Tree/Shrub Establishment (Code 612)

Tree/shrub establishment involves planting seedlings or cuttings, seeding, or creating conditions that promote natural regeneration.

PRACTICE INFORMATION

Trees and shrubs can be established for a variety of purposes. Conservation benefits may include, but are not limited to—

- establishing forest cover
- enhancing wildlife habitat
- controlling erosion
- improving water quality
- capturing and storing carbon
- conserving energy

Species selection, site preparation, planting date and method, and tree spacing will vary depending on the planned purpose and site conditions. Once planted, trees and shrubs need to be inspected periodically and protected from insects, diseases, competing vegetation, fire, and damage from livestock or wildlife.

Depending on the site, supplemental water may be required to ensure survival during the establishment period, typically 1 to 3 years. Periodic applications of nutrients may be needed to maintain plant vigor.

REGENERATION PRINCIPLES

There are two types of regeneration-natural and artificial. For natural regeneration on forestland, there are regeneration harvest regimes (such as: seed tree, shelterwood, un-evenaged or crop tree mgt single tree selection, variable density thinning &/or patch cuts/openings) designed to improve the success rate of natural reforestation and achieve specific forest structure and composition goals. Coppice is also a natural regeneration method. Artificial regeneration is seeding or planting. The benefit of artificial regeneration is the opportunity to choose the distribution pattern, stocking and species composition to meet your manage objectives. Planting 1-3 year old seedlings that have been started in a nursery or green house, has proven to be a reliable method of regenerating trees and shrubs out on the landscape. For this practice, seeding is acceptable for specific sites and species. If seeding or natural regeneration is being use under 612 Tree/Shrub Establishment, contact your Area or State Forester for guidance.
A successful tree/shrub establishment requires: healthy seedling from the correct seed zone, which are adapted to the climate, soil and site (see Washington Seed Zone manual on WA DNR website); seedlings need to be handled and stored properly (see MT Forestry Technical Note 15); seedlings need to be planted correctly in a favorable micro-site; and there needs to be very little competition from other vegetation in the first 3 to 5 years after planting.

Header information
Complete the basic header information at the top of the form. Landowner’s name and Operator’s name if it is different from the landowner. Include the project name and/or contract number. Include the Farm and Tract number and the field or forest stand where the practice will occur.

The Index box is your documentation requirements checklist for planning and design of this practice.

Practice Location Map:
Be sure to attach (for client) or have in case file all maps showing where the practice is to be installed on farm or forest site. This map will show all major treatment areas, fields and their relative location to landmarks and survey benchmarks.

Existing (Benchmark) Conditions
Using the check boxes indicate the land use upon which this practice will be applied. Document the climatic and soil conditions for your site and compare the growth requirements of your chosen species (See USDA Plants database “Characteristics” data) with the site conditions. Climatic data can come from the local weather stations, Geodata layers or soils map unit descriptions. Soils information should come from the soil survey (usually WebSoil Survey) for the area and if possible with on-site verification. Also document the representative species and the site index (with base year if available), for the site, from the forest productivity soils report. Document the participant’s current management regime, the ecological site (using ESDs, USFS Plant Associations or WA DNR Natural Heritage Program Ecosystems.

If there are acceptable healthy trees and/or shrubs present then determine the most prevalent species(s) and estimate overall total number per acres.

Make an on-site assessment of the remaining existing vegetation and list the dominate species if you know them for tree, shrub, forb and grass layer or just describe the layers (i.e. no over-story with dense sod forming grass understory.)

Identify (by circling the options or creating your own list) the supporting documentation for the benchmark conditions. For Example (but not limited to): Orthophotos site map, topographic map, soils maps and interpretations (Forest productivity including common trees to manage, seedling mortality, forestland planting, forestland site prep and erosion hazards), field notes, Bio TN 14, SVAP2, WQ TN 1, USFS Aerial Detection Survey Maps for root rot, 1/50th acre plots and WebSoil Survey Range and Forest Vegetation Classification report for expected native vegetation.

Within this section safety issues associated with the site are identified.

The Practice Purpose
Check all the purposes that apply and meet the participant’s objectives. These purposes need to be consistent with and supported by the benchmark conditions and documented resource concerns. Plus, the specifications need to be consistent with and effectively addressing the purposes.
Desired Conditions (Goals and Objectives)

Describe the goals and objectives of the project area and desired site conditions after treatment. Include items like species composition %, stocking rates, average spacing, survival rate, and arrangement or layout of trees and shrubs. This section should also be consistent with the practice purpose. For example: Stand is fully stocked with 75% Douglas fir and 25% other species. There are approximately 435 trees per acre that are at an approximately 10’ spacing with + or – 50% variation in spacing due to obstacles, unplantable sites or selecting quality microsites. In general, the trees are evenly distributed across the unit. Survival is greater than 80% after the first growing season.

Specification:

Establishment Acres is the proposed treatment acres (practice extent).

Timing of Initial Practice Installation is the planned date for installation and/or time period that is optimal for installation. In Western Washington the optimal planting period is usually January through March. In Eastern Washington this is often immediately after the snow melts in the spring or in late fall just prior to snow fall.

Site Preparation

Is site preparation needed? If so refer to 490 Tree/Shrub Site Preparation standard and specifications or describe in general the type of site preparation to be used (hand, chemical or mechanical) and the method. For example: hand scalping or chemical, hand spot spray. It could also be a combination of treatments like chemical, hand spot spray followed by hand scalping.

General Treatment Method

This section documents the regeneration method to be used: planting, seeding or natural regeneration. It also documents the general technique, for example planting by hand or machine. Check all the boxes that apply.

Planting Specifications

In this section, enter by species, the stock type (it is optional but often helpful to spec the minimum acceptable seedling height and stem caliper-stem diameter at expected ground line when planted), planting rate, acres to plant and total number of plants to be planted for that species and stock type. See WA Forestry Technical Note 10: Stand density guidance for minimum planting rates for commercial species. See USDA Plants or WA Plant Material Technical Note 1 for minimum planting rates for conservation species.

Match the selected species to the climatic and soil site conditions. If you are selecting species that need more water than what the average annual precipitation will provide or is not as drought tolerant as the area might require, then discuss the supplemental watering or mulch requirements. If there is root or stem disease present on site, try to identify the areas so resistant species may be planted in those sites.

Stock types come in three basic categories: bareroot (B), container or plugs (Co or P) or cuttings (C). Bareroot (B) seedlings are grown in an outdoor seedling nursery subject to uncontrolled environmental factors. Container seedlings or plugs (P) are usually grown in the greenhouse under a more controlled environment. Outdoor nurseries take 1-3 years to grow a seedling. Greenhouses can grow a seedling in 1
year or less, depending on the species. In addition, stock types are also identified by the number of years it spends in the nursery. For information on the care and handling of hardwood cuttings see WA Plant Material Technical Note 10: Riparian Revegetation-Plants.

**For conifer reforestation stock:**

Bareroot 1+1 (sometimes shown as 1-1) represents a seedling that spent one year in the original seedbed where seedlings are planted at an approximate density of 25-30 seedlings per square foot. The seedlings are lifted and roots pruned and then transplanted into a transplant bed where seedlings are planted at approximately 6-8 seedling per square foot. The transplanting process results in larger stems and more fibrous root systems. These seedlings have potential to survive on infertile sites, some competition from other vegetation, and browse damage.

Bareroot 2+0 (sometimes shown as 2-0) stock type represents a seedling that has grown 2 years at approximately 25-30 seedlings per square foot. This will be a smaller stock type. This is an appropriate stock type for sites that do not have much competing vegetation or browse damage. **This stock type is commonly used for broadleaf shrubs for a variety of sites.**

Bareroot 2+1 (sometimes shown as 2-1) stock type was grown for 2 years in the seedbed with 25-30 seedlings per square foot. Then the seedling is lifted, poor seedlings sorted out, root pruned, and planted in a transplant bed with a density of approximately 6-8 seedlings per square foot. This seedling has a large stem and root mass. Planner would recommend this seedling for areas that need a fast green up or areas with extreme browse issues.

For these three stock types 2+0 would be the cheapest, on average the smallest and least competitive conifer seedling stock and 2+1 would be the most expensive and on average the largest and most competitive conifer seedling stock to out-plant.

1+0 is a common commercial hardwood bareroot stock type. hardwoods often grow fast and are competitive enough to out plant after one year in the nursery seedbed. For conifers, Larch or maybe Ponderosa pine are the only species that might be big enough to out plant as 1+0, but it is generally not recommended.

Container plugs are grown in a greenhouse. Styro-10 or 10 cubic inch containers are used if the trees will be out planted.

Container Plug +1 are grown in a greenhouse for a year. Styro-2A or 2 cubic inch container are often used when the plug is going to be planted into a transplant bed (these are not big enough to out plant directly in the field). After a year in the greenhouse, the seedling is extracted from the container, root pruned and planted into the transplant bed with around 6-8 seedlings per square foot. It spends about a year in the transplant bed. This will create a larger stem and more root mass than standard plug. Cedar, hemlock, larch, some pines and true firs are commonly grown as Plug+1’s for reforestation.

These are common densities for seedbeds and transplant beds, however each nursery has its own protocol on the number of seedlings per square foot (density) will be in the seedbed and transplant bed.

**Temporary Storage Instructions and Seedling Handling Guidance** have some standard instructions provided on the IR. Provide any site specific information, if needed. Refer to MT Forestry Technical Note 15: Transportation, Care and Storage of Seedlings; MT Plant Materials Technical Note 51: Temporary Storage and Handling of Seedlings; ID Plant Materials Technical Note 45: Temporary Storage and Handling of Container, Bareroot and Cutting Stock.

**Tools to use and Spacing Requirements** section is for describing ecological characteristics or references for species selection and stocking/seeding rates, and general spacing requirements. Determine from the
participant their desired tools for planting or seeding and document in this section or used this section to recommend tools and discuss additional planting techniques such as products used to help maintain moist roots during the planting process in hot dry situations (jells, vermiculite, ...). For example: Based on Forestry TN 10 and Soil Surveys Ecological Site Description, plant on approximately a 10’ by 10’ spacing with planting shovel or hodad. Choose microsites that include natural shade and ensure seedling roots are completely in mineral soil. Plant above root collar and below first live branch and avoid J roots. All seedlings need to be upright and not leaning.

For natural regeneration describe technique (seed tree, shelterwood…) and expected distribution.


**Seeding Specifications**

Direct seeding for trees and shrubs is a significantly less common regeneration method. The information needed is the Seeding rate by species which will be adjusted for the expected % of pure live seed; the % of the seeding mix for the individual species; the seeding rate/acre which is the seeding rate for that species times the % of the seeding mix that species occupies; and the total amount of seed needed for the project area for that species. Remember to sum the total for seeding rate for all the species and the total lbs of seed for all the species within the project area.
Natural Regeneration Specifications

It is not common for us (NRCS) to write a specification for natural regeneration for trees and shrubs. Describe your seed source and method of natural regeneration, as well as the site and climatic conditions that support the choice of natural regeneration. In terms of coppice and other systems describe the silvicultural techniques for achieving successful natural regeneration including site conditions and species requirements that affect site prep, vegetation control, or the need for pruning or tree removal. Document expected species composition, distribution and potential for the need to interplant.

Additional Criteria for the purposes of Reducing Nutrients and Pollutants; for Restoring or Maintaining Native Plant Communities; for Sequestering and Storing Carbon; for Developing Renewable Energy Systems; to Conserve Energy; and for Habitat for Beneficial Organisms

Review the Standard and address any additional criteria required for the chosen purposes.

Considerations and Mitigations

Describe and document any considerations that affects the timing, location, logistics, method, tools and equipment of the treatment or any need for mitigation. It may also include tree protection, controlling competing vegetation, supplemental watering, mulch or nutrient amendments.

Damage Protection Needed?

Protection against animal damage

There are many types of tools and methods to protect seedlings against animal damage: fencing, physical barrier protectors, repellents, habitat manipulation, silvicultural modifications and depredation. There are several different types of physical barrier protectors such as: solid rigid plastic tubes, rigid plastic mesh tubes, netting, tree cages, bud caps and stem guards. Plus, there is a variety of chemical repellents. All these protection methods provide varying levels of protection against the different types of critters (damaging agents).

Figure 2:

Bud caps come in a variety of materials including paper, tiller netting and rigid plastic mesh leader tubes. Use bud caps for species that are not preferred forage and brows levels are from light to moderate. Do not use bud caps for Western Redcedar. Bud caps require regular maintenance to keep the caps covering the leader and terminal bud. Plus, bud caps often blow off the trees and require replacement. If it is an
exposed site which gets a lot of wind, bud caps would not be the appropriate choice. Bud caps are appropriate for the very hottest driest sites. Bud caps are the least expensive of the barrier protection but last 6 to 18 months.

Netting comes in semi-rigid to very flexible material. Netting will protect most conifer seedlings from browse (not Western Redcedar). If it is installed properly and if down to the ground it can even protect against small mammals. It is not particularly effective against Elk or Mt Beaver. Netting can have a higher rate of leader damage than the other barrier protectors. Avoid using netting on very hot dry sites, because mortality from heat can occur. Netting is designed to last only a 1-3 years. Netting costs about the same as bud caps or just a couple cents more per tree.

Rigid plastic mesh tubes are usually anchored by bamboo stakes. Use 1 to 2 stakes based on the stability needs of the site. If an even more stable anchor is needed then the use of a ½” - 1” wooden stake would be appropriate. Rigid plastic mesh tubes cost more than bud caps and netting, but provide superior protection against browse, by deer, elk, rabbit and mountain beavers. Research indicates that these mesh tubes can improve early growth rates, but this improvement does not carry long into the future. This improved growth does however, give it a slight edge on survival rate. If the tube is installed correctly then leader damage is not likely to occur. The planting may incur some increase in mortality due to heat on your hottest and driest sites. There will be some maintenance associated with this treatment, especially as the seedling grows, the client may want to raise the mesh tube up to continue protection and as the tree grows the mesh tube will likely need to be removed to avoid damage to the bole. These rigid plastic mesh tubes are design to provide 3-5 years of protection and are reusable.

Solid walled rigid plastic tubes (tree shelters) provides brows protection from deer, elk, mt. beavers, rabbits and girdling by small mammals. Solid walled tubes are usually anchored by wooden stakes. Solid walled tubes also provide protection against the wind but tend to fill with debris in the floodplain. The solid walled tubes act as little green houses and traps moisture for the seedling, improving the relative humidity, increases temperature, increase concentrations of CO₂ and can extend the growing season but they need to have vents so the tree will harden off properly in the fall. Furthermore, do not use these tubes on very hot dry sites. These tree shelters were originally created for hardwoods but will work on conifers as well. There are types of solid walled tubes that will split when the tree stem out grows it. Other types may need to be removed, to avoid damage to the tree stem. Because of their protection against mice and other small mammals, tree shelters are an appropriate choice for afforestation of old pastures. Some maintenance is required each year. These solid tubes provide 3-5 years of protections and are reusable. These are more expensive than the previous three treatments.

Tree cages are made of wire mesh fencing and fence posts. It usually requires 1-3+ fence posts to stabilize it. These are usually used for oak planting when they are on sites with livestock or elk pressure. Tree cages would also be appropriate for small riparian planting of Western Redcedar on sites with very heavy elk pressure. This is a very expensive protection method.

Tree stem guards can range from very costly to inexpensive for the product and installation. Use these for very specific sites and projects. Smaller planting projects where grasses and forbs are the main competing vegetation are the most likely to fit with this type of protection. This type of protection, protects against girdling by small mammals and potentially sun scald.

Chemical big game repellents are commonly used for protection as well. I have found third party testing on two formulations—egg based (such as Deer Away) and blood meal based (such as Plantskydd). Both have been shown to provide protection about the level of bud caps and maybe as good as netting. They cost about the same as bud caps or maybe a little less. This type of treatment requires a significant amount of maintenance in the form of reapplication every 6 weeks to 6 months depending on the repellent and the site factors. Because of the amount of maintenance required, it is recommended to limit their use to small plantings that are easily accessed. These repellents might be appropriate for very hot dry sites where the...
netting, rigid plastic mesh and solid plastic tubes may not be appropriate due to their increase risk of mortality.

**Protection against heat and sun scald**

Stay aware of aspect. In much of the state, the aspect of the site can affect species selection, planting densities, shading needs, microsite selection or even planting project site selection.

When in drier and warmer climates, such as we have in parts of Eastern Washington, shade is an important part of protecting seedlings from damage. Selecting planting spots that take advantage of shade opportunities is an important step for seedling survival and plantation success. Planting on the north and east side of stumps, logs and slash piles improves a seedlings chance of survival in the hotter sunnier climates. Allow up to 50% flexibility in spacing between individual trees in order to utilize shade opportunities. However, encourage an overall adherence to the specified stocking rate within ± 10%. That means if trees are tighter in one spot, they are wider in another. This will also create a more natural look for the plantation. When planting trees to provide shade to buildings or specialty areas, you would choose to plant on the south, and west sides of the object to be shaded first and the east side as a third option.

**Post-Plant Weed Control Needed?**

If the site lends itself to fast growing highly competitive native or invasive species that will likely rob the seedling of moisture, nutrients, light and growing space then document the issue here and direct the client to see the specification under 314 Brush Management or 315 Herbaceous weed control either singularly or in combination. If you are using both of these practices then put the overall schedule here, especially if this is a wildlife planting and 645 is used for monitoring and management after the post plant weed control treatments.

Mulch may also be used, either in combination with other weed control practices or as a preventative action instead of other weed control practices. See Practice 484 Mulch for defining the acceptable material, coverage of that material and required depth of material. For more information see WA Plant Materials Technical Note 8: Mulches and Mulching for Erosion Control.

Describe your use and scheduling of associated practices, for the purposes of post-plant weed control. These associated practices are part of the conservation system for treating the resource concerns, so describe how these practices support each other in treating that resource concern.

**Mulch or Supplemental Water Needed?**

Discuss whether or not mulch or supplemental watering will be needed to establish the trees & shrubs and how the participant should address this issue. Discuss associated practices, if they are needed. Practice 484 Mulch may also be used for soil moisture conservation. If supplemental water is needed for the successful establishment of this tree/shrub planting, then discuss whether or not, there is irrigation already on site. If not, what type of irrigation will be installed and what practices will be used or will the supplemental watering be done by hand?

**COMMON ASSOCIATED PRACTICES**

Tree/Shrub Establishment is commonly applied as part of a Conservation Management System and Tree/Shrub Site Preparation (490) commonly preceding it. Other associated practices may include (but not limited to): Brush Management (314) and Herbaceous Weed Control (315) are common for post-plant vegetation control; Critical Area Planting (342) on disturbed or reclamation sites; Woody Residue Treatment (384) if excessive amounts of woody residue needs to be treated; Access Control (472), Integrated Pest Management (595); Forest Stand Improvement (666); and Wildlife practices such as Upland Wildlife Habitat (645) or Restoration and Management of Rare and Declining Habitats.

For further information, refer to the practice standard for these associated practices in the local Field Office Technical Guide and their Implementation Requirements/specification worksheets or job sheets.
Check all the practices that are part of the conservation system that is treating the selected purposes and resource concerns.

**Operation and Maintenance**

Monitoring and a list of actions to be carried out in order for the practice to function properly for the life of the practice. Controlling competing vegetation, controlling access of vehicles and livestock, adding additional nutrients, and monitor the site for survival and damage are some of the issues addressed in this section.

**Signature Page includes Client Acknowledgement, Practice Installation and Certification**

Client's Acknowledgement section is where the client signs and dates. With their signature the client is accepting the specifications, indicate the planner reviewed the specifications with them, agrees to install according to the specifications and that they are responsible for the permits and notifying the appropriate, governmental agencies or utilities prior to implementation of practice.

NRCS (or TSP) Design Review Only (Document JAA or TSP Certification) comes after Client Acknowledgement and documents the planner (or Technical Service Provider (TSP)) and their JAA or TechReg certification for practice design. The Planner (or TSP) will sign and date this section.

If the planner does not have enough JAA to approve the specifications there is an Approved section that allows for someone who does have the appropriate JAA to document their JAA and to approve the design with their signature. Include the date.

**Practice Installation and Certification** section will be filled out when the practice is complete. This section has the documentation requirements for certifying this practices. Check all items that apply and have been completed. Person with appropriate JAA will sign this form for the certification that this practice was installed according to NRCS standards and specifications.

**References**


Schnepf, Chris, Seedling Terms from A-Z, University of Idaho Cooperative Extension, Tree Planting and Care No. 5


WA Forestry Technical Note 10: Stand Density Guidelines


WA Plant Materials Technical Note 8: Mulch and Mulching for Erosion Control

WA Plant Materials Technical Note 10: Riparian Revegetation-Plants

ID Plant Materials Technical Note 43: Tree and Shrub Planting, Care and Management

ID Plant Materials Technical Note 45: Temporary Storage and Handling of Container, Bareroot and Cutting Stock.

ID Department of Lands, 1976 Planting contract.

MT-Plant Materials Technical Note 15: Transportation, Care and Storage of Seedlings.

MT Plant Materials Technical Note 45: Seedling Protectors.

MT-Plant Materials Technical Note 51: Temporary Storage and Handling of Container, Bareroot, and Cutting Stock.
NRCS CONSERVATION PRACTICE EFFECTS - NETWORK DIAGRAM

Initial setting: 1) Nonforested sites capable of supporting woody plants; or 2) cutover forestland. Both settings lack desired woody species, and planting or seeding is needed to establish desired species.

Start

Tree/Shrub Establishment
(Code 612)

1. Woody plants established

D.4 (+/-) Crop/timber production

D.1 (+) Woody plant growth

D.2 (+) Canopy cover/vegetative structure

D.3 (+) Species composition change

1.1 (+) Nutrient/pollutant uptake

1.5 (+) Interception and infiltration of precipitation

1.6 (+) Trap sediment and sediment-attached pollutants

1.7 (-) Surface erosion, runoff, and sediment production

1.8 (+) Quantity and quality of tree/shrub habitat

1.9 (+) Forest and forest edge wildlife, fish, plants, beneficial organisms

1.11 (+) Shade

1.10 (+/-) Recreation opportunities

C.1 (+) Soil quality

C.2 (+) Greenhouse gases

C.4 (+) Quantity and quality of water produced, and groundwater recharge

C.3 (+/-) Landscape-scale structure/composition/function

C.5 (+) Health of humans and animals; (-) associated costs

C.6 (+/-) Income and income stability (individuals and community)

C.7 (+/-) Income and income stability (families and communities)

Forest Stand Improvement, 665 periodic tree removal to maintain

I.3 (+) Wood and other forest products

I.4 (+) Potential income

I.2 (+) Carbon capture and storage

I.1 (+) Wood and other forest products

Note: Effects are qualified with a plus (+) or minus (-). Those symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Legend:
- Mitigating practice
- Associated practice
- Created by practice
- Direct effect
- Indirect effect
- Cumulative effect

Pathway:

May 2016