket

This style is a high-density version of clump-gap as at right, without the gaps. Stage ground covers and shrubs at dense spacing in groups of three to five, with individual tree species placed in between, also at dense spacing. Visually there will be less bare ground than the clump-gap style. This style of planting is particularly useful to address areas heavily infested by invasive weeds, as it maximizes site occupancy by native plants.



Row Irrigation



Plants are placed in irregular intervals along irrigation lines. Plants are in clumps of three to five, by species. Over time, competition and mortality will lend a natural aesthetic to this planting.

Exposed, dry sites may require irrigation. Work with Green Tukwila Partnership staff to develop watering plan in advance of planting. Where drip irrigation is installed, plants need to be placed in rows because the drip emitters are placed at regular intervals and need to be directly adjacent to the plants. The initial aesthetic of these plantings may appear formal, but with careful staging, the plants will grow into a more natural aesthetic.

► Freestyle Planting Plans

If you feel confident in your work group or in your own skills, a freestyle planting plan may be an option. Have volunteers plant “at random,” keeping trees about ten feet apart (two shovel lengths), and shrubs and ground cover three to five feet apart (one shovel length) from each other.

Green Tukwila Partnership staff are always available to assist with plant selection and installation plans.

Installation

Now that you have spent so much time planning for your site, removing the invasive species, and preparing for planting, it is important to know how to plant the trees, shrubs, and groundcovers that will one day grow to make up a healthy forest or natural area. *Adapted from Washington State University Cooperative Extension Bulletin MISC0337, Plant it Right: Restoration Planting Techniques.*

I. Preparing the Hole

- Clear away all loose materials, such as leaves, rocks, and branches from the area where you will plant.
- Dig the hole wide enough to completely spread out the plant roots, without crowding or bending them. If you are planting a container plant, dig a hole that is twice the width of the container.

- Dig deep enough so the plant, when set in the hole, will have the top of the root crown flush with the soil surface. Use a shovel as a level. Use the level of soil around the base of a container plant as a guide for how to plant in the ground.
- Dig a cylindrical hole and thoroughly clear existing roots from the hole.
- Pile soil in a cleared area next to the hole. Take plant roots and grass clumps out of the soil that will be used to backfill the hole.
- Roughen the sides of the hole if they appear slick or clay-like, as it will help the new roots to penetrate the surrounding ground.

2. Preparing the Plant

There are slightly different methods to planting, depending on the stock type.

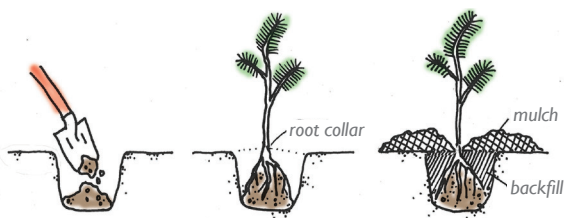
For Potted Plants



Tip the pot on its side and gently press on the pot to loosen the plant.

- It is important to loosen up the roots with your hands or a tool such as a hand tiller. Pull loose roots outward and cut or straighten any that are encircling the root ball, or “J” roots that are growing upwards. These roots may continue to grow around the plant or upwards and affect the health of the plant.
- Place the plant so that the root collar is level with the ground. When you fill the hole in later, the soil should be at the same level as it was in the pot.
- Place the plant in the hole and arrange the roots so they point outward.
- Make sure the plant is placed at its original depth. Do not plant too deeply or too shallowly.

For Bareroot Plants and Plugs



- Keep the roots moist until planting by storing them in moist sawdust or soil. In addition, you may soak them for one to two hours (although never longer than six hours) before planting.

- Prune back any badly bruised, broken, kinked, or jagged roots to sound wood.
- Make a small cone of soil in the bottom of the hole.
- Arrange the roots around the cone so they all point outward from the plant.
- Make sure hole is deep enough for roots to extend downward without curving back up (known as “J” rooting).

For Ball and Burlap Plants

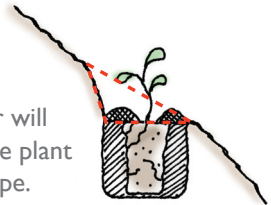


Ball and burlap plants are not commonly used and can be hard to establish. If used keep in mind:

- Keep the ball and burlap plants moist until planting time.
- Place ball and burlap root ball in the hole, and adjust the height of the tree to have the root collar in line with the ground.
- Clip away burlap, twine or packaging as much as possible, leaving roots as undisturbed as possible.

For Planting on Slopes

- Dig plant hole deep enough so that the root collar will be level with the lower edge of the slope. Place the plant so it grows straight up, not perpendicular with slope.



3. Replacing the Soil

- Backfill using the native soil that was dug out of the hole (or a hole nearby if more soil is needed).
- Ensure that only soil goes back into the hole – no large rocks, sticks, clumps of grass, leaves, or mulch.
- Do not add any soil amendments (fertilizer, compost) to the planting hole.
- Push soil around the roots in the hole without disturbing root arrangement. Cover the roots, but leave the entire stem exposed above soil. Planting too deep can cause the stem to rot and kill the plant, and planting too shallow can dry out the roots.
- Push soil down firmly to remove any air pockets.
- Form the surface soil into a small basin around the periphery of the planting hole to hold water, and adjust the soil so that water drains away from the immediate trunk area. Gently pull the plant by holding on to the base of its stem to make sure that it's firmly planted.

4. Finishing Up

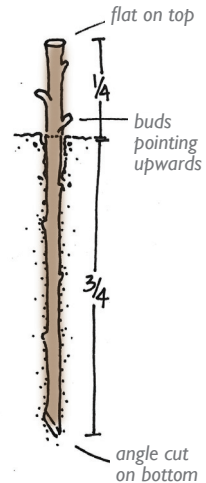
- If possible, water the plant immediately to settle the soil and eliminate air pockets. Add more soil if needed.



- Apply wood-chip mulch to the top of the soil in a circle at least as wide as the roots, but not touching the stem. This mulch “donut” will help to retain water around the plant, suppress weeds, and provide nutrients as the mulch breaks down. Two five-gallon buckets of mulch in a four-inch-deep donut around each container plant is appropriate.

For Live Stakes (Cuttings)

- A planting bar tool is often used to punch a hole for the cutting. In soft soil, cuttings can sometimes be directly pushed or hammered in.
- Place the cutting in the hole right side up. Cuttings are typically cut on an angle on the bottom and flat on the top. When held right-way up, the buds will point upward.
- A general rule is to plant cuttings 18 inches deep, or at least half the length of short cuttings. Deeper is fine, as long as a few buds are exposed at the top.
- Tamp in around the cutting to ensure there are no air pockets along the stem. You can push the planting bar into the soil immediately around the stem and push in the soil toward the plant.



Planting Calendar by Stock Type

Stock Type	Planting Season
Container	November – December
Bareroot and Plugs	November – March (check availability –often not available until Feb/March)
Live Stakes	November – February
Emergent Plants	All year long with adequate soil moisture



Phase 3: Plant Establishment

Most plants require at least three years of establishment care to ensure plant survival. Although native plants have adapted to our summer-dry climate, installed container and transplanted plants both experience transplant shock that affects root and shoot health. In general, sites are weeded in the early growing season, watered in summer, and mulched in late summer.

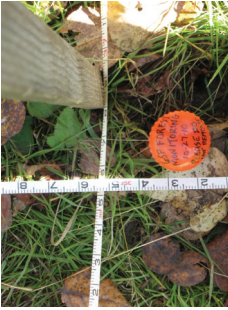
Maintenance: Volunteers can do a lot to ensure plantings survive during Phase 3: creating mulch donuts, watering, removing invasive plants, and doing more planting or plant replacement, if needed. If you ever feel that you are unable to keep up with maintenance on a restoration site please contact Green Tukwila Partnership staff for assistance.

Optimal watering during dry months, most often June through September, would be two gallons per plant per week depending on site conditions and soil moisture. If water is not directly accessible from your site, volunteers can transport water from the nearest source with buckets or watering cans. Installing mulch donuts/ rings (ten gallons, four inches thick) is crucial when access to water is limited or inaccessible.



Phase 4: Monitor and Maintain

After a restoration site has gone through invasive removal and planting, and the trees, shrubs, and ground cover are established, the work still isn't done! We believe that natural areas are never completely "restored" because continued



monitoring and maintenance are needed to make sure that Green Tukwila Partnership sites remain free of invasives and filled with healthy native plants. You should plan to take an annual walk through your site to look for plant mortality, any invasive plants, or possible areas of human impacts that require attention. You can report any work done on work logs under the maintenance section. If you ever feel that you are unable to keep up with maintenance on a restoration site please contact Green Tukwila Partnership staff for assistance.

Long-term Monitoring

Monitoring is an excellent way to measure the success of your restoration site and overall health of the forest over time. The Green Cities program has developed standardized monitoring protocols for baseline and long-term data collections. Some types of information that is important to measure over time:

- Site characteristics such as soil moisture and textures, litter depth, canopy cover, and downed woody debris
- Overstory composition and health
- Vegetation cover, including plant species and percent cover

As the Green Tukwila Partnership grows its program monitoring protocols and training will be made available in the future as restoration efforts progress.

Contact Green Tukwila Program staff or email greentukwila@forterra.org if you are interested in learning more about the current Green Cities Forest Monitoring Protocols.

Monitoring Protocols for Exotic Pests

Exotic forest pests threaten our native forest ecosystems. The Asian longhorned beetle (ALB) has already invaded several states in the eastern US causing damage to native plant ecosystems, urban forests, agriculture, and home gardens. Early detection is the key to preventing the establishment of exotic forest pests in our area.

You can help by examining trees for ALB damage in neighborhood parks, forests, greenbelts, and even in your own backyard. When you examine the trees, please fill out the ALB Survey Data Form, reporting your observations is extremely important, even if you saw no signs of ALB. The survey process is quick, easy, and can be done while monitoring your site, working on site projects, hiking, or just enjoying recreational time outdoors.



Signs and Symptoms to Look For

Defoliation of trees (image below left) and dime-sized exit holes in the trunks of trees (image below right) are evidence of Asian long-horned beetle activity.



Asian Long-horned Beetle Survey Instructions

- Locate at least 10 host trees on your site.
- Examine each tree for signs of ALB infestation, especially beetles and dime-sized exit holes.
- If you observe beetles or evidence of ALB damage, please take digital pictures of the insect and damage to the trees if possible. If you can capture insects you think are ALB, place them in a jar and freeze them.
- Contact Green Tukwila Partnership Project Manager if you are interested in participating in the exotic pest monitoring project for the ALB data form.

Good information website from the University of Vermont:

<http://www.uvm.edu/albeetle/hosts.htm>

Beetle busters website

<http://www.beetlebusters.info>

Useful resources from Forestry Canada

http://www.gfrc.forestry.ca/VLF/invasives/alhbdetecguide_e.pdf

REPORTING FORMS AND VOLUNTEER EVENTS

With this information we can recognize great achievements, monitor success, and track progress on your site and across the City. Reporting our City-wide restoration achievements is **absolutely crucial** for gaining the necessary political and financial support for a successful program.

Reporting Forms

The Green Tukwila Partnership will collectively host many volunteer events each year, plus individual work and paid crew projects. In an effort to simplify and streamline the documentation process, the following forms are required for each site and will be provided on your field clipboard. These forms will be made available on line and emailed to all Habitat Stewards.

Submit **before each work event**:

- Event Request Form: Submit four to six weeks in advance.

Submit together **after each work event**:

- Volunteer Sign-in Sheet: Fill out at each event and submit after each event.
- Event Work Log: Fill out at each event and submit after each event.
- Youth Waivers: For any youth volunteers not accompanied by a parent.

All forms should be sent to Green Tukwila Partnership Project Manager:
Green Tukwila Partnership - c/o Forterra
901 5th Ave S. Seattle, WA 98164
Phone: (206) 292-5907/ 206-905-6924
Email: greentukwila@forterra.org

Volunteer Events

Each group receiving Green Tukwila Partnership support must commit to holding at least three work parties per year. Staff can help each group recruit enough volunteers to meet this goal. Volunteers can help with all four phases of restoration – from initial invasive removal to watering and maintaining plants.

As mentioned, the Habitat Steward for each group needs to submit an Event Request Form at least four weeks in advance of the work party. This is to ensure that there are no other conflicting events in the park and allows the Green Tukwila Partnership staff to better direct interested volunteers to your work party.

An event calendar with all Green Tukwila Partnership work parties is posted on our website (www.greentukwila.org), so fill out the “posting” section if you have specific information you would like to have posted online for your event.

Green Tukwila Partnership staff and paid crews may be available to help lead larger events, as long as you provide us with enough advance notice. Please contact the Green Tukwila Partnership Project Manager to request volunteer-event support. If you cannot accommodate an interested volunteer group, please ask for assistance or direct them to an alternative event listed on the website.

Volunteer Event: Ten Essentials

With all volunteer events, there are ten essential items that help create a successful event.

1. First-aid kit and cell phone
2. Tools
3. Materials (plants, cardboard, mulch, etc.)
4. Signage – at sign-in table or park entrance
5. Clipboard with ballpoint pens
6. Volunteer sign-in sheet, work log, and extra youth waiver forms
7. Water and food (coffee, tea, snacks, etc.)
8. Garbage bags, for trash and as-needed rain ponchos
9. General information about your group, your site plan, Green Everett Partnership brochures, the next work party dates, etc.
10. Volunteers!

Volunteer Event Welcome/Introduction

1. Welcome and thank volunteers for coming. Make sure everyone has signed in and let them know where the bathrooms and other facilities are located. For small groups, have people introduce themselves to each other.
2. Give a brief description of the history of the site, the project, your group, and other involved partners or agencies.
3. Introduce Green Tukwila Partnership and describe our mission. Key points to cover include:
 - Current conditions: Tukwila’s forests and natural areas are threatened by old age and invasive plants are blocking out new plants from naturally regenerating. We are at risk of losing our current tree canopy if we don’t act now to re-establish healthy habitat!

- Healthy forested parks provide many benefits to residents: they improve air and water quality, reduce stormwater runoff and erosion, buffer noise, reduce global warming, increase property value, provide wildlife habitat, promote active lifestyles and make communities more attractive.
 - The Green Tukwila Partnership, made up of Forterra, the City of Tukwila, and its residents, are working together to restore Tukwila's forested parks.
 - The Green Tukwila Partnership is a collaborative effort and we need help spreading the word to individual volunteers, organizations, businesses, and community groups.
 - Thank your volunteers for being a part of this City-wide effort! We look forward to many years of community support for Tukwila's forests.
4. If there are a large number of volunteers, we advise you to break out into working groups for safety talks and instructions. Suggested work group sizes: 10-15 for adults and 5-7 for youth groups.
 5. Give a brief safety talk that discusses these issues.
 - Where is the first-aid kit and cell phone?
 - Who has first aid training?
 - Make volunteers aware of possible site hazards. Glass, needles, or other unsafe materials shall only be handled by a lead volunteer with proper gloves for safety disposal. Contact Green Tukwila Partnership Project Manager to arrange pick up of "sharps" containers.
 - Steep slopes are an additional site hazard. If they are present, warn volunteers about the steep slopes and limit access to those who are capable of negotiating them with care. Remember, volunteers are not allowed on steep slopes (greater than 40%) or where safety is a concern.
 - Ask if anyone is allergic to bee or wasp stings. Point out that there are often nests in natural areas during the summer and let volunteers know to move quickly away from any nests or swarms.
 - Discuss how to carry, store and use each tool. Each tool has a set of rules that go with it. (Check out: www.americantrails.org search: tools for information on all types of restoration tools.) Some basic rules that apply for all tools are 1) always wear gloves, 2) make sure you have enough room to use your tool, and 3) use the right tool for the right job.
 6. Demonstrate proper work techniques and BMPs. Be sure to set a realistic goal for what can be accomplished that day.
 7. Get your volunteers to start working first. Walk around, talk to, and check on them before you start to work yourself. As a volunteer-event leader, your main job is quality control and to ensure that your volunteers are working safely and enjoying their time.

8. At the end of the day, wrap things up and thank volunteers for coming. Ask for feedback on what went well and how to improve any areas where there were problems. Let volunteers know about upcoming events at your site, or steer them to www.greeneverett.org for other upcoming restoration events around the City.

Creating a Tool List for Your Event

Green Tukwila Partnership Habitat Stewards can borrow tools for a volunteer event from the City, using the Event Request form to request tools. When planning for your event, estimate about one to one-and-one-half hand tools per expected volunteer (not including buckets, wheelbarrows, tarps, etc.). Volunteers can share or trade tools as needed, so you do not need all of the different tools per volunteer. Requested tools will be available for pick up by Habitat Stewards (or a member of your group).

Habitat Stewards who demonstrate a long-term commitment to a site and need tools on a regular basis may qualify for an on-site tool box and tools if funding is available. Contact the Green Tukwila Partnership Project Manager for more information.

Please note that the preferred tool for a job varies among volunteers. The following suggestions are based on what tools are most readily available.

All Restoration Activities

- Gloves! Make sure you have enough for each volunteer
- Garbage bags

Invasive Plant Removal

- Hand tillers and/or mini-mattocks (digging out small roots)
- Loppers (all-purpose cutting)
- Hand pruners (cutting smaller invasive plants)
- Folding hand saw (cutting ivy vines from trees)
- Digging shovels (digging out blackberry roots)
- Tarps (carrying piles of invasive plants)
- Hard rake (moving piles of invasive plants)
- Weed Wrench™ (removing Scotch Broom and small invasive trees –limited number available)

Mulching and Sheet Mulching

- Buckets (moving mulch or gravel)
- Pitchfork
- Wheelbarrow
- Utility knife (prepping cardboard)
- Hard rake (spreading mulch)

Planting

- Digging shovels
- Hand trowels (for smaller four-inch plants)
- Rock bar or pick-mattocks (rocky or difficult digging)
- Utility knife (cutting cardboard or fabric)

Basic Trail Work

- Pick-mattocks (grubbing trails or big roots)
- Pulaski – half ax, half adze (grubbing trails or big roots)
- Hard rake (spreading gravel)
- Hazel hoe (grubbing trails)
- Buckets/wheelbarrows (moving gravel)
- Digging shovel

Other Available Tools

- Broom (cleaning up paved surfaces)
- Leaf rake
- Litter picker-uppers

Example

20 volunteers for blackberry removal as well as some ivy will need:

12 shovels

8 loppers

3 hand pruners

2 hand tillers

1 folding hand saw

2 tarps

20 sets of gloves

3 buckets (for carrying tools)

Contact greentukwila@forterra.org if you need the Event Request Form to request your tools.

Tips for keeping track of your tools

- Count your tools before you start working!
- Keep tools in a central location at the site when they are not in use.
- Collect and count tools when breaking for snacks or lunch.
- Assign one of your volunteers to sort and count tools at the end of the day before volunteers leave. If there are tools missing, have everyone go back and look together.
- Tie brightly colored flagging tape to small tools such as hand pruners and folding saws.
- Sweep through the site as people are working to look for abandoned tools.
- Make sure people remember to return gloves neatly rolled together.

Working with Students

Students are enthusiastic volunteers and they can help you get some great work done. Before working with school or youth groups please consult with Green Tukwila Partnership Project Manager to set up appropriate support and come up with a plan. We recommend a ratio of 1:5 to 1:7, supervisors to youth. When you work with students it is important to go over tool safety, explain why we need to restore our forests and natural areas, and then have fun!

Students can help to remove invasive plants and mulch, but they need to have permission, most likely granted to the school by their parents. You still need to have a sign-in sheet for the event. You can have adults and/or teachers sign in on the sign-in sheets and have the teacher bring a class list to staple to it.

Hints for planting: Have students work in teams of two. Have them identify plant species with ID cards if available, name their plants, and make mulch donuts.

Hints for invasive removal: Have students compete to remove the largest blackberry root ball, create the largest compost pile, or pull the longest strand of ivy. Middle-school and high-school students can also help measure the area cleared to help with the work log.

If you need special tools for young children, or would like extra help for a youth event, please notify the Green Tukwila Partnership staff four weeks in advance.

Resources for student activities and educational lessons can be found at the Starflower Foundation (www.wnps.org/education/resources/index.html). If a school group is interested in more educational materials to tie volunteer restoration to their curriculum, we have resources they can use. Please contact the Green Tukwila Volunteer Project Manager for more information. Please ensure that all volunteers under 18 have a signed waiver if a guardian is not with them.

FIELD TOOLS

Appendix A: Soil Quality

Soil quality is an important consideration in restoration plantings, especially in urban habitats where there can be significant disturbance. As part of preparing your planting plan, spend some time digging in and getting familiar with what is going on below the ground's surface.

Soil texture is key to our understanding of the capacity of a soil to hold and supply water and nutrients to a plant. Texture refers to the distribution of different sized soil particles.

- Sand particles are the largest and make for well-aerated and well-drained soil that consequently has poor water and nutrient holding capacities.
- Clay particles are the smallest and have slow drainage and poor aeration, but high water and nutrient capacities.
- Silt particles fall between sand and clay in size, nutrients, and moisture conditions.
- Loam refers to a soil that has half as much clay as sand or silt, making for a well-structured soil with ideal pore space and surface area to hold water and nutrients.

Field Analysis

Select a soil sample from the rooting zone (between four and eight inches deep). Place in the palm of your hand, add water, and knead until the soil is like moist putty. When you squeeze it, see if the soil remains in a ball; if not, add more water or soil to get the correct consistency. If your soil still will not remain in a ball it is **Sand**.

Next, if your soil is not sand, place your ball of soil between thumb and forefinger. Push soil upwards into a ribbon shape with uniform depth of about 1/8". Let it break under its own weight.

Does the soil form a ribbon?

Yes: Use the chart on the next page to ID your soil.

No: Your soil is **Loamy Sand**.

Adapted from: Thien, S. J. 1979. "A Flow Diagram for Teaching Texture by Feel Analysis." Journal of Agronomic Education. 8: 54-55.)

	Forms a weak ribbon of less than 1 inch	Forms a ribbon 1 - 2 inches before breaking	Forms a ribbon 2 inches or longer before breaking
Feels Gritty?	Sandy Loam	Sandy Clay Loam	Sandy Clay
Feels equally gritty and smooth?	Loam	Clay Loam	Clay
Feels very smooth?	Silt Loam	Silky Clay Loam	Silky Clay

The results of your soil-texture ribbon test will help determine your best options for plant installation and management practices. Consider the following:

- Knowing your soil texture will change your approach to moisture management during droughty summer months. Because sandy soils drain quickly, any supplemental irrigation should be applied more frequently at decreased amounts. Clay or clay loam soils may make irrigation unnecessary.
- Organic amendments such as mulch rings can improve the water-holding capacity of sandy soils by decreasing evaporation and improving soil structure as the mulch decomposes.
- Because soil amendments can be expensive and logistically impossible for many sites, often your best option is to plant the right species for the existing conditions. For sandy soils with no natural seeps, include plants that establish roots quickly and can tolerate drought. Slow-draining soils heavy in clay should be planted with species that can tolerate anaerobic conditions common in saturated soils.
- Clay soil can have adequate organic content, providing for a combination of good moisture-holding capacity and a structure that allows for drainage and aeration.
- At sites where plant establishment has proven to be difficult, you may consider sending a soil sample to a testing lab such as the University of Massachusetts Soil Laboratory (www.umass.edu/plsoils/soiltest).

(Adapted from: Harris, W. H., J.R. Clark, N.P Matheny. 2004 Arboriculture: Integrated Management of Landscape Trees, Shrubs, and Vines. New Jersey: Prentice Hall. Thien, S.J. 1979. "A Flow Diagram for Teaching Texture by Feel Analysis." Journal of Agronomic Education. 8: 54-55.)

Appendix B: Mulch Calculation

Calculating Cubic Yards

1 cubic yard = 27 cubic feet. To convert cubic feet to cubic yards:
number of cubic feet ÷ 27 cubic feet = number of cubic yards

Example: You have an area of 1,000 square feet and you want to cover it with four inches (0.33 feet) of mulch.

1,000 square feet × 0.33 feet (depth of the mulch) = 330 cubic feet
330 cubic feet ÷ 27 cubic feet = 12.2 cubic yards

Cubic Yards Calculator

If you don't want to go through all the calculations above.

Square Feet	Depth 3 inches	Depth 4 inches	Depth 5 inches	Depth 6 inches	Depth 7 inches	Depth 8 inches
100	1	1-1/4	1-1/2	2	2-1/4	2-1/2
150	1-1/2	2	2-1/2	2-3/4	3-1/4	3-3/4
200	2	2-1/2	3	3-3/4	4-1/2	5
250	2-1/2	3	4	4-3/4	5-1/2	6-1/4
300	2-3/4	3-3/4	4-3/4	5-1/2	6-1/2	7-1/2
350	3-1/4	4-1/2	5-1/2	6-1/2	7-3/4	8-3/4
400	3-3/4	5	6-1/4	7-1/2	8-3/4	10
450	4-1/4	5-3/4	7	8-1/2	9-3/4	11-1/4
500	4-3/4	6-1/4	7-3/4	9-1/4	10-3/4	12-1/2
600	5-3/4	7-1/2	9-1/4	11-3/4	13	15
700	6-1/2	8-3/4	11	13	15-1/4	17-1/4
800	7-1/2	10	12-1/2	15	17-1/2	20
900	8-1/2	11-1/4	14	16-3/4	19-1/2	22-1/4
1,000	9-1/2	12-1/2	15-1/2	18-1/2	21-3/4	24-3/4
2,000	18-1/2	24-3/4	31	37	43-1/4	49-1/2
3,000	28	37	46-1/2	55-3/4	65	74
5,000	46-1/2	61-3/4	77-1/4	92-3/4	108	123-1/2

Converting Square Feet into Acres

1 acre = 43,560 square feet (1 acre measures 208.71 ft. × 208.71 ft.)

Example: You have a restoration area that is 7,850 square feet.
7,850 square feet ÷ 43,560 square feet = 0.18 acres

Appendix C: Native Plant Chart

NRCS Code	Species	Botanical Name	Soil Texture	Soil Moisture	Light/Slope	Target Forest Type
TREES						
ACMA	Bigleaf maple	<i>Acer macrophyllum</i>	mineral	moist-dry	● ● ● ▲	1, 3-9
PREM	Bitter cherry	<i>Prunus emarginata</i>	mineral	moist	●	2, 3, 4, 6
POBA	Black cottonwood	<i>Populus balsamifera</i>	mineral	wet-moist	● ●	6, 10
CRDO	Black hawthorn	<i>Crataegus douglasii</i>	organic	moist	●	9
RHPU	Cascara	<i>Rhamnus purshiana</i>	mineral	wet-dry	● ● ● ▲	2, 4-9
PSME	Douglas fir	<i>Pseudotsuga menziesii</i>	mineral	moist-dry	● ● ▲	1-9
QUGA	Garry oak	<i>Quercus garryana</i>	mineral	dry	●	2, 4, 7, 9
ABGR	Grand fir	<i>Abies grandis</i>		moist-dry	● ▲	1, 2, 4-9
FRLA	Oregon ash	<i>Fraxinus latifolia</i>	organic	wet-moist	●	9
ARME	Pacific madrone	<i>Arbutus menziesii</i>	mineral	dry	●	1-7, 9
BEPA	Paper birch	<i>Betula papyifera</i>		moist	●	7
SALU	Pacific willow	<i>Salix lucida</i>		wet-moist	● ● ▲	10
ALRU	Red alder	<i>Alnus rubra</i>	mineral	moist	●	1, 3-9
SASC	Scouler's willow	<i>Salix scouleriana</i>		moist-dry	● ● ▲	1-6, 10
PICO	Shore pine	<i>Pinus contorta</i>		moist-dry	● ▲	1, 2, 5
PISI	Sitka spruce	<i>Picea sitchensis</i>	organic	moist	● ●	8
CONU	Wstrn. flowering dogwood	<i>Cornus nuttallii</i>	organic	moist	● ●	1, 4, 7, 9
TSHE	Western hemlock	<i>Tsuga heterophylla</i>	mineral	moist-dry	● ● ●	1-9
THPL	Western red cedar	<i>Thuja plicata</i>	mineral, organic	wet-moist	● ●	1-9
SHRUBS						
ROGY	Baldhip Rose	<i>Rosa gymnocarpa</i>		moist-dry	● ●	1-9
COCO	Beaked hazelnut	<i>Corylus cornuta</i>	mineral	moist	● ●	1-9
OPHO	Devil's club	<i>Oplopanax horridus</i>	mineral	moist	●	7, 8
MANE	Dull Oregon grape	<i>Mahonia nervosa</i>		moist-dry	● ●	1-9
VAOV	Evergreen huckleberry	<i>Vaccinium ovatum</i>	mineral	moist-dry	● ● ●	1-8
ARDI	Goat's beard	<i>Aruncus dioicus</i>		moist	●	
SPDO	Hardhack	<i>Spiraea douglasii</i>		moist-wet	● ●	10
SAHO	Hooker's willow	<i>Salix hookeriana</i>		wet-moist	● ● ▲	10
OECE	Indian plum	<i>Oemlaria cerasiformis</i>	organic	moist-dry	●	2, 4, 6-9
PHLE	Mock-Orange	<i>Philadelphus lewisii</i>		moist-dry	●	1, 2, 4, 6, 10
RONU	Nootka rose	<i>Rosa nutkana</i>	mineral	moist-dry	●	1-9
HODI	Oceanspray	<i>Holodiscus discolor</i>	mineral	moist-dry	● ▲	1-9
PHCA	Pacific ninebark	<i>Physocarpus capitatus</i>	mineral	wet-moist	● ●	9, 10
RHMA	Pacific rhododendron	<i>Rhododendron macrophyllum</i>		moist-dry	● ●	2, 6, 7
SARA	Red elderberry	<i>Sambucus racemosa</i>	mineral	moist	● ●	1, 4-8
VAPA	Red huckleberry	<i>Vaccinium parvifolium</i>	organic	moist	● ● ●	1-9
COSE	Red osier dogwood	<i>Cornus sericea</i>	organic	wet-moist	● ▲	10
RISA	Red-flowering currant	<i>Ribes sanguineum</i>	mineral	dry	●	1, 2, 4, 6
RUSP	Salmonberry	<i>Rubus spectabilis</i>	mineral	wet-moist	● ● ▲	1, 2, 4-8, 10

Code	Species	Botanical Name	Soil Texture	Soil Moisture	Light/Slope	Target Forest Type
SHRUBS continued						
AMAL	Serviceberry	Amelanchier alnifolia	mineral	moist-dry	● ●	1-9
SOSI	Sitka mountain ash	Sorbus sitchensis	mineral	moist-dry	● ●	
SASI	Sitka willow	Salix sitchensis		wet-moist	● ● ▲	10
SYAL	Snowberry	Symphoricarpos albus	mineral	moist-dry	● ● ▲	3, 6-9
MAAQ	Tall Oregon grape	Mahonia aquifolium		moist- dry	● ●	8
RUPA	Thimbleberry	Rubus parviflorus	mineral	dry	● ▲	1, 4-9
LOIN	Twinberry	Lonicera involucrata	mineral	wet-moist	● ●	8
ACCI	Vine maple	Acer circinatum	mineral	wet-moist	● ● ▲	1, 4-9

GROUND COVER/HERB

PTAQ	Bracken fern	Pteridium aquilinum	mineral	wet-moist	● ●	1-7, 9
BLSP	Deer fern	Blechnum spicant	mineral	moist	●	6-8
TITR	Foamflower	Tiarella trifoliata	organic	moist	●	6-8
TEGR	Fringecup	Tellima grandiflora		moist	● ●	8
ARUV	Kinnikinnick	Arctostaphylos uva-ursi	mineral	dry	● ▲	1-4, 9
ATFI	Lady fern	Athyrium filix-femina	organic	wet-moist	● ●	1-9
POGL	Licorice fern	Polypodium glycyrrhiza	organic	moist	● ●	1-9
ADPE	Maidenhair fern	Adiantum pedatum	organic	moist	● ●	1-8
LOCI	Orange honeysuckle	Lonicera ciliosa		moist	● ●	1-9
DIFO	Pacific bleeding heart	Dicentra formosa		moist	●	1-8
TOME	Piggy-back plant	Tolmiea menziesii		moist	●	1-3, 5-8
TODI	Pacific poison-oak	Toxicodendron diversilobum	mineral	moist	●	4, 9
GASH	Salal	Gaultheria shallon	mineral	dry-moist	● ● ●	1-9
URDI	Stinging nettle	Urtica dioica	organic	moist	● ●	1-8
POMU	Sword fern	Polystichum munitum	mineral	dry-moist	● ▲	1-9
RUUR	Trailing blackberry	Rubus ursinus		moist-dry	● ● ●	1-9
TROV	Western trillium	Trillium ovatum	organic	wet-moist	● ●	1-9
FRVE	Woodland strawberry	Fragaria vesca		moist	● ▲	1-9

EMERGENTS

SCAC	Hardstem bullrush	Scirpus acutus	mineral, organic	wet	● ●	
CAOB	Slough sedge	Carex obnupta	mineral	wet	● ● ●	1-8
SCMI	Small-fruited bullrush	Scirpus microcarpus	mineral	wet	● ●	

Code	Species	Botanical Name	Soil Texture	Soil Moisture	Light/Slope	Target Forest Type
INVASIVES						
ROPS	Black locust	Robinia pseudoacacia L.				
PRLA	Cherry laurel	Prunus laurocerasus				
HEHE	English ivy	Hedera helix				1 - 9
ILAQ	English holly	Ilex aquifolium				1 - 9
RULA	Evergreen blackberry	Rubus laciniatus				1 - 9
GERO	Herb-Robert	Geranium robertianum				1 - 8
COAR	Hedge/Field bindweed	Convolvulus arvensis				
RUDI	Himalayan blackberry	Rubus discolor				1 - 9
PLCU	Japanese knotweed	Polygonum cuspidatum				
SODU	Nightshade	Solanum dulcamara				4 - 9
LYSA	Purple loosestrife	Lythrum salicaria				
PHAR	Reed-canary grass	Phalaris arundinacea				4, 10
CYSC	Scotch broom	Cytisus scoparius				1 - 4, 9
SPAL	Smooth cordgrass	Spartina alterniflora				10
CLVI	Western clematis	Clematis vitalba				

KEY Environmental Preferences

Soil

Organic: Plant prefers organic rich soil in humus and generally moist.

Mineral: Plant prefers sandy soil, generally well drained and drier.

Blank: No preference, or unknown

Soil Moisture

Soil preferred: Wet, Moist or Dry

Light/Slope

- Full Sun - Mostly Sun
- Partial Sun
- Mostly Shade - Full Shade
- ▲ Suitable for steep slopes

Target Forest Types

1. Douglas-fir—Pacific madrone / salal
2. Douglas-fir—Pacific madrone / oceanspray / hairy honeysuckle
3. Douglas-fir—Pacific madrone / evergreen huckleberry
4. Douglas-fir—salal / sword fern
5. Douglas-fir—western hemlock / salal - dwarf Oregon grape
6. Douglas-fir—western hemlock / salal / sword fern
7. Douglas-fir—western hemlock / dwarf Oregon grape / sword fern
8. Western redcedar—western hemlock / devils club / sword fern
9. Oregon white oak—Douglas-fir / common snowberry / sword fern
10. Riparian and wetland

Helpful tools for plant ID can be found at the University of Washington Herbarium (<http://www.burkemuseum.org/herbarium/>)

Appendix D: Target Forest Types

One of the most important aspects of forest restoration is the identification of a reference ecosystem (a.k.a. target forest type) that serves as a guide for planning projects as well as a benchmark for evaluating projects in the future. In its simplest form, our target forest types are based on a range of agreed-upon attributes that we want for a site, but could also be based on measurements from a real forest that we wish to emulate.

Classifying target forest types can provide a framework for planning forest restoration projects at forested sites. Measured over time, the attributes of a particular forest type will also serve to evaluate the project. As an example, an ultimate restoration goal at a particular site might be to move toward a Douglas fir / salal / sword fern forest community. Then, the plant palette of our restoration site should closely model the plant community of an old growth Douglas-fir / salal / sword fern forest. Throughout the restoration process, we can strive to create the environment best suited for that forest type.

These target forest types are consistent with a statewide effort to characterize the plant associations that naturally occur in forest ecosystems in the Puget Trough ecoregion. The “associations” are named by dominant plant species (the dashes in the names separate trees, shrubs and herbs in the same canopy layer; slashes in the names separate species in different canopy layers).

For more information on Target Forest Types go to: www1.dnr.wa.gov/nhp/refdesk/communities/index.html

Appendix E: Additional Field References and Tools

Pacing

My pace = _____ ft.

10 ft. = _____ paces

50 ft. = _____ paces

100 ft. = _____ paces

Estimating square footage

Average parking space: 150 – 200 sq. ft.

Olympic-sized swimming pool: 13,448 sq. ft. (82' x 164')

One acre: 43,560 sq. ft.

Football field: 57,600 sq. ft. (160' x 360')

One hectare (10,000 sq. m.): 107,639 sq. ft.

Invasive Plants

Record invasive plants present in your restoration site and any notes on quantity or percent cover:

Example: *English Ivy*- 5% ground cover and growing up a few trees.

Native Plants

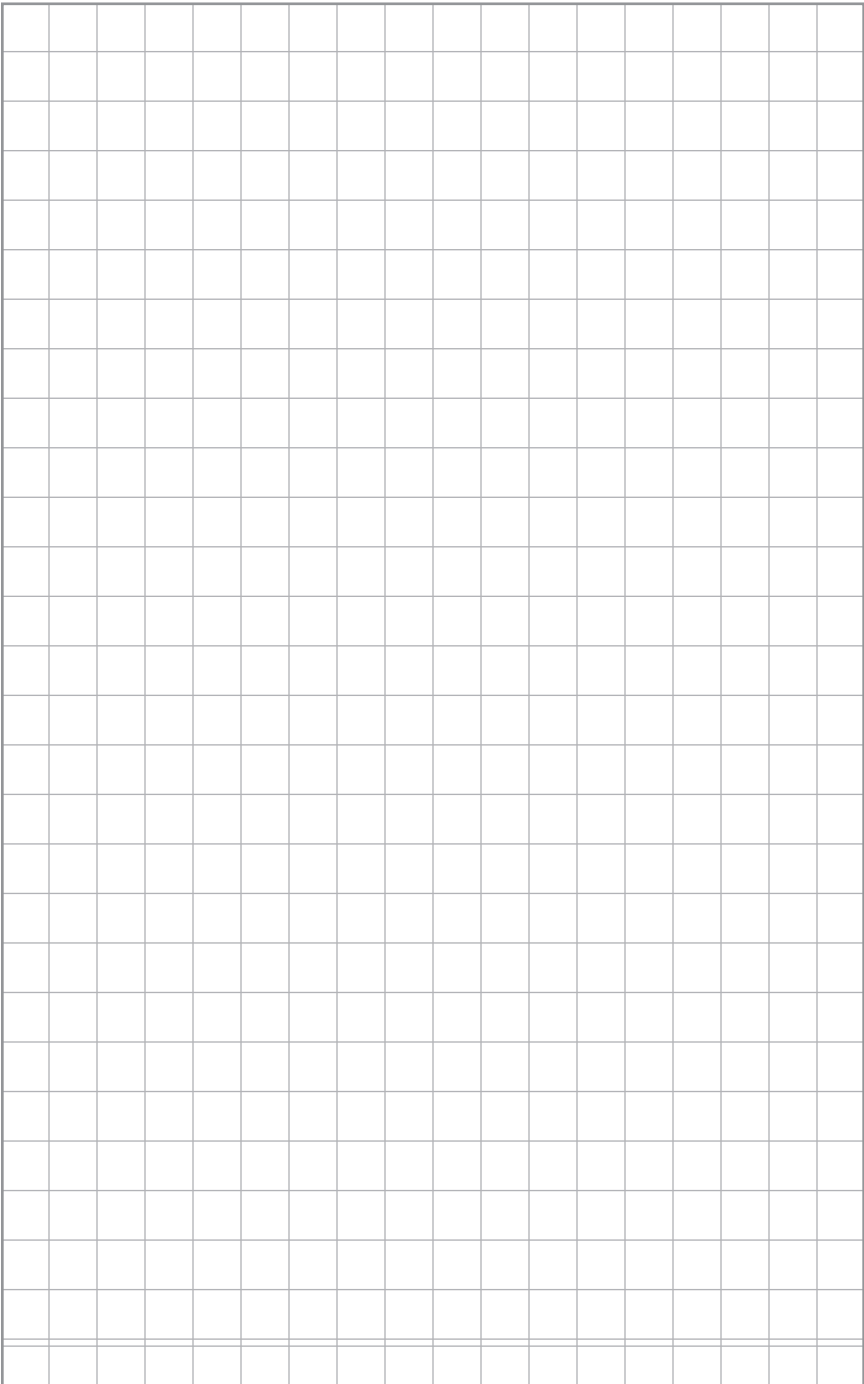
Record native plants present in your restoration site; add the new species as you plant your restoration site.

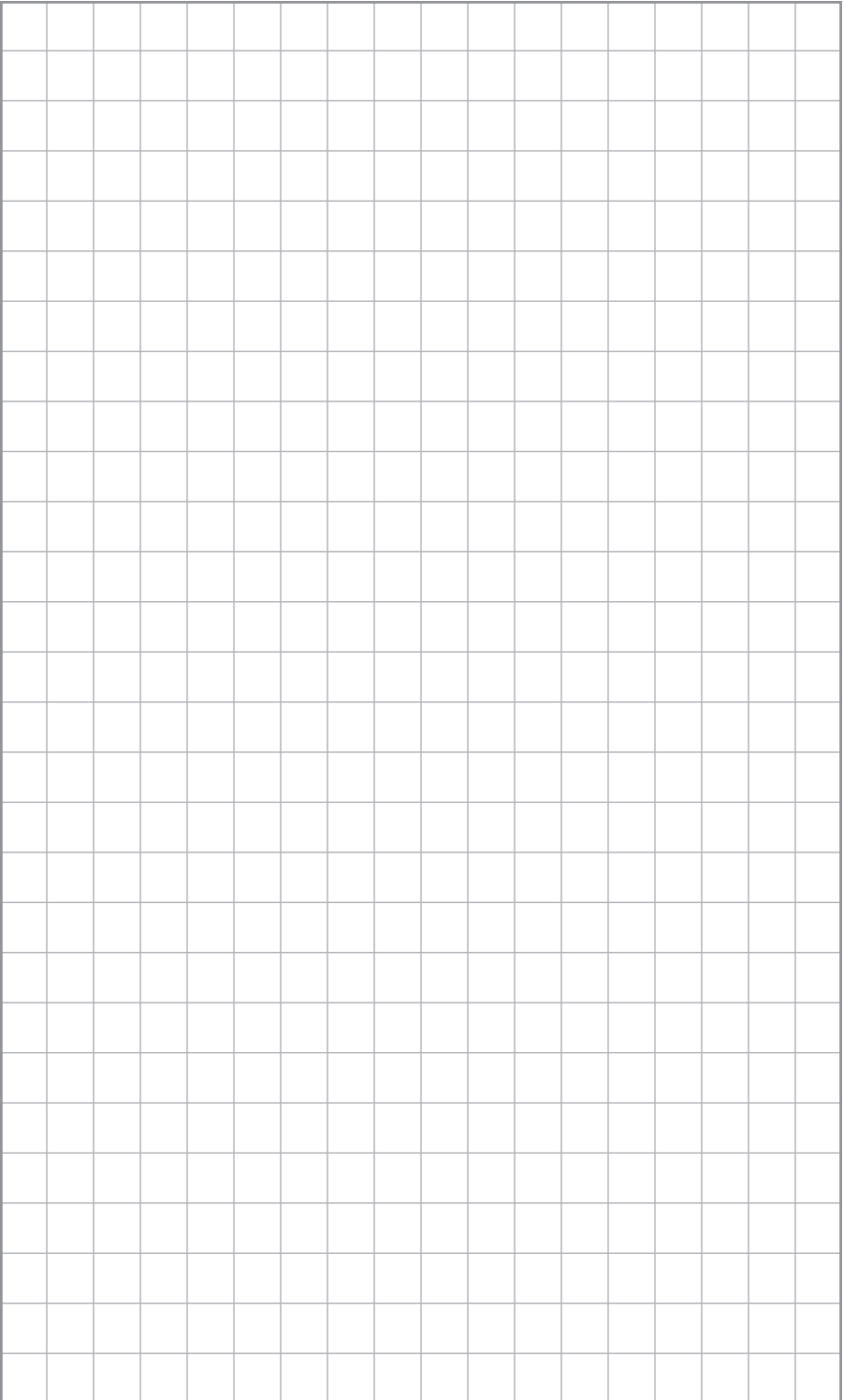
Trees

Shrubs

Groundcover/Herbaceous

Sketch a map of your restoration site.





A photograph of a dense forest. The foreground is dominated by a lush carpet of green plants, likely wild strawberries, growing on a mossy forest floor. The background is filled with tall, slender trees, possibly pines or spruces, reaching towards a bright sky. Sunlight filters through the canopy, creating dappled light on the forest floor. The overall atmosphere is serene and natural.

keep going... and thanks!



This Field Guide was made possible through a grant from the USDA Forest Service, Urban and Community Forestry Program.

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