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Reforestation Planning Guide: Helping Insure Reforestation Success for Woodland Owners

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Reforestation Planning Guide
Helping Insure Reforestation Success for Woodland Owners

by

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This planning guide was designed for use by small woodland owners in Oregon. It is patterned after a similar decision making guide developed for professional foresters. The guide consists of five parts:

- Part I. Introduction to Reforestation Planning
- Part II. Fundamentals of the Plan
- Part III. Reforestation Planning Worksheets: Instructions and Examples
- Part IV. Supplemental Information for Completing Worksheets
- Part V. Blank Worksheets with Instructions

The purpose of a planning guide, whether used by the professional forester or a small woodland owner, is to increase the probability of reforestation success. The potential for success, to a large degree, depends on planning far enough in advance to expose environmental or operational constraints to reforestation and then select methods to minimize their impact before a problem arises.

The planning guide helps organize the numerous facts that you must consider to establish a vigorous plantation of young trees. The task is complex because many points need to be addressed; however, if you take the time to learn how to use the planning guide your job will be simplified and your chances of success enhanced.

NOTE: YOUR PLANNING GUIDE CONSULTANT

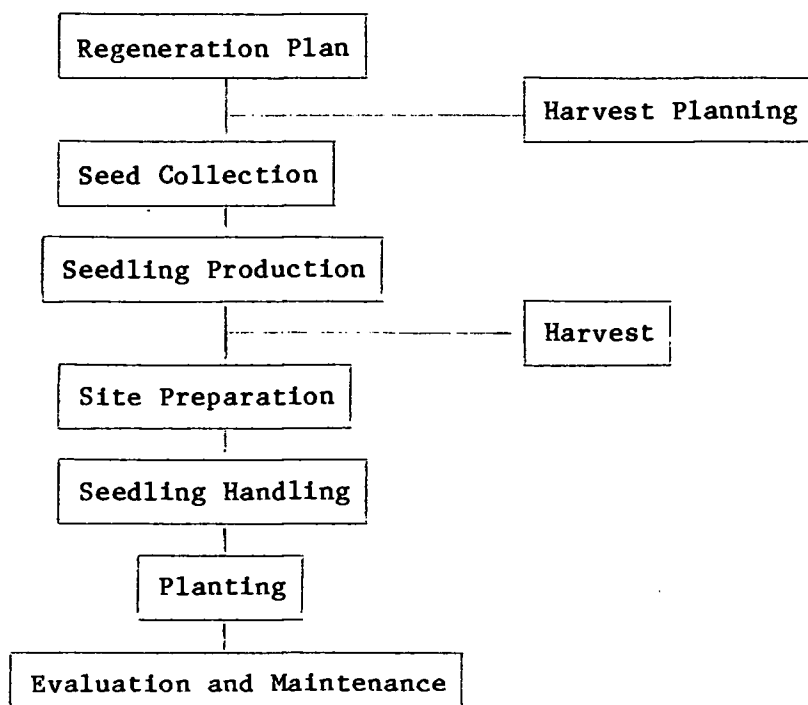
There is no need to pretend that successful reforestation in Oregon comes without work. This guide represents the initial effort you'll need to make if you intend to be successful. To help facilitate that effort it is our intent that you work closely with your local OSU Extension Forestry Agent to gain mastery in use of the planning guide. Your Agent may provide programs, tours and consultation in reforestation that help explain the importance and use of each Worksheet in the planning guide.

PART I: INTRODUCTION TO REFORESTATION PLANNING

Successful reforestation should be the most important objective of those who manage forest resources on a sustained yield basis. Yet the legacy of brush-covered or poorly stocked lands left after logging serves as a continual reminder that not all regeneration efforts have been fruitful. Today, increasing land and timber values stemming from a growing demand for wood products have emphasized the importance of raising trees. In order to meet this demand, reforestation can no longer be left to chance. Indeed, Oregon law now requires successful regeneration of all newly harvested areas within specific time limitations.

Many steps can be taken to enhance the likelihood of success in reforestation. Within the past few decades numerous developments have emerged which have taken the guesswork out of many of the components in the reforestation process (Figure 1).

Figure 1: Components of the Reforestation Process. The planning sequence depicts components of the reforestation process that need to be considered for proper management of each unit. The harvest component would be absent from your plan if the proposed unit lacked a standing tree crop. In addition, if you can purchase good quality seedlings that match the intended planting site directly from the nursery, then the seed collection step, although important to tree improvement, could be excluded. The remainder are essential to any reforestation operation.



However, giving one component emphasis without attention to the remainder can still lead to failure because all are linked together in a chain of events. The weakest link in the chain determines the degree of success for the project. Success can be maximized by constructing a regeneration plan which coordinates steps and specifies operations before any direct action (harvesting, site preparation or planting) is taken.

Planning for reforestation has several advantages over spur-of-the-moment decisions. The most important being that each step in the regeneration process is timed and coordinated with the rest. This avoids delays and reduces unforeseen complications. Since prompt regeneration of a site is often a critical factor in avoiding problems with competing vegetation, removing delays can often spell the difference between success and failure. Developing a regeneration plan before "acting" also provides one sufficient time to evaluate all the alternatives. Then, based on a detailed analysis of the tradeoffs, one can select the set of alternatives which improves the likelihood of success and satisfies personal objectives. Finally, a plan provides a written record of the reforestation history on the site. Use of these records as information sources for subsequent reforestation projects will prove valuable for continual refinement of the regeneration process which can help insure a greater number of successful plantations in the future.

PART II: FUNDAMENTALS OF THE PLAN

Before "on site" forest operations can proceed, you need to address the 5 basic questions that comprise the reforestation planning process.

I. WHAT ARE YOUR PRESENT OBJECTIVES?

A. Establish Your Objectives

Based on your financial goals, your life style and your feelings regarding management of forest land, list personal objectives and desires with which you and your family are comfortable.

II. WHAT IS THE REFORESTATION POTENTIAL OF YOUR PROPERTY?

A. Describe the Site

Evaluate the site based on measurement and/or observation.

B. Do You Need to Harvest Commercial Trees from the Site?

If your site contains harvestable timber evaluate and tentatively select a harvest system.

C. Determine Environmental Constraints

Prepare a site evaluation to estimate the severity of the site so that you can assess seedling environment as it relates to survival and growth. If timber harvesting is to occur then you must envision post-harvest conditions and determine potential environmental limitations to seedling establishment.

III. WHAT SITE PREPARATION METHODS WILL AID SEEDLING ESTABLISHMENT?

A. Target Vegetation

Survey vegetation on the site and rate each site preparation method on its ability to control competing vegetation.

B. Reforestation Constraints: Site and Operational

Evaluate all variables associated with preparing the site for planting and for establishing seedlings, then select the most desirable site preparation method.

IV. WHAT ARE YOUR FINAL OBJECTIVES?

A. Re-evaluate Your Original Objectives

Based on environmental and/or operational constraints inherent to the site, re-evaluate and modify your original objectives.

B. Set Final Objectives

Now that you have analyzed the site in terms of its reforestation potential, evaluated alternative harvesting and/or site preparation methods and carefully assessed your personal goals in managing your property, set well defined objectives to help prepare you for making reforestation decisions that will maximize your success.

V. WHAT MIXTURE OF REFORESTATION TREATMENTS WILL BE SUCCESSFUL?

A. Select a Harvest System and/or Site Preparation Alternative

Based on site conditions and personal objectives determine the best harvest system and/or site preparation method. Justify your selection and prescribe specific treatments.

- B. Select Proper Seedling Stock
Determine the manner by which you propose to acquire seedling stock. Select species and stock type characteristics which match the environment created after harvesting and/or site preparation.
- C. Prescribe Seedling Handling and Planting Operations
Provide for adequate (safe) transportation and storage facilities. Determine planting date, stocking level and planting method. Select concurrent seedling protection treatments.
- D. Plantation Evaluation and Maintenance
Select survey methods and consider potential follow-up treatments.

Answers to these questions are determined by following a sequence of steps (Part III: Reforestation Planning Worksheets - Instructions and Examples) in which the woodland owner evaluates the forest site, clarifies potential problems and then establishes a series of alternatives from which the "best" approach to successful reforestation can be selected based on personal objectives developed for the forest property (refer to page 9).

The first question forces you to establish specific objectives concerning management of the property (Question I: Part III, Worksheet 1). These objectives should be based on your financial status and future goals, your life style and your personal beliefs regarding manipulation of forest land. Once you have identified your objectives you will need to determine if what you want fits what you have. Unless you're very lucky you will probably have to play a "trade-off" game. For example, you may not want to use herbicides, but if the site you wish to reforest is situated on a grassy, southwest slope and supporting a large rodent population herbicide application may be the only alternative that can provide acceptable control of competitors. You may need to make adjustments in your original set of objectives. This will necessitate careful assessment of the reforestation potential of your property, which involves surveying the site you wish to reforest and describing its current status (Question II: Part III, Worksheet 2). If harvestable timber is present you will need to evaluate harvest alternatives and consider one that fits the site and your objectives (Question II: Part III, Worksheet 3). Based on current site status, or on its projected status after harvest, you then need to determine what environmental limitations to seedling establishment may exist (Question II: Part III, Worksheet 4). This involves an analysis of certain environmental factors; moisture, temperature, light and physical variables, which, under certain circumstances, could prove to be unfavorable to seedling establishment. Not heeding constraints can be fatal. Knowledge of your reforestation limitations, on the other hand, sets the stage for evaluation of site preparation methods which can minimize noted constraints and aid in seedling establishment. Evaluation of site preparation methods requires weighing each alternative in light of both site (environmental characteristics) and operational (mechanistics) limitations and determining the most effective means of minimizing potential reforestation problems (Question III: Part III, Worksheets 5, 6A and 6B). At this point, you may need to modify your harvest method (if required) so that the harvest system-site preparation combination blends to give you the best approach to

successful reforestation. Once this has been accomplished you should re-evaluate your original objectives and note any changes in your reforestation plan (Question IV: Part III, Worksheet 7A). Your final set of objectives will likely reflect a series of personal compromises made in an attempt to better manage what you have in light of what you hope to achieve (Question IV: Part III, Worksheet 7B).

The ground work for selecting the mix of reforestation treatments which will maximize your success has now been formed. The decisions you make concerning the harvesting and/or site preparation approach (Question V: Part III, Worksheet 8), the selection of seedling stock (Question V: Part III, Worksheet 9), the handling of seedlings prior to and during planting (Question V: Part III, Worksheet 10), and the evaluation and care of the new plantations (Question V: Part III, Worksheet 11) will determine the degree of success you can realize. Prudent decisions, enlisting the aid of your OSU Extension Forestry Agent when necessary, will be worth their weight in gold in the long run.

The prescription process presented herein outlines the basic sequence of steps needed to accomplish your reforestation goals. As familiarity with both the prescription process and a given management area is accumulated, "standard" regeneration prescriptions may be developed which meet the requirements of the common reforestation projects in that area. These prescriptions can be applied without going through the entire prescription process.

PART III: REFORESTATION PLANNING WORKSHEETS - INSTRUCTIONS AND EXAMPLES

The format for this section of the planning guide is a series of 11 worksheets which should be completed at least 2-3 years before harvesting and/or site preparation operations begin. As you proceed through this section you will learn how to complete the worksheets by following the instructions and the example that accompany each worksheet. Supplements, which are needed to assist you in completing some of the worksheets, are located in Part IV. The example used to show how worksheets might appear when completed follows the development of a reforestation plan for Bear Creek Unit, a fictitious stand with problems comparable to those faced by many woodland owners.

Reforestation Planning Guide Format

Question I - What Are Your Present Objectives?

Worksheet 1 - Establish Present Objectives

Question II - What is the Reforestation Potential of Your Property?

Worksheet 2 - Site Description

Worksheet 3 - Selection of Tentative Harvest System

Worksheet 4 - Limitations to Seedling Establishment

Question III - What Site Preparation Methods Will Aid Seedling Establishment?

Worksheet 5 - Control of Target Vegetation

Worksheet 6A - Site Preparation Alternatives: Determine Your Site and Operational Constraints

Worksheet 6B - Site Preparation Alternatives: Evaluate Impact of Site and Operational Constraints

Question IV - What Are Your Final Objectives?

Worksheet 7A - Re-evaluate Your Objectives

Worksheet 7B - Set Final Objectives

Question V - What Mixture of Reforestation Treatments will be Successful?

Worksheet 8 - Development of Harvest System and/or Site Preparation Plan

Worksheet 9 - Seedling Selection: Species and Stock Type

Worksheet 10 - Seedling Handling and Planting

Worksheet 11 - Plantation Evaluation and Maintenance

Question I

I. WHAT ARE YOUR PRESENT OBJECTIVES?

Financial

Life Style

Land Ethics

Other

Example Worksheet 1

Establish Present Objectives.*

Unit: Bear Creek - 47 acres, 20 miles SE of Portland, Oregon

Objectives	Comments
Financial	
Short Term	<i>To minimize my reforestation expenses. To recover a portion of my expenses through the sale of white oak firewood.</i>
Long Term	<i>To establish a mixed conifer forest ready for harvest in 47 years (pole market). Make a Christmas tree thinning at 8 years.</i>
Life Style	
Time Available	<i>Occasional weekends.</i>
Interests	<i>Hunting, recreating in the forest, fishing.</i>
Commitment	<i>Provide estate for my grandchildren.</i>
Permanency	<i>Long term. Property will be included in my estate.</i>
Land Ethic	
Aesthetics	<i>Want to develop and maintain a park-like atmosphere in the mixed conifer forest.</i>
Utilization	<i>No chemicals. Plant redwoods, sugar pines, Jeffrey pines and other species not normally found locally.</i>
Other	
<i>Neighbors property</i>	<i>Neighbor has a 10 acre fruit orchard which abutts the unit boundary. A very touchy individual.</i>
<i>Buffer strip</i>	<i>Consists of alder-cottonwood mix. I would like to incorporate some conifers.</i>

*Compare Worksheet 1 with Worksheet 7B on page 28, Establish Final Objectives to envision how your objectives might change in light of environmental or operational constraints identified on the unit you wish to reforest.

Directions for Worksheet 1 - Establish Present Objectives

Establishing personal objectives for units you wish to manage is an important step in reforestation planning. It brings to focus your inner feelings about manipulation of forest land before they create a "touchy" situation or an operational delay while you ponder a decision on an unforeseen event. For example, fishing Bear Creek has always been a fun family outing. After contracting firewood removal from the unit adjacent to the stream you realize the contract permits cutting to the stream's edge, which may drastically reduce the fish population, not to mention the area's aesthetic value. Prior coordination of these two variables, fishing pleasure and firewood removal, would have allowed you to establish a stream buffer strip, thus avoiding a possible contract dispute.

In Worksheet 1, indicate the unit identification and acreage. Then define your personal objectives, keeping in mind that some may require revision or deletion to ensure attainment of your ultimate goal--successful reforestation. A description of what is involved in developing your personal objectives follows:

Financial

Financial objectives are broken down into long and short term goals that you associate with forest ownership. Short term goals are usually concerned with minimizing expenses without sacrificing reforestation success. If the unit you wish to manage is harvestable then maximizing profit may be your goal. Long term goals, on the other hand, represent your anticipated financial desires as reflected by the manner in which you intend to manage the unit.

Life Style

Life style objectives focus on personal priorities. How much time are you willing to devote to managing your forest (time available)? What work, recreational or wildlife interest do you and your family have regarding the unit? How committed are you to proper management of your forest lands (commitment)? Finally, how long do you intend to retain and manage the property? Let's be realistic right from the beginning; any successful land management venture takes time, patience, money and work. You must consider your life style priorities to ensure you've got what it takes to do the job right!

Land Ethic

Land ethic objectives reflect your personal feelings regarding manipulation of forest land. This identifies the aesthetic appeal of forest land for you and your family and its influence on your approach to management.

Question II

II. WHAT IS THE REFORESTATION POTENTIAL OF YOUR PROPERTY?

- A. Site Description (Worksheet 2)
- B. Do You Need to Harvest Trees From the Site?
- C. Reforestation Constraints (Worksheet 3)

Site Description

Current Vegetation

Commercial Stock Trees			Competitors Trees-Shrubs-Grasses	
Species	% Stocking	Age	Species	% Cover
<i>Douglas-fir</i>	15	25	<i>White oak</i>	45
			<i>Himalaya black-</i>	30
			<i>berry</i>	90
			<i>Grass</i>	

Soil

Depth: ____ < 6 in ____ 6-12 in ____ 12-18 in X 18-24 in ____ > 24 in

Rock Content: ____ < 10% X 10-30% ____ 30-50% ____ > 50%

Texture: ____ Sand ____ Sandy Loam ____ Loam ____ Silt Loam X Clay Loam ____ Clay

Topography

Climate

Slope: 20%,
occasional 30-40%

Aspect: SW

Elevation: 400'

Precipitation

Rainfall: 35" (late summer droughts)

Snowfall: 6-12" (snowfalls transient)

Temperature

Average Annual: 45°F

Summer Extreme: mid 90's

Winter Extreme: 20°F

Animals

	<u>Present</u>	<u>Intensity (H, M, L)</u>
Deer	<u>✓</u>	<u>M</u>
Elk	<u>_____</u>	<u>_____</u>
Mountain beaver	<u>_____</u>	<u>_____</u>
Gopher	<u>_____</u>	<u>_____</u>
Mice/Vole	<u>✓</u>	<u>L</u>
Rabbit/Hare	<u>✓</u>	<u>L</u>

Summary

Major Problems: *Moisture availability → grass, southwest aspect and clay soils. Physical damage to seedlings → deer.*

Special Considerations:

Directions for Worksheet 2: Site Description

Current Vegetation

Survey the site to be managed and classify the individual plants present.

EXAMPLE: A grassy, southwest facing hill occupied by Douglas-fir, white oak, Himalaya blackberry and various grass types.

Commercial Stock			Competitors	
Trees			Trees-Shrubs-Grasses	
Species	% Stocking	Age	Species	% Cover
Douglas-fir	15	25	White oak	45
			Himalaya blackberry	30
			Grass	90

Note: If woodland owner objectives include commercial firewood production, white oak could be placed under "commercial stock."

Soil

Dig a soil pit to a depth of several feet. Using Supplement A, Part IV and your own judgement determine depth, rock content, texture and, if you wish, type of soil on the site to be managed.

EXAMPLE: Soil depth in the root zone is about 20 inches with a rock content between 10-30%. The texture appears to be a clay loam since dry clods are not easily broken and when moist, thin, fragile ribbons can be formed by squeezing between the fingers.

Topography

As you survey Bear Creek Unit note, from several locations within the unit, the general slope and aspect. Also indicate situations which may vary significantly from the norm, such as flat benches or steep ravines that exist within the unit.

EXAMPLE: You determine the slope of your property to be about 20% with a few places between 30-40% (flat ground = 0%, maximum cat operation = 35-40%, a steep staircase = 70-80%, a verticle wall = 100%). The slope faces to the southwest. The elevation is 400 feet.

Climate

According to your neighbors rain/snow gauge and information obtained from your Extension Forestry Agent you determine average annual rainfall in the

vicinity of Bear Creek to be 35 inches per year and snowfall to be between 6-12 inches. To enhance the informative value of precipitation data, you indicate timing of seasonal rainfall (i.e., summer droughts) and the duration of snowfall (transient). Temperature information you found through meteorological records at the local library. This confirmed estimates you arrived at from your residence in the area for several years.

Animals

During your unit survey you notice visual signs indicative of deer and mice. The browse damage to lower branches of Douglas-fir and small white oak trees plus sporadic pellet piles suggests moderate deer intensity. Although the amount and density of grass is high you observe only a few scattered mice runways and thus designate the mice population to be low. Several scattered blackberry mounds suggest the possibility of rabbits even though you have not observed any signs. Just to be safe you indicate low rabbit intensity.

Summary

This space is set aside for you to determine what you feel may be potential problems to reforestation on the site. Major problems might include heavy brush cover, steep southwest facing slope, high clay content in soil or large deer populations. Special considerations refer to circumstances unique to the site which may have an adverse affect on reforestation or to special use of the site for purposes other than timber production, i.e., recreation, seed orchard, field nursery, etc.

DO YOU NEED TO HARVEST COMMERCIAL TREES FROM THE SITE?

Yes _____ No _____

If "No," proceed as indicated:

- a. Determine limitations to seedling establishment (Question II, Worksheet 4).
- b. Evaluate site preparation alternatives to determine how you can minimize suspected limitations to seedling establishment (Question III, Worksheets 5, 6A and 6B).
- c. Set your final reforestation objectives (Question IV, Worksheets 7A and 7B).
- d. Determine the mix of reforestation treatments that will maximize your success (Question V, Worksheets 8-11).

If "Yes," proceed as indicated:

- a. Evaluate harvest system alternatives and "tentatively" select the harvest system you wish to employ (clearcut, shelterwood, selection, seed tree or some variation → see Supplement B, Part IV, → see Worksheet 3).
- *b. Based on site conditions likely to exist after the chosen harvest system has been implemented, determine limitations to seedling establishment (Question II, Worksheet 4).
- c. Evaluate site preparation alternatives on the basis of how they will complement operational implementation of the desired harvest method. Your goal here is creation of post-harvest site conditions in which suspected limitations to seedling establishment have been minimized (Question III, Worksheets 5, 6A and 6B).
- d. Set your final reforestation objectives (Question IV, Worksheets 7A and 7B).
- e. Determine the mix of reforestation treatments that will maximize your success (Question V, Worksheets 8-11).

*To reduce cost in your regeneration effort harvesting and site preparation operations should be coordinated. Your "final" selection of a harvest system and a compatible site preparation alternative (Question V) should minimize environmental and operational constraints to reforestation (Question III) and be cost efficient. Selecting the best treatment combination may be straightforward or may require an innovative approach. Regardless, the final decision necessitates careful consideration of all variables (your objectives, the site, environmental constraints, operational constraints, etc.) and should not be made in haste.

Example Worksheet 3

Selection of "Tentative" Harvest System

Alternatives Considered	Evaluation
<i>Clearcut entire unit</i>	<i>The stand consists of white oak and sporadically placed Douglas-fir of poor quality. The Douglas-fir is not considered of commercial value, therefore one entry is preferred for this "reclamation" unit. Useable logs and debris will be hauled to designated roadside sites for firewood cutting, splitting and loading. Although the site is SW and grassy, it is not too severe for Douglas-fir establishment if competition is removed.</i>
<i>Shelterwood</i>	<i>Douglas-fir advanced regeneration is not abundant or healthy enough to use oak as a shelter crop without substantial underplanting. Method creates problems in scavenging oak for firewood by reducing accessibility and increasing potential for damage to residuals and new regeneration. It is more aesthetically pleasing, but less appealing in terms of maintaining site productivity (soil compaction, erosion, nutrient loss, etc.) and minimizing cost. The site is not really harsh enough to justify shelter crop to assist in Douglas-fir establishment.</i>

Directions for Worksheet 3: Tentative Harvest System Selection

Since the unit you wish to manage contains a stand of timber, you are faced with the decision of how to manipulate the stand in a matter that will be both biologically and economically desirable. The problem of establishing a reforestation plan requires that you have some idea of post-harvest site conditions on the unit. Therefore, you need to select a tentative harvesting system so that you can envision the site as it will be after treatment. Then you can more efficiently approach the problem of minimizing site and operational constraints through selection of concurrent site preparation method that best fits your harvest plan. Your selection will be based on your personal objectives and the characteristics of the site. Your decision may or may not be modified or changed as you proceed in defining more clearly the site and operational constraints of the unit and the options for concurrent site preparation (Worksheets 4-6B).

Worksheet 3 requires a basic knowledge of the harvest system alternatives available to you. Supplement B, Part IV provides a brief description of the 4 major approaches and the advantages and disadvantages of each. This brief assessment of harvest methods is provided to assist you in making a decision, not to teach you about the harvesting methods. If you are not familiar with all the harvesting options available for use on your property contact your local Extension Forestry Agent.

Example Worksheet 4

Limitations to Seedling Establishment

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MOISTURE	H	M	L	TEMPERATURE	H	M	L	LIGHT	H	M	L	PHYSICAL	H	M	L
Growing Season Precipitation		X		Growing Season Temperature			X	Vegetation Cover			X	Falling Debris			X
Soil Capacity		X		Lack of Shade	X			Standing Debris			X	Insect or Disease			X
Vegetation	X			Air Drainage			X	Aspect			X	Forest <u>Deer</u> Animals	X		
Slope			X	Aspect	X			Slash			X	Snow/Ice			X
Other				Other <i>Soil surface or subsurface</i>		X		Other				Other			

H = Limitations to seedling development by the designated environmental factor will be high.

M = Limitations to seedling development will be moderate.

L = Limitations to seedling development will be of little consequence.

Note: Although each environmental factor is being evaluated individually as a limiting factor for establishment; in the final analysis, interaction of all factors must be considered to accurately define limitations of the Site to seedling development!

Major Problems-Summary:

The factors of concern include: vegetative competition (decreased water and nutrient availability), radiation exposure (seedling dehydration and/or heat damage) and animal damage (terminal browsing by deer). The unit will present a definite regeneration problem if steps are not taken to minimize the impact of these factors on seedling establishment.

Directions for Worksheet 4: Limitations to Seedling Establishment

Once you have described the site, Worksheet 4 will assist you in determining its potential for seedling establishment. Based on the rating system H, M, L (defined below Worksheet 4) and your knowledge of the site complete Worksheet 4.

Example:

1. Moisture - You place an X under H for vegetation because you wish to plant an area that is covered with grass (90%), and Himalaya blackberry (30%). These competitors if not removed will severely limit moisture availability to seedlings. Although you feel there are no moisture limitations to seedling establishment resulting from slope (L), the character of the soil and the occurrence of late summer droughts suggest to you the potential for injury inducing moisture stress between mid-July to mid-October.
2. Temperature - You place an X under H for both aspect and lack of shade because the site is a southwest facing slope and the competitors (primarily grass) do not provide beneficial shade to seedlings. Because of the southerly exposure and the slope angle you feel that too much light could create damaging surface/sub-surface temperatures at the seedling-soil interface, therefore you place an X under moderate (if this site were in southern Oregon the X would go under high). Although there is nothing you can do about aspect, you can provide artificial shade for seedlings. The absence of topographic depressions or physical barriers permitting cold air accumulation (frost pockets) and the moderate winter climate of the area are not, in your opinion, limiting to seedling establishment. Therefore, you place X's under L for air drainage and growing season temperature.
3. Light - You must place X's under L for all categories since in no instance do these factors limit the amount of incoming light the seedling can receive.
4. Physical - You place an X under H for "Forest Animals" which you specify as deer browse. Although the situation is not presently serious, creation of an open feeding habitat plus the proximity of an orchard and stream suggest a high damage potential. The remaining physical constraints to seedling establishment are not a problem (L).

After you have completed Worksheet 4, summarize what you believe to be the major limitations to seedling establishment.

Question III.

III. WHAT SITE PREPARATION ALTERNATIVES WILL AID SEEDLING ESTABLISHMENT?

- A. Target Vegetation (Worksheet 5)
- B. Determine Site and Operational Constraints (Worksheet 6A)
- C. Evaluate Impact of Site and Operational Constraints (Worksheet 6B)

Example Worksheet 5

Eliminating Target Vegetation*

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Target Species	Rated Effectiveness in Controlling Target Vegetation					
	Scarification	Crushing	Slashing	Slash	Spray/Burn Slash	Chemical Application
<i>Annual Grass</i>	4-B	1-A	2-A	1-A	4-C	4-C
<i>Perennial Grass</i>	4-C	1-A	2-B	1-A	4-D	4-D
<i>Blackberry</i>	2-C	1-B	1-A	1-A	4-D	3-D

Rank site preparation alternatives for effective control of target vegetation.

1. Spray & Burn
2. Chemical
3. Tractor Scarification

*Target vegetation refers to the vegetation you want to control or eliminate.

Directions for Worksheet 5: Eliminating Target Vegetation

The purpose of Worksheet 5 is to evaluate site preparation alternatives in terms of their effectiveness in minimizing or eliminating vegetation likely to compete with seedlings for light, moisture, nutrients and other factors necessary for survival and growth. Supplement C, Part IV, is designed to help you accomplish this task. Supplement D, Part IV provides a guide for selection of the appropriate herbicide if chemical application is a component of or the basis for the site preparation alternative you select.

First list the target species, then refer to Supplement C, Part IV to determine the effectiveness of each site preparation alternative in controlling a specific target species. Numerical and letter components of the rating are defined at the bottom of Supplement C, Part IV.

Example: Effectiveness of site preparation alternatives in controlling competing vegetation (Supplement C, Part IV).

Target Species	Tractor Scarification	Tractor Crushing	Hand Slashing	Burn Slash	Spray/Burn Slash	Chemical Application
Annual grass	4-B	1-A	2-A	1-A	4-C	4-C
Perennial grass	4-C	1-A	2-B	1-A	4-D	4-D
Blackberry	2-C	1-B	1-A	1-A	4-D	3-D

It is apparent, for the vegetative competitors in question, that either spray and burn, chemical application or scarification will provide adequate control on this site. (Note: If the site were an old well established brushfield it might be necessary to couple two or more methods of site preparation together to insure obtaining enough plantable sites.)

Chemicals (Supplement D, Part IV)

Annual Grass - Amitrole in summer
 Perennial Grass - Amitrole in summer
 Blackberry - Roundup (Glyphosate) in fall

Now you are ready to give a tentative ranking to site preparation alternatives which are likely to give you satisfactory results with respect to vegetation control. (1) Spray and burn slash (if present), (2) chemical application and (3) tractor scarification. Actual selection will depend on how site and operational constraints influence both the biological and economic feasibility of the alternatives or some combination of the alternatives.

Example Worksheet 6A

Site Preparation Alternatives: Determine Your Site and Operational Constraints

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Mechanical	✓	Manual	✓	Fire	✓	Chemical	✓
Cost		Cost		Cost		Cost	
Legal Liability		Legal Liability		Legal Liability	✓	Legal Liability	
Risk		Risk		Risk		Risk	
Vegetation Recovery	✓	Vegetation Recovery		Vegetation Recovery		Vegetation Recovery	
Steep Slope		Steep Slope		Steep Slope		Steep Slope	
Soil Compaction	✓	Soil Compaction		Soil Compaction		Soil Compaction	
Slash Created		Slash Created		Slash Created		Slash Created	
Slash Untreated		Slash Untreated		Slash Untreated		Slash Untreated	
Labor		Labor		Labor		Labor	
Erosion	✓	Erosion		Erosion	✓	Erosion	✓
Fuel Condition		Fuel Condition		Fuel Condition		Fuel Condition	
Smoke Management		Smoke Management		Smoke Management		Smoke Management	
Wildlife		Wildlife		Wildlife		Wildlife	
Watersheds	✓	Watersheds		Watersheds	✓	Watersheds	✓
Plantability		Plantability		Plantability		Plantability	

Alternatives Considered: Mechanical, Fire and Chemical

Directions for Worksheet 6A - Constraints: Site and Operational

Worksheet 6A requires simply that you place a check (✓) beside those factors which you consider to be restrictive to implementation of a particular type of site preparation alternative. Your reason for designating a particular factor a constraint could have biological, personal, economic or legal foundations. The point is, since you see it as a constraint, it becomes a major consideration in the decision making process for selection of an appropriate site preparation alternative. Supplement E to Worksheet 6A provides a guide for determining the relative degree to which a particular factor may be limiting.

6A Example: Designation of Site and Operational Constraints

<u>Alternatives</u>	<u>Constraints Checked</u>
Mechanical	Vegetation Recovery Soil Compaction Erosion Watershed
Fire	Legal Liability Erosion Watershed Smoke Measurement
Chemical	Erosion Watershed

Note: Based on analysis of methods for control of target vegetation Worksheet 5, you have already eliminated manual slashing as a viable alternative for site preparation.

Proceed to Worksheet 6B: Evaluate the impact of site and operational constraints in terms of the potential for reforestation success and the feasibility of your present objectives.

Example Worksheet 6B

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Site Preparation Alternatives: Evaluate Impact of Site and Operational Constraints

Alternatives Considered	Evaluation
Mechanical	a. <u>Vegetative Recovery</u> - Seed and undisturbed roots of grasses will allow recovery and possible severe competition to small seedlings by mid to late summer. b. <u>Soil Compaction</u> - If soils are not dry or clay content is too high compaction could create unfavorable growth conditions for seedling roots. c. <u>Erosion</u> - High clay content, severe compaction or steep slopes could all lead to severe erosion problems. d. <u>Watershed</u> - Since there is a year-round stream below the site, erosion created by poor scarification could pose siltation problems detrimental to fish and recreational opportunities.
Fire	a. <u>Legal Liability</u> - The upper edge of the unit you wish to reforest abutts BLM second growth (40 years old) timber. Another edge abutts an orchard. Risk is too high to attempt burning. b. <u>Erosion</u> - Sediment erosion becomes enhanced by removal of vegetation cover. c. <u>Watershed</u> - Sediment pollution to year-round stream may prove detrimental to fish habitat and recreational opportunities. d. <u>Smoke Management</u> - Although not a major concern, smoke pollution may be an irritant to neighbors.
Chemical	a. <u>Erosion</u> - In this case erosion refers to increased runoff of precipitation, especially if clay content of the soil is high. b. <u>Watershed</u> - Due to the proximity of the stream you feel chemicals to be a potentially serious constraint, especially if a helicopter is employed for broadcast spraying.

Preferred Site Preparation Method: Chemical Application - Backpack Sprayer

Directions for Worksheet 6B: Evaluation of Site and Operational Constraints

Worksheet 6B serves to evaluate the problems which you checked in Worksheet 6A as being potential constraints to reforestation. An efficient method of evaluation involves the stepwise discussion of each proposed constraint that you checked for a given site preparation alternative. After you have addressed all the potential constraints pertaining to the use of a site preparation method on Bear Creek Unit you are ready to compare the alternatives and select the one that minimizes constraints and is compatible with your personal management objectives.

Decision: You have ranked 3 alternatives for site preparation: (1) spray and burn, (2) chemical and (3) tractor scarification. Since your site requires reclamation of a grassy southwest slope, the first alternative is not really applicable due to the absence of slash or large woody brush. In addition, the added constraints resulting from the combination of fire with chemical application cannot be justified because no significant gain in vegetation control can be realized. Consequently, you need consider only mechanical and chemical alternatives. Based on evaluation of site and operational constraints a feasible site preparation method, which will minimize constraints and allow for seedling establishment, appears to be chemical application. Since the area to be reforested is only 45 acres the use of a backpack sprayer and careful application will provide excellent brush control and minimize the impact on the nearby watershed. This is also an inexpensive alternative.

Question IV

IV. WHAT ARE YOUR FINAL OBJECTIVES?

Financial

Life Style

Land Ethics

Other

Example Worksheet 7A

Re-evaluate Your Objectives.

Objectives	Modifications		
	Yes	No	
Financial			
Short Term		X	
Long Term	X		<i>Due to insufficient manpower, time and funds, the Christmas tree thinning at 8 years will not be pursued.</i>
Life Style			
Time Available	X		<i>In addition to occasional weekends I understand it will be necessary to be free at critical periods to implement certain reforestation treatments.</i>
Interests		X	
Commitment	X		<i>Add: Ensure (1) reforestation after hardwood removal, (2) future reforestation after conifer cut. Coordinate vacations with reforestation operations.</i>
Permanency	X		<i>Add: Estate will specify that unit, if cut, must be reforested successfully by heirs prior to sale.</i>
Land Ethic			
Aesthetics	X		<i>A 100-200 foot buffer strip along Bear Creek will be maintained in park-like status through management of a hardwood-conifer mix.</i>
Utilization	X		<i>No aerial spraying of chemicals. Poor survival or growth of "offsite" species will necessitate planting Douglas-fir and/or grand fir.</i>
Other			
Neighbor Property Buffer Strip	X	X	<i>Plan to underplant buffer strip hardwoods with small amount of tolerant conifers, hemlock and cedars.</i>

Directions for Worksheet 7A and 7B - Setting Final Objectives

Recall that you have been making your decisions based on objectives set before being fully aware of all the ramifications of managing forest property. Now it is time to carefully re-evaluate your objectives (Worksheet 1) and determine if they are compatible with the approach to reforestation you intend to follow based on the site and its associated constraints.

Worksheet 7A identifies whether or not you believe modifications to your preliminary objectives are necessary and why. More than likely you have already diverged from your initial objectives due to unfamiliarity with forest management practices or, inadvertently, to minimize costs, ensure reforestation success and/or maximize stand vigor and value. Cautious divergence from original avenues of thought in response to new facts and ideas is a normal part of any decision making process and can be very helpful in leading you toward a "best" approach to your problem. The important thing is that you note any changes in your objectives and clarify why they were made before you try and set final objectives for the selection of reforestation treatments to maximize success.

Worksheet 7B identifies your final set of objectives and should be referred to as you consider each major reforestation decision in Question V*.

***Note:** Even though you will designate certain "final" objectives to guide you in selecting reforestation treatments, none of these decisions are set in concrete. There is always room for change. Remember a major reason for the plan is simply to discourage spur-of-the-moment decisions which have not been carefully evaluated and therefore pose a serious threat to your success.

Example Worksheet 7B

Set Final Objectives.

Objectives	Comments
Financial	
Short Term	<i>Minimize reforestation expenses. Recover a portion of expenses through sale of firewood (maple and cottonwood). Establish 100-200 foot no cut stream buffer zone.</i>
Long Term	<i>Establish mixed conifer forest outside stream buffer strip. Establish mixed hardwood-conifer "park-like" stream buffer strip. Rotation age - 45 years. Market - poles.</i>
Life Style	
Time Available	<i>Occasional weekends. When necessary to perform periodic reforestation treatments associated with plantation protection and maintenance.</i>
Interests	<i>Hunting, recreating in the forest, fishing.</i>
Commitment	<i>Provide estate for grandchildren. Ensure reforestation after hardwood removal. Ensure reforestation after mixed conifer harvest cut. Maintain healthy, vigorous stand conditions.</i>
Permanency	<i>Long term. Estate to heirs will specify that if the unit is cut, area must be reforested successfully prior to sale.</i>
Land Ethic	
Aesthetics	<i>Will develop and maintain a park-like atmosphere in stream buffer strip. Will minimize competition to seedlings to ensure rapid conifer cover of the unit.</i>
Utilization	<i>No <u>aerial spraying</u> of chemicals. Unit planting - Douglas-fir/grand fir. Stream buffer strip - cottonwood, alder, hemlock and western cedar. No motorized vehicles allowed.</i>
Other	
Neighbor property	<i>Will avoid any treatment that might harm neighbors fruit trees.</i>

Directions for Worksheet 7A and 7B - Setting Final Objectives

Recall that you have been making your decisions based on objectives set before being fully aware of all the ramifications of managing forest property. Now it is time to carefully re-evaluate your objectives (Worksheet 1) and determine if they are compatible with the approach to reforestation you intend to follow based on the site and its associated constraints.

Worksheet 7A identifies whether or not you believe modifications to your preliminary objectives are necessary and why. More than likely you have already diverged from your initial objectives due to unfamiliarity with forest management practices or, inadvertently, to minimize costs, ensure reforestation success and/or maximize stand vigor and value. Cautious divergence from original avenues of thought in response to new facts and ideas is a normal part of any decision making process and can be very helpful in leading you toward a "best" approach to your problem. The important thing is that you note any changes in your objectives and clarify why they were made before you try and set final objectives for the selection of reforestation treatments to maximize success.

Worksheet 7B identifies your final set of objectives and should be referred to as you consider each major reforestation decision in Question V*.

***Note:** Even though you will designate certain "final" objectives to guide you in selecting reforestation treatments, none of these decisions are set in concrete. There is always room for change. Remember a major reason for the plan is simply to discourage spur-of-the-moment decisions which have not been carefully evaluated and therefore pose a serious threat to your success.

Question V

V. WHAT MIXTURE OF REFORESTATION TREATMENTS WILL BE SUCCESSFUL?

- A. Best Harvest System and/or Site Preparation Alternative (Worksheet 8)**
- B. Stock Selection (Worksheet 9)**
- C. Seedling Handling and Planting (Worksheet 10)**
- D. Plantation Maintenance Operations (Worksheet 11)**

Example Worksheet 8

Development of Harvest System and/or Site Preparation Plan

Harvest System (if commercial harvest or reclamation is to be performed)

1. Alternative Selected: *Clearcut (reclamation of oak-grass hill side).*
2. Justification: (a) *Desire a Douglas-fir stand in 45-55 years as a financial aid to my grandchildren and their children.* (b) *Douglas-fir site*. Planting to Douglas-fir is consistent with regional habitat and has a high probability of success in the open, provided competing vegetation is controlled.* (c) *Financial status necessitates that capital be made available to cover reforestation costs. This will be accomplished by sale of oak firewood, which will also clear the site for planting.*
3. Treatment Time Table: (a) 1983 - 6/1 to 9/1: *Harvest all timber (white oak, 45% cover and Douglas-fir, 15% cover). Haul logs and debris (4" diameter and greater) to points along tractor roads. Use designated skid trails to minimize soil compaction and erosion.*

Site Preparation

1. Alternative Selected: *Chemical (mechanical)*
2. Justification: Mechanical: (a) *Construct 5 cat roads for access.* (b) *Tractor haul logs and debris to designated spots along cat road. This will avoid excessive and uncontrolled traffic on the unit during cutting operations (avoid compaction problems).*
Chemical: (a) *Grass, a habitat for mice and competitor for water and nutrients, is best controlled by herbicides.* (b) *Blackberry is readily controlled by herbicide.* (c) *Chemical control is least expensive.*
3. Treatment Time Table: (a) 1983 - 6/1 to 9/1: *Harvest and haul operations.* (b) 8/1 to 10/1: *Firewood cutting.* (c) 10/1 to 11/1: *Roundup application to blackberry.* (d) 1984 - 1/1 to 2/15: *Planting.* (e) 3/15 to 4/15: *Atrazine application to grass.*

*Recognition of the site as a Douglas-fir habitat is accomplished by identifying components of the vegetative community (trees, shrubs and herbs) occupying the area in general. Even though this site is occupied primarily by white oak and grass, the successional trend is to Douglas-fir. Inspection of the surrounding forests verify this.

Directions for Worksheet 8

Development of Harvest System and/or Site Preparation Plan

Now that you have established your final set of objectives for manipulating the unit you wish to reforest, you should be ready to make specific reforestation decisions. These will be based on your evaluation of constraints associated with each treatment alternative. Selecting an alternative is only the first step. You must be able to justify your decision by defining those factors, economic, environmental or operational, that were instrumental in guiding you to your decision. Your justification statements will reflect previously determined reforestation constraints (Worksheets 2, 3, 4, 5 and 6A). Once you have justified the harvest and/or site preparation methods you wish to employ you must establish a strict time table for their implementation. This might be a good time to solicit the assistance of your Extension Forestry Agent. He can help you avoid costly errors in judgement or scheduling that could reduce your potential for success.

The example, which is based on the Bear Creek Unit, includes that portion of the unit outside the stream buffer zone. A separate plan should be developed for the buffer zone. The site description and evaluation of constraints for the Bear Creek Unit outside the buffer zone follow examples for Worksheets 2, 3, 4, 5 and 6A.

Worksheet 9

Seedling Selection: Species and Stock Type

Seed Source and Elevation: 261 0-500 or 500-1000

Species Selected and Percent Mix (if applicable):

	<u>Species</u>	<u>% Mix</u>
1.	Douglas-fir	100
2.		
3.		

Alternatives for Seedling Acquisition:

1. Direct purchase from nursery: No
2. Contact with nursery to meet specific needs: If necessary.
3. Tree Improvement Cooperative: Yes. Cooperative exists for seed collection, processing and certification. Nursery will grow improved seed to my specifications.
4. Wildings: Yes. To fill in holes arising from mortality. Source will be immediate vicinity of the unit.

Specify Species and Stock Characteristics:

Species	Type	Height	Diameter	Shoot/Root Ratio
Douglas-fir	B	35 cm	7 mm	1.5

Specific Standards for Nurseryman:

1. Bed Density ≤ 25/sq ft or Container Size _____
2. Lifting Date January 15
3. Culling Specifications Refuse to accept any seedlings not meeting standards.
4. Root Pruning To 10 inches
5. Storage Specifications (if necessary) Cold - at 33-35°F internal bag temperature till pick up.

Directions for Worksheet 9. Seedling Selection - Species and Stock Type

Worksheet 9 helps the forest manager plan a reforestation strategy far in advance so as to insure the acquisition of planting stock that will satisfy reforestation objectives. Obtaining the desired species and seed source of seedlings necessitates prior contact with the nurseryman to guarantee availability of the requested stock at the specified time. Delays can, and frequently do, lead to reduced survival.

Completion of Worksheet 9:

1. You need to know the seed zone and approximate elevation of the site. For example, Clackamas County occupies a portion of 3 different seed zones, 261, 451 and 452, covering an elevation range of 200 to 6,000 feet. Refer to Oregon Seed Zone Map (Supplement F, Part IV).
2. Appendix F will guide you in selecting the species best suited to the site you wish to plant. In most cases you will be planting a species common to the immediate area. For the Bear Creek example, particularly on a southwest aspect, the selection would likely be Douglas-fir.
3. There are several alternatives open to you for acquiring seedlings. The best alternative is to join or help form a Tree Improvement Cooperative. Collecting seed from your best trees, having it processed, tested and certified as Source Identified A or Select B is not difficult but must be accomplished 2-3 years prior to planting to allow time for the nursery to grow the seedlings to your specifications (refer to Woodland Workbook Fact Sheet on Certification of Tree Seed). If you are lucky you might be able to purchase Source Identified A or Select B seed in quantities sufficient for your needs from federal, state or private organizations that collected seed on sites similar to those you wish to plant and in the general vicinity of your property. The chance that you would be able to acquire seedlings of this caliber from the nursery in the fall prior to winter planting (January/February) is remote. However, if you prefer convenience and lower cost and are willing to assume an increased risk of re-entry and reduced long term growth you can purchase Audit Class seedlings directly from the nursery. Although this is the route that has been taken by most woodland owners in the past it provides no assurance that the seedlings you'll be receiving will be suited to the site you wish to regenerate. Wildings (seedlings growing near the planting site) are useful as transplants to fill in holes from previous planting losses or to plant small openings (less than 1/2 acre).

*Certification of Tree Seed. OSU Extension Fact Sheet for the Woodland Workbook.

4. If you elect to plan 2-3 years in advance to insure acquisition of the best seedlings possible (tree improvement program or contract negotiations with the nursery) you will have the opportunity to specify seedling characteristics that you desire in a seedling. This option will enhance your chances for successful reforestation.
5. Since you elected to join in on the Tree Improvement Cooperative, you and your neighbors will be collecting cones from your best trees*, pooling seed from compatible sites, receiving certification and then contracting with the nurseryman to grow seedlings to your specifications. The information listed in Example Worksheet 9 for Douglas-fir seedlings represents a good basic standard to shoot for on many, but not all, low elevation, valley margin sites.

*Selecting your best tree(s) may take some "scouting" time. Consult your Extension Forestry Agent for advice. The actual process of cone collection and preparing cones for drying will only take a day or two.

Example Worksheet 10

Seedling Handling and Planting

Operational Specifications:

1. Pick up date January 17
2. Transport of Seedlings Pickup covered with adequate radiation shield (not canvas), bed insulated, trip = 2 hours
3. Pre-plant Storage Facilities Store in local cooler, plant as soon as possible
4. Planting Specifications
 - a. Planting Date January 18-26 with 3 person crew
 - b. Site Storage Precautions Place in heavy shade by stream, cover with reflective/insulating blanket
 - c. Tool Type Planting shovel
 - d. Scalp Diameter Not apply
 - e. Trees/Acre 500 Spacing* 9 x 9 feet
 - f. Planting: Patterned X or Microsite _____ → Basic row pattern since vegetation will be controlled and debris removed
 - g. Seedling Protection During Planting Insulated planting bag - cover roots with moist moss or soil
 - h. Protective Measures at Planting Budcaps (Reemay) on all seedlings to avoid anticipated deer damage

*Spacing for desired number of trees/acre is presented in Supplement I, Part IV.

Directions for Worksheet 10: Seedling Handling and Planting

Worksheet 10 identifies factors that need to be considered before the seedlings are picked up from the nursery. If possible, pick up date should coincide with lifting and planting dates to attain the highest establishment potential for seedlings. The time between pick up and planting is critical, for many opportunities for seedling mistreatment exist. Therefore, it is important to know exactly what needs to be done at each step, so that "precautions" necessary to protect seedlings will be ready.

Explanation of Example Worksheet 10:

1. Pick up Date: January 17. Recall lifting date was January 15, therefore seedlings should be kept in cold storage at the nursery for at least 48 hours to reduce the potential for overheating during transport in non-refrigerated vehicles.
2. Transport of Seedlings: The objective during transportation is to prevent drying or overheating of seedlings. Therefore, seedling boxes or bags should be protected from environmental (solar radiation and wind) and vehicular (exhaust heat) heat sources during transport.
3. Pre-plant Storage Facilities: The intention is to plant immediately, keeping seedlings to be planted on succeeding days in a local cooler.
4. Planting Specifications:
 - a. Planting Date: January 18-26. Remove from the cooler only as many seedlings as can be planted each day.
 - b. Site Storage Precautions: The susceptibility of boxed or bagged seedlings to heat damage when exposed to solar radiation on a clear or overcast day is great. Precautions to protect seedlings from direct exposure to radiation will help minimize potential mortality.
 - c. Tool Type: Although seemingly unimportant, selecting your planting tool to match site conditions, specific climatic conditions for the day and seedling morphological characteristics can minimize your frustration and help maximize planting quality.
 - d. Scalp Diameter: If you have opted to prepare each planting microsite by scraping away debris or competing vegetation (grass or herbs) then you should designate the scalp diameter that you believe will be successful. If previous site preparation has provided you with a clean planting microsite, scalping may not be necessary.
 - e. Trees/Acre and Spacing: The number of seedlings you plant per acre and their corresponding spacing must be carefully evaluated and determined early on (preferably 2-3 years prior to planting) to allow sufficient time for your nurseryman to meet designated specifications. Several important economic and biological factors must be considered, if you wish to avoid reduced plantation growth and monetary setbacks. Your Extension Forestry Agent can be contacted for advice.
 - f. Patterned vs. Microsite Planting: In the past most planting was done in rows, either following a contour or moving upslope, with little regard for selecting a "favorable microsite" in which to plant the seedling. There is nothing wrong with this approach as long as site conditions are favorable. However, on sites where seedlings are likely to encounter stress resulting from climatic extremes, soil conditions and/or animal pressure then an attempt should be made to "break" the pattern in order to place the seedling where its chance for survival is enhanced (behind a log or rock away from competing vegetation, downhill side of a stump, etc.).
 - g. Seedling Protection During Planting: Keeping seedling roots moist and cool between the time that they are removed from the packing bag and planted is critical. This is best achieved by placing damp moss around the roots in an insulated planting bag or by water dripping (1 minute) or jelly rolling seedlings prior to placement in planting bags. Do not permit water to "puddle" around the roots in the bag, allow for drainage. Do not be greedy in the number of seedlings you place in your planting bag, for this increases the time that exposed seedlings are subjected to conditions capable of causing stress and reducing seedling vigor.
 - h. Protective Measures at Planting: The decision to use protective seedling devices is a function of their cost versus that of anticipated mortality or growth loss if preventative methods are not employed. If you are more accurate by using physical or chemical treatments to protect against "anticipated" damage then, by all means, do so. If you are a little low on reforestation funds and a bit of a gambler wait and apply the appropriate treatment after periodic field surveys indicate the occurrence of damage. But be warned, if the site is moderately harsh and/or seedling vigor is questionable, the downfall you may receive from deer browse will ultimately cost you more because of re-entry for interplanting and protection.

Example Worksheet 11

Plantation Evaluation and Maintenance

Evaluation of Planting SuccessA. Alternative Methods (check preference as per your objectives)¹

1. _____ Plot count method
2. X Stocked quadrant method
3. _____ Distance method
4. _____ Other: specify _____

B. Survey Frequency (growing seasons after planting)

First X
 Second X
 Third _____
 Fourth X
 Fifth _____

Post 5 year checks? Yes. Even years to age 10, then
every 5 years. Non-data collec-
tion surveys unless considered
necessary by visual surveys.

Maintenance of the Plantation²

A. Anticipated Vegetation Treatments

1. Chemical release Backpack chemical treatment as needed
2. Manual release _____
3. Other (controlled burn, grazing, etc.) _____

B. Anticipated Animal Control Treatments

1. Chemical repellents _____
2. Physical barriers Maintenance of budcaps, reapply if necessary
3. Baiting _____
4. Trapping _____
5. Hunting Recreational - by permission only!

¹Refer to: Regenerating Oregon's Forests pages 205-222 and 243-276, or your Extension Forestry Agent.

²Insect or disease problems are very important, but their control can be complicated. Therefore, if you suspect infestation contact your Extension Agent for advice.

Directions for Worksheet 11: Planting Evaluation and Maintenance

After the seedlings are planted the job of plantation maintenance and evaluation begins. The plantation should be followed closely during the first few years so that potential problems can be detected before they become serious. This evaluation necessitates the use of survey techniques which point out immediate or potential problems that exist in the plantation as determined by random observations made throughout the plantation. Several methods are listed in Worksheet 11. Have your Extension Forestry Agent assist you in developing a survey scheme if you have not been exposed to survey techniques in woodland owner workshops.

Maintenance of the plantation is frequently the result of problem detection during the survey. Maintenance normally involves post-planting treatments aimed at correcting anticipated or unforeseen problems with competing vegetation, animal damage or other environmental factors that enhance the risk of seedling mortality.

Example:

1. A visit to the plantation early in the second growing season reveals that the grasses have recovered more rapidly than anticipated and are becoming a deturrent to seedling vigor. Early detection has provided you the option of an immediate spring spray with atrazine, or with amitrole in early summer, to reduce competition and maximize seedling growth.
2. A survey at the end of the first growing season unveils several small pockets of missing seedlings. Closer examination reveals diagonal severing of seedling stems close to the ground and inconspicuous earth mounding near 4-5 inch diameter holes, some of which exhibit sword fern and clipped seedlings lying neatly along side. Detection of this mountain beaver community has allowed you the option of aggressively trapping the area to stop what could lead to plantation failure.

Note: Supplement I, Part IV is a copy of an actual field stocking survey form used to record your findings and recommendations.

Part IV: Supplement Information for Completing Worksheets

The worksheet supplements provided in this section will be useful in aiding your completion of certain worksheets in the Reforestation Planning Guide. The information in each supplement represents the compilation and organization of facts that will help you make a more accurate decision among a given set of reforestation treatment alternatives, with a reduced risk of neglecting alternatives available to you.

Guidelines for using worksheet supplements are described in the directions and illustrated in the examples of the planning guide. If you need assistance consult the Forestry Extension Agent in your county.

Worksheet Supplements:

- A. Soil Texture Determination
- B. Review of Harvest System Alternatives
- C. Control of Target Vegetation
- D. Susceptibility of Western Forest Species to Aerially Applied Herbicides
- E. Guide for Determining "Relative" Limitations for Site Preparation Alternatives
- F. Oregon State Seed Map - It's Interpretation
- G. Tolerance of Some Major Conifers to Stress
- H. Range of Spacing and Stocking Densities
- I. Stocking Survey Form

Supplement A

Particle size-classes (mm)							
USDA	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.002	<0.002
	Very coarse sand	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
International	2-0.2		0.2-0.002		0.02-0.002		<0.002
	Coarse sand		Fine sand		Silt		Clay

Field determination of soil texture: distinguishing features

Texture class	Features
Sand	Loose and single-grained. Individual grains can be seen and felt. Squeezed in the hand when dry, it will fall apart when pressure is released. Squeezed when moist it will form a cast which will crumble when touched.
Sandy loam	Contains enough silt and clay to make it somewhat coherent. Sand grains are readily seen and felt. Squeezed when dry the cast will readily fall apart. Squeezed when moist the cast will bear careful handling without breaking.
Loam	Mellow, with a somewhat gritty feel, yet fairly smooth and plastic when moist. Squeezed when dry, the cast will not break if handled carefully. When moist a cast can be handled freely without breaking.
Silt loam	When dry it may appear cloddy but the lumps are easily broken. When pulverized it feels soft and floury. When wet the soil puddles. Casts formed of either dry or moist soil can be readily handled without breaking. When moistened soil is squeezed between thumb and finger it will not "ribbon," but will form flat "pastry flakes."
Clay loam	When dry it forms hard lumps or clods. When moist it can be squeezed to form a thin ribbon, which will break readily, barely sustaining its own weight. When moist the soil is plastic and will form a cast that will take much handling.
Clay	Forms very hard aggregates when dry. When wet it is plastic and sticky. Moist clay can be pinched out between thumb and finger to form a long flexible ribbon. Note that some clays are friable and lack plasticity in all moisture conditions.

Supplement B
Review of Harvest System Alternatives

Basically, we have four harvesting methods:

Clearcut
Shelterwood
Seed Tree
Selection

The first three are aimed at the establishment of even-aged stands (a stand is considered even-aged if the difference between the oldest and youngest tree does not exceed 20% of the length of the rotation). The selection method is aimed at establishment and maintenance of an uneven-aged stand. Various modifications of these basic methods have been developed with the intent to minimize some of the disadvantages associated with each of these methods.

1. Clearcut

The clearcut method requires harvesting an entire stand in a single cut. It can be applied to both even-aged and uneven-aged stands. Differences of opinion exist as to when logged areas are sufficiently large to be called clearcuts. The following arbitrary definitions of size have been suggested (1):

<u>Method</u>	<u>Size</u>
Continuous clearcutting	100 acres
Large patch clearcutting	10-50 acres
Small patch clearcutting	1-10 acres
Group selection clearcutting	Two trees to 1/4 acre
Selection	Single tree

Another definition of clearcutting is logging an area large enough, or shaped in such a fashion, that the ground is receiving full sun all the time.

Clearcutting has been, and still is, the predominant reproduction method in the Pacific Northwest. The remarkable success in establishing new crops by this procedure does not imply, however, that clearcutting meets a biological need for successful regeneration of Douglas-fir or any other commercial northwestern tree species. Although simple to describe, clearcutting is a very intensive method and requires a substantial amount of attention, work, and expense. Investments will not pay if not followed by appropriate stand maintenance.

Advantages to Clearcutting	Disadvantages to Clearcutting
a. Lowest harvesting cost per unit area	a. Destroys advanced reproduction
b. Few restrictions in use of logging	b. Favors invasion by light seeded pioneer species
c. Total erosion potential reduced due to fewer roads	c. Favors release of existing brush competitors
d. Damage to soil structure reduced by only one entry, i.e., harvest	d. Increases potential for animal damage by improving browse or cover habit
e. No logging damage to standing timber	e. Creates severe environment for seedling establishment
f. Facilitates control of certain sanitation problems	f. Potential fire hazard exists
g. Facilitates handling of logging residue and slash disposal	g. Combined with natural regeneration 1. High potential for delay of new plantation establishment 2. Seedling distribution, and hence stocking, sporadic 3. Limited species control
h. Combined with planting 1. Permits rapid establishment of new plantation 2. Permits control of species composition, both quality and quantity	

Supplement B (continued)

2. Shelterwood

The shelterwood method requires harvesting in several steps. Typically there are three steps to this method of harvesting.

Step 1, the preparatory cut

The main purpose is development of vigorous seed bearers by leaving the better dominant and codominant trees of the desired species. This step will not be necessary if systematic thinnings were made before the reproduction period.

Step 2, the seed cut

This cut further opens the stand to stimulate seed germination and assist in seedling establishment by providing sufficient light and favorable temperatures. Such a cut should coincide with a good seed crop year to take advantage of the improved regeneration conditions.

Step 3, the removal cut

That cut removes the residual overstory to release the established reproduction. The interval between seed and removal cut should not exceed 8 years. Old trees are very serious competitors for seedlings and seedlings can less easily withstand the rough treatment associated with removal of the overstory the older they become.

The shelterwood method is a feasible alternative to other harvest methods in most forests of the Pacific Northwest. The limited experience with the shelterwood method in the region indicates that it is far more suitable for the harvest of second-growth than old-growth stands. Its use should be restricted to situations where shelter is needed for establishment of regeneration. It is not recommended for average or high sites in the Douglas-fir region where stands are dense, shallow rooted and are not windfirm.

Advantages of Shelterwood	Disadvantages of Shelterwood
a. Minimizes creation of micro-climates too severe for plantation establishment	a. Several re-entries necessary before final harvest and regeneration accomplished
b. Guarantees local seed source	b. Limited availability of logging techniques and equipment which permit re-entry without damage
c. Allows genetic improvement by selection of leave trees	c. Need for trained personnel and supervision enhanced
d. Species selection accomplished by selection of harvest trees and severity of seed cut	d. Alternatives for fuel hazard treatment are limited and costly
e. Natural regeneration reduces problems associated with high elevation planting	e. Preparation of seedbed more difficult
f. Minimizes animal damage problems	f. Risk of blowdown
g. Underplanting option allows species selection and ensures regeneration success	g. Higher the site the greater the potential for brush invasion and regeneration delay
h. Fire hazard reduced by slower fuel drying rate	

3. Selection

The single-tree selection method prescribes harvest of scattered individual trees of rotation age. This makes logging both difficult and expensive. Openings created often are so small that only the most shade-tolerant species can be maintained.

Group selection is a modification that makes the selection method more widely adaptable. The method is suited for application in the ponderosa pine forests east of the crest of the Cascades but is not a guarantee for obtaining natural regeneration.

Advantages of Selection	Disadvantages of Selection
a. Provides excellent site protection by minimizing environmental extremes which limit regeneration success	a. Requires highly skilled personnel
b. Disastrous fire less likely than in young even-aged stand	b. Costs are high due to frequent re-entries
c. Short interval capital returns	c. Potential for damage to the stand is high due to frequent re-entries
d. Aesthetically pleasing	d. Stand sanitation is a problem due to a higher incidence of damage
e. Reproduction of tolerant species readily obtained	e. Young age class intermediate cuts tend to be neglected disrupting age class distribution
	f. Inventory exams, and growth and yield are difficult and time consuming
	g. Conditions are unfavorable for establishment and growth of intolerant species

4. Seed-Tree

As a result of the Morris Act of 1902, the seed-tree method became the first reproduction method prescribed by law. Previous applications mostly failed because delayed seed crops permitted invasion by brush species. Consequently, the method has few merits because it has all the disadvantages of clearcutting and none of the advantages of shelterwoods.

The seed tree method involves leaving enough good seed producing trees scattered over an area to ensure adequate stocking in a predicted period of time. The number of seed trees needed in the area depends on: (1) number of seeds per tree, (2) dissemination distance, (3) survival expectancy of seed trees, (4) frequency of seed crop, (5) seeds per seedling ratios, (6) desired number of seedlings per acre, and (7) duration of seedbed receptivity and favorable growing site conditions. Determination of these criteria is very difficult, but critical to regeneration success. Obviously, special skills are required to make such determinations.

Advantages of Seed Tree	Disadvantages of Seed Tree
a. More uniform seed distribution than with naturally regenerated clearcut	a. Control of spacing and timing of new crop is difficult
b. Better species composition control than with naturally regenerated clearcut	b. Limited to wind firm species
c. No limitation on size of the cutting area as there is with naturally regenerated clearcuts	c. Recommended only for light seeded species
d. Aesthetically more pleasing than a clearcut	d. Rodents, seedbed conditions and growing conditions are hard to control
	e. Monetary losses occur if seed trees are not harvested and damage to reproduction occurs if they are harvested

Note: The current urgency for reforestation of harvested land and the "value" of seed has forced literally all foresters to plant to ensure short term success. The method has become obsolete.

Supplement C

Site Preparation - Characteristics of Alternatives for Western Oregon

	Tractor Scarification	Tractor Crush	Operation Hand Scalping/ Slashing	Slash Burning	Chemical	Spray and Burn
Annual Grasses	4-B	1-A	3-A	1-A	4-C	4-C
Perennial Grasses	4-C	1-A	2-B	1-A	4-D	4-D
Broadleaved Weeds	4-B	1-A	3-B	1-A	4-C	4-C
Alder	4-D	3-C	4-C ¹	2-C	3-D	4-E
Bigleaf Maple	3-E	2-C	1-A	1-A	3-D	4-E
Bitter Cherry	3-C	2-C	1-A ¹	1-A	4-E	4-E
Himalaya Blackberry	2-C	1-B	1-A	1-A	3-D	4-D
Bracken	3-B	1-B	1-A	2-A	4-D	4-E
Cascara	4-D	2-C	1-A	1-A	4-E	4-E
Elderberry	3-B	1-C	1-A	1-A	4-D	4-D
Hazel	3-D	1-C	1-B	1-B	4-D	4-E
Ocean Spray	3-C	1-C	1-B	1-B	4-D	4-E
Poison Oak	3-B	1-A	1-A	1-B	3-D	4-D
Snowberry	3-C	1-A	1-A	1-B	4-E	4-E
Salmonberry	2-C	1-B	1-A	1-A	4-D	4-D
Thimbleberry	2-B	1-A	1-A	1-A	4-D	4-E
Vine Maple	3-E	1-D	1-D	1-B	4-D	4-E
White Oak	3-E	3-D	1-D	1-B	4-E	4-E
Ceanothus Spp.	4-D	1-C	1-C	1-B	4-D	4-C
Chinkapin	4-E	2-C	1-C	1-A	4-C	4-D
Madrone	4-C	2-C	1-B	1-A	4-D	4-D
Manzanita	4-C	1-A	1-B	1-B	4-D	4-D
Rhododendron	4-D	1-A	4-B	3-A	2-D	4-D
Salal	3-C	1-A	1-B	1-B	2-D	3-D
Tanoak	4-E	2-B	1-B	1-A	4-E	4-E
Conifers	4-E	3-E	4-E	4-E	4-E	4-E

¹Recovery may be slower if cut in early summer.

Effectiveness on Vegetation

- 1 = Not effective (few plants killed).
- 2 = Slightly effective (some plants killed).
- 3 = Moderately effective (many plants killed).
- 4 = Effective (most plants killed).

Estimated Duration of Useful Effect

- A = Rapid recovery (1 mo.).
- B = Moderate recovery (3 mo.).
- C = Nominal recovery (6 mo.).
- D = Slow recovery (2 yrs.).
- E = Very slow (> 2 yrs.).

Supplement D

Using Herbicides for Controlling Vegetation

Forest Weed Control in the Coast Ranges of Oregon and Washington

HERBICIDE OR COMBINATION	SEASON	ALDER	BIGLEAF MAPLE	HIMALAYAN BLUEBERRY	GREEN BUCKLEBERRY	BOCKEN FERN	OSCEOLA	ELDERBERRY	HAZEL	SALAL	SALMONBERRY	SCOTCH BROOM	SWORD FERN	THIMBLEBERRY	VINE MAPLE	DOUGLAS-FIR	SITKA SPRUCE	WESTERN HEMLOCK
1 GLYPHOSATE	F																	
2 GLYPHOSATE	LS																	
3 2,4-D:O	W																	
4 2,4-D:W	SP																	
5 2,4-D:W	S																	
6 2,4,5T:O	SP																	
7 2,4,5T:W	S																	
8 2,4,D+2,4,5T:O	W																	
9 2,4,D+2,4,5T:W	SP																	
10 PICLOAM+2,4-D:W	SP																	
11 PICLOAM+2,4-D:W	S																	
12 PICLOAM+2,4-D:W	F																	
13 TRICLOPYR E:O or W+M	W																	
14 TRICLOPYR E:W	SP																	
15 TRICLOPYR E:W	LS																	
16 AMITROL:W	SP																	
17 AMITROL:W	S																	
18 FOSAMINE:W	F																	
19 DINOSEB:W	SP+ F																	

INJURY ~

90-100% HEAVY

60-90% INTERMEDIATE

25-60% MODERATE

<25% LOW OR NONE

+ <25% INJURY PRESENT
CONIFERS ONLY

□ INSUFFICIENT DATA

CARRIERS AND ADDITIVES ~

O: OIL CARRIER

W: WATER CARRIER

M: MORACT @ ADDED

SEASONS ~

W: WINTER (DORMANT)

SP: SPRING (LATE DORMANT TO EARLY FOLIAR)

S: SUMMER (FOLIAR-ACTIVE GROWTH)

LS: LATE SUMMER (AFTER CONIFER BUD SET)

F: FALL (SEPTEMBER & OCTOBER)

COMMENTS ~

V: VARIABLE INJURY

C: PERTINENT COMMENTS OR QUALIFICATION
BELOW

The Herbicide Use Tables were developed by Dr. Susan Conard for the Symposium "The Use of Herbicides in Forest Vegetation Management", Oregon State University, Corvallis, Oregon, 1982.

Grass and Herbaceous Weed Control in Oregon and Washington

HERBICIDE OR COMBINATION	SEASON	EVERGREEN BLACKBERRY	HIMALAYAN BLACKBERRY	TRAILING BLACKBERRY	POISON OAK	ANNUAL GRASSES	PERENNIAL GRASSES	POPLARS	DOUGLAS-FIR	GRAND FIR	POINTEA PINE	*SEEDS (KORYLX-500)	*BIRCH	*WHITE PINE	*NOBLE PINE	*SHASTA FIR	*ENGELMANN SPRUCE
1. ATRAZINE: W or M + W	W																
2. ATRAZINE: W	SP																
3. ATRAZINE: W	F																
4. ATRAZINE & SIMAZINE: W	W																
5. SIMAZINE: W	W																
6. ATRAZINE & DALAPON	W + SP																
7. DALAPON	SP																
8. HEXAZINONE	SP																
9. GLYPHOSATE	W																
10. GLYPHOSATE	SP																
11. GLYPHOSATE	S																
12. GLYPHOSATE	F																
13. 2,4-D: O or W	SP																
14. AMITROL: W	S																
15. PRONAMIDE: W	F																

CARRIERS AND ADDITIVES ~
O: OIL CARRIER
W: WATER CARRIER
M: MORACT (B) ADDED

SEASONS ~
W: WINTER (DORMANT)
SP: SPRING (LATE DORMANT TO EARLY FLOWER)
S: SUMMER (FOLIAR-ACTIVE GROWTH)
LS: LATE SUMMER (AFTER CONIFER BUD SET)
F: FALL (SEPTEMBER & OCTOBER)

COMMENTS ~
V: VARIABLE INJURY
C: PERTINENT COMMENTS OR CLARIFICATION BELOW

INJURY ~
 90-100% (SEVERE)
 60-90% (INTERMEDIATE)
 25-60% (MODERATE)
 <25% (LOW OR NONE)
 <25% INJURY PRESENT (CONIFERS ONLY)
 INSUFFICIENT DATA

* MOST DATA IN THESE COLUMNS ARE BASED ON HIGH VOLUME GROUND APPLICATIONS.

Spot and Individual Plant Treatment of Weed Trees in Oregon and Washington

HERBICIDE OR TREATMENT	SEASON	ALDER	BIGLEAF MAPLE	BLACK OAK	CANYON LIVE OAK	CHINQUAPIN	HAZEL	MADRONE	MANZANITA	POPLARS	TANOAK	VINE MAPLE	WILLOW	DOUGLAS-FIR	HENLOCK	RED CEDAR	POINTEA PINE
BASAL TREATMENTS:																	
1. 2,4,5T: 2-3%, O	ALL																
2. PICLORAM + 2,4,5T: 1% O	ALL																
3. TRICLOPYR E: 2-3%, O	ALL																
CUT SURFACE TREATMENTS:																	
4. 2,4-D AMINE	ALL																
5. PICLORAM + 2,4-D	ALL																
6. GLYPHOSATE	ALL																
7. MSMA	ALL																
8. PICLORAM	ALL																
9. TRICLOPYR A	SP + F																
CLUMP TREATMENTS:																	
10. 2,4-D P: O + W	W																
11. TRICLOPYR E	W																
12. TRICLOPYR E + 2,4-D P	W																
13. GLYPHOSATE	F																
14. AMITROL	S																

INJURY ~
 90-100% (SEVERE)
 60-90% (INTERMEDIATE)
 25-60% (MODERATE)
 <25% (LOW OR NONE)
 <25% INJURY PRESENT (CONIFERS ONLY)
 INSUFFICIENT DATA

CARRIERS AND ADDITIVES ~
O: OIL CARRIER
W: WATER CARRIER

SEASONS ~
W: WINTER (DORMANT)
SP: SPRING (LATE DORMANT TO EARLY FLOWER)
S: SUMMER (FOLIAR-ACTIVE GROWTH)
LS: LATE SUMMER (AFTER CONIFER BUD SET)
F: FALL (SEPTEMBER & OCTOBER)

COMMENTS ~
V: VARIABLE INJURY
C: PERTINENT COMMENTS OR CLARIFICATION BELOW

Forest Brush Control in Southwestern Oregon

HERBICIDE OR COMBINATION	SEASON	CHINQUAPIN	CANYON LIVE OAK	DEARBUSH CANOTUS	DELEAF MAPLE	MIROBEE	MANZANITA	MANZANITA-GREEN	OCEAN SPRAY	POISON OAK	RHODODENDRON	SALAL	SNOWBUSH CANOTUS	TRIOAK	VINE MAPLE	DOUGLAS-FIR	PONDEROSA PINE	GRAND FIR	INCENSE CEDAR
1. 2,4-D: O or O+W	SP														+				
2. 2,4-D: W	LS, F																		
3. 2,4-D: W	S																		
4. 2,4,5-T: O	SP																		
5. 2,4,5-T: W	S																		
6. 2,4-D + 2,4-DP: O	SP																		
7. TRICLOPYR E: O or M + W	SP														+				
8. TRICLOPYR E: W or M + W	LS														+				
9. TRICLOPYR E: W	LS																		
10. TRICLOPYR E: W	F														+				
11. PICLORAM + 2,4-D: W	F																		
12. PICLORAM + TRICLOPYR E	S																		
13. GLYPHOSATE: W	SP																		

CARRIERS AND ADDITIVES ~

O : OIL CARRIER
W : WATER CARRIER
M : MORACT @ ADDED

SEASONS ~

W : WINTER (DORMANT)
SP : SPRING (LATE DORMANT TO EARLY FOLIAR)
S : SUMMER (FOLIAR ACTIVE GROWTH)
LS : LATE SUMMER (AFTER CONIFER BUD SET)
F : FALL (SEPTEMBER + OCTOBER)

COMMENTS ~

V : VARIABLE INJURY
C : PERTINENT COMMENTS OR CLARIFICATION BELOW

INJURY ~

	90-100% (SEVERE)		<25% (LOW OR NONE)
	60-90% (INTERMEDIATE)		<25% INJURY PRESENT (CONIFERS ONLY)
	25-60% (MODERATE)		INSUFFICIENT DATA

Forest Brush Control in Northern Idaho and Northeast Oregon

HERBICIDE OR COMBINATION	MONTH	CHERRY	ELDERBERRY	MUCKLEBERRY	MOUNTAIN MAPLE	NINEBARK	OCEAN SPRAY	RED STEM CANOTUS	RED THIMBERRY	ROSE	SERVICEBERRY	SNOWBERRY	SNOWBUSH CANOTUS	THIMBLEBERRY	TRAILING BLACKBERRY	WILLOW	DOUGLAS-FIR	GRAND FIR	PONDEROSA PINE	WESTERN WHITE PINE	WESTERN RED CEDAR
1. 2,4-D: O+W	6																				
2. 2,4-D: O+W	9																				
3. 2,4,5-T: O+W	6																				
4. 2,4,5-T: W	8																				
5. TRICLOPYR E: O+W	6																				
6. TRICLOPYR E: O+W	9																				
7. TRICLOPYR+2,4-D: O+W	6																				
8. TRICLOPYR E+2,4-D: W	9																				
9. PICLORAM + 2,4-DE: O+W	6																				
10. PICLORAM + 2,4-DA: O+W	6																				
11. GLYPHOSATE: W	9																				

INJURY ~

	90-100% (SEVERE)		<25% (LOW OR NONE)
	60-90% (INTERMEDIATE)		<25% INJURY PRESENT (CONIFERS ONLY)
	25-60% (MODERATE)		INSUFFICIENT DATA

CARRIERS AND ADDITIVES ~

O : OIL CARRIER
W : WATER CARRIER

Supplement E

Guide for Determining "Relative" Limitations of Site Preparation Alternatives

	Cost/A ¹ Site Prep	Cost/A ² Planting	Slope Steepness	Soil Erosion	Soil Compaction	Seedling Plantability	Vegetation Recovery ⁵
<u>Mechanical</u>							
Cat Scarification	☑	☑	■ ³	■	■	☑	☑
Cat Crushing	☑	☒	■ ³	☑	☒	■	☑
<u>Manual</u>							
Hand Slashing	■	☒	☑	□	□	■	■
<u>Fire</u>							
Drip Torch: Ground	☒	☑	☑	☒	□	☑	☑
Drip Torch: Aerial	□	☑	☑	☒	□	☑	☑
Mass Ignition	☑	☑	☑	☒	□	☑	☑
<u>Chemical</u>							
Aerial	☑	☒	□	□	□	☒	☑
Backpack	□	☒	■ ⁴	□	□	☒	☑
<u>Combinations</u>							
Hack & Squirt	□	☒	☑	□	□	☒	□
Brown & Burn	☑	☑	☑	☒	□	☑	☑
Brown & Crush	☒	☒	■ ³	☑	☒	■	☑
Pile & Burn	☒	☑	■ ³	☒	■	□	☒
Scarify & Spray	☒	☑	■ ³	☒	■	☑	□
Spray·Pile·Burn	☒	☑	■ ³	☒	■	□	□

□ = Non-restrictive, ☑ = Slightly Restrictive, ☒ = Moderately Restrictive, ■ = Highly Restrictive.

¹Relative ratings are based on the following cost spectrum: □ = <50, ☑ = 50-100, ☒ = 100-250, ■ = >200.

²Relative ratings are based on the following cost spectrum: □ = <75, ☑ = 75-100, ☒ = 100-150, ■ = >150.

³Not recommended on slopes >35-45%.

⁴Not recommended on slopes >65%.

⁵In this category, □ would indicate recovery to be slow and spotty, as opposed to ■, for which recovery would be rapid and dense.

Supplement F

OREGON STATE SEED MAP - ITS INTERPRETATION

An official Tree Seed Zone map is recognized to aid in identifying the origin of tree seed. Zone boundaries separate regions which differ environmentally. Within each seed zone 500 foot elevational increments are designated.

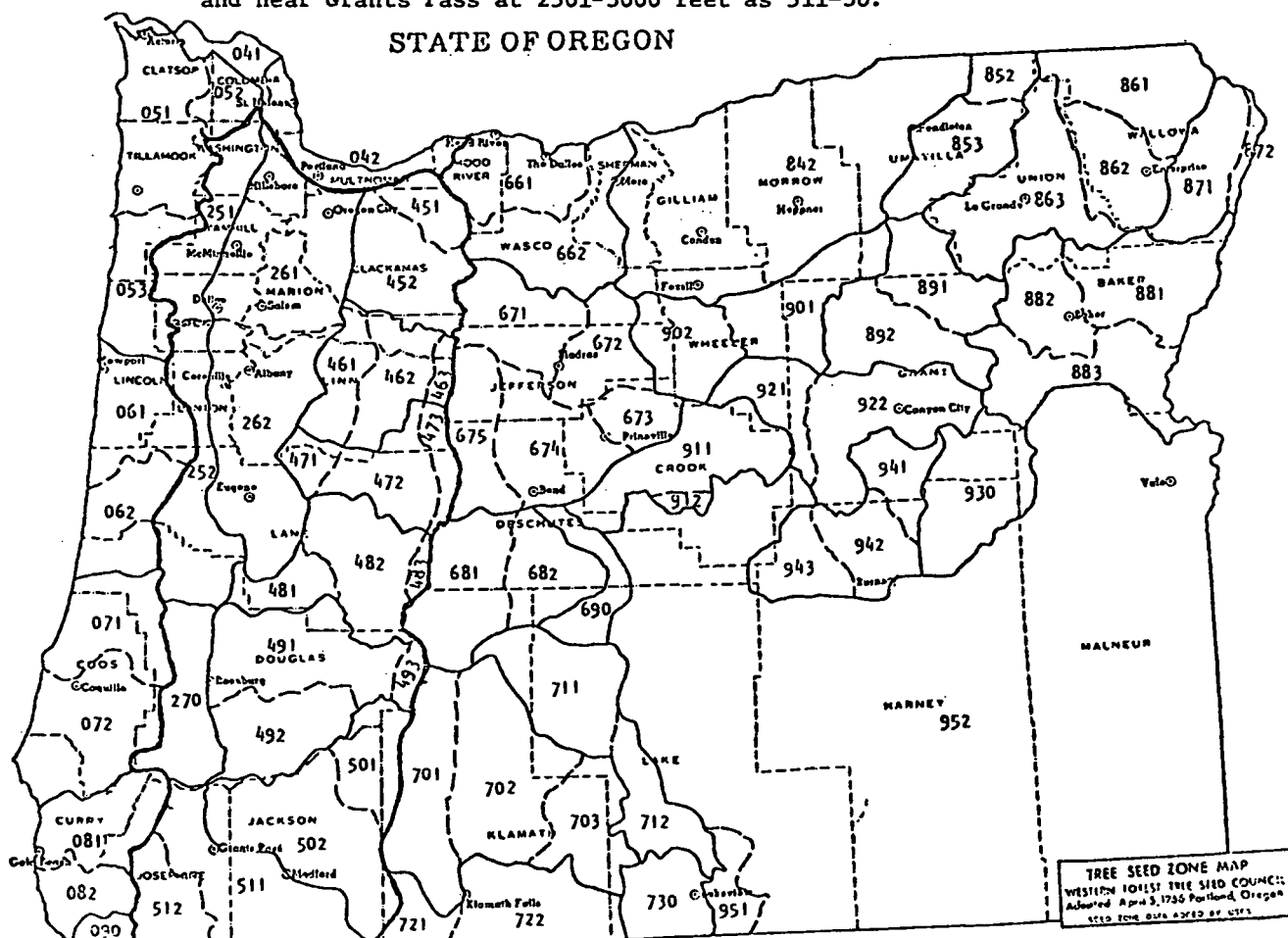
First Digit: Identifies broad geographic regions.

Digit	Region
0	Coastal: Pacific Ocean to Coast Range Summit
2-5	Interior: Coast Range Summit to Cascade Range Summit
6-9	Eastside: Cascade Range Summit to Eastern Boundary

Second Digit: Identifies arbitrarily assigned zones within geographic regions which are classified according to similar environments.

Third Digit: Identifies local regions as subzones which serve to better orient the collector geographically and facilitate seed collection.

Elevation: Identifies 500 foot elevational increments which are used in concert with seed zones to address variation among trees involving altitudinal adaptations. Certified seed collected near Portland at 0-500 feet is designated as 042-05 and near Grants Pass at 2501-3000 feet as 511-30.



Supplement G

TOLERANCE OF SOME MAJOR CONIFERS TO STRESSES

<u>SPECIES</u>	<u>FROST</u>	<u>LOW LIGHT</u>	<u>HIGH TEMPERATURES</u>	<u>DROUGHT</u>	<u>ANIMAL PRESSURE</u>
Douglas-fir					
Grand Fir					
Western Redcedar					
Western Hemlock					
Sitka Spruce					
Incense Cedar					
Ponderosa Pine					
Noble Fir					
	<u>LOW TOLERANCE</u>	<u>MEDIUM TOLERANCE</u>	<u>HIGH TOLERANCE</u>		
					

Supplement H
Range of Spacing and Stocking Densities

<u>Spacing Feet</u>	<u>Trees Per Acre</u>
20.9 x 20.9	100
17.0 x 17.0	150
14.8 x 14.8	200
13.2 x 13.2	250
12.0 x 12.0	300
11.2 x 11.2	350
10.4 x 10.4	400
9.8 x 9.8	450
9.3 x 9.3	500
8.9 x 8.9	550
8.5 x 8.5	600
8.2 x 8.2	650
7.9 x 7.9	700
7.6 x 7.6	750
7.4 x 7.4	800
7.2 x 7.2	850
7.0 x 7.0	900
6.8 x 6.8	950
6.6 x 6.6	1,000
5.4 x 5.4	1,500
4.7 x 4.7	2,000
4.2 x 4.2	2,500
3.8 x 3.8	3,000
3.5 x 3.5	3,500
3.3 x 3.3	4,000
3.0 x 3.0	4,500
3.1 x 3.1	5,000

Supplement I

Stocking Survey Form

Sale or Rehab Area _____ Number: _____

Portion if Stratified _____

Acreage _____ Location _____ Section _____ Twp _____ R _____

Survey Date _____ Surveyed by: _____

Summary Report:

_____ % of area is satisfactorily stocked with free to grow trees;

_____ % of area is stocked with overtopped trees needing release;

_____ % is not stocked and is stockable;

_____ % is not stocked and is nonstockable.

The stocked area averages _____ effective trees per acre.

Average age is _____; average height is _____.

Treatment recommended: _____

Re-survey recommended: _____

Comments: Animal damage: _____

Competing vegetation: _____

Other remarks: _____

Part V: Blank Worksheets with Instructions

Satisfactory completion of Reforestation Plan Worksheets requires an understanding of fundamental concepts in forest biology and silviculture. This information is available to you through the Extension Forester in your county and OSU Extension Forestry publications. Most worksheets also require the additional information presented in Part IV. This section of "supplements" contains information that has been compiled to facilitate completion of specific worksheets. The proper use of a given supplement, with its respective worksheet, is described in the directions and the example that explain how to complete Reforestation Plan Worksheets (Part III).

A helpful approach is to work through the Worksheet set a few times using recent plantations with which you are familiar to get a feel for how all the components fit together. You will find that the planning guide simply promotes inclusion of structure, organization, completeness and unity into the reforestation process, a strategy that can only enhance your potential for reforestation success.

Worksheets

1. Establish Present Objectives
2. Site Description
3. Selection of Tentative Harvest System
4. Limitations to Seedling Establishment
5. Control of Target Vegetation
- 6A. Site Preparation Alternatives: Determine Your Site and Operational Constraints
- 6B. Site Preparation Alternatives: Evaluate Impact of Site and Operational Constraints
- 7A. Re-evaluate Your Objectives
- 7B. Set Final Objectives
8. Develop of Harvest System and/or Site Preparation Plan
9. Seedling Selection: Species and Stock Type
10. Seedling Handling and Planting
11. Plantation Evaluation and Maintenance

Worksheet 1

Establish Present Objectives

Unit Identification: _____

Objectives	Comments
Financial	
Short Term	
Long Term	
Life Style	
Time Available	
Interests	
Commitment	
Permanency	
Land Ethic	
Aesthetics	
Utilization	
Other	

Directions for Worksheet 1 - Establish Present Objectives

Establishing personal objectives for units you wish to manage is an important step in reforestation planning. It brings to focus your inner feelings about manipulation of forest land before they create a "touchy" situation or an operational delay while you ponder a decision on an unforeseen event. For example, fishing Bear Creek has always been a fun family outing. After contracting firewood removal from the unit adjacent to the stream you realize the contract permits cutting to the streams edge, which may drastically reduce the fish population, not to mention the area's aesthetic value. Prior coordination of these two variables, fishing pleasure and firewood removal, would have allowed you to establish a stream buffer strip, thus avoiding a possible contract dispute.

In Worksheet 1, indicate the unit identification and acreage. Then define your personal objectives, keeping in mind that some may require revision or deletion to ensure attainment of your ultimate goal--successful reforestation. A description of what is involved in developing your personal objectives follows:

Financial

Financial objectives are broken down into long and short term goals that you associate with forest ownership. Short term goals are usually concerned with minimizing expenses without sacrificing reforestation success. If the unit you wish to manage is harvestable then maximizing profit may be your goal. Long term goals, on the other hand, represent your anticipated financial desires as reflected by the manner in which you intend to manage the unit.

Life Style

Life style objectives focus on personal priorities. How much time are you willing to devote to managing your forest (time available)? What work, recreational or wildlife interest do you and your family have regarding the unit? How committed are you to proper management of your forest lands (commitment)? Finally, how long do you intend to retain and manage the property? Let's be realistic right from the beginning; any successful land management venture takes time, patience, money and work. You must consider your life style priorities to ensure you've got what it takes to do the job right!

Land Ethic

Land ethic objectives reflect your personal feelings regarding manipulation of forest land. This identifies the aesthetic appeal of forest land for you and your family and its influence on your approach to management.

Site Description

Current Vegetation

Commercial Stock Trees			Competitors Trees-Shrubs-Grasses	
Species	% Stocking	Age	Species	% Cover

Soil

Depth: ____ < 6 in ____ 6-12 in ____ 12-18 in ____ 18-24 in ____ > 24 in

Rock Content: ____ < 10% ____ 10-30% ____ 30-50% ____ > 50%

Texture: ____ Sand ____ Sandy Loam ____ Loam ____ Silt Loam ____ Clay Loam ____ Clay

Topography

Climate

Slope: ____

Aspect: ____

Elevation: ____

Precipitation

Rainfall: ____ (late summer droughts)

Snowfall: ____ (snowfalls transient)

Temperature

Average Annual: ____

Summer Extreme: ____

Winter Extreme: ____

Animals

	<u>Present</u>	<u>Intensity (H, M, L)</u>
Deer	_____	_____
Elk	_____	_____
Mountain beaver	_____	_____
Gopher	_____	_____
Mice/Vole	_____	_____
Rabbit/Hare	_____	_____

Summary

Major Problems:

Special Considerations:

Directions for Worksheet 2: Site Description

Current Vegetation

Survey the site to be managed and classify the individual plants present.

EXAMPLE: A grassy, aouthwest facing hill occupied by Douglas-fir, white oak, Himalaya blackberry and various grass types.

Commercial Stock			Competitors	
Trees			Trees-Shrubs-Grasaes	
Species	% Stocking	Age	Species	% Cover
Douglas-fir	15	25	White oak	45
			Himalaya blackberry	30
			Grass	90

Note: If woodland owner objectives include commercial firewood production, white oak could be placed under "commercial stock."

Soil

Dig a soil pit to a depth of aeveral feet. Using Supplement A, Part IV and your own judgement determine depth, rock content, texture and, if you wish, type of suil on the site to be managed.

EXAMPLE: Soil depth in the root zone is about 20 inches with a rock content between 10-30%. The texture appears to be a clay loam since dry clods are not easily broken and when moist, thin, fragile ribbons can be formed by squeezing between the fingers.

Topography

As you survey Bear Creek Unit note, from several locations within the unit, the general slope and aspect. Also indicate aituatiums which may vary aignificantly from the nurm, such as flat benches or steep ravines that exist within the unit.

EXAMPLE: You determine the slope of your property to be about 20% with a few places between 30-40% (flat ground = 0%, maximum cat operation = 35-40%, a steep staircase = 70-80%, a verticle wall = 100%). The slope faces to the southwest. The elevation is 400 feet.

Climate

According to your neighbors rain/snow gnuge and infurmation obtained from your Extension Forestry Agent yuu determine average annual rainfall in the

vicinity of Bear Creek to be 35 inches per year and anowfall to be between 6-12 inches. To enhance the informative value of precipitation data, you indicate timing of seasonal rainfall (i.e., summer droughts) and the duration of snowfall (transient). Temperature information you found through meteorological records at the local library. This confirmed estimates you arrived at from your residence in the area for aeveral years.

Animals

During your unit survey you notice visual aigns indicative of deer and mice. The browse damage to lower branches of Douglas-fir and small white oak trees plus sporadic pellet piles suggesta moderate deer intensity. Although the amount and density of grasa is high you observe only a few acattered mice runways and thus designate the mice population to be low. Several scattered blackberry mounds suggest the possibility of rabbits even though you have not observed any signs. Just to be safe you indicate low rabbit intensity.

Summary

This space is set aside for you to determine what you feel may be potential problems to reforestation on the site. Major problems might include heavy brush cover, ateeep southwest facing slope, high clay content in soil or large deer populations. Special considerations refer to circumstances unique to the site which may have an adverse affect on reforestation or to special use of the site for purpoaes other than timber production, i.e., recreation, seed orchard, field nursery, etc.

Worksheet 3

Selection of "Tentative" Harvest System

Alternatives Considered	Evaluation

Directions for Worksheet 3: Tentative Harvest System Selection

Since the unit you wish to manage contains a stand of timber, you are faced with the decision of how to manipulate the stand in a matter that will be both biologically and economically desirable. The problem of establishing a reforestation plan requires that you have some idea of post-harvest site conditions on the unit. Therefore you need to select a tentative harvesting system so that you can envision the site as it will be after treatment. Then you can more efficiently approach the problem of minimizing site and operational constraints through selection of concurrent site preparation method that best fits your harvest plan. Your selection will be based on your personal objectives and the characteristics of the site. Your decision may or may not be modified or changed as you proceed in defining more clearly the site and operational constraints of the unit and the options for concurrent site preparation (Worksheets 4-6B).

Worksheet 3 requires a basic knowledge of the harvest system alternatives available to you. Supplement B, Part IV provides a brief description of the 4 major approaches and the advantages and disadvantages of each. This brief assessment of harvest methods is provided to assist you in making a decision, not to teach you about the harvesting methods. If you are not familiar with all the harvesting options available for use on your property contact your local Extension Forestry Agent.

Worksheet 4

Limitations to Seedling Establishment

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MOISTURE	H	M	L	TEMPERATURE	H	M	L	LIGHT	H	M	L	PHYSICAL	H	M	L
Growing Season Precipitation				Growing Season Temperature				Vegetation Cover				Falling Debris			
Soil Capacity				Lack of Shade				Standing Debris				Insect or Disease			
Vegetation				Air Drainage				Aspect				Forest Animals			
Slope				Aspect				Slash				Snow/Ice			
Other				Other				Other				Other			

H = Limitations to seedling development by the designated environmental factor will be high.

M = Limitations to seedling development will be moderate.

L = Limitations to seedling development will be of little consequence.

Note: Although each environmental factor is being evaluated individually as a limiting factor for establishment; in the final analysis, interaction of all factors must be considered to accurately define limitations of the Site to seedling development!

Major Problems-Summary:

Directions for Worksheet 4: Limitations to Seedling Establishment

Once you have described the site, Worksheet 4 will assist you in determining its potential for seedling establishment. Based on the rating system H, M, L (defined below Worksheet 4) and your knowledge of the site complete Worksheet 4.

Example:

1. Moisture - You place an X under H for vegetation because you wish to plant an area that is covered with grass (90%), and Himalaya blackberry (30%). These competitors if not removed will severely limit moisture availability to seedlings. Although you feel there are no moisture limitations to seedling establishment resulting from slope (L), the character of the soil and the occurrence of late summer droughts suggest to you the potential for injury inducing moisture stress between mid-July to mid-October.
2. Temperature - You place an X under H for both aspect and lack of shade because the site is a southwest facing slope and the competitors (primarily grass) do not provide beneficial shade to seedlings. Because of the southerly exposure and the slope angle you feel that too much light could create damaging surface/sub-surface temperatures at the seedling-soil interface, therefore you place an X under moderate (if this site were in southern Oregon the X would go under high). Although there is nothing you can do about aspect, you can provide artificial shade for seedlings. The absence of topographic depressions or physical barriers permitting cold air accumulation (frost pockets) and the moderate winter climate of the area are not, in your opinion, limiting to seedling establishment. Therefore, you place X's under L for air drainage and growing season temperature.
3. Light - You must place X's under L for all categories since in no instance do these factors limit the amount of incoming light the seedling can receive.
4. Physical - You place an X under H for "Forest Animals" which you specify as deer browse. Although the situation is not presently serious, creation of an open feeding habitat plus the proximity of an orchard and stream suggest a high damage potential. The remaining physical constraints to seedling establishment are not a problem (L).

After you have completed Worksheet 4, summarize what you believe to be the major limitations to seedling establishment.

Worksheet 5

Eliminating Target Vegetation*

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Target Species	Rated Effectiveness in Controlling Target Vegetation					
	Scarification	Crushing	Slashing	Slash	Spray/Burn Slash	Chemical Application

Rank site preparation alternatives for effective control of target vegetation.

1. _____
2. _____
3. _____

*Target vegetation refers to the vegetation you want to control or eliminate.

Directions for Worksheet 5: Eliminating Target Vegetation

The purpose of Worksheet 5 is to evaluate site preparation alternatives in terms of their effectiveness in minimizing or eliminating vegetation likely to compete with seedlings for light, moisture, nutrients and other factors necessary for survival and growth. Supplement C, Part IV, is designed to help you accomplish this task. Supplement D, Part IV provides a guide for selection of the appropriate herbicide if chemical application is a component of or the basis for the site preparation alternative you select.

First list the target species, then refer to Supplement C, Part IV to determine the effectiveness of each site preparation alternative in controlling a specific target species. Numerical and letter components of the rating are defined at the bottom of Supplement C, Part IV.

Example: Effectiveness of site preparation alternatives in controlling competing vegetation (Supplement C, Part IV).

Target Species	Tractor Scarification	Tractor Crushing	Hand Slashing	Burn Slash	Spray/Burn Slash	Chemical Application
Annual grass	4-B	1-A	2-A	1-A	4-C	4-C
Perennial grass	4-C	1-A	2-B	1-A	4-D	4-D
Blackberry	2-C	1-B	1-A	1-A	4-D	3-D

It is apparent, for the vegetative competitors in question, that either spray and burn, chemical application or scarification will provide adequate control on this site. (Note: If the site were an old well established brushfield it might be necessary to couple two or more methods of site preparation together to insure obtaining enough plantable sites.)

Chemicals (Supplement D, Part IV)

Annual Grass - Amitrole in summer
 Perennial Grass - Amitrole in summer
 Blackberry - Roundup (Glyphosate) in fall

Now you are ready to give a tentative ranking to site preparation alternatives which are likely to give you satisfactory results with respect to vegetation control. (1) Spray and burn slash (if present), (2) chemical application and (3) tractor scarification. Actual selection will depend on how site and operational constraints influence both the biological and economic feasibility of the alternatives or some combination of the alternatives.

Worksheet 6A

Site Preparation Alternatives: Determine Your Site and Operational Constraints

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Mechanical	✓	Manual	✓	Fire	✓	Chemical	✓
Cost		Cost		Cost		Cost	
Legal Liability		Legal Liability		Legal Liability		Legal Liability	
Risk		Risk		Risk		Risk	
Vegetation Recovery		Vegetation Recovery		Vegetation Recovery		Vegetation Recovery	
Steep Slope		Steep Slope		Steep Slope		Steep Slope	
Soil Compaction		Soil Compaction		Soil Compaction		Soil Compaction	
Slash Created		Slash Created		Slash Created		Slash Created	
Slash Untreated		Slash Untreated		Slash Untreated		Slash Untreated	
Labor		Labor		Labor		Labor	
Erosion		Erosion		Erosion		Erosion	
Fuel Condition		Fuel Condition		Fuel Condition		Fuel Condition	
Smoke Management		Smoke Management		Smoke Management		Smoke Management	
Wildlife		Wildlife		Wildlife		Wildlife	
Watersheds		Watersheds		Watersheds		Watersheds	
Plantability		Plantability		Plantability		Plantability	

Alternatives Considered: _____

Proceed to Table 5B: Evaluate the impact of site and operational constraints in terms of the potential for reforestation success and the feasibility of your present objectives.

Directions for Worksheet 6A - Constraints: Site and Operational

Worksheet 6A requires simply that you place a check (✓) beside those factors which you consider to be restrictive to implementation of a particular type of site preparation alternative. Your reason for designating a particular factor a constraint could have biological, personal, economic or legal foundations. The point is, since you see it as a constraint, it becomes a major consideration in the decision making process for selection of an appropriate site preparation alternative. Supplement to Worksheet 6A provides a guide for determining the relative degree to which a particular factor may be limiting.

6A Example: Designation of Site and Operational Constraints

<u>Alternatives</u>	<u>Constraints Checked</u>
Mechanical	Vegetative Recovery Soil Compaction Erosion Watershed
Fire	Legal Liability Erosion Watershed Smoke Management
Chemical	Erosion Watershed

Note: Based on analysis of methods for control of target vegetation Worksheet 5, you have already eliminated manual slashing as a viable alternative for site preparation.

Proceed to Worksheet 6B: Evaluate the impact of site and operational constraints in terms of the potential for reforestation success and the feasibility of your present objectives.

Worksheet 6B

Site Preparation Alternatives: Evaluate Impact of Site and Operational Constraints

Alternatives Considered	Evaluation

Preferred Site Preparation Method: _____

Directions for Worksheet 6B:

Evaluation of Site and Operational Constraints

Worksheet 6B serves to evaluate the problems which you checked in Worksheet 6A as being potential constraints to reforestation. An efficient method of evaluation involves the stepwise discussion of each proposed constraint that you checked for a given site preparation alternative. After you have addressed all the potential constraints pertaining to the use of a site preparation method on Bear Creek Unit you are ready to compare the alternatives and select the one that minimizes constraints and is compatible with your personal management objectives.

Decision: You have ranked 3 alternatives for site preparation: (1) spray and burn, (2) chemical and (3) tractor scarification. Since your site requires reclamation of a grassy southwest slope, the first alternative is not really applicable due to the absence of slash or large woody brush. In addition, the added constraints resulting from the combination of fire with chemical application cannot be justified because no significant gain in vegetation control can be realized. Consequently, you need consider only mechanical and chemical alternatives. Based on evaluation of site and operational constraints a feasible site preparation method, which will minimize constraints and allow for seedling establishment, appears to be chemical application. Since the area to be reforested is only 45 acres the use of a backpack sprayer and careful application will provide excellent brush control and minimize the impact on the nearby watershed. This is also an inexpensive alternative.

Worksheet 7A

Re-evaluate Your Objectives

Objectives	Modifications		Comments
Financial	Yes	No	
Short Term			
Long Term			
Life Style			
Time Available			
Interests			
Commitment			
Permanency			
Land Ethic			
Aesthetics			
Utilization			
Other			

Directions for Worksheet 7A and 7B - Setting Final Objectives

Recall that you have been making your decisions based on objectives set before being fully aware of all the ramifications of managing forest property. Now it is time to carefully re-evaluate your objectives (Worksheet 1) and determine if they are compatible with the approach to reforestation you intend to follow based on the site and its associated constraints.

Worksheet 7A identifies whether or not you believe modifications to your preliminary objectives are necessary and why. More than likely you have already diverged from your initial objectives due to unfamiliarity with forest management practices or, inadvertently, to minimize costs, ensure reforestation success and/or maximize stand vigor and value. Cautious divergence from original avenues of thought in response to new facts and ideas is a normal part of any decision making process and can be very helpful in leading you toward a "best" approach to your problem. The important thing is that you note any changes in your objectives and clarify why they were made before you try and set final objectives for the selection of reforestation treatments to maximize success.

Worksheet 7B identifies your final set of objectives and should be referred to as you consider each major reforestation decision in Question V*.

***Note:** Even though you will designate certain "final" objectives to guide you in selecting reforestation treatments, none of these decisions are set in concrete. There is always room for change. Remember a major reason for the plan is simply to discourage spur-of-the-moment decisions which have not been carefully evaluated and therefore pose a serious threat to your success.

Worksheet 7B
Set Final Objectives

Objectives	Comments
Financial	
Short Term	
Long Term	
Life Style	
Time Available	
Interests	
Commitments	
Permanency	
Land Ethic	
Aesthetics	
Utilization	
Other	

Directions for Worksheet 7A and 7B - Setting Final Objectives

Recall that you have been making your decisions based on objectives set before being fully aware of all the ramifications of managing forest property. Now it is time to carefully re-evaluate your objectives (Worksheet 1) and determine if they are compatible with the approach to reforestation you intend to follow based on the site and its associated constraints.

Worksheet 7A identifies whether or not you believe modifications to your preliminary objectives are necessary and why. More than likely you have already diverged from your initial objectives due to unfamiliarity with forest management practices or, inadvertently, to minimize costs, ensure reforestation success and/or maximize stand vigor and value. Cautious divergence from original avenues of thought in response to new facts and ideas is a normal part of any decision making process and can be very helpful in leading you toward a "best" approach to your problem. The important thing is that you note any changes in your objectives and clarify why they were made before you try and set final objectives for the selection of reforestation treatments to maximize success.

Worksheet 7B identifies your final set of objectives and should be referred to as you consider each major reforestation decision in Question V*.

***Note:** Even though you will designate certain "final" objectives to guide you in selecting reforestation treatments, none of these decisions are set in concrete. There is always room for change. Remember a major reason for the plan is simply to discourage spur-of-the-moment decisions which have not been carefully evaluated and therefore pose a serious threat to your success.

Worksheet 8

Development of Harvest System and/or Site Preparation Plan

Harvest System (complete only if commercial harvest or reclamation is to be performed)

1. Alternative Selected:

2. Justification:

3. Treatment Time Table:

Site Preparation

1. Alternative Selected:

2. Justification:

3. Treatment Time Table:

Directions for Worksheet 8

Development of Harvest System and/or Site Preparation Plan

Now that you have established your final set of objectives for manipulating the unit you wish to reforest, you should be ready to make specific reforestation decisions. These will be based on your evaluation of constraints associated with each treatment alternative. Selecting an alternative is only the first step. You must be able to justify your decision by defining those factors, economic, environmental or operational, that were instrumental in guiding you to your decision. Your justification statements will reflect previously determined reforestation constraints (Worksheets 2, 3, 4, 5 and 6A). Once you have justified the harvest and/or site preparation methods you wish to employ you must establish a strict time table for their implementation. This might be a good time to solicit the assistance of your Extension Forestry Agent. He can help you avoid costly errors in judgement or scheduling that could reduce your potential for success.

The example, which is based on the Bear Creek Unit, includes that portion of the unit outside the stream buffer zone. A separate plan should be developed for the buffer zone. The site description and evaluation of constraints for the Bear Creek Unit outside the buffer zone follow examples for Worksheets 2, 3, 4, 5 and 6A.

Worksheet 9

Seedling Selection: Species and Stock Type

Seed Source and Elevation: _____

Species Selected and Percent Mix (if applicable):

	<u>Species</u>	<u>% Mix</u>
1.		
2.		
3.		

Alternatives for Seedling Acquisition:

1. Direct purchase from nursery: _____

2. Contact with nursery to meet specific needs: _____

3. Tree Improvement Cooperative: _____

4. Wildings: _____

Specify Species and Stock Characteristics:

Species	Type	Height	Diameter	Shoot/Root Ratio

Specific Standards for Nurseryman:

1. Bed Density _____ or Container Size _____
2. Lifting Date _____
3. Culling Specifications _____

4. Root Pruning _____
5. Storage Specifications (if necessary) _____

Directions for Worksheet 9. Seedling Selection - Species and Stock Type

Worksheet 9 helps the forest manager plan a reforestation strategy far in advance so as to insure the acquisition of planting stock that will satisfy reforestation objectives. Obtaining the desired species and seed source of seedlings necessitates prior contact with the nurseryman to guarantee availability of the requested stock at the specified time. Delays can, and frequently do, lead to reduced survival.

Completion of Worksheet 9:

1. You need to know the seed zone and approximate elevation of the site. For example, Clackamas County occupies a portion of 3 different seed zones, 261, 451 and 452, covering an elevation range of 200 to 6,000 feet. Refer to Oregon Seed Zone Map (Supplement F, Part IV).
2. Appendix F will guide you in selecting the species best suited to the site you wish to plant. In most cases you will be planting a species common to the immediate area. For the Bear Creek example, particularly on a southwest aspect, the selection would likely be Douglas-fir.
3. There are several alternatives open to you for acquiring seedlings. The best alternative is to join or help form a Tree Improvement Cooperative. Collecting seed from your best trees, having it processed, tested and certified as Source Identified A or Select B is not difficult but must be accomplished 2-3 years prior to planting to allow time for the nursery to grow the seedlings to your specifications (refer to Woodland Workbook Fact Sheet on Certification of Tree Seed). If you are lucky you might be able to purchase Source Identified A or Select B seed in quantities sufficient for your needs from federal, state or private organizations that collected seed on sites similar to those you wish to plant and in the general vicinity of your property. The chance that you would be able to acquire seedlings of this caliber from the nursery in the fall prior to winter planting (January/February) is remote. However, if you prefer convenience and lower cost and are willing to assume an increased risk of re-entry and reduced long term growth you can purchase Audit Class seedlings directly from the nursery. Although this is the route that has been taken by most woodland owners in the past it provides no assurance that the seedlings you'll be receiving will be suited to the site you wish to regenerate. Wildlings (seedlings growing near the planting site) are useful as transplants to fill in holes from previous planting losses or to plant small openings (less than 1/2 acre).
4. If you elect to plan 2-3 years in advance to insure acquisition of the best seedlings possible (tree improvement program or contract negotiations with the nursery) you will have the opportunity to specify seedling characteristics that you desire in a seedling. This option will enhance your chances for successful reforestation.
5. Since you elected to join in on the Tree Improvement Cooperative, you and your neighbors will be collecting cones from your best trees*, pooling seed from compatible sites, receiving certification and then contracting with the nurseryman to grow seedlings to your specifications. The information listed in Example Worksheet 9 for Douglas-fir seedlings represents a good basic standard to shoot for on many, but not all, low elevation, valley margin sites.

*Certification of Tree Seed. OSU Extension Fact Sheet for the Woodland Workbook.

*Selecting your best tree(s) may take some "scouting" time. Consult your Extension Forestry Agent for advice. The actual process of cone collection and preparing cones for drying will only take a day or two.

Worksheet 10

Seedling Handling and Planting

Operational Specifications:

1. Pick up Date _____
2. Transport of Seedlings _____

3. Pre-plant Storage Facilities _____

4. Planting Specifications
 - a. Planting Date _____
 - b. Site Storage Precautions _____

 - c. Tool Type _____
 - d. Scalp Diameter _____
 - e. Trees/Acre _____ Spacing* _____
 - f. Planting: Patterned _____ or Microsite _____ - _____

 - g. Seedling Protection During Planting _____

 - h. Protective Measures at Planting _____

*Spacing for desired number of trees/acre is presented in Supplement I, Part IV.

Directions for Worksheet 10: Seedling Handling and Planting

Worksheet 10 identifies factors that need to be considered before the seedlings are picked up from the nursery. If possible, pick up date should coincide with lifting and planting dates to attain the highest establishment potential for seedlings. The time between pick up and planting is critical, for many opportunities for seedling mistreatment exist. Therefore, it is important to know exactly what needs to be done at each step, so that "precautions" necessary to protect seedlings will be ready.

Explanation of Example Worksheet 10:

1. Pick up Date: January 17. Recall lifting date was January 15, therefore seedlings should be kept in cold storage at the nursery for at least 48 hours to reduce the potential for overheating during transport in non-refrigerated vehicles.
 2. Transport of Seedlings: The objective during transportation is to prevent drying or overheating of seedlings. Therefore, seedling boxes or bags should be protected from environmental (solar radiation and wind) and vehicular (exhaust heat) heat sources during transport.
 3. Pre-plant Storage Facilities: The intention is to plant immediately, keeping seedlings to be planted on succeeding days in a local cooler.
 4. Planting Specifications:
 - a. Planting Date: January 18-26. Remove from the cooler only as many seedlings as can be planted each day.
 - b. Site Storage Precautions: The susceptibility of boxed or bagged seedlings to heat damage when exposed to solar radiation on a clear or overcast day is great. Precautions to protect seedlings from direct exposure to radiation will help minimize potential mortality.
 - c. Tool Type: Although seemingly unimportant, selecting your planting tool to match site conditions, specific climatic conditions for the day and seedling morphological characteristics can minimize your frustration and help maximize planting quality.
 - d. Scalp Diameter: If you have opted to prepare each planting microsite by scraping away debris or competing vegetation (grass or herbs) then you should designate the scalp diameter that you believe will be successful. If previous site preparation has provided you with a clean planting microsite, scalping may not be necessary.
- e. Trees/Acre and Spacing: The number of seedlings you plant per acre and their corresponding spacing must be carefully evaluated and determined early on (preferably 2-3 years prior to planting) to allow sufficient time for your nurseryman to meet designated specifications. Several important economic and biological factors must be considered, if you wish to avoid reduced plantation growth and monetary setbacks. Your Extension Forestry Agent can be contacted for advice.
 - f. Patterned vs. Microsite Planting: In the past most planting was done in rows, either following a contour or moving upslope, with little regard for selecting a "favorable microsite" in which to plant the seedling. There is nothing wrong with this approach as long as site conditions are favorable. However, on sites where seedlings are likely to encounter stress resulting from climatic extremes, soil conditions and/or animal pressure then an attempt should be made to "break" the pattern in order to place the seedling where its chance for survival is enhanced (behind a log or rock away from competing vegetation, downhill side of a stump, etc.).
 - g. Seedling Protection During Planting: Keeping seedling roots moist and cool between the time that they are removed from the packing bag and planted is critical. This is best achieved by placing damp moss around the roots in an insulated planting bag or by water dripping (1 minute) or jelly rolling seedlings prior to placement in planting bags. Do not permit water to "puddle" around the roots in the bag, allow for drainage. Do not be greedy in the number of seedlings you place in your planting bag, for this increases the time that exposed seedlings are subjected to conditions capable of causing stress and reducing seedling vigor.
 - h. Protective Measures at Planting: The decision to use protective seedling devices is a function of their cost versus that of anticipated mortality or growth loss if preventative methods are not employed. If you are more secure by using physical or chemical treatments to protect against "anticipated" damage then, by all means, do so. If you are a little low on reforestation funds and a bit of a gambler wait and apply the appropriate treatment after periodic field surveys indicate the occurrence of damage. But be warned, if the site is moderately harsh and/or seedling vigor is questionable, the downfall you may receive from deer browse will ultimately cost you more because of re-entry for interplanting and protection.

Worksheet 11

Plantation Evaluation and Maintenance

Evaluation of Planting SuccessA. Alternative Methods (check preference as per your objectives)¹

1. _____ Plot count method
2. _____ Stocked quadrant method
3. _____ Distance method
4. _____ Other: specify _____

B. Survey Frequency (growing seasons after planting)

- First _____
Second _____
Third _____
Fourth _____
Fifth _____
- Post 5 year checks? _____

Maintenance of the Plantation²

A. Anticipated Vegetation Treatments

1. Chemical release _____
2. Manual release _____
3. Other (controlled burn, grazing, etc.) _____

B. Anticipated Animal Control Treatments

1. Chemical repellents _____
2. Physical barriers _____
3. Baiting _____
4. Trapping _____
5. Hunting _____

¹Refer to: Regenerating Oregon's Forests, pages 205-222 and 243-276, or Forstry Agent.

²Insect or disease problems are very important, but their control can be complicated. Therefore, if you suspect infestation contract your Extension Agent for advice.

Directions for Worksheet 11: Planting Evaluation and Maintenance

After the seedlings are planted the job of plantation maintenance and evaluation begins. The plantation should be followed closely during the first few years so that potential problems can be detected before they become serious. This evaluation necessitates the use of survey techniques which point out immediate or potential problems that exist in the plantation as determined by random observations made throughout the plantation. Several methods are listed in Worksheet 11. Have your Extension Forestry Agent assist you in developing a survey scheme if you have not been exposed to survey techniques in woodland owner workshops.

Maintenance of the plantation is frequently the result of problem detection during the survey. Maintenance normally involves post-planting treatments aimed at correcting anticipated or unforeseen problems with competing vegetation, animal damage or other environmental factors that enhance the risk of seedling mortality.

Example:

1. A visit to the plantation early in the second growing season reveals that the grasses have recovered more rapidly than anticipated and are becoming a deturrent to seedling vigor. Early detection has provided you the option of an immediate spring spray with atrazine, or with amitrole in early summer, to reduce competition and maximize seedling growth.
2. A survey at the end of the first growing season unveils several small pockets of missing seedlings. Closer examination reveals diagonal severing of seedling stems close to the ground and inconspicuous earth mounding near 4-5 inch diameter holes, some of which exhibit sword fern and clipped seedlings lying neatly along side. Detection of this mountain beaver community has allowed you the option of aggressively trapping the area to stop what could lead to plantation failure.

Note: Supplement I, Part IV is a copy of an actual field stocking survey form used to record your findings and recommendations.

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