

Olympic National Forest

Native Plant Notebook



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Olympic National Forest Native Plant Notebook

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and

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Abstract

The purpose of this notebook is to provide Olympic National Forest staff with consistent, forest-wide standards, tools, and approaches for revegetation with native plants and/or non-invasive non-natives, tailored for individual projects and for plant communities of the Olympic Peninsula. Included is information on best plant materials and plant movement guidelines; road decommissioning and roadside treatments; and plants to use for wildlife forage, invasive plant treatments, mulch, and fertilizer. Appendices provide sample forms, contracts, survey results, recommendations from the Native Seed Network, and other supporting materials.

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Introduction and a Little History

To meet a need for a handbook on restoration with native plants focused on western Washington, the first edition of the Mt. Baker-Snoqualmie Native Plant Notebook was produced in 1994 and updated in 1997 (Potash and Aubry 1997). Since that time, a wealth of additional information has become available, to the point where the myriad of options can feel overwhelming. In this era of “information overload,” the purpose of this notebook is to provide Olympic National Forest (ONF) staff with a few consistent, forest-wide agreed-upon standards, tools, and approaches for revegetation with native plants (and/or non-invasive non-natives), tailored for your types of projects and for plant communities of the Olympic Peninsula.

Region-wide contracts have already been prepared for your use so you don’t have to re-invent the wheel. In addition, rather than expecting you to wade through 4,567,890 articles, bibliographies, and URLs, this document provides electronic links to critical sources of information. Finally, hard copies of a few select reference books will be purchased for each office.

Regional and National Native Plant Policy

In 1994, the Pacific Northwest Region (R6) led the way by adopting a native plant policy under Forest Service Manual 2600, *Regional Policy on Use of Native and Nonnative Plants on National Forests and Grasslands*. A national policy was later based on the R6 policy and is more explicit. The public comment period ended August 24, 2006; the final is expected early in 2007. The draft policy can be viewed by clicking http://www.fs.fed.us/rangelands/howeare/documents/FSM2070_Final_2_062905.pdf.

Three key elements of the national policy are:

1. Native plants are defined as all indigenous terrestrial and aquatic plant species that evolved naturally in a defined native ecosystem.
2. Native plant materials will be the first choice in revegetation for restoration and rehabilitation of native ecosystems where timely natural regeneration of the native plant community will not occur.
3. Non-native, non-invasive plant species may be used when:
 - a) Needed in emergency conditions to protect basic resource values, as an interim, non-persistent measure designed to aid in the re-establishment of native plants.
 - b) When native plant materials are not available.
[Ed. Note: This clause should not excuse us from the pre-planning that is necessary to ensure that native plant materials *are* available.]
 - c) In permanently altered plant communities.



It's easy to visualize what this definition means for projects on the Olympic National Forest if you imagine that you stepped into a time machine that enabled you to stand at your project site about 300 or 400 years ago. What plants would you expect to see growing there? See "Definitions Referring to Plant Origin" on the next page.

Definitions Referring To Plant Origin

Native: Plant species present on the Olympic National Forest prior to European arrival, circa 1800.

Example: Pacific trillium (*Trillium ovatum*).

Local Native: A population of a native plant species that originated (that is, grew from seeds or cuttings) from genetically local sources. The geographic and altitudinal boundaries that define a species' genetically local source are determined by seed movement guidelines.

Example: Douglas-fir (*Pseudotsuga menziesii*) seedlings grown from seed collected in the local seed zone.

Non-local Native: This term has two meanings: (1) a population of a native plant species that does not occur naturally in the plant community in which it is planted or (2) plant material of a native species that does not originate from genetically local sources. Non-local native plants can have detrimental effects on the composition of plant communities, plant-animal relationships and the local gene pool; they also can increase the risk of mortality and maladaptation.

Example: 1) black cottonwood (*Populus trichocarpa*) planted on an alpine ridge
2) Douglas-fir (*Pseudotsuga menziesii*) seedlings originating from east of the Cascades planted on the Olympic National Forest

Desirable Non-Native: Annual or short-lived perennial that is not persistent or competitive with native vegetation. Used to decrease surface erosion or as noxious weed competitors.

Example: annual ryegrass (*Lolium perenne* spp. *multiflorum*)

Naturalized species: Non-native species that were introduced by humans to northwest Washington and have become a part of native plant communities.

Example: foxglove (*Digitalis purpurea*)

Exotic species: Non-native species that do not occur in northwest Washington except in landscape plantings or botanical gardens.

Example: southern magnolia (*Magnolia grandiflora*)

Undesirable Plant Species: Either one of the following:

1) Plant species on the Washington Department of Agriculture noxious weed list.

Example: hairy cats-ears (*Hypochaeris radicata*)

2) Horticultural varieties of native species

The Importance Of Using the Best Plant Materials and Plant Movement Guidelines¹

When you collect seed or cuttings from one site and then plant them in your project area, the original plants from which you collected are your source plant materials. Consideration of the *origin* of these plants can be one of the most important decisions in a restoration project. In this context, origin can be thought of as the location where the source plant materials originally grew on the landscape.

If the source plant material is adapted to one set of environmental conditions, moving these plants to a project site with a very similar set of environmental conditions gives the best chances of success.

The “best” or “most appropriate” native plant materials are those which were originally collected from sites that are the most environmentally similar to your project area, because this increases the probability that they will actually survive in the project area itself. In other words, if the source plant material is *adapted* to one set of environmental conditions, moving these plants to a project site with a very similar set of environmental conditions gives the best chances of success.

Conversely, there are a couple of serious concerns if the source plant materials originated from a site very different from the project area. The first concern is that if the new plants are not well-adapted to environmental conditions found in the project area, they’ll die², and there goes your hard-earned project funding. The second, bigger concern is that the plants introduced from the collection area would interbreed with the same species in the vicinity of the project area, introducing these maladaptations to plants in a broad area, with possible long-term ramifications in the watershed. Standards for how to ensure the origin of the collection area is appropriate for the project area on the Olympic National Forest are addressed in Plant Movement Guidelines, later in this section.

Choosing the “best” plant materials also entails consideration of the *genetic diversity* of the source plant material. Natural selection will favor some individual plants within the same species over others when they are planted in the project area. Therefore, overall percent chances of survival are higher if the source of the plant material was collected from a variety of individuals. Standards for how to ensure genetic diversity are addressed in Plant Movement Guidelines.

See <http://frdev.ftcol.wo.fs.fed.us/wildflowers/nativeplantmaterials/rightmaterials.shtml> for an outstanding, concise summary of this subject: *Selecting native plant materials for restoration projects—ensuring local adaptation and maintaining genetic diversity* (Withrow-Robinson and Johnson 2006).

¹ For definitions of key terms (identified in italics), see Definitions Related To Plant Movement Guidelines, later in this section.

² For example, thimbleberry (*Rubus parviflorus*) growing in Sequim might have a trait, such as timing of bud burst, that expresses a full month earlier than thimbleberry that has evolved to grow in avalanche chutes in the silver fir zone. If the Sequim thimbleberry seeds were used for a project 3,000 feet higher, they might die because the buds burst too early, while there are killing frosts.

Protecting Plant Genetic Resources

The protection of plant genetic resources is an important mission of the Forest Service. Safeguards for maintaining local adaptation and genetic diversity in native conifer species, for example, have long been the foundation of reforestation practices and nursery operations. These same considerations are now being applied to the development and use of plant materials for other types of native species, including hardwood trees and shrubs, grasses, and forbs.

The use of genetically inappropriate plant materials can have unanticipated and cascading negative effects throughout the ecosystem.

Plant materials that are not genetically suited to conditions of a planting site may cause the project to fail outright or not be sustainable over time. Poorly adapted plants may even negatively affect neighboring *populations* of the same species if they contribute pollen or seeds to them. Ensuring genetic diversity is also important because it can strongly influence the long-term viability of plant populations and their ability to adapt to changing

climatic and environmental conditions. Plant materials that lack genetic diversity may be more susceptible to pathogens and other environmental stresses, and they may also be less competitive with exotic invasive species. Overall, the use of genetically inappropriate plant materials can have unanticipated and cascading negative effects throughout the ecosystem.³

How Far Can We Move Plants and Seed?

Plant and seed movement or seed transfer guidelines delineate the area over which seeds and cuttings can be collected and planted. The reason for setting plant movement guidelines is to increase the probability that the reproductive materials we use will survive, grow to maturity, and reproduce. The chance of success is much higher if we use locally collected material. The geographic limits of what constitutes a “local native” plant are called plant movement guidelines.

Before discussing the recommendations for plant movement on the Olympic, a brief introduction to the interactions between plants and their environments may be useful. The forces of natural selection result in the diversity of organisms by promoting adaptation to different ways of life (Ayala and Kiger 1980). Natural selection acts on the *genotype*, which is the genetic constitution the plant has inherited. The *phenotype* is the appearance of the plant—what we can see—including form, physiology, and behavior. The phenotype results from the interaction of the genotype and the environment.

Usually, most plants are precisely adapted to their immediate environments. Many widespread species adjust by breaking up into groups (ecotypes or subpopulations), each of which is adapted to the specifically defined ecological situation within one or more sub-areas of the species’ range. Subpopulations are usually continuous but maintain their integrity through ecologically specified selection pressures despite *gene flow* from the other neighboring “ecological” races (Mettler and Gregg 1969). Moving plants outside

³ Excerpt from Celebrating Wildflowers website, Native Plant Materials, <http://frdev.ftcol.wo.fs.fed.us/wildflowers/index.shtml>. Accessed 1/29/2007.

the sub-areas to which they are adapted can result in changes in a number of traits including plant size and shape, growth rate, seed production, and survival. The degree to which these changes occur depends on the difference between any two sub-areas. Planting climatic races in different environments illustrates these differences (Figure 1).

Three plants of the cinquefoil, *Potentilla glandulosa*, were collected in California—one on the coast about 100 feet above sea level (Stanford), the second at about 4,600 feet (Mather), and the third in the Alpine Zone of the Sierra Nevada at about 10,000 feet (Timberline). Each plant was cut into three parts and the parts were planted in three experimental gardens at different altitudes, the same garden for all three plants. The division of one plant insured that all three parts planted at different altitudes had the same genotype.

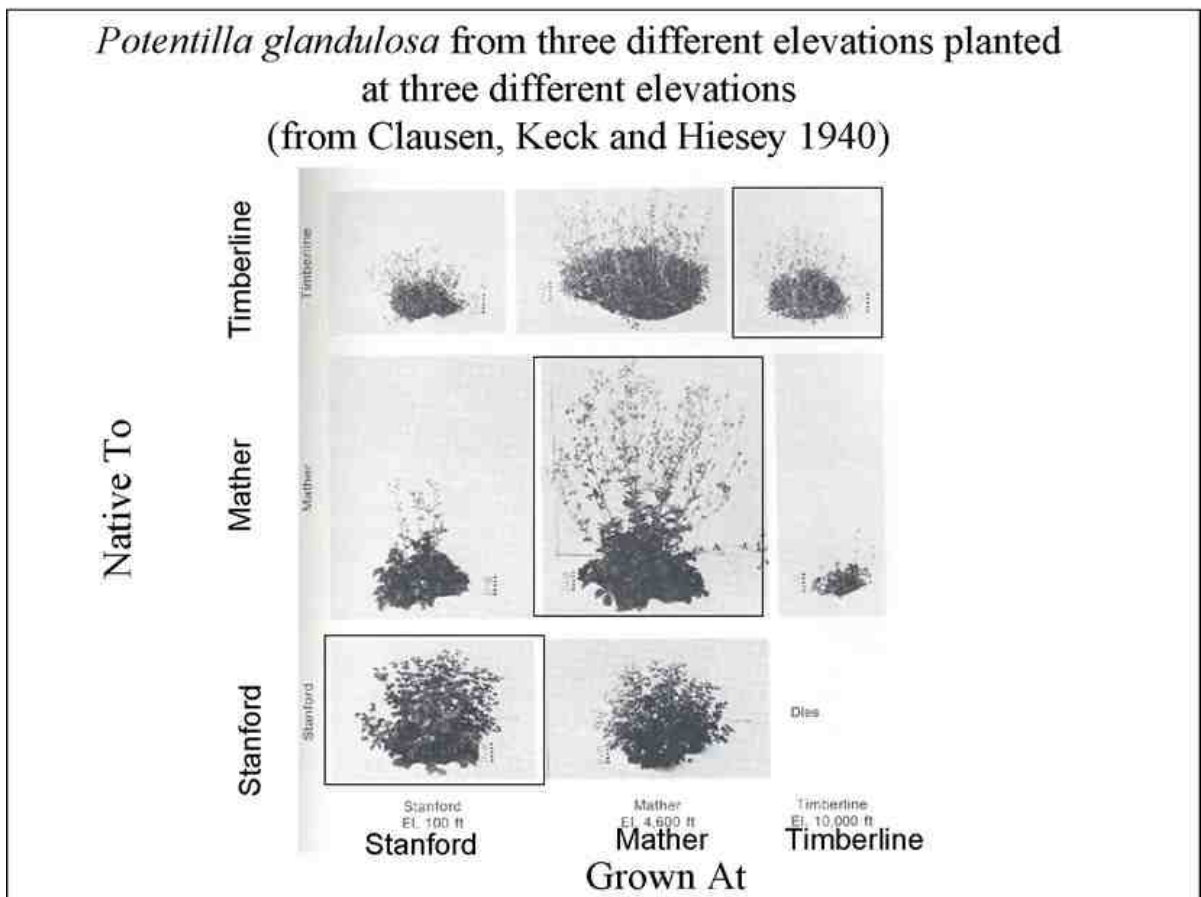


Figure 1. Effects of plant origin and the environment on plant growth. Photos courtesy of the Carnegie Institution of Washington, Palo Alto, California. Used by permission.

Each of the three sources grew differently across the three environments. Besides the obvious differences in appearance, there were differences in fertility, growth rates, and other traits. Plants in the same column in Figure 1 illustrate the effects of growing the three genotypes (sources) in one environment, such as the Timberline, Mather, and Stanford sources grown in the Stanford experimental garden (left-hand column). When the three sources were grown at Timberline (right-hand column), the Stanford source did

not survive; it was unable to adjust to, among other factors, the shorter growing season and harsher temperatures at 10,000 feet. Plants in the same row illustrate the effects of the three environments on a single source. For example, the cuttings from the Mather source (middle row) grew very differently in the three experimental gardens. Photos on the diagonal represent the three genotypes grown in their source environments; in each case, the plants from the source environment were the most vigorous.

Although we would never attempt testing across extreme elevational differences on an operational basis, such testing does show that a single species with a wide geographic range, like many of our forest species, varies in many important characteristics and this variation has a genetic basis. Studies similar to this one involving many more genotypes (chosen over many locations) have been used to develop plant movement guidelines for individual plant species. Few of these studies have been done on plant species native to our forest. The guidelines we will use are based on our knowledge and experience, limited as it is, and are conservative in nature in order to reduce the risk of maladaptation.

Plant Movement Guidelines

As stated above, these guidelines are very conservative and can be adjusted depending on the species and project. Your friendly local area geneticist can help adjust these requirements based on your specific situation.

Plant Movement Guidelines For Upland Tree Species

Collect seeds or cuttings of upland tree species within seed (collection) zones. *Seed zones* are based on climatic and physiographic information and were developed in 1966 to reduce the risk of maladaptation of commercially planted conifers and to provide structure for the commercial seed trade. In addition to geographic boundaries each zone is divided into 500-foot elevation intervals. *Seed lots* are coded by both seed zone and elevation band.

Use the following elevation bands when building large seed lots: 0–500 feet, 500–1,000 feet, 1,000–1,500 feet, etc. When collecting seeds or cuttings for smaller projects (perhaps a one-time collection), a 500-foot elevation band would also be used (approximately 250 feet above and below the elevation of the project site).

Plant Movement Guidelines For Shrubs, Forbs, Grasses, and Riparian species

For shrubs, forbs, grasses, and riparian species, use 5th field watershed boundaries as seed/cutting collection zones. Within 5th field watersheds, make collections in 500- to 1,000-foot elevation intervals, depending on the project and plant species.

Gene Pool Conservation Guidelines

The genetic diversity of the seed or cuttings is just as important as the seed movement guidelines for successful revegetation and is critical for *gene pool* conservation. To prevent the loss of genes in the population, collect from a minimum of 30–50 unrelated *donor plants*. The desired result is 30–50 parent plants represented in surviving seedlings or cuttings. If mortality is expected in some stage of the process, collect from additional

donor plants. Collect relatively equal number of seeds/cuttings from each donor plant to ensure representation by as many parent plants as possible.

Donor plants should also be separated by sufficient distance to reduce the risk of relatedness—that is, originating from the same rhizome or root system or, for out-crossing plants, having one or both parents in common. The minimum distance between donor plants is determined by mating system and pollen flow and will vary by species. Use your best judgment and knowledge of the distribution of plant populations in the area.

Summary Of Guidelines For Native Plant Collection To Ensure Genetic Diversity and Adaptation To Planting Environment

- Collect from 30–50 **unrelated** plants.
- Collect an equal number of seeds or cuttings from each plant.
- For **upland tree species** collect seeds and cuttings within seed zones and 500-foot elevation bands or not more than 250 feet above and below the project site.
- For **shrubs, forbs, grasses, and riparian tree species** collect seeds and cuttings within watersheds and 500-foot elevation bands or not more than 250 feet above and below the project site.

Definitions Related To Plant Movement Guidelines

Adapted: How well plants are physiologically suited for high survival, good growth, and resistance to pests and diseases in a particular environment.

Donor or parent plants: The live plants from which seeds or cuttings are collected.

Gene flow: The exchange of genes between different but (usually) related *populations*.

Gene pool: The sum of all the genetic information carried by members of a *population*.

Genetic diversity: The property of a community of organisms of a certain species, in which members of the community have variations in their chromosomes due to a large number of slightly dissimilar ancestors; this property makes the community in general more resistant to diseases or to changing ecological conditions.

Genotype: The specific genes present in a cell or an individual.

Maladapted: Poorly adapted.

Phenotype: The observable characteristics of an individual, resulting from the interaction between the genotype and the environment in which the individual grows.

Population: A group of organisms of the same species relatively isolated from other groups of the same species.

Seed lot: An indefinite quantity of seed having uniform quality, produced at a specific location, or within a single seed collection zone and collected from a single annual crop.

Seed (collection) zone: An area having defined boundaries and altitudinal limits, within which soil and climate are sufficiently uniform that it is expected that seed can be freely moved without problems of maladaptation.

Get It Together: Native Seeds and Rooted Materials

Focus Species and Native Seed Mixes

In fiscal year 2007, we applied for and were awarded RAC Title II funds to hire the Native Seed Network (a division of the Institute for Applied Ecology) to develop a “focus list” of those native species best suited for seeding or planting for restoration projects on the ONF. The report will include species lists for various project types (wildlife forage, erosion control, etc.), sites (steep/flat, open/wooded), and environments (wet/dry, high/low elevation), as well as information about propagating and planting the focus list species. In addition, they will conduct a case study specifically for the Caraco elk forage units in the Dungeness River drainage. The final report from this effort will be posted later in FY07 on the ONF native plant website: <http://fsweb/onpmp/index.html>.



Five Steps for Acquiring Native Seed for Your Project

Step 1—Surveys

Project Area Surveys. The ideal way to determine what species would be most appropriate to seed at your site is to visit the area and make a species list of all the species that occur there. Other critical information to note is the elevation of your site, and if possible, the plant association according to the keys in *Forested Plant Associations of the Olympic National Forest* (Henderson et al. 1989).

Next, cross-reference your comprehensive list with those species recommended in the “focus list” for the management objective you desire. The best chance of project success is to use those species that are included on the focus list *and* already occur naturally in the vicinity of your site.

Seed Reconnaissance Surveys. Once you know what species you want, you can hire someone to scope out the best places to collect your foundation seed (within the boundaries defined by the Plant Movement Guidelines). That way your seed collector doesn’t waste a lot of time visiting areas that don’t have the species they are hunting for. This process was completed for the Dungeness elk units; a summary is included in Appendix 1, and a prototype contract for this type of reconnaissance is included in Appendix 2.

Tip!

If the proposed project area has already been surveyed by an ONF botanist, you can get the complete species list, elevation, and plant association from them.

Step 2—Seed Collection

Seed collection will be most cost effective if you provide your contractor with the results of a preliminary reconnaissance survey, as mentioned above. Lacking that, you can give them a list of the desired species and have them search the project area. An example of a task order for seed collection is shown in Appendix 3. The entire contract is available on the ONF native plant website: <http://fsweb/onpmp/index.html> .

Tip!

Given the wild storms of FY2007, remember to provide your collector with local district updates about washed-out roads. Also remember to coordinate with the wildlife biologist for keys to gates locked for wildlife closures.

Step 3—Seed Cleaning and Testing

Seed collected (by either you or a contractor) is roughly cleaned to remove obvious debris and then shipped to the Forest Service's Bend Seed Extraction Facility. The Bend Seed Extractory will expect you to include, along with your shipment of rough cleaned seed, their seed collection form #158, which you can download from their website <http://fsweb-ochdes.r6.fs.fed.us/seedextractory/extractory.shtml>. If you have any questions, they're happy to help you—just call 541-383-5481.

The Bend Seed Extractory cleans your seed thoroughly until it meets the industry standard and then sends it to Oregon State University for testing. On form #158 you checkmark which of the following tests you want:

- ☐ **Germination** (the predicted percentage of the seed that will actually sprout vs. duds). The industry norm for commercial crop seed is ≥ 80 percent.
- ☐ **Noxious weeds** (sometimes called the "all states noxious weed test"). Ask them to use the Washington state noxious weed list. They will list any species they find.
- ☐ **Purity** (how much of the seed is actually the species you want, including noxious weeds, any other species, or inert materials like chaff and straw). Industry norm for commercial crop seed is ≥ 90 percent.
- ☐ **Percent pure live seed (PLS)**. This is a calculated number based on multiplying the (percent purity) by the (percent germination). For example, your batch of blue wildrye has $(90\%)(80\%) = 72\%$ pure live seed. That means that 72 percent of the stuff you sow from that batch is more or less "guaranteed" to germinate.

It's important to understand that the pounds of seed needed from the field collections ("rough cleaned") will be greater than pounds of properly cleaned, pure live seed needed to start a seed increase project. Some species, such as oceanspray, have a high proportion of unviable seed; others have thick seed coats, so the amounts vary by species. For example, you'd need to collect between 1 ½ to 3 pounds of broadleaf lupine seeds to yield 1 pound of clean seed, and between 1.5 and 1.8 pounds of sedge seeds to yield 1 pound of clean seed (estimates for other species are available from Bend Pine Nursery).

Step 4—Seed Increase



Tip! A seed increase program can get you the bulk quantities you need and save you money in the long run!

Native seed is usually difficult to collect in large quantities because the plants may be sparsely distributed or difficult to get to, or the seed itself may have low viability. Restoration workers have helped resolve this problem by establishing seed increase programs.

After your seed is cleaned and tested and meets a standard that is specified in the contract, it is sent to J. Herbert Stone nursery for storage—this is called the “foundation seed.” The foundation seed is then sent to one of the pre-approved nurseries in our R6 contract, where it is planted in a nursery bed, babied, and grows up to produce a large quantity of seed that can be readily harvested. Sometimes the same crop can produce even more seed the 2nd or 3rd year. See great diagrams and photos of the seed increase process at <http://frdev.ftcol.wo.fs.fed.us/wildflowers/nativeplantmaterials/stock.shtml>. The nursery needs a minimum amount of foundation seed (meeting certain purity and germination requirements) to establish a 1-acre “production field.” Table 1 shows three examples just to give you an idea.

Table 1—Pounds of foundation seed needed to start a 1-acre production field, three examples

Species	Amount of clean foundation seed needed (lbs)	Germination/pure live seed (percent)	Average yield 1 st year harvest (lbs)	Average yield 2 nd year harvest (lbs)
Blue wildrye	8	75/95	300	300
Common yarrow	2	85/98	165	165
Tufted hairgrass	2	75/90	110	510

Source: Umatilla National Forest, from regional seed increase contracts

Seed increase on the ONF will be a coordinated effort at the forest level and not a project-by-project affair. If you have a project where you’d like to use native seed, discuss it with the coordinator of the ONF Native Plant Materials Program. An example of an R6 task order for seed increase is in Appendix 3. The entire contract is available on the ONF native plant website: <http://fsweb/onpmp/index.html>.

Seed increase is an excellent investment. Figures 2 and 3 provide some examples of seed increase yields from Region 6.

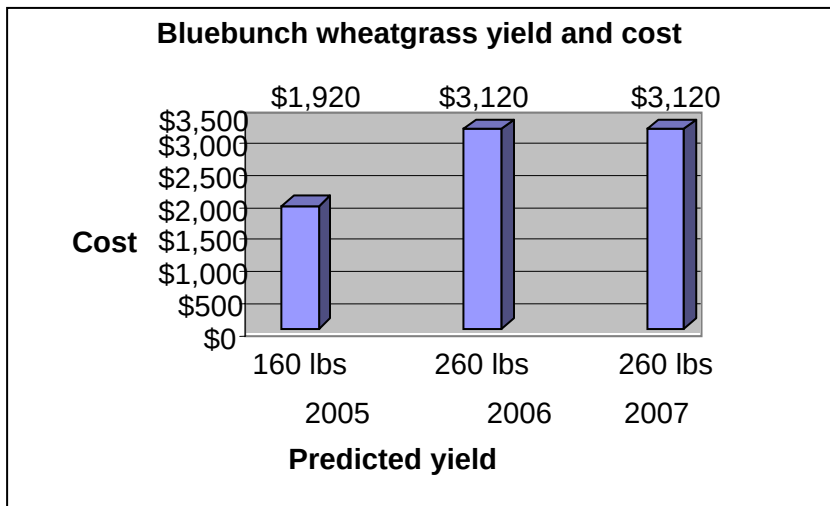


Figure 2—Bluebunch wheatgrass seed yield and cost. In this example, 4 pounds of seed were collected from the Wenatchee River Ranger District to establish 1 acre of bluebunch wheatgrass for seed increase. From this 1-acre stand, seed will be purchased for revegetation work. The predicted yields and associated purchase prices are shown graphically here. Yield predictions are based on past experience with the species being grown. At the end of 3 years, 680 pounds of bluebunch wheatgrass will be produced from the original 4 pounds of foundation seed, at a cost of about \$12/pound.

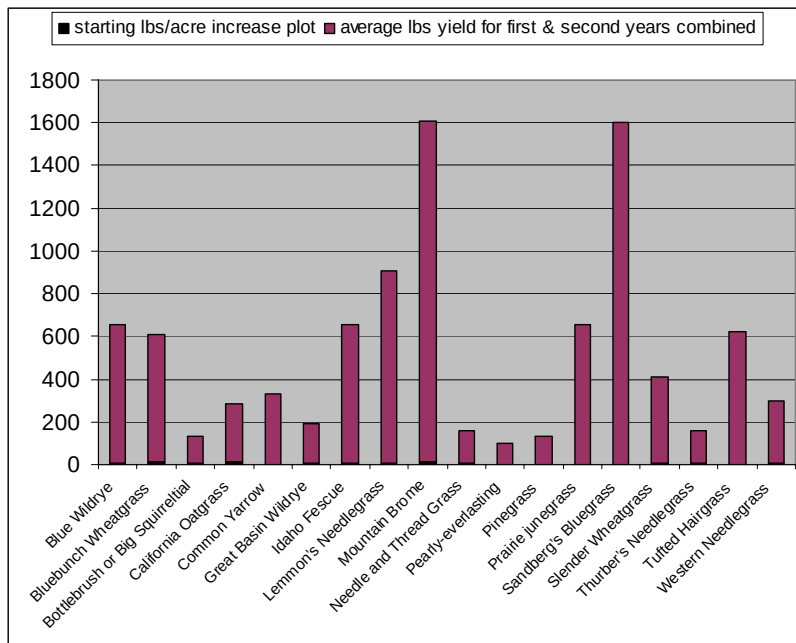


Figure 3—Proportion of seed increased compared to foundation seed. This graph, based on Regional Seed Increase Contracts, shows the number of pounds of foundation seed compared to what can be harvested after 2 years (the little black bars at the base of the colored bars represent starting pounds per acre and are barely visible because of the disproportionate scales). For example, only 8 pounds of blue wildrye were collected, but they yielded 650 pounds after the 2nd year—an 81-fold increase.

Step 5—Storage

If the seed isn't stored properly before it is sowed, there's a good chance it's useless. Rose et al. (1998) (Appendix 4) sums up the issue very well: "Successful storage requires knowledge of the seed characteristics of different species as well as the quality of the seed before storage, its moisture content, and the storage temperature and method."

Obviously this kind of treatment requires the knowledge of a plant materials specialist, and we're fortunate to be able to rely on the expertise of the J. Herbert Stone Nursery. All native seed collected for project use on the ONF (whether it is for simple broadcast at a later time in the project area, or destined for a seed increase program) should be sent to this nursery where it will be properly cared for until it is ready for use (Figure 4).



Seed-bearing material was lightly cleaned and packaged in plastic bags for shipment to the Forest Service's J. Herbert Stone Nursery for storage.

Figure 4—Seeds ready for shipment to J. Herbert Stone Nursery. This seed was one of seven native species collected on the Okanogan-Wenatchee National Forest. There is a nice Powerpoint presentation developed by Robin Shoal that describes their program; it can be viewed by visiting the ONF native plant website: <http://fsweb/onpmp/index.html> .

Rooted Plant Materials

If your project objectives determine that woody plants/shrubs are needed, it is generally not practical to collect and sow their seeds in the project area because they'll take too long to grow. In this case, the contractor usually collects stem cuttings or, depending on the species, root segments. These are delivered to a nursery, where they are grown into entire plants with roots, which are then planted back out on the project site.

Stock Types

Rooted plant materials are available from nurseries in a variety of forms, each with distinct advantages and disadvantages (Dorner 2002)⁴. The following is a list of commonly available nursery stock types:

- **BALLED-IN-BURLAP** or "B&B". The plant is grown in the nursery, dug up with its roots and surrounding soil, and wrapped in a protective material such as burlap.
- **BARE-ROOT**. The plant is sold without any soil around its roots.
- **CONTAINERS**. The plant is sold in a container of soil with drainage holes. Sizes and shapes of containers vary, but they usually are plastic. Examples of common sizes are: 4-inch pots, 6-inch pots, and 1-, 2- or 5-gallon containers.
- **CUTTINGS** or **WHIPS**. A piece of branch, root, or leaf that is separated from a host plant and is used to create a new plant. These may be placed in a rooting medium or stuck directly into the ground for planting.
- **LINERS**. A small grafted plant, rooted cutting, or seedling that is ready for transplanting. They are often used for herbaceous plants and grasses.
- **PLUGS** or **TUBELINGS**. These are similar to liners, but they are individual cylindrical or square planting containers that are longer than they are wide. The longer shape provides room for a plant to build root mass for transplanting.

Calculating Quantity Needed for Different Planting Densities

To plan your budget, you'll need to know how many plants to order. Once you know the pros and cons and decide what stock type you want (see link in footnote), talk to a Forest Service landscape architect and/or your nursery grower to get advice about typical spacing for that species and that stock type. Then use Table 2 to calculate how many plants you'll need. Visit <http://parks.state.co.us/NR/rdonlyres/00A97125-2219-4E68-A28F-6CC62300D43A/0/revegetation.pdf> to see the entire document, which is chock full of useful information.

Table 2—Calculation of the required number of plants to achieve desired density

If the distance on center* is...	Then the number of plants you need is...
0.5 ft	(Area in Square Feet) x 4
1 ft	Area in Square Feet
1.5 ft	(Area in Square Feet) x 0.444
2 ft	(Area in Square Feet) x 0.25
3 ft	(Area in Square Feet) x 0.11
4 ft	(Area in Square Feet) x 0.0625
5 ft	(Area in Square Feet) x 0.04
6 ft	(Area in Square Feet) x 0.028

*The "distance on center" is an expression to describe how many feet apart the plants are spaced, if spaced evenly in a grid-like pattern.

Source: Colorado Natural Areas Program 1998

⁴ An excellent table comparing the advantages and disadvantages of each stock type is on page 30 of the document by Dorner (2002). A hard copy will be provided to you (Appendix 8), or visit <http://www.nps.gov/plants/restore/pubs/intronatplant/toc.htm> to see it now.

Costs For Acquiring Native Seed Or Rooted Plants

Costs for using native species in restoration projects will vary based on a multitude of factors, but here are a few examples to give you a rough idea.

Cost For Step 1, Surveys

Project Area Surveys. The easiest and most effective way to have these surveys done is to allot days in WorkPlan to have an ONF botanist complete the job. Calculate their cost-to-government at about 1 field day per 20 acres + an office day to ID grass species you may want to collect and/or weed species you may want to control. If the survey is also clearance for rare plants, more time will be required. Alternatively, you may be able to use a volunteer from your local chapter of the Washington Native Plant Society (www.wnps.org). If you go this route, it is critical that the volunteer is experienced enough to distinguish native from non-native species in “difficult” families like graminoids (grasses, sedges, rushes) and composites (plants in the sunflower family, such as hawkweeds and thistles).

Seed Reconnaissance Surveys. Once you know what species you want, you can hire someone to map the seed collection sites. In 2006, the elk forage seed inventory in the Dungeness and Gray Wolf watersheds cost \$2,400, which allowed us to pay with a government check and didn’t require routing through the formal contracting process. Average cost of mapping collection sites in eastern Oregon, based on data compiled by the Umatilla National Forest, ran between \$300 and \$350 per species within a 5th field watershed.

Cost For Step 2, Seed Collection.

Tip!

Ask the contractor to bid on the entire job, not on cost-per-pound of clean seed.

Cost will vary based on the number of pounds needed, species desired, and accessibility of collection sites. A recommendation from both the Umatilla and Okanogan-Wenatchee is that you ask the contractor to bid on the entire job (Table 3), rather than a bid based on cost per pound per of clean seed. Contractors like this better because they don’t have a good feel for how

many pounds of “rough cleaned” seed will be needed to reach your desired pounds of clean seed. Of course their bid will be lower if you’re able to provide them with good reconnaissance information (mapped collection sites).

Table 3—Partial Government cost estimates for task order for seed collection for Mission Ridge Highway project, based on experience and costs on other native projects on the Umatilla National Forest

Item No.	Sub-item No.	Description	Quantity order	Unit	Unit price (\$)
2.A	1	Collect bluebunch wheatgrass from approved collection areas (minimum 20 lbs rough cleaned weight)	1	Job	1,800
	2	Collect Sandberg's bluegrass from approved collection areas (minimum 6 lbs rough cleaned weight)	1	Job	900

Item No.	Sub-item No.	Description	Quantity order	Unit	Unit price (\$)
	3	Collect common yarrow from approved collection areas (minimum 10 lbs rough cleaned weight)	1	Job	1,000
	4	Collect silverleaf Phacelia (<i>Phacelia hastata</i>) seed from approved collection areas (minimum 5 lbs rough cleaned weight).	1	Job	1,500

Cost For Step 3, Seed Cleaning and Testing

Bend Seed Extractory charges:

\$43.50 flat fee to clean less than 1 pound of seed

\$65 flat fee to clean between 1 and 25 pounds (that is, 25 pounds costs the same as one pound).

Then they send it to Oregon State University for the whatever tests you requested on form #158. OSU charges:

\$37–\$45 per seed lot for “all states noxious weed” test

\$30 per seed lot for germination

\$72–\$92 per seed lot for purity (which includes noxious weeds and any other species)

Cost For Step 4, Seed Increase

Costs vary widely depending on the grower, the species (some species are harder to grow than others), and the quantity (cost per pound generally goes down the larger the quantity). For example, the Siuslaw contracted a local grower to produce 1,500 pounds of blue wildrye for \$4.84 per pound. The cost to produce 680 pounds of bluebunch wheatgrass (as shown earlier in Figure 2) was \$12/pound.

Cost For Step 5, Storage.

J. Herbert Stone Nursery charges \$1.00 per pound per year to store seeds under refrigeration, and \$1.50 per pound per year to store seeds in their freezer. They can advise you as to which is most appropriate.

Cost To Produce Rooted Plants Materials

Cost will vary depending on what size stock type you want. Three bids received on the Okanogan-Wenatchee National Forest ranged from \$2.25 to \$3 each for “D-40 plugs” and from \$4 to \$5 each for “long tubes.” A nursery in Olympia estimated \$2.75 each for 1-gallon container plants.

Road Decommissioning and Roadside Treatments



The purpose of this chapter is to address the need for immediate erosion control. The ONF aquatics program manager, forest hydrologist, hydrologist technician, and engineers indicated that they want seed mixes that will persist longer than 2 years, can grow rapidly in poor soils, and will stabilize slopes until trees are established. Our approach is to use “non-invasive non-natives” and mulch, with the assumption that if the species recommended are not overly persistent, native species will eventually become established at these sites.

The Revegetation Project Form (Appendix 6) is intended to meet a need to provide a consistent framework for all resource areas to use whenever immediate erosion control is required.

Engineering Contract Specifications (Appendix 7) are intended to meet a need to have consistent language, forest wide, regarding revegetation for erosion control that can be inserted into contracts. There are four different versions, depending on the elevation and soil moisture.

Non-invasive, Non-native Seed Mixes For Road Decommissioning

This section is based on a manuscript by Laura Potash, Marty Chaney, and Carol Aubry (Potash et al. 2007). It addresses those times when we need a seed mix of non-native plant species for road decommissioning. A number of characteristics for the “perfect non-native seed mix” are summarized below:

Objectives

- ☐ 80 percent cover in first through third season
- ☐ Cover rapidly reduces in fourth year and is nearly gone in fifth year
- ☐ Provide environment for natives to seed in
- ☐ Exclude or out compete noxious and obnoxious weeds
- ☐ Prevent erosion

Characteristics

- ☐ Inexpensive
- ☐ Readily available from seed companies
- ☐ Free of noxious weeds
- ☐ Will not hybridize with local native species
- ☐ Noninvasive
- ☐ Provide a variety of stand characteristics
 - Tall or short
 - Deep-rooted or shallow-rooted
 - Vary in level of winter cover
 - Bunchy or mat-like
 - Include at least one nitrogen-fixing species
- ☐ Non-toxic to wildlife

Four seed mixes have been developed for high and low elevations (above and below 2,500 feet) and on dry and wet sites (Table 4). Each mix includes the following:

1. A short-lived (3–5 years) perennial bunchgrass (perennial rye)
2. A non-persistent annual grass (annual rye)
3. One or more annual grain or cereal (oats, wheat, winter triticale, barley)
4. One or more short-lived (3–5 years) perennial nitrogen-fixer (peas, clovers)

Plant characteristics for each of these species is given in Table 5.

Table 4—Non-native seed mixes for road decommissioning^a on the Olympic National Forest^b

< 2500' Elevation			> 2500' Elevation ^c		
Soil droughty to somewhat moist, but not saturated to the surface in mid-summer		Soil saturated to the surface in mid-summer	Soil droughty to somewhat moist, but not saturated to the surface in mid-summer		Soil saturated to the surface in mid-summer
↓		↓	↓		↓
Olympic Mix 1		Olympic Mix 2	Olympic Mix 3		Olympic Mix 4
	Lbs/ ac	pct by wt		Lbs/ ac	pct by wt
Annual ryegrass	40	40%	Annual ryegrass	40	44%
Oats	30	30%	Oats	30	33%
Perennial ryegrass ^d	10	10%	Barley	15	17%
Red clover ^e (inoculated)	5	5%	Alsike clover (inoculated)	5	6%
Austrian winter peas (inoculated)	15	15%			
			Annual ryegrass	40	42%
			Winter triticale	40	42%
			Perennial ryegrass ^d	10	11%
			Red clover ^e (inoculated)	5	5%
			Alsike clover ^e (inoculated)	5	6%

INSPECT YOUR SEED TAGS when you receive shipment from your supplier! The rates above assume **≤ 90% PLS** (pure live seed). Seed tags should be inspected for “other seed” as well as for noxious weed seed, because “other seed” can include many common grasses and weeds.

^a Assumptions:

- ✓ The site has nutrient poor, highly disturbed soil that may be lacking a natural A horizon
- ✓ The site is not intended for continuous disturbance (e.g. mowed ski area); the goal is eventual re-establishment of native species
- ✓ The site is not intended to be retreated in subsequent years

^b Source: Potash et al. 2007. Table draft, last revised 12/20/2006.

^c Higher elevations are less likely to have historical introductions of non-native species. To avoid setting this precedent, the use of local native seed mixes is a high priority here. Excellent species for revegetation on the Olympic National Forest include blue wildrye (*Elymus glaucus*), slender wheatgrass (*Elymus trachycaulus*), and tufted hairgrass (*Deschampsia caespitosa*). Conversely, **cultivars of native species should be avoided** on the Olympic.

^d Although persistent to invasive under many circumstances, perennial rye will drop out if soil fertility is low.

^e Red clover (*T. pratense*) and Alsike clover (*T. hybridum*) are not extremely short-lived but are both less persistent than white clover (*T. repens*). Red is better for dry sites, Alsike for wet.

Table 5—Characteristics of the non-native species in Olympic National Forest Seed Mixes

Characteristic	Plant Species—Common Name, Scientific Name, and NRCS Code							
	Annual ryegrass <i>Lolium multiflorum</i> LOMU*	Perennial ryegrass <i>Lolium perenne</i> LOPE	Oats <i>Avena sativa</i> AVSA	Austrian winter peas <i>Pisum sativum</i> spp. <i>arvense</i> PISAA8	Red clover <i>Trifolium pratense</i> TRPR2	Common barley <i>Hordeum vulgare</i> HOVU	Alsike clover <i>Trifolium hybridum</i> TRHY	Winter triticale <i>Triticosecale</i> spp TRIT12
Longevity	Annual or biennial	Annual or perennial	Annual	Annual	Perennial (acts as biennial) (2–3 years)	Annual	Perennial (acts as biennial)	Annual
Height (inches)	24–36	12–24	24	24–48	12–36	30	12–36	42
Leaves	Sheath round, smooth, open; blade rolled in bud, flat, 1/8-in. wide; ligule small, membranous; auricles small	Sparse leaves on clumps; underside glossy; auricles present; ligule difficult to see; x-section of leaf blade v-shaped	Sheath round, short, hairy, split with overlapping margins; blade rolled in bud shoot, ¼- to ½-in. wide, margins short, hairy; ligule prominent, membranous, rounded, toothed; auricles absent	Opposite, pale green with whitish watermark	palmately trifoliolate ; leaflets not serrated; inverted v-shaped watermark usually present; large stipules ; stems, leaves, and petioles pubescent	Alternate, linear lanceolate, 10 in. long.	palmately trifoliolate ; finely serrated; large, pointed stipules ; glabrous	Similar in appearance to wheat: flat; glabrous or pubescent; internodes usually hollow except for immediately below spike
Inflorescence	4–16 in. long spike; spikelets arranged edgewise, alternately up the stem	Spike; 35 spikelets per spike ; 6–10 florets per spikelet	Panicle large, open, pyramid shaped; spikelets 2–3 flowered, drooping	Raceme arising from leaf axil; flowers range from white to pink or purple	Heads consisting of up to 125 flowers; rose-purple or deep purplish-red; heads nested in 2–3 leaves	Spikelets sessile, arranged in 3s on 2 sides of flattened rachis; densely flowered	Seed head consisting of 17–91 florets supported by petiole from leaf axil; flowers white to pink	Seed head is a spike, with 30–40 awned spikelets arranged alternately on two sides of the rachis
Optimal soil drainage	Does well on heavy, waterlogged soils	Somewhat poorly drained	Grows in everything from well-drained to saturated, heavy soils	Well-drained to moist	Well-drained	Prefers well-drained but can tolerate water-logging	Poorly drained	Tolerates drought better than most cereals
Optimal soil fertility	High	Medium high	Moderate	Moderate	Low to moderate	Prefers calcareous soils	Medium	Prefers more nitrogen than wheat

Characteristic	Plant Species—Common Name, Scientific Name, and NRCS Code							
	Annual ryegrass <i>Lolium multiflorum</i> LOMU*	Perennial ryegrass <i>Lolium perenne</i> LOPE	Oats <i>Avena sativa</i> AVSA	Austrian winter peas <i>Pisum sativum</i> spp. <i>arvense</i> PISAA8	Red clover <i>Trifolium pratense</i> TRPR2	Common barley <i>Hordeum vulgare</i> HOVU	Alsike clover <i>Trifolium hybridum</i> TRHY	Winter triticale <i>Triticosecale</i> spp TRIT12
Optimal soil pH	5.0–7.9	5.6–6.2	5.3–8.5	5.5–6.5	Prefers above 5.0	6.5–8.5	6.0–6.5	Alkaline to acid, no numbers
Palatability (for livestock)	Low	Very high	Medium	High	High (bloat hazard)	Medium	High (bloat hazard)	High
Winter hardiness	Will not withstand severe winters	Better than annual rye	Least hardy compared to other PNW cereals	Good	Good	Excellent	Good	Well-drained to moist
Drought tolerance	Low	Low	Low	Intolerant of waterlogged or very droughty soils	Intolerant of lengthy periods of drought	Low	Moderate	Moderate
Shade tolerance	Intermediate	Intolerant	Intolerant	Low tolerance	Moderately intermediate	Intolerant	Intolerant to moderately intolerant	Prefers full sun
Nitrogen fixation	No	No	No	Yes	Yes	No	Yes	No
Seed description	Awns present	Tan; oblong; rachilla flat and wedge-shaped, not knobbed; awns usually absent	Light tan; long, narrow	Round; various colors depending on variety	Small, kidney-shaped; varies in color from yellow to deep violet	Light brown; oblong	Apple-green to greenish-black, browning with age; nearly heart-shaped except notch slightly off center	Larger than wheat, slightly smaller than rye cereal
Seeds per pound	190,510	227,000	19,400	1,800–3,000	281,000	13,600	700,000	12,000
When to sow	Mid August to early September	Mid August to early September	Spring or fall	Late fall	Sow winter varieties in fall	Fall	Early spring or late summer	Sow winter varieties in fall
Emergence time (days)	6–10	14	Unknown	Rapid	Unknown	Unknown	7	Rapid
Optimum germ temp. (°F)	50–87	60–75	Unknown	55–65	Unknown	Unknown	70	Unknown

* Also known as LOPEM2, *Lolium perenne* ssp. *multiflorum*

Pictures and Drawings

Photos of perennial ryegrass, red clover, oats, alsike clover, annual ryegrass, and their seeds are included as a separate document obtained from NRCS and will be given to each recipient of this notebook (Appendix 8). The document can also be viewed on line at:

www.plantmaterials.nrcs.usda.gov/technical/plantid/herbaceous/ConservationPlants.html.

Three species (barley, Austrian winter peas, and winter triticale), which are not included in the NRCS document, are shown below.



Figure 5—Common barley (*Hordeum vulgare*)
Illustration and photo of seeds courtesy of NRCS PLANTS database.

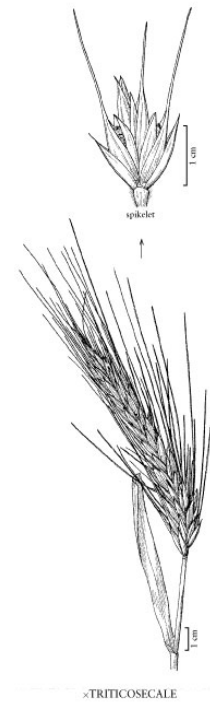


Figure 6—Austrian winter peas (*Pisum sativum* spp. *arvense*) on left. Copyright permission for this notebook obtained from Sustainable Agriculture Network (1998).

Figure 7—Winter triticales (*Triticosecale* spp.) on right. Note the very long awns. Illustration by Cindy Roché; copyright permission for this notebook obtained from Utah State University (Barkworth et al. 2007)

Ordering Information

Non-native Seed Suppliers

The Olympic National Forest is so lucky to have the expertise of folks from the Natural Resource Conservation Service right in the Supervisor's Office. The following local suppliers were recommended by Jeff Swotek, Resource Conservationist with NRCS (jeff.swotek@wa.usda.gov).

- Wilco (formerly Cenex), Centralia, WA. Phone 360-748-9277. FAX 360-748-7204, attention Troy or George.
- Dairygold Feed and Farm Supply, Chehalis, WA. Phone 360-748-3368. FAX 360-748-4363, attention Vern.
- Del's Farm Supply, Yelm, WA. Phone 360-458-5737. FAX 360-458-7753, attention Johnny.
- Kiperts Korner Feed, Olympia, WA. Phone 360-352-3309. FAX 360-352-1739.

If these suppliers can't help you, some larger suppliers the Mt. Baker-Snoqualmie has successfully worked with include:

- Rainier Seeds, Inc. Phone 800-828-8873, x 224. FAX 509-725-7015, attention Harold Wood. [Ed. Note- Harold is very knowledgeable and helpful for all kinds of questions hwood@rainierseeds.com].
- Barenburg Seed Company. Phone 800-547-4101. FAX 541-926-9435, attention Sam Cable, Sales Manager.
- Granite Seed Company. Phone 801-531-1456. FAX 801-768-3967, attention Bill Agnew.

How To Order Commercial Seed.

The best way to get bids is to FAX the supplier your species list (Olympic Mix 1, 2, 3, or 4) and ask them to send you back a bid for the number of pounds you want (see Figure 8 for an example). Multiply the amount in the mix by the number of acres to get total amounts. For example, if your site is 10 acres and you want Olympic Mix #2, multiply all quantities by 10. When you order seed from a commercial supplier, note on your FAX that you would like to receive a copy of the lab report in addition to the seed tag. This will list the names of any species occurring in the mix so you can decide if it's a real problem or something you can live with. For example, if your product is impure because of 2 percent rice seed you may not care but if it's 2 percent knapweed you don't want it!



OLYMPIC NATIONAL FOREST

Supervisor's Office
1835 Black Lake Blvd. SW, Suite A
Olympia, WA 98512-5623
PHONE # (360) 956-2402 Front Desk
FAX # (360) 956-2330 Mail Room

Telecommunication Cover Sheet



Date: _____ Time: _____

Number of pages being faxed: _____

Fax to: _____

Fax from: _____

Message:

We need _____ lbs of a mix of the following proportions (please label and refer to it as "Olympic Seedmix #2"). Please send a bid, including cost for delivery for a mix comprised of:

Annual ryegrass	44 % by weight
Oats	33 % by weight
Barley	17 % by weight
Alsike clover (inoculated)	6 % by weight

When we order the seedmix, we will also need to request the following from you:

- 1) Provide the complete lab report, including results of a crop and weed test.
- 2) Please divide the shipment up so that each individual sack weighs ≤ 50 pounds.

Thank you very much,



USDA Forest Service, Pacific Northwest Region, Olympic National Forest

Figure 8. Sample FAX for requesting bids for commercial seed.

You'll want to check the seed tag that comes with each sack of seed to make sure you're getting a quality product (Figure 9). Definitions and examples of the following terms are in the section on seed cleaning and testing, (see Step 3, earlier in this document):

- Germination rate. (industry norm is ≥ 80 percent);
- Noxious weeds. Ask them to use the Washington state noxious weed list; the lab report will list any species they find. It is illegal to sell seeds with > 2 percent noxious weeds;

or ask them to conduct a

- Crop and Weed Test (lab report will list both weeds and crop plants by species);
- Purity; industry norm is ≥ 90 percent.
- Percent pure live seed (PLS); industry norm is ≥ 72 percent.

Safety tip!

If you're the one who's going to be hauling around the bags, you might want to remind the supplier (on your fax, see Figure 9 above) to package up the product in sacks lighter than 100 pounds each

Regarding Potential Chemical Residues In Seed

In some circumstances, if a grower recently treated his or her fields with certain chemicals for weed control, there may be some risk to aquatic environments if the crop is immediately harvested and the stems are used for mulch, but this is not a concern for seed (Bautista, personal communication, 2007). See Cautions and Considerations in the section on mulch, later in this document, for more information.

Inland Northwest Dryland Mix					NET WT	25 lbs
Lot: 0309-903-17091						
# IN MIX	SPECIES	%BY WEIGHT	PURITY	GERM	ORIGIN	TEST
2,400	Paiute Orchardgrass	27.78	92.60	85.00	OR	05/06
2,400	Manchar Smooth Brome	29.43	98.09	85.00	WA	05/06
2,400	Oahe Intermediate Wheatgrass	29.60	98.66	85.00	MT	06/06
800	Dahurian Wildrye	9.95	99.56	85.00	CN	07/06
Rainier Seeds, Inc. 1404 4th St. Davenport, WA 99122						
CROP:	0.07	INERT:	3.09	AMS730		
WEED:	0.08	NOXIOUS:	None Found			

Figure 9—Sample commercial seed tag. Each company's tag will look a little different. Note that the purity and germination (GERM) rate are above the industry norm, and there are no noxious weeds so basically it looks fine.

Plants To Use For Wildlife Forage



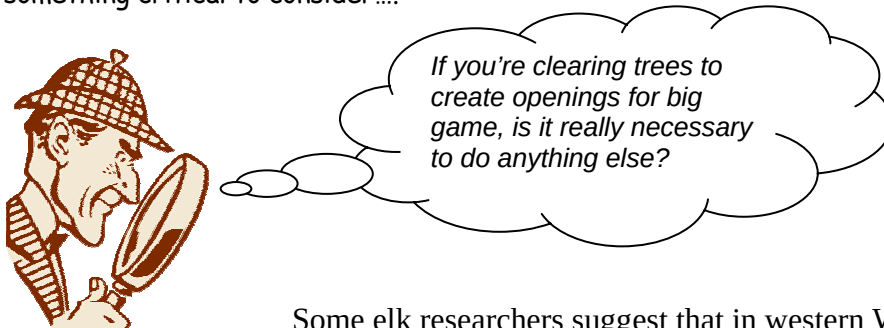
Traditional wildlife managers often use non-native grasses and non-native legumes to enhance wildlife forage. Many of these species (such as orchard grass and white clover) have proven to be persistent to the point of excluding native species. The purpose of this chapter is to provide suggestions for enhancing forage for wildlife with native plants.

Ideal native plants for this purpose have the following characteristics:

- Already occur naturally in the vicinity of your project area
- High caloric content/ nutritional value
- Desired by the animals (selected over other species)
- Easy to propagate
- Herbaceous species are fine for summer forage, but shrubs are best if winter forage is limiting, since the herbaceous species would be buried under snow.

Tip!

Before you invest money in surveys, collection, and propagation of native plants, here's something critical to consider....



Some elk researchers suggest that in western Washington if openings are created, natural regeneration of native herbs and shrubs will provide everything the animals need (Davis, personal communication, 2006). Silvicultural prescriptions only need to take measures to prevent doghair regeneration from occurring in the opening (such as removal of western hemlock seed source around the circumference of the opening). More important than the individual species composition, Cook and others (Puget Sound Energy 2003) found that the driving factor in weight gain of lactating cows and calves was canopy closure.

Findings From Research In the Pacific Northwest

Research Findings From Puget Sound Energy Report

Innovative research in the Nooksack River watershed on the Mt. Baker-Snoqualmie National Forest can be highly instructive for elk management on the Olympic National Forest (Puget Sound Energy 2003). In deciding which species to use for enhancement efforts, this research is recommended here over the standard text usually cited (Toweill and Thomas 2002) for three reasons:

- The herds studied occurred in western Washington, as opposed to the Rocky Mountains.
- Forage value was determined in controlled studies that considered elk preference for certain plant species relative to other plant species growing on the same site. Most other studies show what the elk ate, but not in comparison to what was available. This study ranked plant species preference into three categories: “selected,” “neutral,” and “avoided.”
- Forage value was determined based on nutritional value in terms of digestibility. Most published research is based on studies that only analyze what plant species are present in the scat. The problem with this approach is that what’s leftover in the scat are the food products that are least digestible. The Nooksack elk were temporarily trapped in enclosures so the researchers could accurately record what plant species were eaten (selected) and compare that to weight gain of lactating cows and calves.

Table 6 is a condensed subset of the results of the PSE study, listing the native species that were selected by the elk and occur on the ONF. You may also want to consider using species they listed as neutral, since for many species (such as *Epilobium*, or *Vaccinium*), the difference between selected and neutral had more to do with a marginally positive p-value (statistical issues) than a strong indication of preference. The complete report is available on line at

<http://www.pse.com/energyEnvironment/hydroPDFs/baker/studies/t21studyreport.pdf>.

One of the take-home messages from this list and the discussion above should be to not confine elk forage enhancement efforts to one or two plant species in only one type of growing situation. In fact, in an analysis of food habits Jenkins and Starkey (1991) found that “Roosevelt elk consumed a wide variety of forage species across their range, demonstrating a high degree of dietary plasticity and generalist foraging strategies.”

Findings From Happe et al. (1990) and Happe (1993) Studies

Happe et al. (1990) evaluated nutritional quality of *Rubus spectabilis*, *Vaccinium parvifolium*, *Acer circinatum*, and *Polystichum munitum* growing in clear-cuts and old-growth forest on the Olympic Peninsula. Levels of astringent tannins were higher in clear-cuts than in old-growth. The high tannin levels led to reductions in digestible proteins, thus affecting nutritional value. This was especially true for *R. spectabilis*, *A. circinatum*, and *P. munitum*. However, *V. parvifolium* still contained adequate levels of crude protein.

In general, their findings suggest that browse grown under partial canopy will have higher quality than browse grown under more open canopy conditions, although the ability for the greater quantity of browse and presence of herbaceous forage in clear-cuts to compensate for these differences was not examined. The trade-off however, is that forage under canopy will generally provide less total digestible energy than types and abundance of forage grown in open areas (Happe, personal communication, 2007). This suggested the importance of managing for forested foraging areas in combination with created openings to providing nutritionally and energetically balanced feeding areas for elk. Forested foraging areas have the added benefit of intercepting snow and making forage available when forage in adjacent open areas is buried.

In her doctorate on the ecological relationships between cervid herbivory and understory vegetation in old-growth spruce/hemlock forests in Olympic National Park, ONP Head Wildlife Biologist Patti Happe found that diets of deer (Figure 10) and elk (Figure 11) varied depending on the season (Happe 1993). Therefore, when planning a big game forage enhancement project it's important to consider what part of the diet may be limiting, and whether that involves winter forage or summer forage.

Table 6—Selected native elk forage species that occur on the Olympic National Forest

Plants selected	
Scientific name	Common name
<i>Acer circinatum</i>	Vine maple
<i>Acer macrophyllum</i>	Big leaf maple
<i>Agrostis</i> spp.	Bentgrass
<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Carex</i> spp.	Sedge
<i>Clintonia uniflora</i>	Queen's cup, Beadlily
<i>Lonicera ciliosa</i>	Orange honeysuckle
<i>Maianthemum dilatatum</i>	False lily-of-the-valley
<i>Oplopanax horridus</i>	Devil's club
<i>Rhamnus purshiana</i>	Cascara
<i>Rubus parviflorus</i>	Salmonberry
<i>Salix</i> spp.	Willow
<i>Smilacena</i> spp.	False Solomon's seal
<i>Sorbus sitchensis</i>	Mountain ash
<i>Spiraea douglasii</i>	Rose spirea, Hardhack spirea
<i>Stellaria calycantha</i>	Northern starwort
<i>Symphoricarpos</i> spp.	Snowberry
<i>Trientalis latifolia</i>	Starflower
<i>Valeriana sitchensis</i>	Sitka valerian

Source: Puget Sound Energy 2003

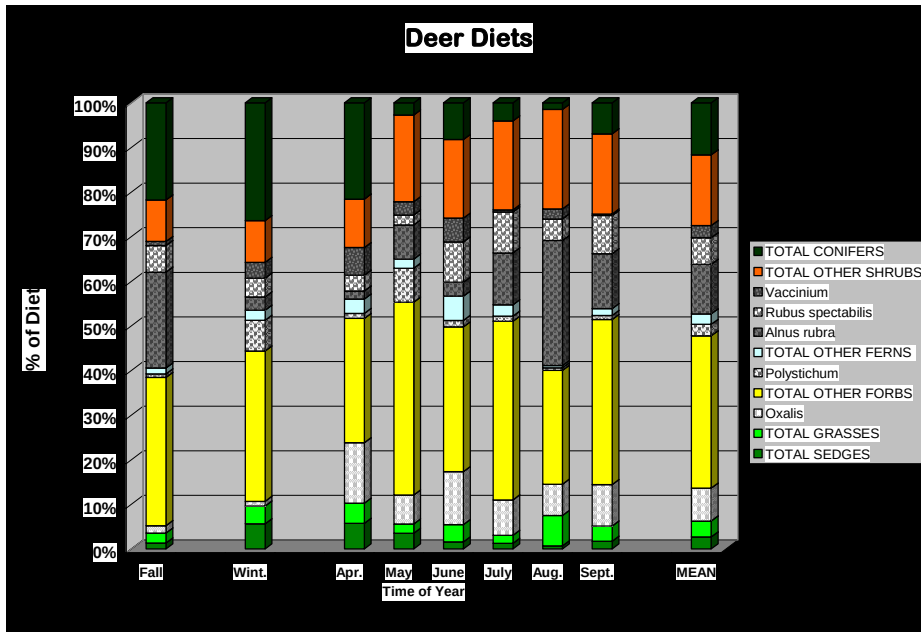


Figure 10—Diets of deer in Olympic National Park. Source: Happe 1993.

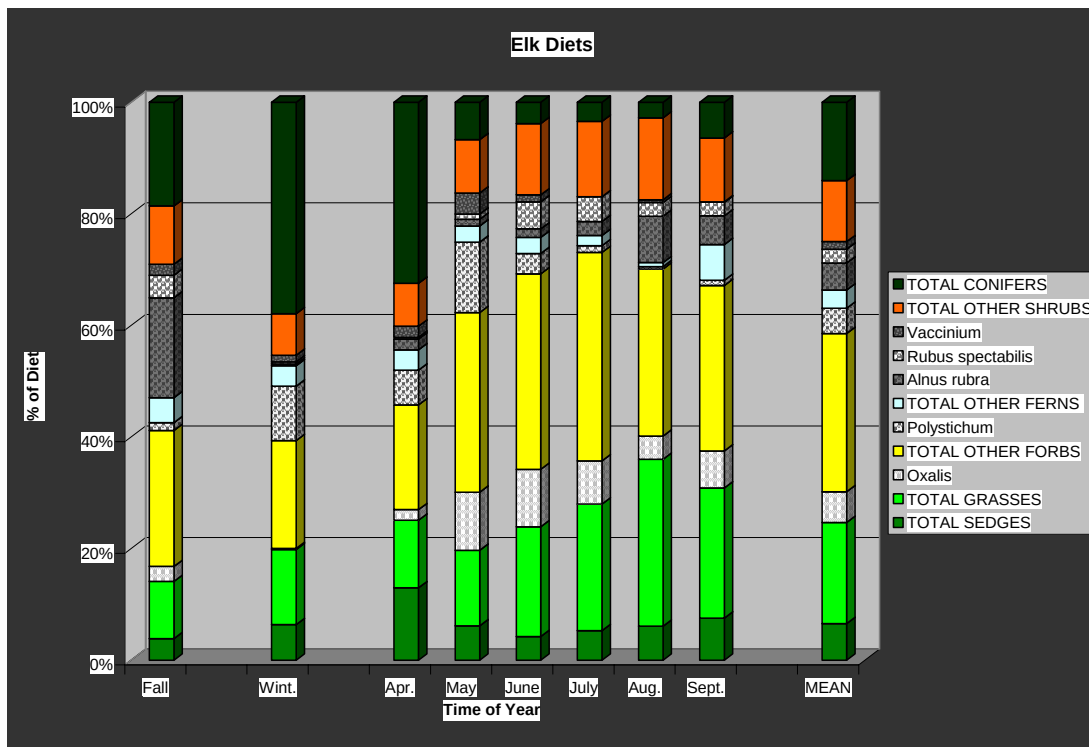


Figure 11—Diets of elk in Olympic National Park. Source: Happe 1993.

Results Of Dungeness Elk Forage Survey

In 2006, the ONF hired a contractor to conduct a survey in the Dungeness and Gray Wolf River drainages to scope out potential collection sites native species suitable for propagation as elk forage. Appendix 1 is a condensed version of the results, showing the species for 11 different sites and their availability at each site. Appendix 2 explains the contracts used for this work.

Recommendations By the Native Seed Network

In 2006, the ONF applied for and was awarded funding through Title II, Resource Advisory Committee, to work with the Native Seed Network, a branch of the Institute for Applied Ecology. The purpose of the project was to “determine which native species are best suited for revegetation activities on the Olympic Peninsula, meet stewardship objectives of enhancing forest ecosystems, restore and improve land health and water quality”. As part of this project, a species list will be developed especially for elk habitat enhancement on the ONF. Appendix 9 summarizes the report, which will be included in the ONF native plant website: <http://fsweb/onpmp/index.html>.

As part of this project, a species list will be developed especially for elk habitat enhancement on the ONF.



Food For Thought

Here are some general considerations influencing the value, availability, and abundance of elk or deer forage.

Overstory

Canopy closure influences abundance and diversity of species or types of forage, energetic content, and even nutritional quality as mentioned above. For example, forage species adapted to under-canopy conditions may be better suited to re-vegetation efforts in commercial thins, or in sections of road decommissioning projects that pass through dense old-growth forest, whereas higher energy forbs and grasses may be more appropriate in more open settings. Canopy cover can also influence the availability of forage during snow-events.

Elevation

Forage species intended for use in a specific season won't be of much use if the animals aren't there or if the species isn't available or nutritionally useful during that time. For example, Taber and Raedeke (1980) found the upper elevational extent of elk winter range on the Olympic National Forest to be from 1,500 to 2,000 feet depending on the location on the forest, and to be influenced by snow fall patterns. Elevation also influences the phenology of the plants in terms of when new growth is available and the value of the portions consumed. Browse species intended for winter use won't be of much use if planted at high elevations.

Migratory and Non-migratory Elk

In some areas of the Olympic National Forest, elk migrate from winter to summer ranges whereas some elk remain in the same general area year round. Understanding the seasonal patterns of elk habitat use is important to maximize the success of elk forage enhancement efforts. Contact your local Washington Department of Fish and Wildlife biologist about information on specific elk herds.

Aspect

The aspect of the project site influences plant phenology, which in turn can influence availability and nutritional value. Consider elk forage availability in a range of aspects, especially at lower elevations.

Roads and Other Forms Of Human Disturbance

Elk may tolerate human disturbance to access high quality forage (as anyone who lives in Sequim can attest), but as a general rule elk forage enhancement efforts will be more successful if insulated from human disturbance. All other things being equal, forage enhancement efforts a quarter-mile or more behind a decommissioned or gated road will probably have more value than one along a well-traveled road. However, a trade-off to this approach is the logistics and effort needed to initially treat the area, and any subsequent efforts.

Juxtaposition

The pattern and placement of food in relation to other elements of functional elk habitat on the landscape (thermal and security cover, water, etc.) is an important consideration that pulls together all of the above information when planning elk forage enhancement efforts. For example, placing forested foraging areas adjacent to non-forest foraging areas offers a suite of food available under a variety of conditions. Proximity to water and high energy food supplies is particularly important if elk are known to calve in a particular area. Hutchins (2006) found that heterogeneous landscapes with patches of good nutritional forage resulted in increased reproductive success in elk in managed forests on the Olympic Peninsula.



Invasive Plant Treatments

The R6 EIS for Preventing and Managing Invasive Plants (USDA Forest Service 2005) emphasizes prevention in every aspect of our management activities. One of the best ways to prevent invasion (or re-invasion) of noxious weeds is to revegetate disturbed bare ground with more desirable species. But revegetation in areas that have recently been dominated by weeds, especially aggressive state-listed noxious weeds⁵, poses some challenging issues.

The first consideration is whether or not to revegetate at all and if so, when and how. Table 7 provides an approach for appropriate follow-up after weed treatment for different scenarios.

Deciding what kind of mulch to use is important for follow-up treatments at weed sites. See the next chapter on mulch for information on the pros, cons, and other consideration of various mulches.

Table 7—Decision matrix for follow-up actions following weed treatments*

Scenario	Follow-up management action with respect to revegetation.
1. Weeds were treated on river gravel bar, stockpile, rock pit, or other area normally unvegetated.	No mulch, no revegetation.
2. Weeds were treated in parking lot, immediate road shoulder next to fog line, chain-up zone, or other area that is regularly plowed, sanded, or graded.	No mulch, no revegetation.
3. Weeds were treated in walkway, around picnic tables, or other area where vegetation is not desired but is not expected to be regularly plowed, sanded, or graded.	Consider heavy mulch of raw wood chips.
4. First year of weed treatment completed but the infestation will require 3–4 years of subsequent follow-up treatments because the weed species is aggressively rhizomatous, or the soil contains a large quantity of weed seeds; infestation is larger than 1/10 th acre.	Option 1: If weeds are fairly dense, and you're using a non-selective herbicide such as glyphosate, then no seed or mulch until the infestation is significantly reduced (e.g. probably no reveg the first 3 years of treatment). When infestation is reduced to small patches (hopefully by year 4), seed with non-invasive non-natives (Table 4) covered with 2-inch mulch in between the patches. Option 2: If the target weed is not a grass, and you're treating with broadleaf selective herbicide (or hand pulling), then apply non-invasive non-native grass seedmix and cover with 2 inches of mulch the same season.

⁵ To see the definition of a “noxious weed”, and the most recent Washington State Noxious Weed List, visit <http://www.nwcb.wa.gov/>.

Scenario	Follow-up management action with respect to revegetation.
5. Weed infestation is small (under 1/10 th acre), no re-treatments expected, and the site is surrounded by native species that will provide a seed source.	No additional revegetation needed. May apply light cover of mulch if needed for soil erosion considerations. Allow natural revegetation to occur.
6. Weed infestation is small, no re-treatments expected, but <i>not</i> surrounded by native species.	Seed with non-invasive non-natives covered with 2-inch mulch <i>or</i> revegetate with local native species.
7. Weed infestation is larger than 1/10 th acre, no retreatments expected.	Seed with non-invasive non-natives covered with 2-inch mulch.

* All other weed prevention measures (such as use of clean equipment) will continue to be implemented regardless of scenario.



Figure 12. Scot's broom hand-pulling weed treatment on the 2870-059 road on the Hood Canal Ranger District in 2005. (This is the access road to the Cranberry Bog Botanical Area.) Upper photo is before treatment, lower photo is after treatment. This site would likely fall under scenario 4, option 2—first year of hand-pulling, with follow-up treatments required because of accumulated weed seeds in the soil. Disturbed soil could be sown with the appropriate non-native seed mix and covered with mulch.

Photos by Carol Dargatz, Clallam County Noxious Weed Control Board

Mulch: What and How Much

Benefits

The virtues of mulch in restoration work are succinctly summarized by Hanbey (1992): “Properly applied mulches can inhibit erosion, retain moisture, protect plants and seeds, ameliorate surface temperatures, reduce frost action, and provide some organic matter for soil build-up.”



Cautions and Considerations

Be an informed decision maker! Here’s some lessons learned the hard way...

- When mulching around planted stock, Hanbey (1992) advises spreading the mulch 2–4 inches deep around the base and in between the plantings, but do *not* push it up around the crown or stem base of the plants—air circulation is needed in this area to prevent fungus damage.
- Research has demonstrated that woody mulch high in raw cellulose can leach nitrogen from the soil (Banke 1980). This phenomenon has pros and cons—see Wood Chips below.
- Avoid the use of hay since it may contain undesirable species. Use approved weed-free straw instead—see Weed Free Straw below.
- Depth of Mulch—see discussion under Weed Free Straw below.

Potential Chemical Residues In Mulch

Concern has been raised that certain chemicals, specifically picloram and clopyralid, may harm fish if the grower used these to control weeds. Shawna Bautista (personal communication, 2007), who wrote the toxicology portion of the Region 6 Invasive Plant EIS (USDA Forest Service 2005), does not claim to be an expert but at least offers us an educated opinion. For clopyralid, the risk to fish is very low and would not be a concern. If however, you were trying to grow native composites (such as pearly everlasting), clopyralid contaminated mulch would be a bad idea. Also, if picloram had been applied to the mulch the same year the material was harvested, it would not be recommended for use on stream crossings. All this said, the risk of contamination should be very low because product labels warn growers not to use these products if their crop is intended to be immediately used for mulch.

Four Common Types Of Mulch; Suppliers; Cost Estimates

Wood Chips

Wood chips have the advantage of being very cheap. A logging mill near the Mt. Baker-Snoqualmie National Forest donated large quantities of wood chips for a high profile restoration project. Chippers have also been brought on site to create wood chips from slash during road decommissioning projects.

As mentioned above, fresh wood chips can result in nitrogen deficiency. This can play in your *favor* if you have treated noxious weeds in an area that you prefer to remain

unvegetated (e.g. walkways at district offices, high-use picnic table areas), because noxious weeds generally prefer more nitrogen than our native plants.

The following information is from Dr. Richard Miller (personal communication). To use wood chips as a mulch for desirable species, add nitrogen (N) to meet the requirements of decomposing bacteria so the plants are not adversely affected. Wood chips have a carbon/nitrogen ratio of about 100:1 and you want about 50:1. So in general, for a wood chip mulch 1–2 inches thick, apply 50–100 lbs of nitrogen per acre.

Fresh wood chips can result in nitrogen deficiency. In general, for a wood chip mulch 1–2 inches thick, apply 50–100 pounds of nitrogen per acre. Urea is the cheapest N available.

Time-release pellet fertilizers are expensive; use urea because it's the cheapest N available. If your N is in the form of urea, apply 100–200 lbs of urea per acre, *but only when it is wet and rainy*. If urea is applied in warm weather you could lose over 50% of the N to volatilization (lost to the atmosphere as nitrogen gasses). Also, if the weather is too dry, you could get concentrations of ammonium and ammonia in the soil that would be toxic to the plants.

For supplies of wood chips, try:

- Willis Enterprises, Hoquiam 360-249-5244. Prices vary depending on species of tree used to make the chips and the quality. “Hogfuel”, which is mostly bark, runs about \$100/truckload. Actual wood chips run about \$2,500/truckload (32 tons).
- North Mason Fiber, Bob Dressel 360-275-0228

For urea, try any of the suppliers of non-native seed listed previously, such as:

- Wilco (formerly Cenex), Centralia, WA. Phone 360-748-9277. FAX 360-748-7204, attention Troy or George. 200 lbs of urea costs about \$46.

WoodStraw™ Wood-strand Erosion Control Material

This is a relatively new product produced by ELWd Systems, a division of Forest Concepts LLC. Its sounds like a miracle cure according to the manufacturer: a high sediment storage blend of sliced wood strands for steep slopes and highly erosive soils, weed-free, lasts much longer than straw, and stays put much better than straw in high winds.

Cost. A truckload (20 tons) normally costs \$8,500 + shipping and delivery. It comes in 50 pound bales @ 11.95 each (price maybe negotiated down for large quantities). They recommend about 3–4 tons per acre. About 70 percent cover of WoodStraw™ = 2 inches deep of regular straw.

Contact. ELWd Systems, 1911 SW Campus Dr. #655, Federal Way, WA 98023; (253) 838-4579 Fax (253) 815-9000. www.elwdsystems.com.

Weed Free Straw

Depth Of Straw. The “ideal straw depth” is 2–4 inches depending on whom you talk to. For example, engineers on the Mt. Baker-Snoqualmie National Forest found that seed (sown along the same stretch of road) germinated when covered with very light mulch of straw, but did not germinate under 3–4 inches of mulch (Martinez and Hamilton, personal

communication, 2006). To determine the optimum straw depth for road decommissioning, the ONF will be conducting a study in 2007 using varying application rates of straw with the non-native seed mix. The results of this study will be posted on the ONF website in 2008.

Quantity To Order To Achieve Desired Depth.

- Mt. Rainier NP Restoration Handbook (Rochefort 1990), cites an application rate of 4,000 pounds (2 tons) per acre for a 4-inch thick mat of straw, so 2 inches thick = 2,000 lbs per acre.
- The Washington State Department of Ecology recommends 2 to 3 inches of mulch, equating to 2 to 3 tons per acre (Washington State Department of Ecology Water Quality Program 2001, p. 4-21)

Standards, Guidelines, Contract Specifications. Standard #3 in the R6 EIS for Preventing and Managing Invasive Plants (USDA Forest Service 2005) specifies that:

“If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed free using the North American Weed Free Forage Program standards ... or a similar certification process.”

Washington State does not have a certification process in place at this time⁶. Since 1999, in lieu of “State Certified” weed-free straw, the MBS National Forest has included the following specifications in contracts, per the concurrence of Bill Whitson, which could be modified for the ONF as follows:

“Erosion control material (such as commercial erosion control mat or straw) for this project shall be weed free. Straw shall be obtained from a grower whose fields have been annually inspected by the county coordinator for the Washington State Noxious Weed Control Board. The Olympic National Forest Supervisor’s Office has inspection letters on file—contact the contracting officer if you want access to the letters.

If a contractor wants to buy straw from a source that is not already approved, the local county weed coordinators may be able to inspect that grower’s fields. The current list of coordinators can be found on their website at www.wa.gov/agr/weedboard. A signed letter from the county weed coordinator (or other qualified botanist) must be provided to the USFS to serve as documentation that the grower’s fields were inspected. Enough lead-time must be allowed since inspections have to occur before the straw is baled.”

Remember—you need to make sure the inspection letters are recent! Straw sitting around uncovered for 2 or 3 years could be contaminated with noxious weeds.

Growers Of Weed Free Straw. You can buy directly from the grower; some growers of weed free straw that have been approved in the past include:

- Richard Jones, Douglas County (509) 745-8351

⁶ Washington State Department of Agriculture is hoping to have a certification process in place by summer 2007 (Nancy Phelps, personal communication, 2007). When available, details will be added to this notebook and posted on the ONF native plant website <http://fsweb/onpmp/index.html>.

- Kurt Isaak, Douglas County (509) 632-5712
- Steve Koelzer Farms, Franklin County (509) 543-3772
- Jerry Heilig, Grant County (509) 765-5023
- Elwin Crutcher, Stanwood, WA (Snohomish County) 360-939-2334

Distributors Of Weed Free Straw. You can buy from a distributor:

- S-K Environmental, Okanogan WA. Sheilah Kennedy 509-322-6909, shokennedy@hotmail.com
- King Feed, Enumclaw WA 360-825-6554. Straw buyer is Mike Hamlin (253-261-1001). He buys from farmers in eastern Washington whose fields have been inspected by Dean Alverson (Coordinator for Intercounty Weed District #52). Mr. Alverson provides a letter for the farmers.

Price per bale: \$4.75 per bale (Average weight per bale: 60–70 lbs)

\$4.25 for 10+ bales

\$4.15 for 350 bales

Erosion Control Blankets Or Erosion Control Matting

In general, the advantage of using a blanket or mat is that it is more long lasting than straw, readily available, easy to transport, and guaranteed weed free. The disadvantage is that it is more expensive, and requires labor intensive pinning to hold it in place. There are literally dozens of types and manufacturers so for the sake of simplicity, a “favorite” is described here.

Subalpine restoration workers on the Leavenworth Ranger District (Therrell, personal communication, 2007) and Olympic National Park (Albright, personal communication, 2007) have both favored “Curlex[®] blankets” by American Excelsior Company for many years. For more information visit http://www.curlex.com/pro_blankets.php. Albright now has concerns because of changes in the plastic net backing that make it much more difficult to remove, and they are trying WoodStraw[™] in 2007. NPS removes the backing because they have found that it traps and kills wildlife.



To Fertilize or Not to Fertilize

Native plants in the Pacific Northwest have adapted to low nutrient levels in the soil, so in general, fertilizer is not recommended for native seeds or plants. In addition, noxious weeds thrive on high nitrogen levels and will get the competitive advantage if you use fertilizer and there are sources of weeds in the vicinity. However, if you are trying to restore an area that has been stripped down to the C horizon and contains only sterile sub-soils, you will want to provide some sort of organic matter, after making sure (through ripping or other means) that the substrate has been de-compacted.

Biosolids have been used successfully in restoration projects to increase native plant biomass and total vegetative cover on the MBS National Forest (Bergeron 2003). However, there is controversy regarding the potential risk of contamination from heavy metals (Mortvedt 1995, Paré et al. 1999, Sloan et al. 1997)

Compost can be purchased commercially and used to both improve texture and nutrient levels of sterile soils. For more information contact Cedar Grove Compost at 1-877-SOILS-4U (1-877-764-5748), write to them at infocg@cedar-grove.com , or visit their website at <http://www.cedar-grove.com>.

Lastly, as discussed in detail in the chapter on Mulch above, if you are using wood chips as a mulch for desirable species, add nitrogen in the form of urea because it's the cheapest N available.

Monitoring

Finally, in order to assess the effectiveness of any revegetation or restoration effort, it is important to incorporate several years of post-treatment monitoring into the project plan. Monitoring is defined as “the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective” (Elzinga et al. 1998, p.1).

Monitoring should be conducted one year after the revegetation treatment, again the second or third year after treatment, and at five and ten years after treatment (DiGregoria et al. 1995). Aubry and Potash (1998) developed a revegetation effectiveness monitoring protocol for decommissioned roads that is included with this Notebook as Appendix 10. This is a straightforward monitoring technique that requires some botanical expertise for plant identification. The document includes all the forms, codes, and instructions needed to conduct the monitoring, and to visually document changes on the site using permanent photo points.

Monitoring provides an excellent opportunity for volunteers to become involved with revegetation and restoration projects. Groups such as the Washington Native Plant Society have the knowledge and skills to conduct the monitoring, and are generally enthusiastic about these monitoring opportunities.



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Appendix 1

Results Of Dungeness Elk Forage Survey

This is a condensed version of the results, showing the species for 11 different sites and their availability at each site. In this notebook, the information is sorted alphabetically by species' scientific name. For the raw data and a map of the sites, see ONF native plant website <http://fsweb/onpmp/index.html>.

Caveat—not all the species on this list are of high or even moderate value as elk forage (Aluzas, personal communication, 2007). This appendix is included only to show an example of a process. To decide which species to actually collect for your particular project, refer to studies relevant to the Puget Sound area, consider which plants are selected by elk, and consider the other factors discussed in the section titled Food for Thought in the chapter on Wildlife Forage.

Key to the Abundance Ranking in this table:

1 = Abundant along a high percentage of or within 200 feet of ¼-mile-long survey sites along the side of the road.

2 = Common along a high percentage of or within 200 feet of ¼-mile-long survey sites along the side of the road.

3 = Frequent, but absent from many stretches of road

4 = Occasional, but not hard to find.

5 = Rare, but found more than 10 plants in more than 2 sites.

6 = Found , but not more than 10 plants in more than 2 sites.

NO = None of this species found in the study area.

Additional Information about each site:

x = either among the better species to collect at this site or among the better sites to collect this species

p = present, but not necessarily in great enough numbers to fit collection criteria, or ubiquitous throughout the study area.

Species name	Common name	Abundance rank	Propagation method	Site number:	1	3	4	5	6	10	11	12	13	14	15
<i>Acer circinatum</i>	Vine maple	NO	seed			x				p				p	
<i>Acer macrophyllum</i>	Bigleaf maple	3	Seed			p		p	p						x
<i>Alnus rubra</i>	Red alder	1	Seed					p							x
<i>Anaphalis margaritacea</i>	Pearly everlasting	2	Seed					p	x						
<i>Asarum caudatum</i>	Wild ginger	5	Seed										x		
<i>Athyrium filix-femina</i>	Lady fern	3	Rhizomes, spores				x	p							
<i>Berberis nervosa</i>	Oregon grape	3	Cuttings or seeds				x	x	p					x	
<i>Blechnum spicant</i>	Deer fern	4	Rhizomes, spores			p	p	x			p		x	x	
<i>Bromus carinatus</i>	California brome	6	seed					x					x		
<i>Clintonia uniflora</i>	Queen's cup	5	Seed, rhizome division.		p		p	p	x		p				
<i>Cornus stolonifera</i>	Red-osier dogwood	NO	cuttings					p							
<i>Cornus unalaschkensis</i>	Bunchberry dogwood	3	Seed			x		p		x		p			
<i>Corylus cornuta</i>	Filbert	NO	Cuttings												
<i>Danthonia californica</i>	Poverty oatgrass	NO	seed					x							
<i>Danthonia spicata</i>	Poverty oatgrass	NO	seed											x	
<i>Deschampsia caespitosa</i>	Tufted hairgrass	NO	seed						p				x	x	
<i>Dicentra formosa</i>	Bleeding heart	5	Seed, division.					p						p	
<i>Dryopteris austriaca</i>	Spreading wood fern	3 - 4	Spores, division.				x							p	
<i>Elymus glaucus</i>	Blue wildrye	1* - cultivars planted along roads	seed												
<i>Epilobium angustifolium</i>	Fireweed	2 - 3	Seed											x	
<i>Equisetum sp.</i>	Horsetail	2 - 3	Spores, division.			p				x					x
<i>Equisetum telmateia.</i>		3 - 4						p			x	x	x		

Species name	Common name	Abundance rank	Propagation method	Site number:	1	3	4	5	6	10	11	12	13	14	15
<i>Festuca rubra</i>	Red fescue	NO (didn't take much time to I.D. fescues to species)	seed												
<i>Galium triflorum</i>	Sweetscented bedstraw	1 - 2	Seed, division.			p		p	p		p		x	p	
<i>Gaultheria shallon</i>	Salal	1 - 2	Cuttings or seed					p		p					
<i>Geum macrophyllum</i>	Large-leaved Avens	3	Seed				p				p				
<i>Gymnocarpium dryopteris</i>	Oak fern	3	Spores, division.					x							
<i>Heracleum lanatum</i>	Cow parsnip	4 - 5	seed					p	x	p		x			
<i>Holodiscus discolor</i>	Oceanspray	3 - 4	Seed					x						p	
<i>Linnaea borealis</i>	Twinsflower	1	Rhizome				p	p							
<i>Lonicera ciliosa</i>	Orange honeysuckle	4 - 5	Seed												
<i>Luzula parviflora</i>	Small flowered woodrush	4 - 5 (some may have been L. glabrata - Smooth Wood-rush)	Seed												
<i>Lysichitum americanum</i>	Skunk cabbage	4	Seed, rhizome division.												
<i>Maianthemum dilitatum</i>	False lily of the valley	4	Rhizome						x		x		x	x	
<i>Menziesia ferruginea</i>	Fool's huckleberry	5	Seed, cuttings, division					p		p		p			
<i>Montia siberica</i>	Candyflower	3 - 4	seed												
<i>Oemleria cerasiformis</i>	Osoberry, Indian plum	6	Cuttings or seed.					p							
<i>Oplopanax horridum</i>	Devil's club	2 - 3	Seed, cutting, layering					x							
<i>Oxalis oregana</i>	Oregon oxalis	NO	rhizomes			p		p	x					p	

Species name	Common name	Abundance rank	Propagation method	Site number:	1	3	4	5	6	10	11	12	13	14	15
<i>Petasites frigidus</i>	Colt's foot	2	Seed						p						
<i>Picea sitchensis</i>	Sitka Spruce	6						x	p						
<i>Polystichum munitum</i>	Swordfern	2	Rhizomes, sports												
<i>Populus trichocarpa</i>	Black cottonwood	3 - 4	Cuttings or seed.												
<i>Prunus emarginata</i>	Bitter cherry	4	Cuttings or seed.					p	p					p	
<i>Pseudotsuga menziesii</i>	Douglas-fir	1													
<i>Pteridium aquilinum</i>	Bracken fern	1	Rhizomes					p		x	p	x	p		
<i>Rhamnus purshiana</i>	Cascara	NO	Seed, cuttings												
<i>Rosa gymnocarpa</i>	Baldhip rose	4	Cuttings					x							
<i>Rubus parviflorus</i>	Thimbleberry	2	Seed					p	x		p	p		x	
<i>Rubus spectabilis</i>	Salmonberry	2	Seed or cuttings.										p	x	
<i>Salix lucida ssp. lasiandra</i>	Pacific Willow	4 - 5													
<i>Salix scouleriana</i>	Scouler's Willow								p		x	x	x	x	
<i>Salix sitchensis</i>	Sitka Willow								x		p	x			
<i>Salix sp.</i>	Willow	1	Live stakes or cuttings.			p	x	p						x	
<i>Sambucus racemosa</i>	Red elder	3 - 4	Cuttings												x
<i>Smilacina racemosa</i>		4 - 5			x				p		p				
<i>Smilacina sp.</i>	Solomon plume	4 - 5	Rhizome			p			p	p	p	p			
<i>Smilacina stellata</i>	Starry False-solomon's-seal	4 - 5						x							
<i>Sorbus sitchensis</i>	Mountain ash	6	Seed												
<i>Stellaria calycantha</i>	Northern Starwort	2			p				x	p	p	x	p		
<i>Stellaria crispa</i>	Crisped Starwort	4					x	p		p		p	p		

Species name	Common name	Abundance rank	Propagation method	Site number:	1	3	4	5	6	10	11	12	13	14	15
<i>Stellaria</i> sp.	Starwort	2	Seed				x	p			p	x	x	x	
<i>Stipa lemmonii</i>	Lemmon's needlegrass	NO	Seed												
<i>Stipa nelsonii</i>	Nelson's needlegrass	NO	seed												
<i>Symphoricarpos albus</i>	Common snowberry	6	Seed or cuttings.			x				x					
<i>Tiarella trifoliata</i>	Foamflower	1	Clump division, seed.							x	p	x	x	p	
<i>Tolmiea menziesii</i>	Youth-on-age	4	Rhizomes, seeds		p		p	p	p	p	p		x		
<i>Trillium ovatum</i>	Trillium	4 - but usually pretty sparse	Seed				x		x			p			
<i>Tsuga heterophylla</i>	Western Hemlock	2													
<i>Vaccinium ovatifolium</i>	Oval-leafed Huckleberry	5													
<i>Vaccinium parvifolium</i>	Red Huckleberry	4						p		p	p	x			
<i>Vaccinium</i> sp.	Huckleberries	4	Seed			x	x								

Appendix 2

ONF Elk Forage Inventory Contract



In 2006, the ONF hired a contractor to conduct a survey in the Dungeness and Gray Wolf River drainages to scope out potential collection sites native species suitable for propagation as elk forage. After interviewing several potential contractors, Olympic National Forest Wildlife Program Manager Susan Piper chose an individual who had extensive experience in botanical surveys and seed collection. We provided the following information to the contractor:

- Instructions for the contractor (document follows);
- A list of elk forage species for the survey (document follows);
- A seed source survey form to record information on the sites, species, and phenology (available on the ONF Native Plants website: <http://fsweb/onpmp/index.html>);
- An information sheet that includes collection guidelines to maintain genetic diversity and codes to use on the seed source survey form (available on the ONF Native Plants website: <http://fsweb/onpmp/index.html>).

Since the contract work cost less than \$2,500, we were able to pay the contractor by check. With this simple contract we gained enough information to plan for seed collection in the summer of 2007.

The results of this survey can be found in Appendix 1.

Dungeness Elk Forage Inventory

Seed Collection Sites Location and Mapping Identify potential seed collect sites for elk forage species listed on the 2 attached tables. Collection sites may be remote requiring significant driving and/or hiking. Sites may also be along traveled highway corridors. Inventory and mapping involve locating, identifying, evaluating, and recording potential collection sites, species, and phenology. Information on each collection site will be recorded on the ***Seed source survey and collection form*** (attached).

Ideal seed collection sites will meet the following criteria:

General:

For each population in a seed lot, collect from at least 30 to 50 parent plants in good condition. Try to collect from as many separate populations as is feasible. Strive to collect a similar amount of seed from each population harvested. Separate populations by at least ¼ mile, this distance should ensure that no pollen or seed exchange occur between the populations. Try to collect an equal number of seeds/cuttings from each source plant. These tactics will ensure that a representative sample of genetic variation is collected.

Select only vigorous, healthy parent plants. Avoid plants with signs of insects and disease. Collect seed when it is mature (take from the plant, not the ground). Be especially alert for black fungus diseases such as ergot in grass seed heads. Do not pick seed heads that are touching the ground.

Specific:

For each species for which there is a sufficient number of plants to make seed collection feasible:

- Number of sites: 8-10
- Distance between sites: 0.25 mile minimum, 1 mile optimum
- Number of plants per seed collection zone: 30 minimum, 50 optimum
- Number of healthy plants per site: 10 minimum
- Distance between plants in one site: 5-10 feet

Locations

Pat's Prairie Botanical Area
Cranberry Bog Botanical Area
Along Forest Service roads in project area (see map)

Timeline Project must be completed (submission of field forms) by September 1, 2006.

Contact Information:

Susan Piper, Wildlife Program Manager
(360) 956-2435
spiper@fs.fed.us

Carol Aubry, Area Geneticist
(360) 956-2361
caubry@fs.fed.us

Olympic National Forest
1835 Black Lake Blvd SW Suite A
Olympia, WA 98512-5623

Native Elk Forage Species

Code	Species name	Common Name	Propagation
ACCI	<i>Acer circinatum</i>	Vine maple	seed
ACMA3	<i>Acer macrophyllum</i>	Bigleaf maple	Seed
ALRU2	<i>Alnus rubra</i>	Red alder	Seed
ANAPH	<i>Anaphalis margaritacea</i>	Pearly everlasting	Seed
ASCA2	<i>Asarum caudatum</i>	Wild ginger	Seed
ATFI	<i>Athyrium filix-femina</i>	Lady fern	Rhizomes, spores
BENE2	<i>Berberis nervosa</i>	Oregon grape	Cuttings or seeds
BLSP	<i>Blechnum spicant</i>	Deer fern	Rhizomes, spores
BRCA5	<i>Bromus carinatus</i>	California brome	seed
CLUN2	<i>Clintonia uniflora</i>	Queen's cup	Seed, rhizome division.
COST4	<i>Cornus stolonifera</i>	Red-osier dogwood	cuttings
COUN	<i>Cornus unalaschensis</i>	Bunchberry dogwood	Seed
COCO6	<i>Corylus cornuta</i>	Filbert	Cuttings
DACA3	<i>Danthonia californica</i>	Poverty oatgrass	seed
DASP2	<i>Danthonia spicata</i>	Poverty oatgrass	seed
DECA18	<i>Deschampsia caespitosa</i>	Tufted hairgrass	seed
DIFO	<i>Dicentra formasa</i>	Bleeding heart	Seed, division.
DRAUS2	<i>Dryopteris austriaca</i>	Spreading wood fern	Spores, division.
ELGL	<i>Elymus glaucus</i>	Blue wildrye	seed
EPAN2	<i>Epilobium angustifolium</i>	Fireweed	seed
EPAN2	<i>Epilobium angustifolium</i>	Fireweed	Seed
EQUIS	<i>Equisetum sp.</i>	Horsetail	Spores, division.
FERUA3	<i>Festuca rubra</i>	Red fescue	seed
GATR3	<i>Galium triflorum</i>	Sweetscented bedstraw	Seed, division.
GASH	<i>Gaultheria shallon</i>	Salal	Cuttings or seed
GEMA4	<i>Geum macrophyllum</i>	Large-leaved Avens	Seed
GYDR	<i>Gymnocarpium dryopteris</i>	Oak fern	Spores, division.
HERAC	<i>Heracleum lanatum</i>	Cow parsnip	seed
HODI	<i>Holodiscus discolor</i>	Oceanspray	Seed
LIBO3	<i>Linnaea borealis</i>	Twinflower	Rhizome
LOCI3	<i>Lonicera ciliosa</i>	Orange honeysuckle	Seed
LUPA4	<i>Luzula parviflora</i>	Small flowered woodrush	Seed
LYAM3	<i>Lysichitum americanum</i>	Skunk cabbage	Seed, rhizome division.
MADI	<i>Maianthemum dilitatum</i>	False lily of the valley	Rhizome
MEFE	<i>Menziesia ferruginea</i>	Fool's huckleberry	See, cuttings, division
MOSI2	<i>Montia siberica</i>	Candyflower	seed
OECE	<i>Oemleria cerasiformis</i>	Osoberry, Indian plum	Cuttings or seed.
OPHO	<i>Oplopanax horridum</i>	Devil's club	Seed, cutting, layering
OXORS	<i>Oxalis oregana</i>	Oregon oxalis	rhizomes
PEFR5	<i>Petasites frigidus</i>	Colt's foot	Seed
POMU	<i>Polystichum munitum</i>	Swordfern	Rhizomes, sports
POTR15	<i>Populus trichocarpa</i>	Black cottonwood	Cuttings or seed.
PREM	<i>Prunus emarginata</i>	Bitter cherry	Cuttings or seed.

Code	Species name	Common Name	Propagation
PTAQ	<i>Pteridium aquilinum</i>	Bracken fern	Rhizomes
RHPU	<i>Rhamnus purshiana</i>	Cascara	Seed, cuttings
ROGY	<i>Rosa gymnocarpa</i>	Baldhip rose	Cuttings
RUPA	<i>Rubus parviflorus</i>	Thimbleberry	Seed
RUSP	<i>Rubus spectabilis</i>	Salmonberry	Seed or cuttings.
SALIX	<i>Salix sp.</i>	Willow	Live stakes or cuttings.
SARA2	<i>Sambucus racemosa</i>	Red elder	Cuttings
SM__	<i>Smilacina sp.</i>	Solomon plume	Rhizome
SOSI2	<i>Sorbus sitchensis</i>	Mountain ash	Seed
STELL	<i>Stellaria sp.</i>	Starwort	Seed
STLE2	<i>Stipa lemmonii</i>	Lemmon's needlegrass	Seed
STNE3	<i>Stipa nelsonii</i>	Nelson's needlegrass	seed
SYAL	<i>Symphoricarpos albus</i>	Common snowberry	Seed or cuttings.
TITR	<i>Tiarella trifoliata</i>	Foamflower	Clump division, seed.
TOME	<i>Tolmiea menziesii</i>	Youth-on-age	Rhizomes, seeds
TRILL	<i>Trillium ovatum</i>	Trillium	Seed
VACCI	<i>Vaccinium sp.</i>	Huckleberries	Seed.

Appendix 3

Region 6 Restoration Contracts

There are basically two categories of contracts for use in restoration projects. The contract language and the contractors have been pre-approved in R6. These contracts and contractors are required by USFS and BLM units in the Blue Mountains area; they are optional (but recommended) in the rest of Region 6.



There is a lot of documentation and the sheer number of pages and filenames can seem overwhelming at first. To keep it all straight, the whole set of documents has been summarized in a structured, organized fashion here.

The first page is just the file name of the document so you can easily find it on the ONF Native Plant website (<http://fsweb/onpmp/index.html>), followed by a brief summary explaining the purpose of the form. This is followed by the first page (or some selected pages) so you can begin to become familiar with it.

All the examples are from the Umatilla National Forest unless stated otherwise. Karen Prudhomme (kprudhomme@fs.fed.us) worked on putting all these contracts together and is a good source of information if you have questions. She also put together a comprehensive document called “**Questions.and.Answers.doc**” to help us understand all the aspects of seed increase contracting. It’s too large to include here but you can find it on the ONF Native Plant website.

The two general types of contracts are:

- **Seed Increase Contract and Straw Production.** Native seed increase will be a coordinated effort at the forest level. To accomplish this work, a task order needs to be filled out.
- **Restoration Services Contract.** This includes all other tasks except for seed increase (for example, surveys to find potential collection sites, collection of seed or other plant materials, growing of cuttings, out-planting).

Contract Category: Seed Increase Contract and Straw Production

File Name: Native.Grass.Production.Contract.doc

Purpose: This Standard Form 1449, which you would need to do a seed increase contract. This is what be telling the grower to produce for you after you have supplied clean, tested seed. Only the first page of a 42-page document is included here.

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS <i>Offeror to complete blocks 12, 17, 23, 24, & 30</i>				1. REQUISITION NUMBER	PAGE 1 OF
2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE	4. ORDER NUMBER	5. SOLICITATION NUMBER R6-14-06-35019		6. SOLICITATION ISSUE DATE March 7, 2006
7. FOR SOLICITATION INFORMATION CALL	a. NAME Peggy Patten		b. TELEPHONE (No Collect Calls) 541-278-3844		8. OFFER DUE DATE/LOCAL TIME 4:30 PM April 7, 2006
9. ISSUED BY (MAIL OFFERS TO) CODE			10. THIS ACQUISITION IS ☒ UNRESTRICTED ☐ SET-ASIDE. ____% FOR ☐ SMALL BUSINESS, ☐ HUBZONE SMALL BUSINESS ☐ 8(A) ☐ SOLE SOURCE NAICS: 111998 SIZE STANDARD: 0.75 MIL		11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED. ☐ SEE SCHEDULE ☐ 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700) 13b. RATING 14. METHOD OF SOLICITATION ☒ RFQ ☐ IFB ☐ RFP
15. DELIVER TO: CODE			16. ADMINISTERED BY CODE		
As Specified on Task Order(s)			As Specified on Task Order(s)		
17a. CONTRACTOR/OFFEROR CAGE		FACILITY CODE	18a. PAYMENT WILL BE MADE BY CODE		
TELEPHONE: TIN:			18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a UNLESS BLOCK IS CHECKED: ☐ SEE ADDENDA		
☐ 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER					
19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES		21. QUANTITY	22. UNIT	23. UNIT PRICE
	Produce quantities of native grass and forb seed and straw from Government-furnished, purity and germination-tested seed for the Umatilla National Forest in accordance with the attached specifications. Note: Use of this contract is optional by Forest Service and Bureau of Land Management units located in the States of Oregon, Washington and Idaho. No award will be made to a Contractor not registered in CCR or who has not completed ORCA. See FAR Clauses 52.212-3 AND 52.212-4. (Use Reverse and/or Attach Additional Sheets as Necessary)		SEE NEXT PAGE FOR ESTIMATED QUANTITY		
25. ACCOUNTING AND APPROPRIATION DATA				26. TOTAL AWARD AMOUNT (For Govt. Use Only)	
☒ 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 and ADDENDA ☒ ARE ☐ ARE NOT ATTACHED. ☒ 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4. FAR 52.212-5 AND ADDENDA ☒ ARE ☐ ARE NOT ATTACHED.					
28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN ORIGINAL TO ISSUING OFFICE. ☒ CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.			29. AWARD OF CONTRACT: YOUR OFFER ON SOLICITATION (BLOCK 5), DATED (BLOCK 30c) INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS: ☐		
30a. SIGNATURE OF OFFEROR/CONTRACTOR			31a. UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)		
30b. NAME AND TITLE OF SIGNER (TYPE OR PRINT)		30c. DATE SIGNED	31b. NAME OF CONTRACTING OFFICER		31c. DATE SIGNED

AUTHORIZED FOR LOCAL REPRODUCTION

STANDARD FORM 1449 (Rev. 4/2002)

Contract Category: Seed Increase Contract and Straw Production

File Name: Amendment.Number.One.doc

Purpose: This Standard Form 30, which you would need to make an amendment to your seed increase contract. *The amendment is created if you want to make any changes to the text of your contract before it is actually awarded.* It is sent to the potential bidders, kind of like a formal errata sheet. The 1-page amendment is shown on the next page.

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE	PAGE 1	OF 1	PAGES
2. AMENDMENT/ MODIFICATION NO. 1		3. EFFECTIVE DATE May 12, 2006		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. (If applicable)	
6. ISSUED BY Umatilla National Forest 2517 SW Hailey Avenue Pendleton, OR 97801		CODE		7. ADMINISTERED BY (If other than Item 6) Same as Block 6		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State, and ZIP Code) ALL OFFERORS				☒ (X)		9A. AMENDMENT OF SOLICITATION NO. R6-14-06-35019	
				☒		9B. DATED (SEE ITEM 11) 03-07-2006	
				☐		10A. MODIFICATION OF CONTRACT/ORDER NO.	
				☐		10B. DATED (SEE ITEM 13)	
CODE		FACILITY CODE					

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

- ☒ The above numbered solicitation is amended as set forth in item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning ____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted;

Or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(X)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
☐	
☐	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
☐	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 52.242-17 Government Delay of Work
☐	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/~~MODIFICATION~~ (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

PRODUCE QUANTITIES OF NATIVE GRASS AND FORB SEED AND STRAW FOR THE UMATILLA NATIONAL FOREST

UNDER clause number 8 entitled ACCEPTABLE QUALITY LEVELS (AQL), paragraph (b) (1), delete the first two sentences and replace with the following: "(1) The Government retains the right of first refusal for any additional amount of seed or straw produced. Price will remain the same as offered for additional amounts within 25% of the original quantity ordered. A price reduction will be negotiated for any additional quantities that exceed the 25%."

The hour and date for receipt of offers is extended to May 24, 2006.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)

16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)

PEGGY PATTEN, Contracting Officer

15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)		(Signature of Contracting Officer)	
NSN 7540-01-152-8070 Previous edition unusable		30-105	STANDARD FORM 30 (REV. 10-83) Prescribed by GSA FAR (48 CFR) 53.243

Contract Category: Seed Increase Contract and Straw Production

File Name: Mod_Amd.doc

Purpose: This is Standard Form 30 again, which you would need to make a modification to your seed increase contract. *A modification is created if you want to make any changes to the text of your contract after it is actually awarded.* The modification itself (page 1) and its' required attachment (page 2) have been included here.

Olympic National Forest Native Plant Notebook

Rev. March 2007

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT		CONTRACT ID CODE		PAGE OF PAGES 1 2	
2. AMENDMENT/MODIFICATION NO. 1		3. EFFECTIVE DATE 6/19/06		4. REQUISITION/PUCHASE REQ. NO.	
6. ISSUE BY CODE Umatilla National Forest 2517 SW Hailey Avenue Pendleton, OR 97801		5. PROJECT NO. (IF APPLICABLE)			
7. ADMINISTERED BY (if other than item 6) CODE					
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		9A. Amend Solicitation.			
*		9B. Dated			
*		10A. Mod Contract/Order #AG-04R3-C-06-002?			
*		10B. Dated (see Item 13) 6/15/06			
code		facility code			
11. THIS ITEM APPLIES ONLY TO AMENDMENT OF SOLICITATION					
[] The above numbered solicitation is amended as set forth in the item 14. The hour and date specified for receipt of Offers [] is extended [] is not extended. Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing items 8 and 15 and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted, or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.					
12. Accounting and Appropriation Data (if required)					
13. THIS ITEM APPLIES ONLY TO MODIFICATION OF CONTRACTS/ORDERS.					
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.					
X	A. This change order is issued pursuant to; (specify authority) The changes set forth in item 14 are made in the Contract/Order # in item 10A.				
	B. The above numbered Contract/Order is modified to reflect the administrative changes (such as changes in paying office, appropriation date, etc.) set forth in item 14, pursuant to the authority of FAR 43.103(b)..				
	C. This supplemental agreement is entered into pursuant to authority of:				
	D Other: (Specify type of modification and authority):				
	E. IMPORTANT: Contractor [] is not [] is required to sign this document and return __ Original to the issuing office.:				
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible)					
<u>Native Grass, Forb and Straw Production</u>					
SEED CROP AND STRAW QUALITY STANDARDS - 4.(b)					
Delete: Fields of the individual seed lots shall be isolated from contaminating sources which may potentially cross-pollinate with species being grown under this contract. Isolation distances shall be in accordance with State Certification Standards (certified class), unless otherwise approved by the COR.					
Change to: Fields of individual seed lots shall be isolated by a minimum of 165 feet from contaminating sources which may potentially cross-pollinate with species being grown under this contract. If a species is known to be predominately self-pollinating, then a mechanical separation is allowed (See Attachment for list of self-pollinating species). Growers may choose to use a larger isolation distance in order to meet State Certification Standards, or a COR may specify the isolation distance on individual task orders.					
By signature in Block 15B Contractor releases the Government from all claims relating to this modification. This settlement is complete accord and satisfaction. Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.					
15A. NAME AND TITLE OF SIGNER (Type or print)			16A. NAME AND TITLE OF CONTRACTING OFFICER		
			Contracting Officer		
15B. CONTRACTOR/OFFEROR		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA	
By _____ (Signature of person authorized to sign)				By _____ (Signature of Contracting Officer)	
				16C. DATE SIGNED	

Standard Form 30

Prescribed by GSA

FAR (48CFR) 53.243

ATTACHMENT TO MODIFICATION OF CONTRACT

(Prepare and submit with SF30)

CONTRACT NO. AG-04R3-C-06-002? **MODIFICATION NO.** 1**CONTRACT OR PROJECT NAME** Native Grass, Forb, and Straw Production**CONTRACTOR**

Minimum Isolation Distance: Species listed in the following table are predominantly self-pollinating. The distance between fields of any other germplasm (seed lot) of the same species must be adequate to prevent mechanical mixture (e.g., 25 feet), unless otherwise specified on the Task Order. For all other species, a minimum isolation distance of 165 feet is required, unless otherwise specified on the Task Order

SPECIES CODE	SPECIES	COMMON NAME	FAMILY	MATING SYSTEM	MINIMUM ISOLATION DISTANCE
BRCA5	<i>Bromus caninatus</i>	California/mountain brome	Gramineae	Selfing	Mechanical
BRMA4	<i>Bromus marginatus</i>	mountain brome	Gramineae	Selfing	Mechanical
DASP2	<i>Danthonia spicata</i>	poverty danthonia	Gramineae	Selfing	Mechanical
ELEL5/SIHY	<i>Elymus elymoides</i>	squirreltail	Gramineae	Selfing	Mechanical
ELGL	<i>Elymus glaucus</i>	blue wildrye	Gramineae	Selfing	Mechanical
POSE	<i>Poa secunda</i>	Sandberg's/pine bluegrass	Gramineae	Selfing and apomixis	Mechanical

NET CHANGES THIS MODIFICATION			\$
CONTRACT AMOUNT PRIOR TO THIS MODIFICATION			\$
NEW CONTRACT TOTAL			\$
CONTRACT TIME	DAYS INCREASED	DAYS DECREASED	REVISED CONTRACT TIME
I hereby accept this modification as to work to be performed, prices to be paid, and contract time as shown above. Effective only upon approval by the Contracting Officer.			
CONTRACTOR OR REPRESENTATIVE (signature)		TITLE	DATE
SUBMITTED	SIGNATURE	TITLE - Contracting Officer's Representative	DATE
RECOMMENDED	SIGNATURE	TITLE	DATE
FUNDING APPROVAL	SIGNATURE	TITLE	DATE
	FUNDS AVAILABLE?	MGT CODE	
APPROVED	SIGNATURE	TITLE Contracting Officer	DATE

Contract Category: Seed Increase Contract and Straw Production

File Name: EXHIBITS.doc

Purpose: This document contains three exhibits.

Exhibit 1 is a table showing the results of seed tests for various native species. This is for your information and something you could give to your contractor for their information in seed increase contracts.

In this table, GERM means a germination test – this is where a sample of the seed lot is grown out for 21 days to see the % that actually germinate. TZ stands for tetrazolium – this is a 24 hour chemical test where a sample is treated to see how many are alive and how many seed are dead. An “X” in the column marked GERM means that a germination test is best for that species. An “X” in the column headed TZ means a tetrazolium test is best. Only the first page of Exhibit 1 is included in this notebook.

Exhibit 2 contains two tables. Table 1 shows standards to be expected for each species. Table 2 shows the source of the information used in Table 1. Again, this is information you provide to the seed increase contract grower. Only the first page of each table is included here.

Exhibit 3 are samples of various task orders for the product you expect to receive from the contractor who is doing seed increase. Only the first task order is included in this notebook.

EXHIBIT 1—General Rules for OSU Seed Tests for native plant viability (source: Nita Rauch, Bend Seed Extractory, 2/3/06)

<i>Type</i>	<i>Species Symbol</i>	<i>Plant Name</i>	<i>Common Name</i>	<i>GERM</i>	<i>TZ</i>	<i>COMMENTS</i>
Grass	ACLE8	Achnatherum lemmonii	Lemmon's needlegrass		X	unpredictable germ rates.
Grass	ACLEL/STLE2	Achnatherum lemmonii lemmonii	Lemmon's needlegrass		X	unpredictable germ rates.
Forbe	ACMI2	Achillea millifolium	yarrow	X		light & 7 day prechill
Grass	ACOCO	Achnatherum occidentale	western needlegrass		X	unpredictable germ rates.
Grass	ACTH7	Achnatherum thurberianum	Thurber's needlegrass		X	needs cold & warm strat, germ variable.
Forbe	ALAC4	Allium acuminatum	tapertip onion		X	TZ works better. Variable germ rates.
Shrub	AMAL2	Amelanchier alnifolia	Saskatoon serviceberry		X	berry; needs chemical scarification.
Forbe	ANMA	Anaphalis margaritacea	pearly everlasting	X		light & 7 day prechill
Forbe	ARHOR	Arabis holboellii	second rockcress		X	TZ works better. Variable germ rates.
Shrub	ARNE	Arctostaphylos nevadensis	pinemat manzanita		X	hard seedcoat, needs chem scarification.
Forbe	ARTRV	Artemisia tridentata	Mtn. big sage		X	TZ works better. Variable germ rates.
Forbe	BAMA4	Balsamorhiza macrophylla	cutleaf balsamroot		X	TZ works better. Variable germ rates.
Shrub	BENA	Betula nana	dwarf birch	X		21 day prechill
Grass	BRCA5	Bromus caninatus	California brome		X	deep dormancy situation.
Forbe	CAAN7	Castilleja angustifolia	NW Indian paintbrush		X	TZ works better. Variable germ rates.
Forbe	CABR2	Calochortus bruneaunis	Bruneau mariposa lily		X	TZ works better. Variable germ rates.
Grass-like	CAH05	Carex hoodii	Hood's sedge		X	TZ works better. Variable germ rates.
Grass	CARU	Calamagrostis rubescens	pinegrass		X	no info on germ requirements.
Shrub	CECO	Ceanothus cordulatus	whitethorn ceanothus		X	hard seedcoat, needs chem scarification.
Shrub	CEIN3	Ceanothus integerrimus	deerbrush	X		hot water soak required.
Shrub	CONU4	Cornus nuttallii	Pacific dogwood		X	berry; needs chemical scarification.
Shrub	COSES	Cornus sericea	redosier dogwood		X	berry; needs chemical scarification.
Forbe	CRCI2	Cryptantha cirumscissa	cushion cryptantha		X	TZ works better. Variable germ rates.
Grass	DACA3	Danthonia californica	California oatgrass		X	berry; needs chemical scarification.
Grass	DECA18	Deschampsia caespitosa	tufted hairgrass	X		7 day prechill

EXHIBIT 2—GUIDELINES FOR SEED STANDARDS

These standards, although not required, are intended to serve as a guide for minimum standards for seed quality.

(Source: Oregon Seed Certification Service)

Table 1 Pre-variety Germplasm Seed Standards: Generations G1, G2, etc. (Revised November 18, 2005, subject to continuing change)

Genus and Species	Common Name	Purity Sample wt (gms)	Pure Seed, (min%)	Other Crop, (max%)	Inert, (max%)	Common Weed Seed, (max %)	Noxious Sample wt.(gms)	Prohibited Weeds. Restricted Weed Seeds (singly or combined)¹
<i>Achillea millefolium</i>	Yarrow	0.4	98.0	0.10	2.0	0.20	4.0	113/lb
<i>Agrostis exarata</i>	Spike bentgrass	0.25	96.0	0.25	4.0	0.25	2.5	181/lb
<i>Alopecurus geniculatus</i>	Water foxtail	0.8	96.0	0.10	4.0	0.20	8.0	57/lb
<i>Anaphalis margaritacea</i>	Pearly everlasting	0.25	85.0	0.10	15.0	0.20	2.5	181/lb
<i>Atriplex canescens</i>	Four-wing saltbush	19.0	85.0	0.50	15.0	0.50	190.0	2/lb
<i>Beckmannia syzigachne</i>	American sloughgrass	1.0	94.0	0.60	6.0	0.30	10.0	45/lb
<i>Bromus carinatus</i>	California brome	20.0	90.0	0.50	10.0	0.30	200.0	2/lb
<i>Bromus carinatus</i>	Mountain brome	20.0	90.0	0.50	10.0	0.30	200.0	2/lb
<i>Bromus marginatus</i>	Mountain brome	20.0	90.0	0.50	10.0	0.30	200.0	2/lb
<i>Bromus sitchensis</i>	Alaska brome	20.0	90.0	0.50	10.0	0.30	200.0	2/lb
<i>Bromus vulgaris</i>	Columbia brome	7.0	90.0	0.50	10.0	0.30	70.0	6/lb
<i>Calamagrostis rubescens</i>	Pinegrass	0.5	75.0	0.10	25.0	0.20	5.0	91/lb
<i>Collomia grandiflora</i>	Grand collomia	7.5	98.0	0.10	2.0	0.10	75.0	7/lb

¹ None of the Prohibited Weed Seeds listed in Section V in the OSCS Handbook, nor St Johnswort is allowed.

Restricted weed seed tolerances as indicated for each crop, allows one seed to be found in the Noxious weed seed exam working sample [ref. 1 lb = 453.6 grams], and applies to the following species: Corn bedstraw, Buckhorn plantain, Docks, Sheep sorrel. In no crop, may Corn Bedstraw exceed 45 per pound, as per Restricted Noxious Weed Seed Tolerances [OAR 603-056-0205].

Table 2. Source of Standard

Genus and Species	Common Name	Source of Standard
<i>Achillea millefolium</i>	Yarrow	Purity test results
<i>Agrostis exarata</i>	Spike bentgrass	Existing Astoria bentgrass standards, and seed test results
<i>Alopecurus geniculatus</i>	Water foxtail	Purity test results; working sample test weights are tentative (based on initial sample), therefore so is Restricted tolerance.
<i>Anaphalis margaritacea</i>	Pearly everlasting	Purity test results & Jim Barner
<i>Atriplex canescens</i>	Four-wing saltbush	AOSCA Woody Plant standards
<i>Beckmannia syzigachne</i>	American sloughgrass	Developed from seed test results
<i>Bromus carinatus</i>	California brome	Existing variety, same species
<i>Bromus sitchensis</i>	Alaska brome	Similar species
<i>Bromus vulgaris</i>	Columbia brome	Other Bromus standards
<i>Calamagrostis rubescens</i>	Pinegrass	Purity test results, comments from Wash. Dept. Ag Seed Lab and from Bend Pine Nursery.
<i>Collomia grandiflora</i>	Grand collomia	Purity test results; working sample test weights are tentative (based on initial sample), therefore so is Restricted tolerance.
<i>Danthonia californica</i>	California oatgrass	Rec. for G0 by Dale Darris, NRCS, Cor PMC; revised inert 3→6%, crop 0.1→0.15%, weed 0.25→0.15% (8/19/03); revised inert 6→10? based on history of cleaning effort/test results and concurrence from D.Darris and C.Edminster (9/8/05).
<i>Danthonia spicata</i>	Poverty oatgrass	Based on Fine fescue Fdn and Reg (similar seed size) and history of increasing inert standard for D. californica. Both species have cleistogamous seed in the sheaths.
<i>Deschampsia caespitosa</i>	Tufted hairgrass	Existing variety, same species
<i>Elymus elymoides</i>	Squirreltail	Pure (feds guide & clean db), test result
<i>Elymus glaucus</i>	Blue wildrye	Existing variety, same species
<i>Elymus trachycaulus</i>	Slender wheatgrass	Review of other OSCS standards and seed standards published for Minnesota, Montana, North Dakota, & Washington
<i>Epilobium densiflorum</i>	Dense-flowered boisduvalia	Based on standards for similar sized seed (KBG)
<i>Festuca idahoensis</i>	Idaho fescue	Existing Fine fescue standards, adj. for inert
<i>Festuca paradoxa</i>	Cluster fescue	Standards for Fine fescue and Idaho fescue and test results.
<i>Festuca roemerii</i>	Roemer's fescue	Existing Fine fescue standards for Foundation and Registered classes.
<i>Glyceria elata</i>	Tall mannagrass	Based on similar sized seed and results
<i>Gilia capitata</i>	Globe gilia	Purity test results; working sample test weights are tentative (based on initial sample), therefore so is Restricted tolerance.
<i>Hordeum brachyantherum</i>	Meadow barley	Based on limited cleaning experience.(96%, Based on similarity of size and shape to Blue WR & expectation that debearding will be done).
<i>Iris tenax</i>	Oregon iris	Purity test results; working sample test weights are tentative (based on initial sample), therefore so is Restricted tolerance.
<i>Lupinus polycarpus</i>	Small-flowered lupine	Based on test results and seed size.
<i>Lupinus rivularis</i>	Streambank lupine	Reg. Sickle-keeled & Wisconsin PVG per.lupine

EXHIBIT 3—TASK ORDER EXAMPLES

TASK ORDER NO. AG-04R3-D-06-0998

Contract No.		53-04R3-06-XX	Project Name:	Native Grass and Forb Production		County: Umatilla	
Contractor:			Issuing and Billing Office: Umatilla National Forest 2517 SW Hailey Avenue Pendleton, OR 97801				
Item No.	Subitem No.	Description	Quantity to Date	Quantity Order	Unit	Unit Price	Amount
1	1A	Blue Wildrye (<i>Elymus glaucus</i>) FS Seed Lot# ELGL-50-MEACHA-04 Meacham WS, 4500-5000' From 5 lbs of GF* seed (germ-85%, purity-95%, weeds-0.1%, inert-4.9%)		400	lbs	\$ _____	\$ _____
	1B	Mountain Brome (<i>Bromus carinatus</i>) FS Seed Lot# BRCA5-14-901-02100-45-WALL-05 Wall WS, 4000-4500' From 7 lbs of GF* seed (TZ-86%, purity-98%, no weeds)		1000	lbs	\$ _____	\$ _____
	1C	Seed Delivery to Pendleton, Oregon		1400	lbs	\$ _____	\$ _____
		TOTAL ITEM 1				XXXXXX	\$ _____
Required Delivery Date: From date of award through 11/15/2008. Delivery shall occur within 90 days of harvest for each production year. Item will be evaluated and awarded based on Total Price for Item 1 – Only one award will be made for this task order. GF* - Government-furnished						Total Price: \$	
Contractor: (Name and Signature)							
Requested By: (Name and Signature) COR							
Fund Authorization: (Name and Signature) Line Officer							
Ordered By: (Name and Signature) Contracting Officer							
Order Date: 6/30/06				Job Code: NFWVXX			

Original to CO, CC to Contractor, B&F and COR

Contract Category: Restoration Services

File Name: sample_taskorder051506.doc

Purpose: This is a sample of a task order to hire someone to go out and map seed collection areas, collect seed, and rough clean the seed. It explains all the standards the contractor is to use and how it is all to be documented to ensure you get a quality product. Only the first page of the 20 page document is included here.

TASK ORDER NO. AG-04R3-D-06-XXXX

IF THIS ORDER IS GREATER THAN \$2,500.00, IT IS

NOT VALID UNTIL SIGNED BY THE CONTRACTING OFFICER

Contract No.		53-04R3-06-XXXX		Project Name:	Wildland Seed Collection		County: Umatilla	
Contractor:				Issuing and Billing Office: Umatilla National Forest 2517 SW Hailey Avenue Pendleton, OR 97801				
Item No.	Subitem No.	Description		Quantity to Date	Quantity Order *	Unit	Unit Price	Amount
2.A	1a	Locate and map low elevation seed collection areas for bluebunch wheatgrass (PSSPS, <i>Pseudoroegneria spicata</i>)			1	Job		
	1b	Collect bluebunch wheatgrass from approved collection areas (minimum 20 lbs rough cleaned weight)			1	Job		
	2a	Locate and map low elevation seed collection areas for Idaho fescue(FEID, <i>Festuca idahoensis</i>)			1	Job		
	2b	Collect Idaho fescue from approved collection areas areas (minimum 15 lbs rough cleaned weight)			1	Job		
	3a	Locate and map low elevation seed collection areas for prairie junegrass (KOMA, <i>Koleria macrantha</i>)			1	Job		
	3b	Collect prairie junegrass from approved collection areas (minimum 10 lbs rough cleaned weight)			1	Job		

Contract Category: Restoration Services

File Name: Contractors_items_ContactInfo.doc

Purpose: This document lists the names of the contractors that have been pre-approved for restoration services in the left hand column. In the right hand column, the little trees are used in lieu of a checkmark or the word “YES” to indicate whether or not that particular contractor can provide item #1, item #2, or item #3.

The “items” are essentially a description of a type of work or a type service the contractor can perform. A description of the three items follows. A review of these items will give you a good understanding of what restoration services are all about, so the entire document is included here.

Restoration Service Contractors and Contact Information

**Info: Contracting – Gary Dillavou- 541.278.3841; Technical – Scott Riley- 541.278.3829;
Task Order Manager – Karen Prudhomme- 541.427.5391**

Item	1.0	2.0	3.0
Contractor			
Apex Curb & Turf, LLC			
John Larson P.O. Box 417 Asotin, WA 99402 Office: (509) 758-1543 E-mail: apex@clarkston.com Fax: (509) 758-7831 Contract No. AG-04R3-C-06-0022	Project task order awards & dates:		
Bitterroot Restoration, Inc.			
Mark J. Sherbine P.O. Box 310 445 Quast Lane Corvallis, MT 59828 Office: (406) 961-4991 E-mail: Fax: Contract No. AG-04R3-C-06-0020	Project task order awards & dates:		
Hanging Rock Excavation & Construction, Inc.			
Jason Hedgepeth 54695 Coombs loop LaGrande, OR 97850 Office: (541) 915-7542 E-mail: Fax: (541) 428-2159 Contract No. AG-04R3-C-06-0017	Project task order awards & dates:		

Item	1.0	2.0	3.0
Contractor			
Wildlands, Inc.			
Bill Mast 1941 Saint Street Richland, WA 99354-2101 Office: (509) 375-4177 E-mail: wildland@gte.net Fax: (509) 375-4717 Contract No. AG-04R3-C-06-0010	Project task order awards & dates:		
Clearwater Native Nursery			
Micheal Lattig 1980 SW 55th St. Redmond, OR 97756 Office: (541) 504-8211 E-mail: mlattig@msn.com Fax: Contract No: AG-04R3-C-06-0016	Project task order awards & dates:		
Currans Family Farm			
Sean Currans 53671 W. Crockett Road Milton-Freewater, OR 97862 Office: (541) 938-8182 E-mail: seancurrans@charter.net Fax: (541) 938-8182 Contract No: AG-04R3-C-06-0014	Project task order awards & dates:		

Item			
	1.0	2.0	3.0
Contractor			
Derby Canyon Natives			
Theodore Alway P.O.Box 385 Peshastin, WA 98847 Street Address: 9750 Derby Canyon Road Peshastin, WA 98847 Office: (509) 548-9404 E-mail: ted@derbycanyonnatives.com Fax: (509) 548-9404 Contract No: AG-04R3-C-06-0015	Project task order awards & dates:		
Eastern Oregon Stewardship Services			
Berta Youtie P.O. Box 606 Prineville, OR 97754 Office:(541) 447-8166 E-mail: byoutie@crestviewcable.com Fax: Contract No: AG-04R3-C-06-0018	Project task order awards & dates:		
Methow Natives, LLC			
Robert Crandell 19 Aspen Lane Winthrop, WA 98862 Office: (509) 996-3562 E-mail: methownatives@methownet.com Fax: Contract No: AG-04R3-C-06-0012	Project task order awards & dates:		

Item	1.0	2.0	3.0
Contractor			
Mt. Jefferson Farms, Inc.			
Shirley Dague P.O. Box 12708 Salem, OR 97309 Street Address: 3394 Browns Island Road South Salem, OR 97302 Office: (503) 363-0467 E-mail: mjfarms@heleport.com Fax: (503) 362-5248 Contract No: AG-04R3-C-06-0019	Project task order awards & dates:		
Siskiyou BioSurvey, LLC			
Richard Callagan 265 Ball Road Eagle Point, OR 97524 Office: 541-826-6104 E-mail: richmar@ccountry.com Fax: Contract No: AG-04R3-C-06-0013	Project task order awards & dates:		

Description of Items

Item One (1) - Restoration Services

1.A Hydroseeding/Mulching. Provide a variety of products (tackifiers, mulches, fertilizers, mycorrhizae, etc.) and capabilities (equipment, application methods, personnel, etc.) suited to each individual project. Minimum equipment requirements may be imposed if terrain is limiting. Projects will consist primarily of treating new road construction related to cut and fill slopes, shoulders, decommissioned roadways, source pits, spoils areas, and new landscaping. For example work may involve applying hydromulch only for temporary soil stabilization to meet National Pollutant Discharge

Elimination System (NPDES) permit requirements, or for watering newly seeded, planted, or vegetated soils prone to drying before plants can become established.

NOTE: For pricing purposes only use those items described above in 1.A. However, individual Task Orders competed at a later date may require use of the following.

Aerial Seeding/Mulching Application/Project Material(s) transport. Services may include but are not limited to, helicopters and/or fixed wing aircraft for the application of dry seed, dry fertilizer, hydro-seed/mulch/fertilizer, grass straw and wood product mulches, compost, etc. Applying approved herbicides for help in controlling an assortment of introduced and/or invasive plant species.

Anticipated projects might involve Ferry (helicopter) restoration materials, equipment, and supplies into remote or inaccessible project sites or aiding post fire restoration work, such as Burned Area Emergency Response (BEAR) efforts to quickly provide soil stabilization or erosion prone area, for example. All appropriate Forest Service aircraft requirements will apply and would be addressed in the specific Task Orders.

1.B Pneumatic/Mechanical/Hand - Seed/Mulch/Compost Installation.

Provide a variety of products (tackifiers, compost, straw, wood chips, fertilizer, amendments, etc) and capabilities (equipment, application methods, personnel, etc.) suited to each individual project. Projects will consist mainly of treating new road construction related to cut and fill slopes, shoulders, decommissioned roadway, source pits and spoils areas, and new landscaping. Additional services may include constructing compost berms, filling and creating wattles, socks, etc. using mulch or compost with a selection of casing materials.

1.C Mechanical/Hydraulic Planting. Provide a variety of mechanical and hydraulic equipment (mounted augers, handheld augers, water jet, excavator mounted hydraulically actuated expanding “stingers”, tree spades, etc.) and capabilities (various whole diameters, depth, portability, reach, substrate penetration, plant configuration capacity, etc.) to maximize planting efficiency and plant survival. Plant a variety of conifer, shrub, grass, sedge and forb container configurations including bare root into a wide range of ecological settings and substrates. Projects may include road cut and fill slopes, stormwater treatments, mine tailings, mine spoils, landscaping, riparian/wetland areas, and decommissioned roads for example.

1.D Hand Planting/Plant Salvage. Prepare and plant sites with shovels, dibbles, hoe-dads, planting bars, etc into varied substrates and ecological settings a range of container stock and bare-root plant materials including conifers, shrubs, grasses, sedges and forbs. Work may range from steep road cut and fill slopes to riparian/wetland settings. Access may be difficult for some projects, involving four-wheelers to transport plant materials and labor. Work may require the use of pesticides to control competing vegetation, rodents, or insects. In addition, application may include fertilizer, mycorrhizae, and game repellants. Protection of new plantings using a variety of caging and fencing options may be necessary to help insure plant survival and establishment. Work may also entail salvaging plant materials, transplanting directly or at a later time.

1.E Mechanical/Hand Seeding. Provide equipment capabilities appropriate for the ecological setting (seed drills, mounted broadcast seeders, hand seeders, etc.) including site and seedbed preparation equipment (discs, harrows, rippers, rakes, etc.) Projects may consist of treating new road construction related to cut and fill slopes, road shoulders, decommissioned roadways, source pits and spoils areas, and new landscaping.

1.F Bioengineering/Stormwater Treatment. Projects may involve cut and fill slope stabilization utilizing (live stakes and fascines, live crib-walls, vegetated geo-textiles, vegetated gabion walls, vegetated riprap, vegetated rock walls, retaining walls, “stinger” plantings, etc), stream bank stabilization, stormwater treatments including: mechanical filtration systems, bio-retention, bio-filtration swales, vegetated buffer strips, sodding, settling basins, wet detention ponds, storm water wetlands, Ecology embankments, etc. in conjunction with run-off generated from road surfaces, parking lots, and disturbed sites often related to road construction processes.

1.G Slash Shredding/Chipping/Hauling. Provide mobile equipment that can efficiently reduce slash into shredded or chip form for use in creating compost (shredded) or used as mulch (shredded or chipped) on cut and fill slopes, decommissioned roads, etc. Provide equipment which can size, sort, or screen out and separate product as needed. For example, produce material for mulch blowing applications to a specific maximum size. Source material may be existing slash piles generated from timber management activities or highway right-of-way clearing for new road construction. Slash may vary from green to dry and brittle. Provide trucking, loading and unloading of product to designated sites, in general within a 10 mile radius of the project site.

1.H Road Decommissioning/Obliteration. Highway construction often realigns existing roads, leaving behind abandoned road surfaces which are severely compacted and will not support vegetation. Provide services to decommission and obliterate roads, this may involve pulling culverts, ripping the road bed, improving drainage and creating barriers to prevent further use as well as, recontouring and shaping. The Government will provide an implement for decommissioning that effectively rips, seeds and harrows in one pass. The implement is towed with a contractor provided dozer (minimum of 175 horse power) and is attached via the tool bar; the vertical ripping depth is controlled by the dozers hydraulics while the seeder is electrically powered, with seed rate/density controlled by the operator. Salvage and maintain plant materials for future use.

1.I Vegetation/Invasive Plant Treatment/Inventory/Mapping/Monitoring. Provide weed treatment plans for road construction projects including inventory, mapping, and monitoring. Provide appropriate state licensing, and experienced personnel to control undesirable vegetation, and state listed noxious weeds. Project areas are primarily along existing roads scheduled for improvement/reconstruction. This involves inventory, treatment, and monitoring 1) prior to construction activities, 2) during construction, and 3) post construction. Adjacent lands, right-of-ways, gravel pits, waste areas, and parking lots would be inventory, treatment, and monitoring candidates as well. Control may be necessary in both riparian and wetland restoration projects. Treatments may involve the use of herbicides applied by vehicle mounted boom or sprayer, or mechanized means such as mowers, etc. Back sprayers, brush cutters, weed whackers, hand pulling, burning, scalding, covering, etc. may also be employed. A weed treatment plan for a given project could continue for 3-5 years.

NOTE: For pricing purposes only use those items described above in 1.I. However, individual Task Orders competed at a later date may require use of the following. Approved biological control agents may be used including collection and release. The use of goats and/or prescription grazing to help control invasive species may also be used. Inventories of existing populations and areas susceptible to invasion, such as new construction, would be carefully monitored during all phases of treatment.

1.J Vegetation Monitoring. Perform, establish, and analyze various established sampling and monitoring protocols throughout a multitude of ecological settings. Begin base-line establishment monitoring, and follow-up with effectiveness monitoring of restoration and revegetation projects. Primary work will be along transportation corridors following construction and revegetation of cut and fill slopes, decommissioned roads, and interchanges.

1.K Riparian/Wetland Restoration/Channel Realignment. Provide all services necessary to perform riparian and wetland restoration, including but not limited to: wetland delineation, stream classification, federal and state regulations, licenses, and permitting requirements, heavy equipment sufficient to relocate/reconstruct stream channels, build and place in stream structures, plant large size container trees and shrubs, haul large volumes of rock, sand, sediment, etc, minimize and mitigate resource damage. Design, plan, mitigate, and implement complex riparian/wetland restoration projects involving TES species. Effectively remove invasive species such as reed canary-grass. Enhance and restore hydrologic function, when practical, to reestablish a functional wetland or riparian stream segment. Additional services may involve plant salvage, direct transplanting, maintaining plant materials on site or transplanting off site for future use.

1.L Landscaping. Work will be primarily associated with previously completed road construction involving restoration work within transportation corridors and may include, weigh stations, rest-stops, overlooks, trail-heads, parking facilities, road medians and shoulders, safety zones, over and underpasses, wildlife crossings, ramps, noise abatement screens, and interchanges. Primary to this work is soil stabilization, beautification, maintenance, and functionality. Additional work may consist of designing and building appropriate temporary or permanent irrigation systems, providing topsoil, gravels, rock, stone, mulch, compost, erecting barriers, such as placing a large boulder to restrict/redirect pedestrians and traffic. Design and implement project specific stormwater treatments as needed.

1.M Container/Bare-root Propagation. Provide nursery services and facilities sufficient to propagate, produce, and track a wide variety of tree, shrub, grass, sedge, and forb species from seed and/or vegetative means providing an array of container and/or bare-root configurations. Delivery to project sites may be requested, necessitating appropriate transportation and storage equipment, such as a refrigerated trailer. Container requests may range from small volume grass plugs (8 ml) to one gallon tree (TPG-1) or larger, requiring a tree spade, depending on project needs. Often, information on germination or production of many native species is limited. Due to the uncertainties involved in large road construction projects scheduled delivery dates of plant materials for a specific project may occasionally need to be modified. This may involve delaying

delivery (weeks-months), changing container configuration and/or production strategy to accommodate an additional year of growth, or over wintering in a secure facility. The Government will generally provide all plant materials to the grower.

1.N Seed Collection/Inventory/Mapping/Seed Cleaning. Services may be required in part or whole depending on project requirements. Identify and collect phenologically appropriate native tree, shrub, forb, grass, sedge, and rush seed from a wide range of habitats and conditions. Collection sites may be remote requiring significant driving and/or hiking. Sites may also be along traveled highway corridors. Inventory and mapping involve locating, identifying, evaluating, and recording potential collection sites, species, and phenology. A typical project for example may first involve the contractor performing a 5-6 species inventory and mapping exercise, followed up with species specific seed phenology collecting over a range of elevations and habitats.

1.O Vegetative Collection/Salvage/Inventory/Mapping. Services may be required in part or whole depending on project requirements. Identify and collect phenologically appropriate native hardwood, shrub, forb, grass, sedge, and rush vegetative plant materials from a wide range of habitats and conditions. Collection sites may be remote requiring significant driving and/or hiking. Sites may also be along traveled highway corridors. Inventory and mapping involve locating, identifying, evaluating, and recording potential collection sites, species, and phenology. Post collection material handling, storage and transport may require refrigeration and/or overnight delivery. Long term cold storage (2-4 months) may be required prior to nursery planting. Collection requests for vegetative materials, for example, may vary from small twigs to rhizomes to large poles depending on project design.

1.P Sediment/Erosion Control. Design and implement sediment and erosion control plans for highway construction projects. Implement an already existing control plan or provide advice on design, implementation, or improve existing plans. Provide, install, or construct control devices, such as erosion control bales, wattles, logs and rolls, silt fence, temporary rolled erosion control products both short and long term, temporary mulching/seeding, check dams, settling ponds, basins, bio-filtration, geo-textiles, and geo-composite materials, etc sufficient to meet all local, state and federal regulatory requirements. The Government anticipates exercising this task order item infrequently if at all.

1.Q Project Mobilization In/Out. This cost should reflect the amount of time and resources required to travel to and from a project with the appropriate equipment to perform the task at hand. Mobilization may be incidental on some Task Orders.

Item Two (2) - Seed and Vegetation Collection

2.A Seed Collection/Inventory/Mapping/Seed Cleaning. Services may be required in part or whole depending on project requirements. Identify and collect phenologically appropriate native conifer, hard-wood, shrub, forb, grass, sedge, and rush seed from a wide range of habitats and conditions. Collection sites may be remote requiring significant driving and/or hiking. Sites may also be along traveled highway corridors. Inventory and mapping involve locating, identifying, evaluating, and recording

potential collection sites, species, and phenology. A typical project for example may first involve the contractor performing a 5-6 species inventory and mapping exercise, followed up with species specific seed phenology collecting over a range of elevations and habitats.

2.B Vegetative Collection/Inventory/Mapping. Services may be required in part or whole depending on project requirements. Identify and collect phenologically appropriate native hardwood, shrub, forb, grass, sedge, and rush vegetative plant materials from a wide range of habitats and conditions. Collection sites may be remote requiring significant driving and/or hiking. Sites may also be along traveled highway corridors. Inventory and mapping involve locating, identifying, evaluating, and recording potential collection sites, species, and phenology. Post collection material handling, storage and transport may require refrigeration and/or overnight delivery. Long term cold storage (2-4 months) may be required prior to nursery planting. Collection requests for vegetative materials, for example, may vary from small twigs to rhizomes to large poles depending on project design.

Item Three (3) - Plant Propagation

3.0 Container/Bare Root propagation. Provide nursery services and facilities sufficient to propagate, produce, and track a wide variety of tree, shrub, grass, sedge, and forb species from seed and/or vegetative means providing an array of container and/or bare-root configurations. Delivery and or shipping to project sites or other locations may be requested, necessitating appropriate transportation and storage equipment arrangements, such as a refrigerated trailer for example. Container requests, for example, may range from small volume grass plugs (8 ml) to one gallon tree (TPG-1) or larger, requiring a “stinger” or tree spade, depending on project needs. Often, information on germination or production of many native species is limited. Due to the uncertainties involved in large road construction projects scheduled delivery dates of plant materials for a specific project may occasionally need to be modified. This may involve delaying delivery (weeks-months), changing container configuration and/or production strategy to accommodate an additional year of growth, or over wintering in a secure facility. The Government will generally provide all plant materials (seeds and/or cuttings) to the grower.

Appendix 4

Propagation Of Pacific Northwest Native Plants

by

Robin Rose, Caryn E.C. Chachulski, and Diane L. Haase
Corvallis, OR: Oregon State University Press. 1998.

A paper copy of this 148-page book will be provided to each office.

Propagation of Pacific Northwest Native Plants provides propagation information on nearly 140 native plants. Designed for use by both nursery professionals and home gardeners, this working manual presents the most current and comprehensive information in this emerging field. Drawn from forestry and agricultural journals, as well as from gardening and horticultural handbooks and personal sources, the techniques presented here offer invaluable direction to the many who wish to grow native plants.

Robin Rose is associate professor and the director of the Nursery Technology Cooperative in the Department of Forest Science at Oregon State University. Caryn E. C. Chachulski is a faculty research assistant for the Nursery Technology Cooperative. Diane L. Haase is the associate director of the Nursery Technology Cooperative.

Appendix 5

An Introduction To Using Native Plants In Restoration Projects

Prepared by
Jeanette Dorner

Seattle: University of Washington, Center for Urban Horticulture. 2002.
for

Plant Conservation Alliance; U.S. Department of the Interior, Bureau of Land Management; and
U.S. Environmental Protection Agency.

This publication provides information intended mainly as a guide for native plant restoration projects. After a discussion of the reasons to use native plants, the book provides guidance for planning a native plant project, preparing the site, planting the site, and caring for the site. Included are appendices with selected websites and literature cited.

This document is available electronically on the ONF Native Plant Materials website (<http://fsweb/onpmp/index.html>), and at <http://www.nps.gov/plants/restore/pubs/intronatplant/index.htm>.

Appendix 6

Revegetation Project Form

This form is intended to meet a need to provide a consistent framework for all resource areas to use whenever immediate erosion control is required.

This form was modified from the ONF Erosion Control Plan; it is in the process of being revised to address invasive plants and other issues. Please provide your input to Joan Ziegltrum (jziegltrum@fs.fed.us).

REVEGETATION PROJECT FORM**Project Name:****Sub-watershed (6th field):****Waterbody:****Location:****Brief Project Description:** (i.e. same as PCEF description)**Erosion Control Measures** (list – from NEPA, Consultation, standard USFS spec 204, BMPs, FHWA etc.).

General (overall – entire project):

Temporary:

1. Seed and mulch all disturbed areas within 7 days of completion of construction activities at the site.
2. Install temporary check dams and sediment fences as necessary to minimize the entry of silt-laden water into streams or other water bodies.
3. Dewater any live streams prior to culvert removal or other instream work.
4. If wet weather conditions during project operations generate and transport sediment to a stream channel or other water body, cease operations until the weather conditions improve.
5. Revegetate disturbed streambanks with woody vegetation within one year after project completion.
6. _____
7. _____

Permanent:

1. Space cross ditches to minimize erosion
2. Armor all cross drain outlets
3. Dispose of excess material (spoils) so it does not enter stream channels or other water bodies.
4. _____
5. _____

Specific Sites of Concern: (large fills, stream-adjacent slopes, unstable soils):**Erosion Control Measures for Specific Sites of Concern (if any):**

Temporary:

1. _____
2. _____

Permanent:

1. _____
2. _____

Scheduling (includes timing, item/provision, and contract spec/reference):

PHASE I

Contract

Site	Item/provision	Timing	Spec	Sheet

Provisions for inclement weather: (narrative, dates, contract provisions, especially specific to sensitive sites as applicable).

- ☐ Contractor provided winterization plan approved by COR. End of construction season for winter shutdown October 15.
- ☐ ? Others items contractor was given:

PHASE II Post-contract implementation needs (list who, what, when):

PHASE III Maintenance (list who, what, when; if any):

Completed by: _____

Date: _____

Designer: _____

Date: _____

Appendix 7

Engineering Contract Specifications

These specifications are intended to meet a need to have consistent language, forest wide, regarding revegetation for erosion control that can be inserted into contracts. The text has been reviewed by ONF engineers and their counterparts at the Pacific Northwest Regional Office level (Cisneros, personal communication, 2007). There are four different versions, depending on the elevation and soil moisture.

In the Engineering Contract Specifications, these will be referenced in Section 625.02 (materials).

Contract Specifications for sites that are $\leq 2500'$ in elevation, where soil is *not* saturated to the surface in mid-summer.

Seed mix: Apply Olympic Seed mix #1, in the following proportions and application rate per acre:

Perennial rye	10 lbs/acre
Annual ryegrass	40 lbs/acre
Oats	30 lbs/acre
Austrian winter peas (inoculated)	15 lbs/acre
Red clover (inoculated)	5 lbs/acre

Mix must contain at least 72% pure live seed, and 0% species on the Washington State Noxious Weed List. Provide lab test report to USFS contact.

Timing of application: Sow in late fall.

Fertilizer: None.

Mulch: Cover with 2" of approved weed-free straw (or other weed-free material such as erosion control mat), spread evenly over the entire area that was seeded. If using straw, provide signed and dated documentation from whoever inspected the grower's fields to ensure the product does not contain species on the Washington State Noxious Weed List. Inspectors can include County Weed Board staff, WSU extension agents, or anyone else the USFS deems capable of identifying the weeds. If the USFS invasive species coordinator has a list of approved suppliers, these suppliers may be used.

Contract Specifications for sites that are $\leq 2500'$ in elevation, where soil is saturated to the surface in mid-summer.

Seed mix: Apply Olympic Seed mix #2, in the following proportions and application rate per acre:

Annual ryegrass	40 lbs/acre
Oats	30 lbs/acre
Barley	15 lbs/acre
Alsike clover (inoculated)	5 lbs/acre

Mix must contain at least 72% pure live seed, and 0% species on the Washington State Noxious Weed List. Provide lab test report to USFS contact.

Timing of application: Sow in late fall.

Fertilizer: None.

Mulch: Cover with 2" of approved weed-free straw (or other weed-free material such as erosion control mat), spread evenly over the entire area that was seeded. If using straw, provide signed and dated documentation from whoever inspected the grower's fields to ensure the product does not contain species on the Washington State Noxious Weed List. Inspectors can include County Weed Board staff, WSU extension agents, or anyone else the USFS deems capable of identifying the weeds. If the USFS invasive species coordinator has a list of approved suppliers, these suppliers may be used.

Contract Specifications for sites that are > 2500' in elevation, where soil is *not* saturated to the surface in mid-summer.

Seed mix: Apply Olympic Seed mix #3, in the following proportions and application rate per acre:

Annual ryegrass	40 lbs/acre
Winter triticale	40 lbs/acre
Perennial ryegrass	10 lbs/acre
Red clover (inoculated)	5 lbs/acre

Mix must contain at least 72% pure live seed, and 0% species on the Washington State Noxious Weed List. Provide lab test report to USFS contact.

Timing of application: Sow in late fall.

Fertilizer: None.

Mulch: Cover with 2" of approved weed-free straw (or other weed-free material such as erosion control mat), spread evenly over the entire area that was seeded. If using straw, provide signed and dated documentation from whoever inspected the grower's fields to ensure the product does not contain species on the Washington State Noxious Weed List. Inspectors can include County Weed Board staff, WSU extension agents, or anyone else the USFS deems capable of identifying the weeds. If the USFS invasive species coordinator has a list of approved suppliers, these suppliers may be used.

Contract Specifications for sites that are > 2500' in elevation, where soil is saturated to the surface in mid-summer.

Seed mix: Apply Olympic Seed mix # 4, in the following proportions and application rate per acre:

Annual ryegrass	40 lbs/acre
Oats	30 lbs/acre
Barley	15 lbs/acre
Alsike clover (inoculated)	5 lbs/acre

Mix must contain at least 72% pure live seed, and 0% species on the Washington State Noxious Weed List. Provide lab test report to USFS contact.

Timing of application: Sow in late fall.

Fertilizer: None.

Mulch: Cover with 2" of approved weed-free straw (or other weed-free material such as erosion control mat), spread evenly over the entire area that was seeded. If using straw, provide signed and dated documentation from whoever inspected the grower's fields to ensure the product does not contain species on the Washington State Noxious Weed List. Inspectors can include County Weed Board staff, WSU extension agents, or anyone else the USFS deems capable of identifying the weeds. If the USFS invasive species coordinator has a list of approved suppliers, these suppliers may be used.

Appendix 8

Conservation Plants—Pocket ID Guide

by
U.S. Department of Agriculture, Soil Conservation Service, Elsberry Plant Materials Center. [no date]

A paper copy of this pocket-sized booklet will be provided to each recipient of the Native Plants Notebook. It is also available on the ONF Native Plant Materials website (<http://fsweb/onpmp/index.html>), and at <http://plant-materials.nrcs.usda.gov/technical/plantid/herbaceous/ConservationPlants.html>

The purpose of this guide is to help people identify commonly used conservation plants. The target audience was in Iowa, Illinois, and Missouri but many of the plants are also found in the Pacific Northwest. Included are color photos, line drawings, and seed photos, as well as plant stand evaluation and recommended use charts. Additional copies of the guide can be obtained from the National Association of Conservation Districts, 1-800-825-5547. Information about the USDA-NRCS Plant Materials Program can be found at <http://plant-materials.nrcs.usda.gov>.

Appendix 9

Recommendations from the Native Seed Network

In FY2007, the ONF applied for and was awarded funding through Title II, Resource Advisory Committee, to work with the Native Seed Network, a branch of the Institute for Applied Ecology. The purpose of the project was to “determine which native species are best suited for revegetation activities on the Olympic Peninsula, meet stewardship objectives of enhancing forest ecosystems, restore and improve land health and water quality.” When completed, the entire report will be distributed on the ONF, and will be available on line via the ONF native plant website <http://fsweb/onpmp/index.html>, or via www.nativeseednetwork.org.

Appendix 10

Revegetation Effectiveness Monitoring Report

This study, published internally in 1998, is titled Revegetation Monitoring Report: Mt. Baker-Snoqualmie National Forests. It was authored by Carol Aubry and Laura Potash.

The report presents the results of monitoring revegetation on decommissioned roadways and other road-related activities on the Mt. Baker-Snoqualmie National Forest. A total of 44 roads were surveyed.

An electronic version of the entire document, including photographs of each site, can be found on the ONF Native Plant website: <http://fsweb/onpmp/index.html>.