NATIVE SEED COLLECTION GUIDE

FOR ECOSYSTEM RESTORATION

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Wallowa-Whitman National Forest
August 1993

ACKNOWLEDGEMENTS

Many individuals contributed information, suggestions, and encouragement for the production of this guide. A growing awareness of the need for native plant species for implementation of ecosystem restoration is the underlying impetus for this guide. There is interest in this topic at all levels and in many disciplines within the Forest Service. The information in this guide was compiled from journal articles, Forest Service documents, horticultural texts, and correspondence with experienced growers of native species.

All those with the vision for improving management of our National Forests have contributed to creating a practical, ecologically sound approach to native plant revegetation. It is impossible for me to thank each one of you, so I thank you all -- we are one in spirit!

Special thanks are in order for a few people who facilitated the production of this publication: Sheila Martinson, Region 6 Geneticist, for providing project support; La Grande District Silviculture and Botany Departments, for providing office space and computer access; and Craig Dremann, Redwood City Seed Company, for generously sharing his insights and experience with native species.

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INTRODUCTION

Native Species for Ecosystem Restoration

The Forest Service is undergoing a shift of direction from an emphasis on utilization of resources to one that focuses more on stewardship and restoration of native ecosystems. This new emphasis on ecosystem management demands that we turn our attention to planting other species in addition to conifers and nonnative grasses on National Forest System lands. The public is also asking for the use of natives on public lands. Plants and seeds of native species are not readily available commercially, and those that are usually did not originate in the area they will be planted. There is potential danger in introducing native plants that are not genetically adapted to local areas. This concern includes questions regarding the long-term ability of these plants to survive and reproduce in an environment that may be different from their place of origin. There are also concerns about pollution of the gene pool of existing plant populations when nonlocal plants are introduced into an area.

There is an increasing demand for production of nontimber native species to satisfy a wide range of resource objectives. Native species are currently being grown at Forest Service nurseries for a variety of management goals. Some examples are gene pool preservation, erosion control on roads, riparian habitat improvement, wildlife forage, recreation site rehabilitation, and ecological restoration.

Collection of local native seeds is the first step in a lengthy process of making native species available for projects. It is unrealistic to expect large quantities of local native seed to be produced for district projects in the near future. Many species have never been tested or propagated, so little is known about growing the seed. Even species that have been researched often exhibit highly variable germination rates, so production results are unpredictable from year to year. This variation is the important quality that allows species to survive a changing environment in the wild -- but it does make propagation more difficult.

Initially, a realistic goal is simply to collect desired species from each district, and send seed to Forest Service nurseries for processing and storage. These small collections will establish seed banks, at a minimal cost, to be used for later increasing quantities of each seed lot. Working one step at a time, patience will pay off in the long run!

Regional Forest Service policy and procedures for collecting and growing native species are currently being developed. Individual experiences and feedback can contribute greatly toward determining what is effective. This booklet is a first step towards working out the techniques and guidelines for collecting and using native plants for ecosystem management projects. To assess future efforts toward this goal, please send any suggested improvements or additions guide to: Forest Botanist, Wallowa-Whitman National Forest, P.O. Box 907, Baker City, OR

Types of Plant Materials

A variety of different plant materials can be used in natural resource planting projects. “Plant materials” is a general term for anything that can be used to establish a plant: seeds, cuttings, or seedlings. These materials must be genetically suited to the specific environment where they will be planted. Plant material that meets these standards is called source-identified and locally adapted. Depending on the needs of the project and the site conditions, plants can be established by sowing seed, transplanting plants collected in the wild, planting unrooted cuttings, or planting nursery seedlings or rooted cuttings.

Obtaining seed for revegetation purposes requires planning ahead and adhering to the procedures described in this guide. Part I describes considerations for planning and documenting native species projects. Part II discusses procedures for collecting and handling native seed. The appendices contain nursery contacts, species charts, an equipment list, and supplemental information.

This guide explains procedures only for obtaining seed from grasses, shrubs and broad-leaved herbs (wildflowers). Hardwood cutting procedures are explained in the Wallowa-Whitman Hardwood Cutting Collection Guide, by the author, March 1993.

Nurseries - Forest Service and Private

Forest Service nurseries have a long tradition of providing plants for reforestation and other conservation plantings. Their personnel understand the biological and operational aspects of growing, handling, and storing plant materials. They are willing to help natural resource specialists make effective decisions about how to obtain and propagate appropriate plant handle and store them, and transport them to planting sites.

A function of Forest Service nurseries is to provide seed banks of native species from the national forests on an at-cost basis. They may also establish demonstration plots free of charge for species not yet grown in their nurseries. These plots are small (10 x 40 feet for example) perennial stands of individual species grown from seed collected on a National Forest. This service contributes to the knowledge and preservation of native species on National Forest System Lands. Contact one of the nurseries for details.

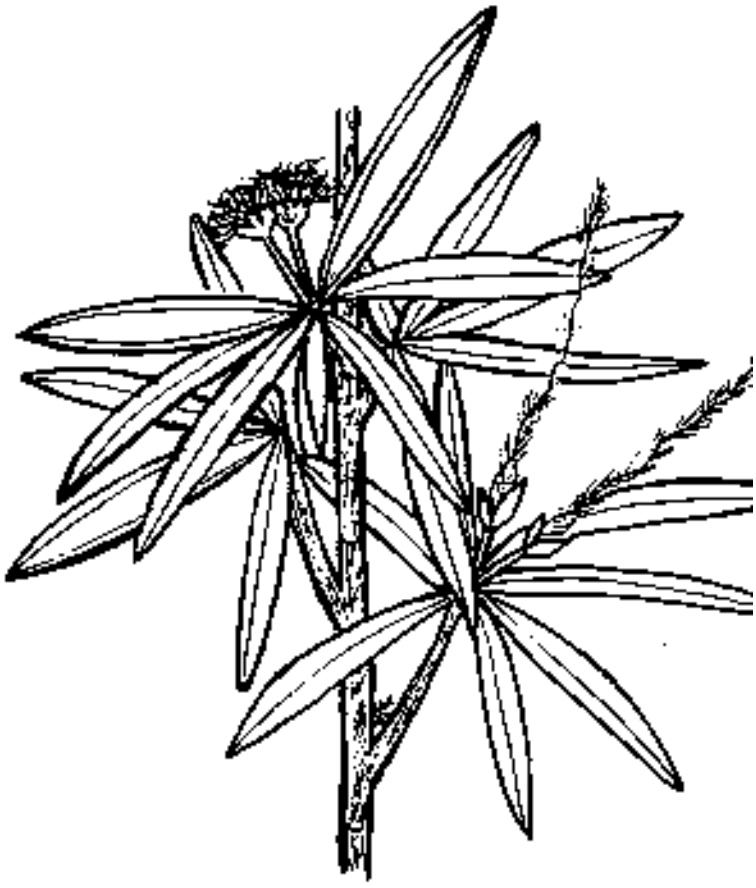
Forest Service nurseries have no intention of competing with private nurseries. After seed banks are established, contracts can be entered into with local private growers to eventually produce increased quantities of seed or seedlings to be planted back on public lands.

Caution: Care must be taken to verify that private growers are offering local source-identified weed-free seeds. Cooperative efforts are currently under way to develop a native seed certification system that will maintain ecologically sound standards of quality for revegetation activities. Forest Service geneticists and botanists, as well as state crop seed certification officials, and seed growers are contributing their expertise to ensure that large quantities of native seed will be truly source-identified and locally-adapted. The same criteria for movement and tracking of plant materials applies to all species and growers (see Section 3 - PARENT PLANT SELECTION CRITERIA on page 7).

Until there is a supply of locally collected seed, it is recommended that people do not order “native seed” from commercial growers. Unless it can be assured that the seed is indeed from the local area (ask them where they got it, don't tell them where you want it to be from) it is better to keep using the standard non-native mixes, or try sterile annuals or non-persistent perennials until true local natives are available.

PART I

PLANNING FOR NATIVE SEED PROJECTS



Section 1 - INITIATING NATIVE SEED PROJECTS

Planning ahead and communicating with specialists are crucial to the success of native plant regeneration projects. Coordination with nurseries is critical, from the initial planning stages through the delivery of seed. The following specialists can provide help at various stages of project planning:

- Nursery culturist - Assistance with planning from start to finish, and demonstration plot funding.
- Botanist - Assistance with selecting species to collect, and accurate identification specific parent plants.
- Ecologist - Evaluation of project area ecosystem, role of species being considered, and project monitoring design.
- Geneticist - Assistance with plant movement guidelines to ensure genetic diversity and adaptation of plant materials.
- Silviculturist (Reforestation specialist) - Assistance with Working Capital Fund procedures, district cooler storage, and coordination of shipping and receiving of seeds.
- Hydrologist - Assistance with watershed names, codes, and maps.
- Range Conservationist - Adjustment of grazing systems and allotment plans to prevent destruction of plantings, assistance with fencing plans, grass identification, and seeding methods.

Critically assess where seeding will occur. Make sure that no sensitive plant populations or special plant communities will be negatively impacted. Plant seed only where it is needed, can germinate and survive, and will achieve management goals.

Native seed revegetation projects must be planned well in advance! One to five years are required from the time of seed collection on the forest in summer or fall, to the time seed Is sown back on the forest. There are two basic approaches to seeding with local natives,

Direct Seeding - Time required: 1 - 1 1/2years. Direct seeding is sowing a seed lot that was collected from the wild directly on a project site. This procedure involves collecting seed from desired species, sending it to a Forest Service nursery for cleaning, testing, and storage. The original seed is then sown directly back into the wild. This approach can be used for small restoration projects that do not require large volumes of seed. Adequate populations of desired species must be located near the site in order to collect sufficient quantities for direct reseeding. This method results in the most expensive cost per pound of seed sown. It also will not provide a seed bank for future use.

Increased Seeding - Time required: 2 - 5 years. Increased seeding is sowing seed that was increased by nurseries or growers, from the original seed lot collected in the wild. This is not practical for shrubs. This procedure involves collecting seed, sending it to a Forest Service nursery for cleaning, testing, and storage. The nursery, or a local grower, sows it in demonstration plots or larger areas. This first seeding increases the original collected seed quantity and establishes a seedbed. This seed can then be harvested and sown back in the wild, or used to further increase quantities in future plantings. Larger quantities will require more years of increasing the size of production stands. Although expensive at first, this will lead to the least expensive cost per pound of seed once the seedbeds are established. This method is the ideal to strive for, the ultimate goal will be to have a steady supply of seed available for all projects.

NOTE: An established stand of native seed grown under commercial production conditions will be irrigated and/or fertilized with the goal of maximum yield per acre. In a few years, a selection process occurs favoring individual plants that thrive under such cultivation. Individuals that are most adapted to low moisture and nutrients, as exists on much of the forest, may gradually drop out of the population. Seed harvested from a high-yield production field should be used as a source for no more than five years, because the artificial growing conditions may reduce the population's genetic ability to adapt to harsh natural conditions.

Initiating Native Seed Projects (continued)

The district botanist (or other designated person) should keep a concise record of when and where populations of desirable native species are located and when they are ready for collection. This person also needs to keep a map of collection sites on that district.

Funding and Costs

- Secure funding early in the planning stage for all people involved in the project. Investigate funding sources for watershed improvement, ecosystem restoration, forest health, recreation projects, fish/wildlife/range habitat improvement, and the KV trust fund. The Working Capital Fund (WCF) established for reforestation and tree improvement is another possible source of funds for collection and propagation of native seed. Reforestation or silviculture specialists can explain the system and procedures. Application for these funds must be submitted by July of each year, so plan ahead for this.

- Forest Service nurseries will clean, test, store and grow seed collected from National Forests on an actual yearly cost basis. Seed grown the first year will be the most expensive due to the cost of establishing stands. Subsequent years will be less expensive.

  ~REFER TO APPENDIX D FOR AN EXAMPLE OF APPROXIMATE FOREST SERVICE NURSERY COSTS. The figures are estimates, and will vary depending on the nursery, species, yearly conditions, and other factors. Cleaning, testing, and storage costs have been about $3.00 per pound per year. J. Herbert Stone Nursery is equipped to process and propagate seed. Details must be obtained from the individual nursery.

- Cooperative private growers can also establish initial stands of collected seed lots (see Seed Certification Process chart on the following page). The first year harvest can then be used as Foundation Seed by large-scale private growers, to increase amounts of seed using commercial production methods. The system for native seed lots outlined in the chart merely presents an initial proposal for large-scale propagation of native species.

Seed Certification Process

The right column of this flow chart outlines the existing system used to increase quantities of cultivated, domestic grass species, called “named varieties” or cultivars. The seed certification program was established for this purpose, and monitors production to ensure varietal purity and to reduce weed contamination. Field checks are conducted by crop certification officials at planting and harvest, for each development step. It is not the same program or personnel as the tree certification program utilized by silviculture. The left column suggests a possible adaptation of the system to facilitate increasing of locally collected native seed. An “alternative” certification program could monitor native species genetic integrity and source identification, in addition to weed standards.

NATIVE SEED LOT	INCREASING STEPS	NAMED VARIETIES
Each step free of listed weeds	Two field inspections each	Each step free of listed weeds
Collected locally by FS or private grower. Collected in small quantities only. Documented and tracked by seed lot. Any one seed lot controlled by one grower. Grown in natural habitat conditions. Seed bank, planted for foundation seed. Not for retail sale	BREEDER SEED | increased	Variety developed by plant breeder. Available in small quantities only. Stock see din control of plant breeder. Not for retail sale. Planted to produce foundation seed. Labelled with a white tag.
Available in limited quantities only. Any one seed controlled by one grower. Not for retail sale. Tracked by seed lot. Grown in natural habitat conditions. Seed bank, planted for registered seed or for FS seeding.	FOUNDATION SEED | increased	Available in limited quantities only. Stock and seed controlled by foundation seed organization. Not for retail sale. Planted to produce registered seed. Labelled with a white tag.
Available in larger quantities. Any one seed lot controlled by one grower. Not for retail sale. Tracked by seed lot. Planted to produce certified seed or for FS seeding.	REGISTERED SEED | increased	Available in larger quantities. Stock and seed controlled by foundation seed organization. Not for retail sale. Planted to produce certified seed. Labelled with a purple tag.
Produced in large quantities. Might combine this step with registered seed step. Controlled by certified seed producers. Tracked by combined seed lot(s). Sown back into the wild.	CERTIFIED SEED	Produced in large quantities. Controlled by certified seed producers. Available for retail sale. Planted to produce crops. Planted for commercial prodction. Labelled with a blue tag.

Section 2-**PLANT SELECTION CRITERIA**

Selecting Species

- Determine what species are appropriate to fulfill project objectives.

- Select species that normally occur in the area, and try to include more than one species in any given project area. Identify potential parent plant populations at the appropriate time. For most species this is when they are in flower; however some grasses and sedges need to be in fruit.

- Have botanists or other plant experts provide accurate species identification. Ask them to accompany people into the field to select appropriate species prior to collection. Another option is to bring samples from the field in for identification. Be sure samples include flowers and/or fruit if possible. Positive identification of grasses and broad-leaved herbs often requires the whole plant, including roots.

- Maintaining species diversity is a primary objective of ecosystem restoration so it is highly desirable to work with nurseries in experimenting with more species than those currently being grown.

Locating Parent Plants

- Locations to consider for collections include unstocked cattle allotments, riparian exclosures, and pastures in a rest year. Make sure the areas are reasonably accessible.

- Locate sites as close to planting areas as possible. Avoid areas with heavy weed infestation. Within each subwatershed being considered for collection, identify several sites with various elevations, aspects, and geographic locations for each species.

- Geneticists and ecologists emphasize that collecting from a sufficient number of individual parent plants within a watershed is critical to the success of planting projects. Collecting from many parent plants ensures the genetic diversity of each nursery seed lot. Variations among individuals makes the difference between temporary landscaping, and a healthy, self-perpetuating population that is an integral part of the ecosystem.

- 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 in each elevation band and subwatershed. Strive to collect a similar amount of seed from each population harvested. Separate populations by at least 1/4 mile, this distance should ensure that no pollen or seed exchange occur between the populations. 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. Be especially alert for black fungus diseases such as ergot in grass seed heads. Do not pick seed heads that are touching the ground.

- Do not collect in research natural areas, near sensitive plant sites or other environmentally sensitive area.

Estimating Quantities of Seed

- Evaluate necessity for full initial seeding, or partial seeding combined with subsequent natural regeneration. Project objectives will be a factor in this determination. The number of parent plants available in the project area may also be a factor.

- Consider time/labor available, funds, and supplemental seeding. Section 1 - INITIATING NATIVE SEED PROJECTS, under "Funding and Costs" briefly describes funding possibilities, and nursery costs. Details must be obtained from the nursery involved.

- Collect as much seed as is available and time allows. Small seed lots are more susceptible to nursery losses than larger lots. About 500 - 1,000 seeds per species is the minimum required for Forest Service nursery processing, and to use for increasing quantities. Direct sowng will necessitate collecting the quantity of seed needed for a particular project area, plus extra to compensate for unknown germination rates. Additional mortality will occur after seeding as well.

- Calculate miles or acres treated and seeding rates for each species in the project area (pounds of seed per acre, or plants per square foot). This will have to be a very rough estimate until seed lots are tested. Germination rates for native species are highly variable, and the seeding rate must be adjusted for individual seed lots, ratio of various species in the mix, site conditions, and seeding method.

- To calculate the number of pounds of seed needed for reseeding projects, it is necessary to calculate the number of pure live seeds per pound. This will vary depending on which species, and even within each different batch of seed.

Pure live seed (PLS) calculations take into account the purity (amount of actual seed of the species) and the germination rate of that batch of seed. So for any given batch of seed the PLS equals:

$$\frac{\%\ \text{purity} \times \%\ \text{germination}}{100} = \%\ \text{pure live seed}$$

The PLS figure is then used to calculate the actual seeding rate needed. To do this, divide the PLS figure into the recommended seeding rate to get the actual seeding rate:

$$\frac{\text{recommended seeding rate}}{\%\ \text{Pure Live Seed}} = \text{actual seeding rate needed}$$

Section 3 - PLANT MATERIAL MOVEMENT GUIDELINES

Plant material movement criteria presented here are considered guidelines. Development of regional policy is in progress, these guidelines will be revised as more information becomes available. If limitations of a project area make compliance impossible, then come as close to these recommendations as is feasible. The most important factor is to keep complete and accurate records of the entire process. Plantings of native species need to be tracked so that knowledge can be gained about how well seeds germinate and grow, what species survive best, what diseases and insects are a problem, and how far they can be successfully moved from collection points. Maintaining the integrity of original seed stock while increasing quantities, and preventing weed contamination, are also critical areas of concern.

Mapping, data forms, and GIS will provide tracking to help ensure genetically acceptable movement of plant materials in project areas. Seeding as close to the collection site as possible will help maintain the long-term genetic viability of native populations within a given watershed. Polluting the gene pool by introducing plants from other elevations and watersheds can risk degradation of locally-adapted native species.

The geographic restrictions imposed here are more strict for collecting seed than they are for sowing seed back into the wild. After individual seed lots are cleaned and tested, they can be combined for distribution over larger areas, according to the guidelines that follow.

Parent Population Documentation

- Parent plant material will be collected and tracked in 1,000 foot elevation bands within each subwatershed. Each batch of seeds from one 1,000 foot elevation band and subwatershed will be a seed lot. Each district hydrologist has a map delineating the subwatersheds.

  ~USE THE SEED COLLECTION FORM ON PAGE 15 FOR FIELD DOCUMENTATION OF COLLECTIONS. Complete and accurate documentation is critical to ensure that seed lots are tracked correctly, and returned to the correct planting area. To increase efficiency in the field, some of the information can be filled out before or after collecting. Be sure to complete it though.

- For each seed lot, mark the location of each collected population on a topo map, and attach this map to the field collection form. Each seed lot should include several populations all within the same elevation band and subwatershed.

- If time is limited, for a given seed lot, begin collecting from the highest elevation within the designated elevation band and work down (for example start with 4,400 feet as opposed to 3,600 feet). This is recommended because mortality is greater when plant material is moved to higher elevations, and relatively less if it is moved to a site lower than where it was collected. However, try to collect from all elevations within an elevation band.

Seed Distribution Areas

- On the Wallowa-Whitman National Forest, seeds produced from natives ideally should not be moved outside of the National Forest System Watershed that they were collected in. Seeding within the same subwatershed where seeds were collected is an even better goal. National Forest System Watersheds correlate to fourth or fifth order stream drainages. Consult a hydrologist to obtain a copy of the Wallowa-Whitman National Forest Watershed Codes Handbook. This handbook lists two-digit codes for each watershed, and adds a one-letter code for each subwatershed. In an ideal world, seed would not be moved outside of the 1,000 foot elevation band for that seed lot.

- For small projects, it may be possible to distribute seed very near to the collection site. Small areas may be revegetated by direct seeding, as described in the planning section, until seed banks are established. This might be justified if seeding is necessary in the near future. It would be best to save some of the seed collected for this type of project for seed banking.

- For large projects, it may be necessary to distribute seed farther from the collection sites. Distributing seed within the same full watershed where the initial seed was collected is the ideal. If seed must be moved beyond the watershed of collection, then it can be distributed within the same seed zone on one district. Seed zones are geographic areas designated by geneticists, based on past research and experience. These zones are considered the largest areas within which plant materials can be successfully moved.The district reforestation people have a precise map of each district. It may become necessary to use these large distribution areas in the future, when large quantities of seed are grown by production growers. It is critical that seed lots are carefully tracked from collection sites and monitored, even for large distribution areas. Some species may not survive far from the original collection site; monitoring will provide such information.

- For large seed lots and big projects (when seed is grown commercially), seed collected in a given 1,000 foot elevation band may be sown back into that same elevation band, or one elevation band above, or one elevation band below the one it was collected from.

- Attention must be given to the habitat of parent plant populations to increase survival rates of seed that is sown. For small projects involving collection and seeding within one elevation band and subwatershed, collect from the same habitat as the site to be seeded. For example, if the seeding site is a south aspect, dry area, with moderate slope and shallow soil, collect from a similar site.

- For large projects involving a range of habitats, try to collect from each major habit represented within the seeding area. As in combining seed lots, combining habitats will contribute to the overall genetic variation of seed distributed, thus helping to ensure that some of the seed will survive in each habitat of the seeding area. It is not feasible to document and track individual habitats for large projects.

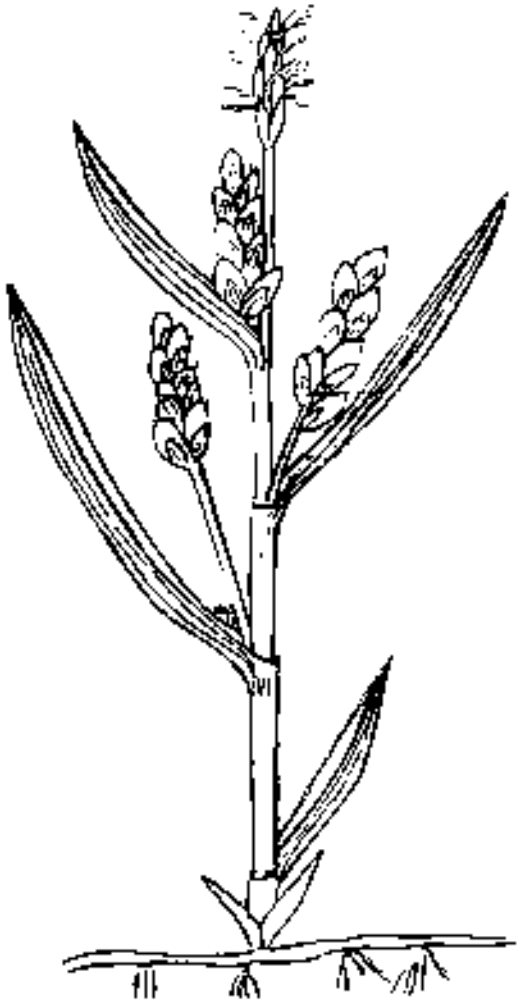
- In general, cross pollinated species are more genetically variable than self pollinated species, and so can be successfully moved farther than self pollinated species. Mountain brome (Bromus carinatus) and blue wildrye (Elymus glaucus) are examples of self pollinated species. Most grasses are cross pollinated via wind.

- Combined seed lots - If different seed lots of one species are collected from different 1,000 foot elevation bands in a subwatershed, and then are later combined for distribution throughout a subwatershed, watershed, or seed zone, then it is best to collect from as many areas within the distribution area as possible.

- Regardless of the size of an area used for seed distribution, collection and tracking of parent populations needs to follow the criteria described under “Parent Plant Documentation”.

Part II - PROCEDURES

FOR NATIVE SEED COLLECTING



Section 4 - COLLECTING NATIVE SEED

The following collection procedures apply to both hard and fleshy seeds. Differences in collection methods are described under each heading. Most grass and herbaceous plant seeds are hard, while many shrub seeds are surrounded by fleshy fruits. The methods described here are low cost, low tech and simple. For really big projects, there are machines available that are designed for large-scale harvesting. Check agricultural and horticultural publications for information on more sophisticated equipment. Experiment and share new information with other people working on these types of projects.

There are many techniques for hand-harvesting seed. Use the one that works best in a given situation, or develop something new. Some techniques that have proven to be effective are:

Cutting: Used for herbaceous plants, especially grasses, this involves gathering all the stems of one plant in one hand, and then cutting the seed heads with a sickle in the other hand. Wear leather gloves for protection from sharp blades!

Stripping: Used also for herbaceous plants and some shrubs, when the seeds are ready to shatter (fall off), this requires only pulling along the seed head to dislodge seeds into a container held beneath. Gloves should be worn for this.

Beating: Used for shrubs, this method involves gently tapping branches with a stick to dislodge seeds onto a tarp spread under the plant.

Shaking: Used for shrubs, this is similar to beating but involves gently shaking branches to dislodge seeds onto a tarp.

Pruning: Used for tall shrubs or trees, this involves cutting branches and then collecting seed off the plant. Use this method only when all others fail. The goal is minimal impact to existing vegetation.

General Collection

~OBTAIN EOUIPMENT LISTED IN APPENDIX B.

- For each population in a seed lot (one elevation band and subwatershed) collect from at least 30 to 50 parent plants in good condition. Try to collect from as many separate populations as is feasible in a seed lot. Strive to collect a similar amount of seed from each population harvested. Separate populations by at least 1/4 mile. These tactics will ensure that a representative sample of genetic variation is collected.

- Leave some seed for regeneration of the native population. Never take more than 50% of the seed from a given area.

- NEVER combine seed of different species while collecting. The only exception to this would be to collect a mix of all natives that would then be directly reseeded back into the wild. Nurseries will not accept any mixed seed.

- Be absolutely sure of the identification of each species collected. If there is any doubt, key the plant in the field, and/or collect a voucher specimen so the ID can be checked later. This will also help build an herbarium for future reference.

~ DOCUMENTATION! BEFORE COLLECTING ANY SEED, RECORD PARENT POPULATION INFORMATION ON SEED COLLECTION FORM. Form and instructions are on pages 15 and 16. Mark each population location on topographical maps, and aerial photos if desired. It - is not necessary to fill out Form 158 until just before the seeds are shipped to a nursery.

- Securely attach to **EACH CONTAINER** the white Forest Reproductive Material ldentification Tag R6-FS-2400-112, accurately completing all information.

~SEE FIGURE 3 ON PAGE 17-18 FOR FOREST REPRODUCTIVE MATERIAL IDENTIFICATION TAG AND INSTRUCTIONS.

- Drying and processing information is provided in Section 5 - DRYING AND TRANSPORT

IMPORTANT SAFETY NOTE

Cutting tools are very sharp and can inflict serious cuts. It is imperative to wear a leather glove on the hand holding the plant. Walking through the forest with an exposed blade could also lead to disaster; have your local shoe repair person make a leather scabbard for your sickle, and always cover the blade when not actually cutting (especially when hiking over rough terrain). File the tip of the sickle to a round point, it is not needed for cutting anyway. Carry Band-Aids and disinfectant to treat any cuts that may result.

Collecting Herbaceous Plant Seed

- Grass and broad-leaved plant seed is collected in summer and early fall, when seeds art mature. Check selected populations frequently after bloom to determine when seeds are ripe. The window for collection can be a few days to several weeks. Keep records of when seed from various species are ripe at different elevations and locations.

- Test seeds for ripeness. A general rule is that if the seed feels hard, and cannot easily be punctured by a thumbnail, then it is mature. Most native plants produce seed that ripens unevenly on each seed head. Grass seed matures first at the bottom of the stem, and matures progressively toward the top. The optimal quantity of mature grass seed can be harvested when the lowermost seeds are just starting to fall off (shatter). Some broad-leaved herbs follow this ripening pattern, while others have seed that matures all at once.

- Make sure there is seed in the seed heads. Sometimes seed never sets, so there is an empty shell with nothing inside. With grasses and sedges make sure you aren't just collecting empty bracts (once the seed has fallen out).

- Seeds can be stripped by hand (wear gloves!), or shaken off stems. The fastest way to obtain larger quantities is to collect entire seed heads. Some broad-leaved herbs and a few grasses have stems that break away when mature, and can simply be pulled off; one spike oatgrass (Danthonia unispicata) and arrowleaf balsamroot (Balsamorhiza saqittata) are examples of this type. A rake can be used to collect these type of plants. Most grasses will require cutting the stem.

- A grass sickle is perhaps the simplest and most versatile tool for cutting seed heads. Gather clump of stems in one hand and cut with the other. Try to cut as close to the seed head as possible.

- ATTENTION to weeds is crucial at this point! Do not accidentally collect weed seeds along with the desired species. It is difficult, and in some cases impossible, to eliminate weed seed contamination once it is collected in a seed lot. Check each handful of seed heads before and after it is cut.

- Thoroughly clean out the collection container between species.

- Place entire seed head in carrying container. These can be brown paper bags, tree planting bags (try lining them with brown garbage bags), canvas totes, buckets, or smaller plastic containers. Handles can be attached to belts for more efficient harvesting. Bring larger containers (or more bags) for emptying the carrying container.

- A very general collection estimate for a relatively dense, nonweedy grass stand is about one pound of seed (without stems) per hour of harvesting. This will vary greatly depending on species, site conditions, seed set, etc.

Collecting Shrub Seed

Many shrubs have fleshy fruits. These are best picked when the fruits are ripe For shrubs with hard seeds, use the thumbnail test for maturity, as described under herbaceous plant seed.

Collection methods will vary depending on the size of the shrub. Experimentation will reveal the best method for a particular situation. Low shrubs can be stripped or picked. Medium height shrubs can be lightly beaten or shaken, with a tarp to catch the failing seeds. Tall shrubs/trees can be lightly pruned with pole pruners if necessary.

- Place containers of fleshy seed in a cool, shady place while collecting. Overheating can kill seeds, and most fruits are especially susceptible.

- Fleshy fruits spoil quickly if not dried right after collection. Be sure to spread them out to dry the same day they are collected, or send them off to the nursery within 24 hours.

SEED COLLECTION FORM

1) SCIENTIFIC NAME_____

2) COMMON NAME _____

3) SPECIES CODE _____ 4) SEED LOT CODE _____
4 - 6 letter from nursery form 158

5) WATERSHED_____ 6) SUBWATER_____
Name Code (2 digit) Name Code (1letter)

7) LEGAL_____ 8) QUAD NAME _____
Twnshp. Range Sec(s)

9) ROAD NUMBER(S)_____

10) CREEK OR SITE NAME _____

11) AREA RELOCATION DIRECTIONS_____
_____

ATTACH A QUAD OR ROAD MAP OF COLLECTION AREA ON BACK

12) ELEVATION(S) _____ 13) SLOPE(S)_____%

14) ASPECT(S) (N, S, E, W) _____

15) HABITAT DESCRIPTION (S)_____

16) PLANT ASSOCIATION(S)_____
Name (use key or leave blank)

17) NUMBER OF PLANTS IN EACH POPULATION _____

18) NUMBER OF POPULATIONS IN THIS SEED LOT _____

19) COLLECTOR(S) NAME_____

20) COLLECTION DATE_____21) HOURS SPENT COLLECTING _____

22) COMMENTS_____

DRYING AND TRANSPORT DATA

23) DRYING METHOD_____ 24) DRYING TIME _____

25) NURSERY NAME _____ 26) DATE SHIPPED _____

27) DISTRICT CONTACT PERSON_____

Figure 1 - Seed Collection Form

Collection Form Instructions

* Asterisk indicates data that does not need to be recorded in the field. This information can be recorded before or after collection to save field time. But be sure to do it!

1) SCIENTIFIC NAME: Be absolutely sure of the identification. Use the names In Flora of the Pacific
2) COMMON NAME: Use the names on the charts in this guide, or the ones used for stand exams.
3) * SPECIES CODE: This is the code used for stand exams. Use the CORRECT four to six letter code. Leave blank it you don't know. Refer to PNW Publication Northwest Plant Names and Symbols.for Ecosystem Inventory and Analysis.
4) * SEED LOT CODE: This Is from Nursery Lot Form 158. See instructions accompanying that form.
5) * WATERSHED NAME AND CODE: Get a map of these from the district hydrologist.
6) * SUBWATEFTSHED NAME AND CODE: Got a map of these from the district hydrologist
7)..LEGAL: This Is the Township, Range, and Section the seed was collected from. More than one entry for large batches.
8) QUAD NAME: This Is the USGS Quad map name. For large batches there can be more than one entry here.
9) ROAD NUMBER(S): List the main roads that are nearest to the area collected. This doesn't have to be real specific.
10) CREEK OR SITE NAME: General name of the area.
11) AREA RELOCATION DIRECTIONS: This can be fairly general.
12) ELEVATION(S): H more than one population is included, give the range of elevations, or list each one.
13) SLOPE(S): ff more than one population is included, give the range of slopes, or list each one.
14) ASPECT(S): ff more than one population is included, give the range of aspects, or list each one.
15) HABITAT DESCRIPTION: General habitat information, such as riparian, forested, grassland.
16) PLANT ASSOCIATION: Use the appropriate guide to determine this. If more than one population is collected, list each association name. If in doubt leave it blank.
17) NUMBER OF PLANTS IN EACH POPULATION- Estimate the number of plants (10?, 50?, 100?) that were harvested in each population. This line will have one entry only since it will be the same for all populations in a seed lot
18) NUMBER OF POPULATIONS IN SEED LOT - Number of populations, separated by 1/4 mile, that were
19) COLLECTOR(S) NAME: The person who did the collecting (or people).
20) COLLECTION DATE: Date the material was collected. Important for tracking success rates.
21) HOURS SPENT COLLECTING: Time spent actually collecting (donl count driving time).
22) COMMENTS: Any extra information that may be helpful

DRYING AND TRANSPORT

23)DRYING METHOD: Record where (sun or shade) and how.
24) DRYING TIME: How many days the material was dried.
25) NURSERY NAME: Name of the nursery the material was sent to.
26) DATE SHIPPED: Date the material was sent to the nursery.
27) DISTRICT CONTACT PERSON: Name of person nursery should contact if there are any questions.

Figure 2 - Collection Form Instructions

Forest Reproductive Material Identification Tag and Instructions

Get these tags from your District reforestation specialist. Be sure to let them know far in advance how many are needed, so they will order extra. Form number is R6-FS-2400-112 (4/86).

FOREST REPRODUCTIVE MATERIAL

IDENTIFICATION TAG

U.S.DA - FOREST SERVICE

The collector shall complete Items 1 thru 6 at point of collection and firmly attach tog to outside of container of forest reproductive material before loading for transport.

1. Species Name:_____
2. Place of Collection:_____
_____
_____
_____
3. Number of Parents or Clones From Which Collected:
   a. Selected Tree Number(s)_____OMIT____
   b.Number of Trees: NO. OF PARENT PLANTS
4. Elevation:_____
(in feet above sea level)
5. Date of Collection-_____
6. To the best of my knowledge, the above statement is correct.

_____
(signature of collector)
7. Color Code For Reproductive Material Lot: ..
_____OMIT_____
_____

Do not use codes to fill in items 1-7. Use only one identification tog per container. Use waterproof ink to complete all items on tag.

If more than one container of forest reproductive material is harvested from a tree, record as 1 (Number of containers), etc.

WFS-2400-112 (4/96)

Figure 4 - Bundle Tag and Instructions

* U.S. GPO: 1990-792-127

FOREST REPRODUCTIVE MATERIAL
IDENTIFICATION TAG

U.S.D.A. - FOREST SERVICE

8. Species:_____
(Name and code)

9. Forest: _____
(Name and Code)

10. Seed Zone Code:_____

11. Ranger District _____
(Name and code)

12. Type of Collection Code:_____711_____

13. Breeding Zone Code_____OMIT_____
(leave blank if item 10 is completed)

14. Elevation_____
(in feet above sea level)

15. Certification Class Requested, _____OMIT_____

16. Date:_____. I certify that the information on this tag s correct.

Signature:_____

Items 7 thfough 17 are to be completed by Forest Service employee In charge of procurement of forest reproductive material. Use names and codes unless indicated otherwise, reference FSH 2409.25f R6.
Securely attach tag to outside of container.
Use only one identification tag per container.
Use waterproof ink to complete all items on tag.

R6-FS-2400-112 (4/85)

Section 5 - DRYING AND TRANSPORT

- Discuss plans with nursery personnel well in advance, so that preparations can be made to receive shipments of seeds. Each batch of seed from one 1,000-foot elevation band and subwatershed will be a nursery seed lot. More than one bag can have the same seed lot number, but each must have an attached Forest Reproductive Material Identification Tag. Each seed lot in a shipment must also have a completed Nursery Lot Form 158.

~ Use the data collected on the Seed Collection Form to complete Form 158 before shipping seeds to the nursery.

- Forest Service nurseries can dry and clean the seed they receive to remove impurities, such as stems and chaff. However, some precleaning at the district level will reduce this cost, and eliminate unnecessary bulk. Drying hard seed thoroughly will maximize yield and germination success.

- The two types of seed are handled differently after collection:

  Fleshy seed Seed surrounded by moist fruit, such as dogwood (Cornus stolonifera and honeysuckle (Lonicera species) should be shipped to the nursery immediately. A few species need to be cleaned and planted before they dry excessively. Leathery fruits should be shipped immediately to prevent mildew or overheating. Nurseries can extract the seed from the fruit.

  Hard seed - Seed that is hard and dry at maturity, without a fleshy fruit covering, should be processed according to procedures described below. Seed of species that do not have Chaff and stems (most dry shrub seed) can be sent directly to the nursery at this point.

Drying Seed

- MAKE SURE FOREST REPRODUCTIVE MATERIAL IDENTIFICATION TAGS ARE NOT LOST OR MIXED DURING THE DRYING AND CLEANING PROCEDURES!!

- If rodent predation is a serious problem, it may be necessary to have the nursery dry and clean the seed. This will increase costs.

- To ensure optimal quality, it is important to dry the seed well. Dry the material in a protected area outdoors, or indoors where there is good air circulation. Material can be spread on tarps, screens, wood, cardboard or anything moveable. It is best to dry ft in a sunny area, unless it is over about 90 degrees, because excess temperatures can kill the seed. The layer should be only a few inches thick. If nights are cool and/or moist, bring the drying seed under cover at night and take it back out during the day. If seed gets wet, it may mildew and rot. If wind or birds are causing losses, cover the seed with screens.

- Another method for small lots is to dry the material in grocery bags. To do this, place the material in a donut shape around the sides of the bag; leave a big hole in the middle. Fill the bag about 1/3 and stir it every few days.

Cleaning Seed

- A fast way to remove seed from stems, especially for grasses, is to use a pitchfork or shovel to beat the drying seeds. Then turn the pile and continue thrashing it. Move the chaff aside and sweep up the seed underneath. Inspecting seed heads will indicate if all or most of the seed has fallen. If not, then leave the layer to dry a few more days and repeat. This is a good system for large quantities.

- For smaller quantities, dry seed can be screened from seed heads. Take a handful of stems, and gently rub on top of a screen (see equipment list) until the seeds have fallen through. Discard the stems and repeat with another handful. Screening one handful at a time will give the best results. Some broad-leaved herb and shrub seed capsules may require crushing with a piece of lumber while rubbing, to release seeds.

- Chaff can be removed from the screened seed before shipment if desired. To do this, simply pour the seed onto a tarp in front of a fan set on low, or in a light breeze outdoors. Another technique is to gently agitate a shallow container of seed in front of a fan. Seed that blows away with the chaff is probably empty, so don't panic if a little is lost.

- It is not necessary to clean seed to a perfectly pure state, nurseries have machines that are made to do this efficiently. While removing stems, always keep watch for weed seeds or other unwanted species.

Shipping

- It is not advisable to store seed at districts. Rodents and insects can devour seed rapidly, and most districts do not have completely secured facilities. Forest Service nurseries have seed storage rooms that are completely sealed, and are maintained at the optimal humidity and temperature to maintain live seed for the maximum length of time. If seed moisture rises above 12%, and temperature is not near or below freezing, extensive losses will occur. Storage cost is minimal for one year, about $3.00 per pound at present.

- Shipping containers for prepared seed can be brown paper bags, small mesh nylon bags (GSA laundry bags), or anything similar. Place the container in a plastic bag to prevent moisture penetration, then in a cardboard box. Be sure each seed lot container has a completed FOREST REPRODUCTIVE MATERIAL IDENTIFICATION TAG attached, and NURSERY FORM 158 attached. Several seed lots can be shipped together in larger boxes.

- SHIP SEED AS SOON AS POSSIBLE AFTER DRYING AND CLEANING. The sooner it is properly handled at the nursery, the higher the germination rates will be.

- Consult with your district silviculturist or reforestation specialist to learn about the system for seed shipments to and from nurseries. Be sure to follow the proper protocol.

- Contact nearby districts to determine if a group shipment can be made. This coordination effort will save money.

- Seed can be shipped via UPS if containers are wrapped in plastic bags and placed in boxes. Do not ship after Thursday, as conditions could be harmful if seed sits in a warehouse over the weekend.

APPENDIX A

Wallowa-Whitman National Forest Species Charts

This table did not scan. Contact the Forest for this 6 page table.

APPENDIX B
Equipment List

Leather Gloves- one pair per set of cutting tools.

Collecting containers, such as brown paper grocery bags, canvas totes, buckets, plastic milk jugs.

Extra containers for collected seed, such as more bags or boxes.

Tree planting bags, for collecting (borrow these from silvicuture).

Tarps, for collecting seed shaken off shrubs. Also for drying seed.

Cutting Implements, such as sickles, grass hooks, or scissors. For shrubs, clippers or pole pruners may be needed. An efficient hand tool is the Japanese light sickle (Cat. No. 2720), 7 oz., about $15.00, available from: Smith & Hawkin 25 Corte Madera, Mill Valley, CA 94941 (415) 383-2000.

Rake and/or scissors, optional, for certain species.

Scythe sharpening stone, Master Mechanic is one brand, special ordered at a hardware store and available from: Cotter and Co., Chicago, Illinois, 60614

First Aid kit, with Band-Aids.

Seed collection forms one for each seed lot.

Forest Reproductive Material Identification Tags, #R6-FS-2400-112, one for each container of seed.

Aerial photos and topo maps, for documenting parent plant locations.

Permanent marking pens (Sharpies), for tags and forms.

Sun protection, food, and water.

Compass and clinometer.

Plant Association Guide for the area, to type out the collection sites.

Flora of the Pacific Northwest by Hitchcock and Cronquist.

Common Plants of the Inland Pacific Northwest by Charles G. Johnson (available fall 1993**).**

Seed cleaning screen. Used for cleaning seed after collection and drying. This will have to be made. It is a wooden frame about 2 x 3 feet, with ¼" hardware cloth (screen) attached securely. Additional frames with different guage screens can be used for various sized seeds. The frame can be constructed of 1 x 2 's, or 2 x 2 's.

APPENDIX C

Nursery Contacts

Contact persons from J. Herbert Stone Forest Service Nurseries have generously offered to visit districts for instruction and advice. They are available for field consultation or indoor workshops. Nursery personnel are happy to assist with planning any phase of native plant revegetation projects; talk with them!

J. Herbert Stone Nursery
2602 Old Stage Rd.
Central Point, OR 97502
Phone: (541) 858-6100

Local private growers may want to produce native seed. Policy and procedures need to be established to guide commercial production. This process is currently under way. Considerations to preserve genetic integrity will be integral to this process.

APPENDIX D

Supplemental Information

NATIVE SEED INFORMATION SOURCES

Dremann, Craig D. 3rd E Cal-Oregon-Reveg-Notes: Utilizing Locally Collected Seed for Revegetation of Dry Forest Soils in California or Oregon. 60 pp. This booklet deals exclusively with grasses. It has information on chosing species to plant, collecting seed, testing germination, and procurement of seed. The cost is $8.50, from Redwood City Seed Company, P.O. Box 361, Redwood City, CA 94064

Hitchcock, A.S., 1950. 2nd ed. revised by Agnes Chase. Manual of Grasses of the United States (two volumes). Misc. Publication 200 USDA, Washington D.C. 1,051 pp. This includes keys and descriptions for all grasses in the U.S. Some of the names are out of date, but the other information is still good.

Hitchcock, C.L, Art Cronquist et. al. 1969. Vascular Plants of the Pacific Nonhwest: Part One. University of Washington Press, Seattle, WA. 914 pp. This is the expanded version (with full descriptions and drawings) of Flora of the Pacific Northwest for all the monocots. This is the main key for grasses and sedges in our area.

Johnson, Charles G. and R. Clausnitzer. 1992. Plant Associations of the Blue and Ochoco Mountains, USDA Forest Service Pub. #R6-ERW-TP-036-92.163 pp.; AND

Johnson, Charles G. and Steve Simon. 1987. Plant Associations of the Wallowa-Snake Province. USDA Forest Service Pub. #R6-ECOL-TP-255A-86. 400 pp. These guides provide ecological information to help choose which species to plant in different habitats in northeastern Oregon.

Johnson, Charles G. 1993. Common Plants of the Inland Pacific Northwest. Photo guide (available fall 1993).

Larson, John E. 1980. Revegetation Equipment Catalog. USDA Pub. #001 -001 -00518-5. This book discusses mostly large scale equipment, but it has some grass collection, planting, and seeding equipment. It also has a chart in the back that has good information on wildland seed such as number of seeds per pound, forage characteristics, environmental needs, and application rates.

McKell, Cyrus M., Blaisdell, J. P., and Goodin, J. R.. 1972. Wildland Shrubs-Their Biology and Utilization. 495 pp. USDA General Technical Report INT-1. Information specific to shrub seeds and propagation.

Society for Ecological Restoration, University of Wisconsin-Madison, Arboretum, 1207 Seminole Hwy., Madison, WI 53711. (608) 262-9547. They publish a twice yearly journal with information and news on restoration projects. Annual membership is $30 for individuals, $80 for government agencies.

Stefferud, Alfred (editor). 1948. Grass, the Yearbook of Agriculture, 1948. USDA, Government Printing Office (probably out of print). This book is old, but ft has some good basic information on grasses and seeding.

Stefferud, Alfred (editor). 1961. Seeds, the Yearbook of Agriculture, 1961. USDA, Government Printing Office (probably out of print). This book also has some out of date information, but has lots of good info on seeds.

Young, James A. and Cheryl G. 1986. Collecting, Processing, and Germinating Seeds of Wildland Plants. Timber Press, Portland, OR. 236 pp. This book covers aspects of collecting, cleaning, storage,, and germination of seeds. Over half of the book is information on germination of various species.

Young, James A. and Cheryl G. 1992. Seeds of Woody Plants in North Americas Revised and Enlarged Edition.. Dioscorides Press, Portland, OR. 407 pp. This book is based on the USDA publication Agriculture Handbook 450, seeds of Woody Plants of the United States. It lists by genus the collection, cleaning, storage, and stratification requirements of hundreds of plants. It also has an extensive list of pertinent literature.

J. HERBERT STONE NURSERY
NATIVE GRASS PROGRAM

The Native Grass Production program at J. Herbert Stone Nursery provides materials and support services for managers of publicly owned lands. It began in 1991 in response to a new policy on the Rogue River National Forest. The policy stated that for most seeding or planting projects, native species from local gene pools will be used. At that time, there were no commercial sources of local native grass seed available and it didn't appear that there would be any in the near future. We were told that commercial seed suppliers were reluctant to branch out in this market until they saw a firm commitment from the Forest Service and others to buy the seed. Also, before they can begin full scale seed production, they need information on culturing, seed yields, harvesting and cleaning each species. Contract growers will also require larger quantities of Foundation or 'starter' seed than can be economically collected from the wild. Filling the information gap and producing Foundation Seed for contract growers are the main purposes of our Native Grass Production Program.

LEARNINGING ABOUT NATIVE GRASSES

Learning the growing requirements and growth characteristics of the wide variety of native grass species growing on federal lands is the first step in propagating seed and seedlings. This is done by establishing small stands of grass in demonstration beds. Over the years, these beds will give us information on germination rates, seed yields, flowering dates, diseases and growth habits. Since these plots are side by side, they display the unique differences between species, thus serving as educational guides. Currently the species in our demonstration area number 19 grass species:

Festuca idahoenis
Festuca occidentalis
Bromus vulgaris
Trisetum cernuum
Festuca californica;
Bromus suksdorfli
Agropyron spicatum
Bromus carinatus
Stipa lemmonii
Elymus glaucus
Koeleria cristata
Melica harfordii
Bromus orcuttianus
Sitanion hystrix
Melica subulata
Trisetum canescens
Agrostis exara"
Festuca rubra
Poa scabret

At any public land manager's request, we will add grass species not listed above. Approximately 1000 seeds must be supplied to establish a plot.

SEED PRODUCTION

Once seed of a species has been successfully produced, we will accept orders to establish production beds of that species. Currently we have three acres in production. The seed from these production fields can be used for immediate reseeding, stored for later use or used as Foundation Seed by private growers to produce larger amounts of seed.

We are taking several measures to assure that the seed we produce is of high quality. Based on the genetic requirements, we are isolating seed collections of the same species by the minimum distance to prevent cross pollination. We are also aggressively controlling weed species through mechanical and hand weeding. Our stands have not been established long enough to have encountered damage caused by diseases. However, we will take measures to assure that diseases on the seed are kept to an acceptable level.

The costs for producing seed will be based on the actual cost of growing and processing the seed on a yearly basis. Since most seed lots will be of small quantity, the costs will be higher than commercially produced grass seed. First years cost for a pound of seed will always be higher than the following years for several reasons. First, the cost to establish a crop includes preparing the seed and the fields, sowing the seed, weeding and fertilizing. Once the crop is established, maintenance of the grass stands is minimal. Secondly, for most species, the yields from the first years crop are usually lower than subsequent years. The higher establishment costs of the first year are spread over a lower yield of seed resulting in high costs per pound of seed. The best investment, therefore, would be to establish and maintain a stand of grass for more than one year.

Our best estimates on prices at this time are between $4 and $6 per pound of seed the first year and $2 and $4 per pound the following years for high seed yielding species (1200 pounds/acre). Low yielding species (400 pounds/acre) will cost between $13 and $15 the first year and $7 to $9 the following years. Information on seed yield and harvesting/cleaning costs this year will give us a better estimate on the actual costs for each species that we grow.

At any public land manager's request, the Nursery will establish grass seed production beds. Seed can be sown in early fall or late winter. Since an early fall sown stand will produce seed by the following summer, this is the preferred time to sow. Most species need at least several weeks of stratification and some up to three months. For most species, we must receive the seed by late August to sow in the fall.

SEEDLING PRODUCTION

For species that are difficult to grow or sites where seeding is not feasible, revegetating with native grass seedlings should be considered. The Nursery is ideally set up to produce and harvest bareroot seedlings whether it be conifers or grasses. However, there is very little experience in producing native grass seedlings for outplanting and we must develop the best procedures for growing, processing and storing grass seedlings. The costs for this work should be less than the production of 1-0 bareroot seedlings.

Producing a seedling takes from two to six months, depending on the time of year the seed is sown and stratification requirements of the seed. An alternative to bareroot seedlings is seedlings is seedlings produced in containers or flats. Although the costs are higher, these seedlings can be planted at any time of the year and might do better on harsher sites.

SEED STORAGE

Cleaned seed can be stored for more than one year. Seed viability depends on the quality of the storage facility. For most species, long term viability is best in freezer storage. Where long term storage is not critical, facilities that maintain a cool and dry environment are adequate. Both J. Herbert Stone Nursery and Bend Pine Nursery have seed storage facilities. Contact either Nursery for storage costs.

LOOKING AHEAD ...

The J. Herbert Stone Nursery is committed to furthering the knowledge of native grasses. As program moves forward, we see our roles expanding to include:

- administering public agency contracts for large scale production of seed from commercial growers.
- Developing a library on native grasses which is accessible to all.
- Facilitating workshops on grass collection, propagation and site restoration with native plants for public agencies and interested publics.
- Developing new equipment and techniques to produce grass seed and seedlings in cost
- Developing partnerships with other agencies, the scientific community and our public to answer basic questions on seed transfer, production and restoration techniques

We look forward to working in this new and exciting new field. Call us with suggestions, ideas or proposals.

J. HERBERT STONE NURSERY
2606 OLD STAGE ROAD
CENTRAL POINT OR 97502
(503) 776-4281

Program contacts: David Steinfeld or Colleen Archibald.

Herbert Stone Grass Seed Production and Cost Estimates

Species		Lbs/ac/Yr 1	Lbs/Ac Yr 2
Agropyron spicatum	Bluebunch wheatgrass	Information not compiled	
Bromus carinatus	Mountain brome	500	500
Bromus vulgaris	Columbia brome	100	200-300
Danthonia California	Calif. Oatgrass	Information not compiled	
Danthonia unispicata	One spike oatgrass	Hasn't grown yet; recommend establishment of demonstration area.	
Elymus glaucus	Blue wild rye	500	500
Festuca idahoensis-	Idaho fescue	-0	500
Koeleria cristata	Prairie Junegrass	Info. not compiled (good spp.; grows well at Stone)	
Poa sandbergii	Sandberg's bluegrass	250	250
Poa scabrella	Pine bluegrass	250	250
Sitanion hystrix	squirreltail	Information not yet compiled (good spp. grows well)	

First year costs for production beds are estimated to be -$3-4 M/acre, and include seed handling, sowing, fertilization, and weeding. An additional -$1000/ac will be charged for seed harvest. Demonstration areas are established at no cost to the Forest.