HARDWOOD CUTTING COLLECTION GUIDE

FOR ECOSYSTEM RESTORATION

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Edited by Paula J. Brooks

Wallowa-Whitman National Forest
March 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 establishing the guidelines included here. 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 new and better ways to manage our National Forests have contributed to creating this 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: Nita Rauch, Cultural Assistant at Bend-Pine Nursery, for providing project support; Paula Brooks, Wallowa-Whitman Forest Botanist, for project initiation, and editing; La Grande District Silviculture and Botany Departments, for generously sharing office space and computer access; and Jackie Dougan, Baker/Unity Zone Fisheries Biologist, for devoting organizational skill and energy toward coordination of efforts in ecosystem restoration.

The cover drawing of Sitka willow *(Salix sitchensis)* is from USDA Agricultural Handbook No. 148 Key to Important Woody Plants of Eastern Oregon and Washington. The Branch Age Determination drawing is by the author. The drawings of snow willow *(Salix nivalis)* on page 1, and Lewis' mockorange *(Philadelphus lewisii)* on page 7, are courtesy of Karl Urban, Umatilla National Forest Botanist.

Lucinda Huber, Botanist

March 1, 1993

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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 non-native 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 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 non-local plants are introduced into an area. There is an increasing demand for production of noncommercial native species to satisfy a wide range of resource objectives. Native species are currently being grown for a variety of management goals. Some examples are:

- Gene-pool preservation - Pacific yew, an important long-lived understory species used for cancer research.
- Erosion control on roadcuts - Hairyleaf manzanita, California hazel, bitterbrush, and ocean spray.
- Riparian habitat improvement - Cottonwood and willow (from cuttings), and big leaf maple (from seeds).
- Wildlife forage - Bitterbrush seedlings are produced to provide food for wildlife, especially helpful in critical winter habitat.
- Recreation site rehabilitation - Producing source-identified, locally-adapted large caliper stock (sturdy plants).
- Forest health - Planting pest-resistant species in heavily impacted areas.
- Ecological restoration - Human impact has radically changed the composition of many plant communities. Reintroduction of a full range of native species can help bring these impacted lands back into a more diverse and ecologically resilient condition.

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 they will be planted in, and properly hardened to withstand the stresses of handling, storage and outplanting. 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 direct sowing of seed, transplanting wildlings or unrooted cuttings, or planting nursery seedlings or rooted cuttings.

The use of unrooted cuttings can be a gamble; the success rate is highly variable and usually very low. Unrooted cuttings may seem economical, but once the low success rate and other project costs are factored in, they become very expensive. Give your cuttings a good start: Put roots on them before planting them out in world!

Obtaining rooted cuttings for revegetation purposes requires planning ahead and adhering to the procedures described in the five sections of this guide: NATIVE PLANT PROJECT PLANNING, PARENT PLANT SELECTION, COLLECTING CUTTINGS, STORAGE AND TRANSPORT, RECEIVING ROOTED CUTTINGS. The appendices contain species-specific information, contacts, an equipment list, and a glossary.

This guide explains procedures for obtaining rooted hardwood cuttings only. Potential future guides will cover other propagation methods, such as softwood cuttings, root cuttings, sucker collection, and seed collection, as well as planting and maintenance of seedlings.

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 materials, handle and store them, and transport them to the outplanting site. Forest Service nurseries can be particularly useful for species that are difficult to produce in large quantities. These nurseries are complete facilities which can offer the full range of plant propagation services.

Forest Service nurseries have no intention of competing with private nurseries. Do not hesitate to contract with private nurseries for propagation of local hardwood cuttings. Caution: Care must be taken to verify that private nurseries are offering source-identified native plants. The same criteria for movement and tracking of plant materials applies, regardless of species grown or location of nursery (see Parent Plant Selection, page 6).

NATIVE PLANT PROJECT PLANNING

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 rooted cuttings. The following specialists can provide help at various stages of project planning:

- Nursery culturist - Assistance with planning, from start to finish.
- Botanist - Assistance with selecting species to collect, and accurate identification of 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 district cooler storage, coordination with shipping and receiving of seedlings, and planting.
- Hydrologist - Assistance with watershed names, codes and maps.
- Range Conservationist - Adjustment of grazing systems and allotment plans to prevent destruction of plantings, and assistance with fencing plans.

Native plant revegetation projects must be planned well in advance! Eighteen to thirty months are required from the time parent plants are located in the summer, to the time rooted cuttings are received from nurseries after one or two growing seasons.

Native Plant Project Planning Checklist

1. **Establish objectives of the project:**
    - Determine desired objectives, such as shade, erosion control, reintroduction of native species, forage enhancement, visual quality, habitat improvement, ecological restoration.

2. **Consider timeframes, from locating parent plants to outplanting**:
    - Coordinate with nurseries, specialists listed above, and nearby districts.
    - Allow 1.5-2.5 YEARS from tagging parent plants to planting rooted cuttings. Willow and cottonwood often develop sufficient root systems and top growth after one nursery growing season. Discuss plans with nursery.

3. A**ttempt to anticipate future budget and project area opportunities**:
    - Focus revegetation plans and collection on areas that are likely to be funded in the future.
    - Secure funding for all people involved in the project.

Native Plant Project Planning Checklist (Continued)

- Investigate funds for watershed improvement, ecosystem restoration, forest health, recreation projects, fish/wildlife/range habitat improvement, and KV.

4. **Determine appropriate species to fulfill project objective**s:
   - Refer to Appendix II for species that are suitable for propagation by hardwood cuttings.
   - Gather species information from botanists and ecologists. Coordinate plans with them in advance, and allocate funding for their time spent working on the project. Plan on using more than one species in a project area.

5. **Select only native species that occur in the project area watershed:**
   - See Parent Plant Selection section for plant material movement guidelines.
   - Identify, tag and map parent plants to collect from, while plants are in leaf, flower, and/or fruit. This is done during the field season before collection.
   - Insist on complete and accurate collection documentation. Long-term success requires locally-adapted and source-identified stock.

6. Contact nurseries for propagation of the species you want:
   - Consider sending cuttings to more than one nursery, in case of failure at one location.
   - Consider private nurseries, district evaluation plantations, and seed orchards, as other options to Forest Service nurseries.
   - Refer to Appendix I for a list of Forest Service nursery contacts.

7. Incorporate protection measures for planted area:
   - Plan on measures to deter wild and domestic browsers and grazers from utilizing planted area for at least one or two years. Fencing has proven to be by far the most effective deterrent.

8. Estimate quantity of cuttings needed - then double that amount:
   - Calculate acres treated and stocking level for each species (plants per mile, or per acre).
   - Evaluate necessity for full initial stocking, or partial stocking combined with subsequent natural regeneration.
   - DOUBLE ESTIMATES to compensate for mortality before and after planting.
   - Consider time/labor available**,** funds, and replanting needs.

9. **Prepare for receiving rooted cuttings in time for spring planting:**
    - See section on Receiving Rooted Cuttings for details.
    - Discuss cost factors with nursery personnel. Payment to Forest Service nurseries is due on delivery of rooted plants.
    - Specify to nurseries if one or two year rooted cuttings are needed. A trip to the nursery to view the progress of cuttings will help in making this determination.
    - Organize with nurseries regarding needs for winter storage of lifted cuttings, packaging and return shipping instructions.

10. **Include maintenance and monitoring in project planning**:
    - Plan on maintenance that might involve replanting, fence repair, weed control, watering, fertilizing, and individual plant protection.
    - Monitor planting project results to provide information on survival rates, and to increase knowledge for success of future projects.

PARENT PLANT SELECTION

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 project area.

- Contact district or forest botanists who will provide accurate species identification. Botanists can accompany those who select parent plants during the summer. Another option is to bring samples of each tagged/flagged plant to botanists for identification, including flowers and/or fruit if possible. Positive identification of some species is very difficult after plants are dormant; this is especially true of willow species. Willows also are dioecious, so both male and female plants need to be selected for collection, in order for the population to remain viable in the future.

  ~REFER TO APPENDIX II FOR A CHART OF SPECIES THAT CAN BE PROPAGATED BY HARDWOOD CUTTINGS. Species in the upper chart involve the least risk of failure. Many species not listed are best propagated by other methods.

- 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

- Identify potential parent plants during the field season, while plants are in leaf. Unstocked allotments, riparian exclosures, and pastures in a rest year may all be good options. Make sure the areas are reasonably accessible.

- Obtain cuttings from areas as close to planting sites as possible. Identify several sites with various elevations, aspects, and geographic locations for each species desired.

- Select parent plants with adequate size and branching to allow for removal of branches without destroying the original plant; this would be counter-productive.

- Select only vigorous, healthy parent plants. Avoid those with signs of insects, disease, and damage due to repeated or excessive browsing.

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

Plant Material Movement Guidelines

Plant material movement criteria presented here are considered guidelines. If limitations of a project area make compliance impossible, then come as close to these recommendations as is feasible. It is preferable to have some local native stock, from as close to the planting site as possible, even if "ideal" goals cannot be attained. The most important factor is to keep complete and accurate records of the entire process. Plantings of native species need to be tracked similarly to tree plantings, so that knowledge can be gained about how well cuttings survive and grow, what size plants survive best, what diseases and insects are a problem, and how far they can be successfully moved from collection points.

Mapping, tagging parent plants, data forms, and GIS mapping will be used to ensure genetically acceptable movement of plant materials in project areas. Planting rooted material 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.

On the Wallowa-Whitman National Forest, materials grown from cuttings should not be moved outside of the National Forest System Watersheds that they were collected in. National Forest System watersheds correlate to fourth or fifth order stream drainages. Consult a hydrologist to obtain a copy of the your local Watershed Codes Handbook. This handbook lists two-digit codes for each watershed, and adds a one-letter code for each sub watershed. Tracking plants by subwatersheds is recommended.

Parent plant material will be collected and tracked in 500 foot elevation bands,-according to established silvicultural guidelines. Codes for the elevation bands are explained on page 15. Complete and accurate documentation is critical to ensure that nursery lots can be returned to the correct planting area. The bundles from each watershed elevation band will be a nursery lot, and must have Nursery Lot Form 158A attached when shipped.

Outplanting - Planting rooted cuttings within the same subwatershed they were collected from is ideal, but plants can be moved within an entire watershed. Movement of plant materials is restricted to 1,000 feet (two bands) within each watershed. Cuttings from a given 500 foot elevation band can be planted within that band, within one band above, or within one band below the collection band. In some instances, it may be acceptable to move material lower than 1,000 feet from the parent plant, but moving rooted cuttings higher than 1,000 feet will greatly increase mortality in the long run. Begin collecting at the highest elevation of the project area to acquire as many cold-tolerant individuals as possible.

Parent Plant Documentation

~ USE THE COLLECTION FORM ON PAGE 11 FOR FIELD DOCUMENTATION OF PARENT PLANTS AND CUTTINGS. Some of the information can be filled out before or after collecting cuttings, to reduce time spent in the field.

Mark each plant location on topographical maps and aerial photos, to facilitate relocation of parent plants in winter, and for tracking purposes.

Tag parent plants with metal identification tags indicating the species of each plant. Make sure tags are attached above the winter snowline! Be careful to not girdle the main stem; put the tag on a branch, or nail a circular metal tag to a larger branch. Flagging might also assist with relocation. It is not necessary to track each parent plant individually by number, unless there is special interest in a particular plant. The recordkeeping involved with individual tracking would be excessive for districts and nurseries.

Estimating Quantities Of Cuttings

- Calculate miles or acres treated and stocking levels for each species (plants per mile, or per acre).

- Evaluate necessity for full initial stocking, or partial stocking 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: For each species, locate 30 to 50 individual parent plants in good condition, separated by at least 100 feet. The separation is necessary because many plants spread by rhizomes. Less than 100 foot separation could result in the genetically identical plant being considered as more than one parent plant.

- 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 lot. Variations among individuals make the difference between temporary landscaping, and a healthy, self-perpetuating population that is an integral part of the ecosystem.

- Consider time/labor available, funds, supplemental planting. The last section of this guide, Receiving Rooted Cuttings (page 17), briefly describes propagation costs. Obtain details from the nursery involved.

- DOUBLE ESTIMATES - at least. Small lots of cuttings are more susceptible to nursery losses than larger lots. For orders of less than I 0,000 plants, collect twice the number of hardwood cuttings needed for planting. Additional mortality will occur after planting; this can be as high as 50 percent again, depending on various factors.

COLLECTING CUTTINGS

- Hardwood cuttings must be collected when trees and shrubs are dormant, generally in late winter. Do not make cuttings after the buds begin to swell, because they usually die.

  ~ OBTAIN EQUIPMENT LISTED IN APPENDIX III.

- For each species, relocate the 30 to 50 individual, tagged parent plants, each separated by at least 100 feet. This provides a representative sample of genetic variation for the species.

- Remove no more than 30 percent of the branches from any one plant. Leave the plant with adequate reserves for regrowth!

~ DOCUMENTATION! BEFORE CUTTlNG ANY BRANCHES, RECORD PARENT PLANT INFORMAT1ON ON PLANT MATERIAL COLLECTION FORM. Form and instructions are on pages 11 and 12. Mark each plant location on topographical maps and aerial photos, if this was not done when plants were selected. It is not necessary to fill out Form 168A until just before the cuttings are shipped to a nursery.

- Collect an equal number of cuttings from each parent plant.

- Take cuttings from the ends of branches, including the terminal bud (tip). Cuttings must be from wood that is one to three years old - no older! The youngest wood will root most successfully.

  ~ SEE FIGURE 3 ON PAGE 13 TO DETERMINE AGE OF BRANCHES.

- Cuttings can be about 8 - 24 inches long, and a minimum of 3/8 inch diameter (thickness of a pencil). Thick, young stems root better, and grow more vigorously. They contain greater carbohydrate reserves that provide energy for rapid growth. Long cuttings can be cut down to shorter lengths later, depending on nursery preferences.

- Make the bottom cut at a 45 degree angle. Cut off any side shoots close to the main branch. Side shoots of sufficient size can be used for more cuttings.

- Bundle cuttings together from each 500 foot elevation band, fastening with a large rubber band. Do not combine cuttings from different elevation bands, or from more than one species. Bundle workable amounts together, possibly 25 to 50 sticks. Count the number of cuttings in each bundle, and record this number on the bundle tag.

- Securely attach to EACH BUNDLE the white Forest Reproductive Material Identification Tag R6-FS-2400-112, accurately completing information for numbers 1 - 6.

  ~SEE FIGURE 4 ON PAGE 14 and 15 FOR BUNDLE TAG AND INSTRUCTIONS.

- While collecting cuttings, keep bundles coot and moist, in damp-burlap sacks inside plastic bags, damp sawdust in boxes, or sealed three-ply paper seedling bags. Be sure to keep wrapped bundles in a shady place; even in winter, sunshine can heat and dehydrate shoots quickly. If buds and bark dry out, cuttings will die. Label or tag containers so contents can be identified.

PLANT MATERIALCOLLECTION FORM

I. **SPECIES DATA**:

COMMON NAME_____SCIENTIFIC NAME _____

SPECIES CODE_____SOURCE LOT CODE_____
4 - 6 letter

II. **LOCATION**:

WATERSHED NAME _____
Name Code (2 digit) Subwater. Name & Code (1 letter)

LEGAL_____, _____ QUAD NAME_____
Twnshp. Range Section ¼ of 1/4

ROAD NUMBER_____ DISTANCE FROM ROAD_____

CREEK OR SITE NAME _____

AREA RELOCATION DIRECTIONS_____
_____
_____
_____

DIAGRAM OR MAP OF COLLECTION AREA ON BACK

III. **CUTTING DATA:**

ELEVATION_____ SLOPE _____ ASPECT (N, S, E. W) _____

HABITAT DESCRIPTION _____

PLANT ASSOCIATION _____
Name (use key or leave blank) Code

NUMBER OF CUTTINGS COLLECTED FROM EACH PLANT_____

NUMBER OF PARENT PLANTS IN THIS 500' ELEVATION BAND_____

COLLECTOR NAME_____ COLLECTION DATE_____

IV. **STORAGE AND TRANSPORT DATA:**

STORAGE METHOD_____ STORAGE TIME_____

NURSERY NAME_____ DATE SHIPPED_____

DISTRICT CONTACT PERSON _____
Name of person who shipped cuttings

Figure 1 - Collection Form

Instructions for Plant Material Collection Form

* 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 ft!

1. SPECIES:

Write out full names. Ask a botanist to help with identification and names.

- SPECIES CODE - This can be filled out after cuttings are collected. Use the CORRECT four to six letter code. Leave blank if you don't know. Refer to PNW Publication Northwest Plant Names and Symbols for Ecosystem Inventory and Analysis.
- SOURCE LOT CODE - This can be filled out after cuttings are collected. It needs to correlate with Nursery Lot Form 158A. See instructions accompanying that form.

II. LOCATION:

- WATERSHED NAME AND CODE - This can be filled out before cuttings are collected. Subwatershed name and code is also recommended.
- LEGAL, QUAD NAME, CREEK/SITE NAME - These can be filled out before collection.
- RELOCATION DIRECTIONS AND MAP - Make sure your directions can be followed by someone else who has never been there! Draw a diagram showing the collection site with each tagged plant mapped in relation to roads and landmarks.

III. CUTTING DATA:

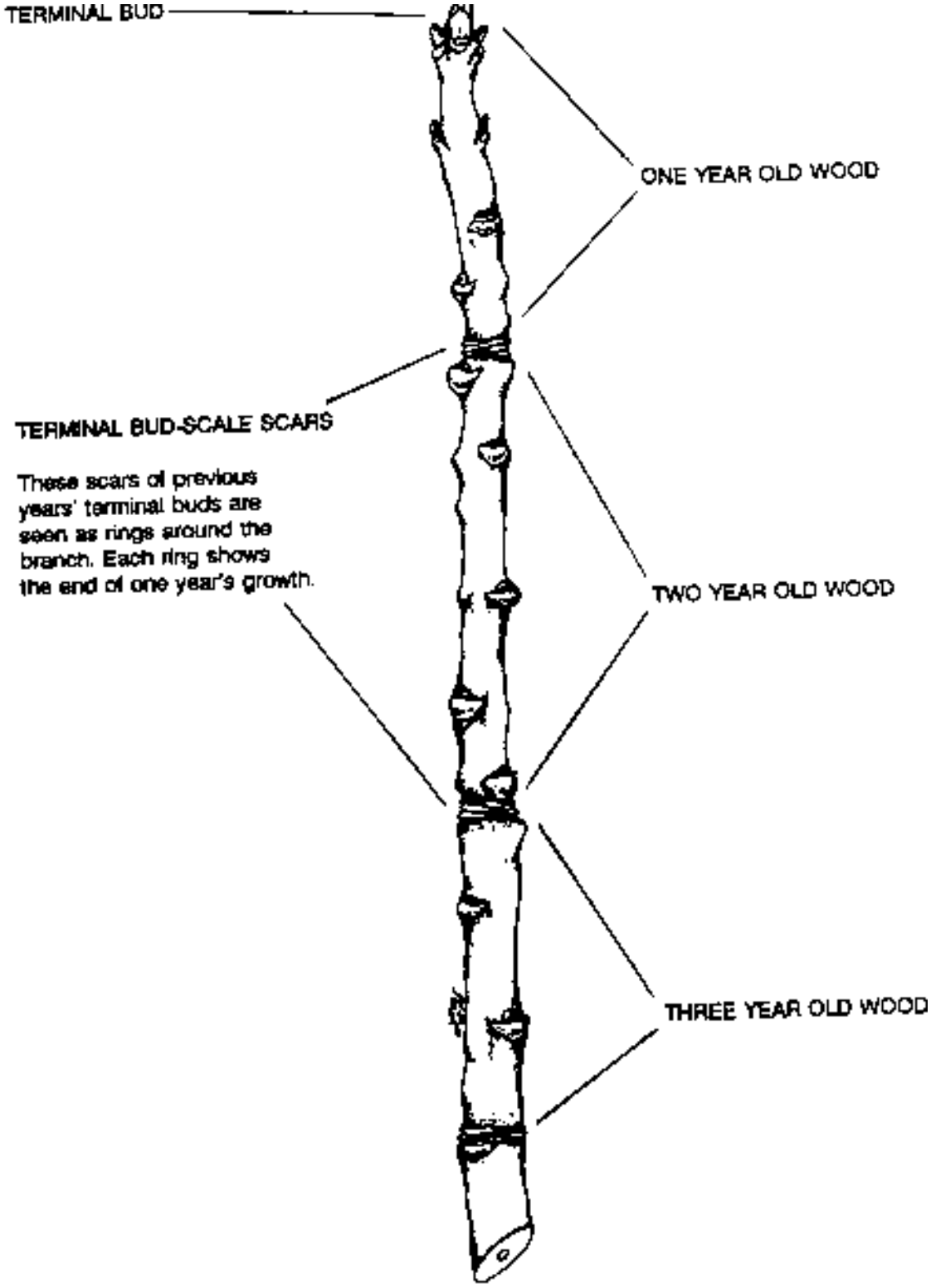
- HABITAT DESCRIPTION - General habitat information, such as riparian, forested, grassland.
- PLANT ASSOCIATION It is best to key this out in the field using a Plant Association Guide to determine the CORRECT plant association name. Or, this can be filled out before or after cuttings are collected, using GIS or plant association maps. If in doubt, leave it blank.
- NUMBER OF CUTTINGS COLLECTED FROM EACH PLANT - This should be the same for each parent plant in a given watershed. This is very important.
- NUMBER OF PARENT PLANTS IN ELEVATION BAND - Number of individual parent plants that were used for collection within one 500 foot band; this will constitute one nursery lot.
- COLLECTION DATE - Very important for tracking success rates for future collecting.

IV. STORAGE AND TRANSPORT DATA:

* This information will be filled out after collecting. It is also crucial for determining optimal methods for each species in the future.

- STORAGE METHOD - Record where (cooler or outside) and how (wrapping materials).
- DISTRICT CONTACT PERSON - This information will be filled out after collection by the person who is supervising the project. This person needs to oversee shipping to be sure that cuttings are properly tagged and have Nursery Lot Form 158A included with each watershed elevation band lot.

Figure 2 - Collection Form Instructions


TERMINAL BUD
ONE YEAR OLD WOOD
TERMINAL BUD-SCALE SCARS
These scars of previous years' terminal buds are seen as rings around the branch. Each ring shows the end of one year's growth.
TWO YEAR OLD WOOD
THREE YEAR OLD WOOD

Bundle 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.

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 thm 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)

STORAGE AND TRANSPORT

- Discuss plans with nursery personnel well in advance, so that preparations can be made to receive shipments of cuttings. Each group of bundles from one watershed 500 foot elevation band will be a nursery lot, and have an attached Nursery Lot Form 158A.

  ~ Data collected in the field on the Plant Material Collection Form can be used to complete Form 158A before cuttings are shipped to the nursery.

- Reforestation processes have been developed for regeneration of commercial conifer species. Consult with your district silviculturist or reforestation specialist to learn about the system used for cold storage, and shipments to and from nurseries.

- Packing for storage and transport: If cuttings will be stored for a short period (a few days to a few weeks) before shipping, proper temperatures and packing will help provide for high survival rates.

- Cuttings must be kept at 34 to 38 degrees F., and protected from freezing. Warmer temperatures may induce bud break, causing eventual mortality. Cooler storage is highly recommended. If no cooler is available, an alternative method is outside storage.

  <u>Storage in cooler:</u>
  Sealed in three-ply brown bags, or damp burlap bags inside plastic bags, will retain sufficient moisture for cuttings.
  <u>Storage outside:</u>
  Protect from freezing and warm temperatures. Pack bundles in plastic or damp burlap, surrounded by moist sawdust, sand, peat moss or vermiculite to a depth of about four inches. Place bags or boxes of cuttings along the north side of a wall, well protected from drying winds and sunshine.

- Coordinate with silviculture on storage and shipping dates prior to collection. Districts with a cooler (refrigerated storage room) have established timelines when the cooler is operational, and shipments via refrigerated trucks are received for reforestation. There may be space available for short-term storage of cuttings until shipping to the nurseries. When trucks deliver tree seedlings to districts, cuttings could be shipped back to the nurseries on the return trip.

- Contact nearby districts to determine if a group shipment can be made from several districts at the same time. This coordination effort would save money.

- Dormant cuttings can be shipped via UPS if burlap or paper bags are wrapped in plastic bags and placed in boxes. Do not ship cuttings after Thursday, as conditions could be harmful if cuttings sit in a warehouse over the weekend.

RECEIVING ROOTED CUTTINGS

Pricing and Payment

Discuss cost factors with nursery personnel. The cost for noncommercial species and those new to the nursery will be billed on an actual cost basis. Forest Service nurseries will set up a special management code and keep track of actual costs to produce the cuttings, applied as cost per 1,000 plants. Payment to Forest Service nurseries is generally due on delivery. However, arrangements may be made to obligate available funds in advance of delivery.

Rooted Cutting Specifications

Sturdier plants with more developed root systems, hence higher survival rates, can be produced by allowing rooted cuttings to stay at the nursery for two growing seasons. This will increase the cost per 1,000 but significantly reduce planting mortality.

In situations that require planting as quickly as possible, one year rooted cuttings may be adequate. Willow and cottonwood root and grow vigorously, so nurseries may prefer to lift rooted cuttings after one growing season. Some nurseries are equipped to trim roots and tops after one season, allowing plants to grow another season at the nursery to develop more dense, compact root systems and sturdier, taller stems. Discuss options with nursery personnel.

An inventory of the number of plants, and the amount that are expected to reach acceptable size, is taken during July and August of each growing season in the nursery. This will be sent to the districts in September for planning quantities and final grading specifications for each lot.

Lifting and Packing Specifications

The nursery is responsible for meeting all of the lift, pack, storage, and handling instructions for each cutting lot. Generally, an early spring (early March through early April) lift is recommended. The nursery will request information such as:

1. Minimum size of plant.
2. Bag or box storage.
3. Shipping and storage instructions.

Decide the earliest and latest dates for receiving plant materials in the spring. Once lifted and packed, rooted cuttings can be held for several months in refrigerated storage. In most cases, the best time to plant is in the early spring. Freezer storage of some species permits very long-term storage for high elevation and late spring planting. In some cases, lifting can be done in late fall or early winter.

Nurseries encourage occasional visits for viewing seedlings as they grow. This will help acquaint clients with nursery operations, and allow viewing the development of rooted cuttings. During the visit, a determination can be made if the cuttings will need an additional year of growth.

The last step is to prepare for planting rooted cuttings, and to watch them grow and thrive. Bask in the satisfaction of making a significant contribution to ecosystem restoration!

APPENDIX I

Nursery Contacts

Contact persons from 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!

David Steinfeld
J. Herbert Stone Nursery
2606 Old Stage Rd.
Central Point, OR 97502

Rogue River NF:
Phone: (541) 776-4151
Internet: dsteinfeld@fs.fed.us
FAX: (541) 776-3764

Local Private Nurseries may want to contract the growing of hardwood cuttings. Contact them directly for information.

APPENDIX II

Wallowa-Whitman National Forest Native Species Chart

Species Successfully Reproduced at Forest Service Nurseries by Hardwood Cuttings

CODE	SCIENTIFIC NAME	COMMON NAME
COST	*Cornis stolonifera*	Red-osier dogwood
POTR2	*Populus trichocarpa*	Black cottonwood
RIBES	*Ribes sp.*	Gooseberry and currant species
SALIX	*Salix spp.* Except *S. scouleriana*	Willow species except Scouler's willow
TABR	*Taxus brevifolia*	Pacific yew

Species Known to Reproduce by Hardwood Cuttings

CODE	SCIENTIFIC NAME	COMMON NAME
ARTR	*Artemisia tridentata*	big sagebrush
ARCTO	*Arctostaphylos spp.*	manzanfta,kinnikinnick
JUNIP2	*Juniperus spp.*	juniper species
MEFE	*Menziesia ferruginea*	fool's huckleberry
PAMI	*Pachystima myrsinites*	Oregon boxwood
PEFR3	*Penstemon fruticosus*	shrubby penstemon
RHGL	*Rhus glabra*	smooth sumac
VACCI	*Vaccinium* SPP	.huckleberry species

Species That May Reproduce by Hardwood Cuttings

CODE	SCIENTIFIC NAME	COMMON NAME
AMAL	Amelanchier alnifolia	Serviceberry
CEANO	Ceanothus spp.	Ceanothus species
HODI	Holodiscus discolor	Ocean-spray
LOIN	Lonicera involucrate	Nearberr honeysuckle
LOUT2	Lonicera utahensis	Utah honeysuckle
PHLE2	Philadelphus lewisii	Lewis' mockorange
PHMA	Phisocarpus malvaceus	Mallow ninebark
POFR	Potentilla fruiticosa	Shrubby cinquefoil
PUTR	Pursha tridentate	Bitterbrush
SACE	Sambucus caerulea	Blue elderberry
SARA	Sambucus racemosa	Black ekderberry
SPBE	Spiraea betulifolia	Shiny-leaf spirea
SYMPH	Symphoricarpos spp.	Snowberry species

NOTE:Many species not listed in this chart are known to reproduce with greater success using other methods of propagation, such as root cuttings, suckers, softwood cuttings, or seeds. Experimentation may reveal that more species than are on this list can be propagated by hardwood cuttings.

APPENDIX III

Equipment List

SHARP pruning tools: Loppers, clippers, and pole pruners.
Dull pruning tools can damage parent plants and cuttings.

DAMP burlap bags, three-ply brown paper bags, plastic bags, and boxes.
Proper handling of cuttings will keep them moist, cool, and alive!

Large, strong rubber bands, or something to fasten bundles of cuttings together.

Labels and forms:
Forest Reproductive Material Identification Tag R6-FS-2400-112.
Wire or string to attach tag.
Plant Material Collection Form and Instructions.

WATERPROOF pens for labels and forms.

Topographic maps and aerial photos:
For relocation directions to selected parent plants
that were tagged during the previous growing season, or
For recording locations of selected parent plants.

Metal tags, wire or string for fastening, and flagging
For identification of selected parent plants.

Compass and Clinometer

APPENDIX IV

Glossary

Bud break - The opening of buds on branches of deciduous plants, that occurs in early spring. Bud break is the beginning of leaf and shoot growth in a new growing season.

Bud swell - Enlarging buds on branches of deciduous plants, occurring in late winter or early spring. Bud swell precedes bud break, and indicates the end of dormancy.

Deciduous plants - Woody plants (trees and shrubs) that loose their leaves during the winter dormant season. Deciduous plants include both hardwood and softwood species. Black cottonwood and willow are examples of deciduous trees.

Hardwood cuttings - A nursery term for sections of woody branches cut from dormant deciduous or evergreen plants for the purpose of reproduction. These cuttings are taken from branches that are one to three years old, the growth having occurred at least one growing season previously. Hardwood cuttings are collected during late fall and winter.

Hardwoods - A group of trees having dense, hard wood often utilized for this specific quality. Walnut, maple, and birch are examples of hardwood deciduous trees.

Outplanting - A nursery term referring to planting rooted cuttings or seedlings in their permanent environment, after they have been propagated in a nursery.

Root cuttings - Sections of plant roots (usually rhizomes) that are cut and dug up, for the purpose of reproduction.

Softwood cuttings - A nursery term for sections of soft, growing branch ends, cut from woody plants during the current growing season while plants are in leaf. Softwood cuttings are collected in late spring and early summer.

Sucker division - Sprouts from a parent plant that grow from ground level. These can be cut and rooted for propagation.