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**FIVE STEPS TO SUCCESSFUL
REGENERATION PLANNING**

**B.D. CLEARY
B.R. KELPSAS**



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ABSTRACT

Planning for successful reforestation by planting is difficult because many variables must be integrated to produce a carefully designed and economical plan. Without a systematized approach, essential elements are often neglected or overlooked altogether. This paper presents a method in which planning information is organized step by step and then used as the basis for choosing among possible alternatives. In the first four steps, site information is compiled; harvest systems are analyzed;

seedling environment is assessed; and site-preparation alternatives are evaluated. In the fifth and final step--the prescription--the harvest system is selected; the site-preparation method, stock type, and seedling handling and planting practices are determined; and operations for plantation maintenance are identified. A sample prescription illustrates application of this plan to a specific site.

INTRODUCTION

Successful reforestation is the most important objective of those who manage forest resources on a sustained basis. Yet the legacy of brush-covered or poorly stocked lands left after logging is 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 emphasize the importance of raising trees. 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 periods.

Over the past few decades, increased sophistication has eliminated much of the guesswork in the reforestation process. However, emphasizing one component of the process while neglecting the others can still lead to failure because all are joined in a chain of events whose weakest link determines the degree of success for the project. Attention to the total process as well as to its individual components is the key, but this can be difficult, particularly if the project spans a year or more.

One effective approach is to construct a regeneration plan that specifies operations before an area has been harvested and coordinates their timing, thereby avoiding delays. Prompt site regeneration is often critical to preventing problems with brush or other competing vegetation. In

addition, constructing a regeneration plan before harvest allows a manager time to evaluate alternatives and then make the best choice based on a detailed analysis of trade-offs. Too often, operations are prescribed without justification because too little time was taken to fully assess the options. Finally, compiling a plan provides a written record of the reforestation history on a site. Using such records as information sources in subsequent reforestation projects promotes continual refinement of the process and increases the likelihood of a greater number of established plantations.

We have designed--and present here--a plan for reforestation by planting.¹ Although artificial seeding or natural methods (such as a shelterwood) may sometimes be appropriate, planting has been the most widely used approach. Our plan comprises five basic steps (Fig. 1), each of which addresses at least one major component in the reforestation system (Fig. 2). Steps 1 through 4 are an information-gathering sequence that helps you evaluate alternatives to formulate the best possible plan; step 5 is the actual reforestation prescription. You may need to repeat the first four steps or step 5 several times to put all the information in its proper

¹You will find additional helpful information in Regenerating Oregon's Forests (Cleary et al. 1978). We have prepared this publication to supplement and improve upon material presented in Chapter 9 of that publication.

perspective because each decision affects all others in the process.

As your familiarity with both the prescription process and a given management area increases, you may develop several "standard" prescriptions that meet the requirements of the common reforestation projects in your area and effectively apply these without repeating all five steps. Such prescriptions should, however, be reviewed annually and then modified, as needed, to match the specific characteristics of each reforestation site.

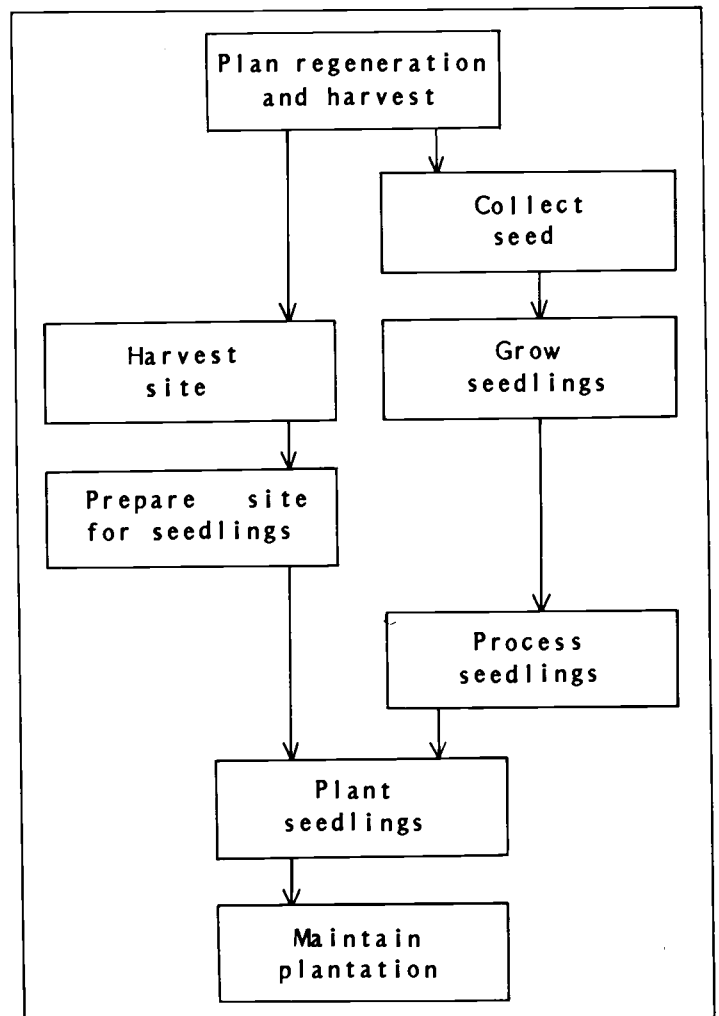
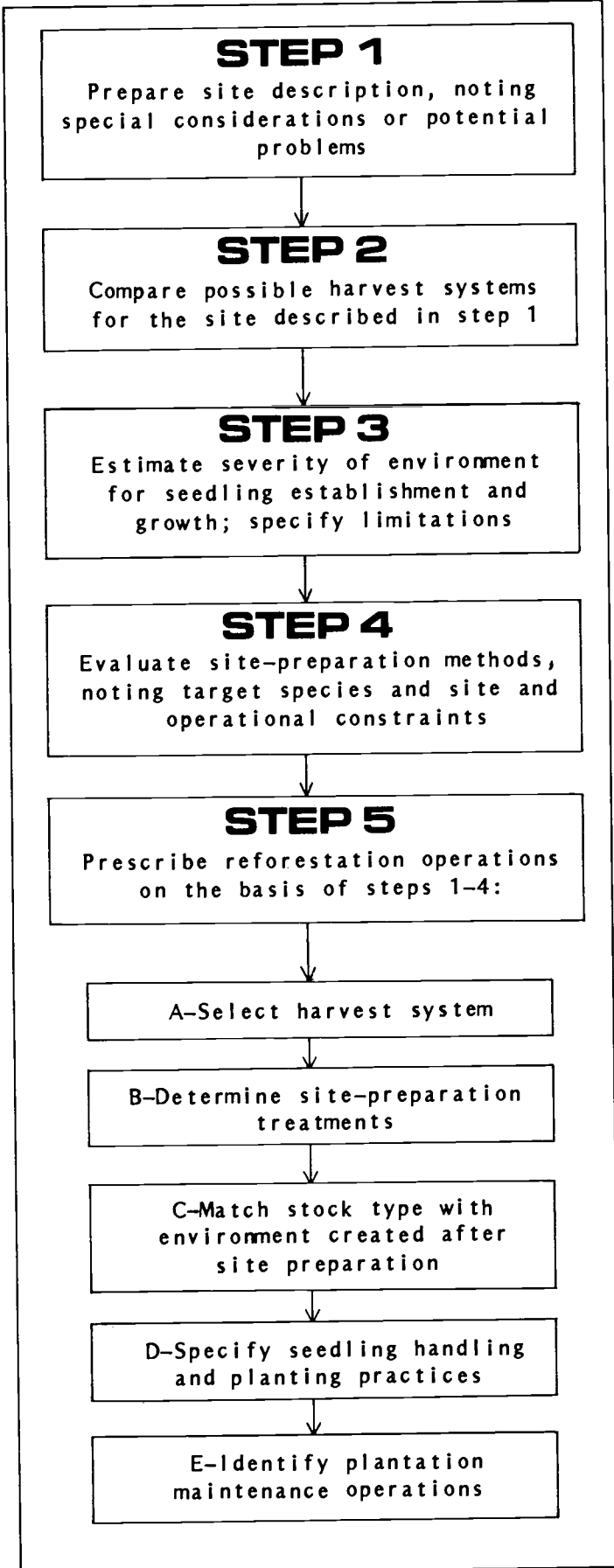


FIGURE 2.

RECOMMENDED REFORESTATION BY PLANTING.



FIGURE 1.

FIVE STEPS TO SUCCESSFUL REGENERATION PLANNING.

BEFORE YOU BEGIN TO PLAN . . .

Carefully identify your silvicultural objectives (see form); record these and any other considerations or constraints that could ultimately affect your prescription. Once you specify your goals, they will be far easier to reach. Then proceed with the

five steps, using the forms we have developed and provided here. We have included a sample prescription for an area in the Oregon Coast Range to illustrate development of this step-by-step plan for a specific site.

SILVICULTURAL OBJECTIVES

REFORESTATION GOALS

Trees per acre 250 at age 5 YRS.
 To produce: WOOD PRODUCT MIX

OBJECTIVES FOR OTHER USES

Water DRAINS TO ANADROMOUS FISH HABITAT
 Recreation SCATTERED HUNTING, FISHING
 Grazing —
 Wildlife COORDINATE WITH BIOLOGIST

CONSTRAINTS

Administrative SMOKE MANAGEMENT
 Environmental CLASS I STREAM DOWNSTREAM
 Other —

SILVICULTURAL OBJECTIVES

REFORESTATION GOALS
Trees per acre _____ at age _____
To produce: _____

OBJECTIVES FOR OTHER USES
Water _____
Recreation _____
Grazing _____
Wildlife _____

CONSTRAINTS
Administrative _____
Environmental _____
Other _____

STEP 1 PREPARE SITE DESCRIPTION

Step 1, in which site characteristics are assessed, is extremely important because the features of the site ultimately determine the choice of harvest system, site-preparation method, stock and species types, and maintenance program after establishment. Collect and record data on vegetation, soil, topography, biotic influences, and other agents or conditions. Also, carefully evaluate ground surveys, aerial photos, or other relevant, available information.

UNIT NAME/NO. BUCK CREEK 0012 T 12 S. R 6 W. SEC 13
 ACRES 38 PHOTO NO. 0649 SITE INDEX 140 CROP TREES/ACRE 80

CURRENT VEGETATION

LIST SPECIES BY VEGETATION LAYER						
HERB (0-3')	% COVER	SHRUB (3-20')	% COVER	TREE (>20')	% COVER	HEIGHT
GRASSES	35	SALMONBERRY	15	DOUGLAS-FIR	50	150 FT
SWORD FERN	40	VINE MAPLE	20	GRAND FIR	10	120
BRACKEN FERN	15	HAZEL	10	ALDER	20	70
SALAL	15	THIMBLEBERRY	20	BIGLEAF MAPLE	5	60
		OCEAN SPRAY	10			

HABITAT TYPE WESTERN HEMLOCK / SALMONBERRY / SWORD FERN

SOIL

Parent material TYEE SANDSTONE, SOME BASALT OUTCROPS
 Texture (sand, silt, clay, organic matter) CLAY LOAM
 Depth 2-3 FT.
 Rock content 10%

TOPOGRAPHY

Slope 40-50%; NEAR DRAW; BENCHES, FLATS < 25%
 Aspect MOST, SW SLOPE; NE ACROSS DRAW
 Elevation 1300 FT.
 Major features DRAW DOWN ONE SIDE OF UNIT; SOME BENCHY TOPOGRAPHY OVER REST.

BIOTIC INFLUENCES

Animals DEER, RABBIT, MT. BEAVER
 Disease ~
 Insects ~

CLIMATE

Precipitation 50-60 in. WINTER RAIN
 Temperature 20°F WINTER MIN. MILD-90°F SUMMER MAX;
 Snowpack LITTLE TO NONE
 Growing season LONG; EARLY MAY - MID SEPT.

SEED SOURCE

Zone 252
 Availability GOOD - SEED HAS BEEN COLLECTED

SPECIAL CONSIDERATIONS AND POTENTIAL MAJOR PROBLEMS

UNIT NAME/NO. _____ T _____ R _____ SEC _____
ACRES _____ PHOTO NO. _____ SITE INDEX _____ CROP TREES/ACRE _____

CURRENT VEGETATION

LIST SPECIES BY VEGETATION LAYER						
HERB (0-3')	% COVER	SHRUB (3-20')	% COVER	TREE (>20')	% COVER	HEIGHT

HABITAT TYPE _____

SOIL

Parent material _____
Texture (sand, silt, clay, organic matter) _____
Depth _____
Rock content _____

TOPOGRAPHY

Slope _____
Aspect _____
Elevation _____
Major features _____

BIOTIC INFLUENCES

Animals _____
Disease _____
Insects _____

CLIMATE

Precipitation _____
Temperature _____
Snowpack _____
Growing season _____

SEED SOURCE

Zone _____
Availability _____

SPECIAL CONSIDERATIONS AND POTENTIAL MAJOR PROBLEMS

STEP 2 COMPARE POSSIBLE HARVEST SYSTEMS

Consider the advantages and disadvantages of alternative harvest systems by placing a check (✓) next to the four or five characteristics that will be most important in selecting a method for your specific site. Compare the ratings for each characteristic checked for the three harvest systems listed. Then use this information and that in step 1 to help select and justify a harvest-system prescription in step 5A.

✓	CHARACTERISTIC	HARVEST SYSTEM ²		
		CLEARCUT	SHELTERWOOD	SELECTION
<input checked="" type="checkbox"/>	Cost per unit area	L	M	H
<input checked="" type="checkbox"/>	Physical difficulty of harvesting	L	M	H
<input checked="" type="checkbox"/>	Adaptability to maintenance and fire-hazard reduction	H	M	L
<input type="checkbox"/>	Environmental extremes emphasized	H	M	L
<input type="checkbox"/>	Visual impact	H	L	L
<input type="checkbox"/>	Road building required	L	M	M
<input checked="" type="checkbox"/>	Watershed disturbance	H	M	L
<input type="checkbox"/>	Risk of blowdown	M	H	L
<input type="checkbox"/>	Manpower required	L	M	H
<input type="checkbox"/>	Genetic selection possible	L	M	H
<input type="checkbox"/>	Guarantee of local seed source	L	H	H
<input type="checkbox"/>	Seedbed preparation	H	M	L
<input type="checkbox"/>	Special habitats retained	L	M	H
<input type="checkbox"/>	Adaptability to insect or disease control	H	M	L
<input type="checkbox"/>	Impacts from repeated entries	L	M	H

²H = High, M = Moderate, L = Low.

✓	CHARACTERISTIC	HARVEST SYSTEM ^a		
		CLEARCUT	SHELTERWOOD	SELECTION
___	Cost per unit area	L	M	H
___	Physical difficulty of harvesting	L	M	H
___	Adaptability to maintenance and fire-hazard reduction	H	M	L
___	Environmental extremes emphasized	H	M	L
___	Visual impact	H	L	L
___	Road building required	L	M	M
___	Watershed disturbance	H	M	L
___	Risk of blowdown	M	H	L
___	Manpower required	L	M	H
___	Genetic selection possible	L	M	H
___	Guarantee of local seed source	L	H	H
___	Seedbed preparation	H	M	L
___	Special habitats retained	L	M	H
___	Adaptability to insect or disease control	H	M	L
___	Impacts from repeated entries	L	M	H

^aH = High, M = Moderate, L = Low.

From FIVE STEPS TO SUCCESSFUL REGENERATION PLANNING,
 B.D. Cleary and B.R. Kelpsas, Forest Research Laboratory,
 Special Publication 1, 1981.

STEP 3 ESTIMATE SEVERITY OF ENVIRONMENT FOR SEEDLING ESTABLISHMENT AND GROWTH

Step 3 will help you evaluate how the new, post-harvest environment will influence seedling establishment, survival, and growth. Identify the severity of environmental components by rating their effects (H, M, L) on seedling survival (SUR) and growth (GR) for your site (top chart). Summarize the limitations by describing the factors that reduce the chances for seedling establishment (bottom chart). You will use this information to help determine site-preparation method (step 5B) and stock type (step 5C).

ESTABLISHMENT CONSTRAINTS^a

SUR/GR	MOISTURE	SUR/GR	TEMPERATURE	SUR/GR	LIGHT	SUR/GR	PHYSICAL
H/H	Precipitation (Growing season)	L/L	Elevation	M/H	Vegetation	H/H	Animals
L/L	Precipitation (Winter)	H/M	Aspect	M/M	Aspect	L/L	Snow or ice
L/L	Soil capacity	L/L	Air drainage	L/L	Standing debris	L/L	Slash
H/M	Vegetation	L/L	Growing season	L/L	Slash	M/L	Soil movement
L/L	Slope	M/L	Lack of shade	L/L	Excess light	L/L	Insects or disease
~	(other)	~	(other)	~	(other)	~	(other)

^aH = Severe limitation, M = Moderate limitation, L = Slight or no limitation.

SUMMARY OF LIMITING COMPONENTS

M O I S T	MUCH OF SW SLOPE COVERED WITH GRASSES, BRACKEN, THIMBLE BERRY, WITH SOME SHALLOW SOILS. DURING SUMMER, MOISTURE WILL BECOME LIMITING.
T E M P	HIGH TEMPERATURES MAY REDUCE SURVIVAL ON SW SLOPE
L I G H T	LIGHT NOT A PROBLEM, EXCEPT ON NE SLOPE IN SWORD FERN - BRUSH COVER.
P H Y S	DEER BROWSING A PROBLEM OVER ENTIRE AREA; MT. BEAVER SEEM CONCENTRATED ON NORTH SLOPE, IN DRAW; RABBITS PROBABLY EVENLY DISTRIBUTED.

ESTABLISHMENT CONSTRAINTS^a

SUR/GR	MOISTURE	SUR/GR	TEMPERATURE	SUR/GR	LIGHT	SUR/GR	PHYSICAL
	Precipitation (Growing season)		Elevation		Vegetation		Animals
	Precipitation (Winter)		Aspect		Aspect		Snow or ice
	Soil capacity		Air drainage		Standing debris		Slash
	Vegetation		Growing season		Slash		Soil movement
	Slope		Lack of shade		Excess light		Insects or disease
	<u>(other)</u>		<u>(other)</u>		<u>(other)</u>		<u>(other)</u>

^aH = Severe limitation, M = Moderate limitation, L = Slight or no limitation.

SUMMARY OF LIMITING COMPONENTS

M O I S T	
T E M P	
L I G H T	
P H Y S	

STEP 4 EVALUATE SITE-PREPARATION METHODS

Fire, chemicals, or mechanical methods may be used either singly or in combination to modify the seedling environment or gain access for planting. Identify and list important target species for your site (top chart); obtain the effectiveness rating for each species from Table 1 (p. 14). Determine the site-preparation constraints by placing a check (✓) next to any of the limitations in each column (bottom chart). If a listed restriction does not apply to your site, leave blank. Table 2 (p. 15) may help you establish constraints.

VEGETATION CHARACTERISTICS

TARGET SPECIES	EFFECTIVENESS				REMARKS
	MECHANICAL	FIRE	MANUAL	CHEMICAL	
SALMONBERRY	2-C	1-A	1-A	4-D	ASSUMES USE OF CORRECT HERBICIDE FOR EACH SPECIES - MIXTURE REQUIRED
VINE MAPLE	3-E	1-D	1-B	4-D	
BRACKEN	3-B	1-A	2-A	4-D	
ALDER	4-D	4-C	2-C	4-D	
GRASSES	4-B	3-A	1-A	4-C	
THIMBLEBERRY	2-B	1-A	1-A	4-D	

SITE AND OPERATIONAL CONSTRAINTS

✓ MECHANICAL	✓ FIRE	✓ MANUAL	✓ CHEMICAL	REMARKS
✓ Steep slopes	✓ Smoke management	✓ Slash untreated	✓ Slash untreated	
✓ Cost	Cost	✓ Cost	Cost	
Equipment scheduling	Hazard	Slash created	Sensitive areas	
✓ Erosion	✓ Fuel conditions	✓ Temporary effects	✓ Water	
Compaction	Erosion	Hazard	Equipment scheduling	
Agency policy ^a	Agency policy	Agency policy	Agency policy	
✓ POSSIBLE INJURY TO FISH HABITAT (other)	(other)	(other)	(other)	

^a Agency policy may include restrictions on use of chemicals or fire, or protection of rare plants or animals, wildlife corridors, snags, or other natural features.

VEGETATION CHARACTERISTICS

TARGET SPECIES	EFFECTIVENESS				REMARKS
	MECHANICAL	FIRE	MANUAL	CHEMICAL	

SITE AND OPERATIONAL CONSTRAINTS

✓ MECHANICAL	✓ FIRE	✓ MANUAL	✓ CHEMICAL	REMARKS
Steep slopes	Smoke management	Slash untreated	Slash untreated	
Cost	Cost	Cost	Cost	
Equipment scheduling	Hazard	Slash created	Sensitive areas	
Erosion	Fuel conditions	Temporary effects	Water	
Compaction	Erosion	Hazard	Equipment scheduling	
Agency policy ^a	Agency policy	Agency policy	Agency policy	
_____ (other)	_____ (other)	_____ (other)	_____ (other)	

^aAgency policy may include restrictions on use of chemicals or fire, or protection of rare plants or animals, wildlife corridors, snags, or other natural features.

TABLE 1.

SITE-PREPARATION ALTERNATIVES AND THEIR EFFECTS FOR WESTERN OREGON.

	<u>Effectiveness of method on vegetation</u>		<u>Estimated recovery rate from method</u>			
	Tractor	High-lead	Hand scalping/ slashing	Slash burning	Chemical	Spray and burn
Annual grasses	4-B	2-A	3-A	1-A	4-C	4-C
Perennial grasses	4-C	2-A	2-B	1-A	4-D	4-D
Broadleaf herbs	4-B	2-A	3-B	1-A	4-C	4-C
Alder	4-D	3-C	4-C ^a	2-C	4-E	4-D
Bigleaf maple	3-E	2-A	1-A	1-A	3-D	4-E
Bitter cherry	3-C	2-A	1-A ^a	1-A	4-E	4-E
Himalaya blackberry	2-C	2-A	1-A	1-A	3-D	4-D
Bracken	3-B	2-A	1-A	2-A	4-D	4-E
Cascara	4-D	3-A	1-A	1-A	4-E	4-E
Elderberry	3-B	3-A	1-A	1-A	4-D	4-D
Hazel	3-D	2-A	1-B	1-B	4-D	4-E
Ocean spray	3-C	2-A	1-B	1-B	4-D	4-E
Poison oak	3-B	2-A	1-A	1-B	3-D	4-D
Snowberry	3-C	2-A	1-A	1-B	4-E	4-E
Salmonberry	2-C	2-A	1-A	1-A	4-D	4-D
Thimbleberry	2-B	2-A	1-A	1-A	4-D	4-E
Vine maple	3-E	2-C	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	2-C	1-C	1-B	4-D	4-C
Chinkapin	4-E	3-C	1-C	1-A	4-C	4-D
Madrone	4-C	3-A	1-B	1-A	4-D	4-D
Manzanita	4-C	2-B	1-B	1-B	4-D	4-D
Rhododendron	4-D	3-C	1-B	2-B	2-D	4-D
Salal	3-C	3-C	1-B	1-B	2-D	3-D
Tanoak	4-E	3-D	1-B	1-A	4-E	4-E
Conifers	4-E	3-E	4-E	4-E	4-E	4-E

^aRecovery may be slower if cut in early summer.

TABLE 2.
CHARACTERISTICS OF SITE-PREPARATION ALTERNATIVES.

Alternative	Range of costs/acre ^a		Level of restriction					Equipment schedule
	Site preparation	Planting	Slope	Erosion	Compaction	Plantability		
Mechanical								
Tractor scarification	70-175	65-100	5 ^b	4	4	2	3	
High-lead scarification	250-350	85-150	3 ^c	3	2	3	4	
Tractor crushing	90-200	85-150	5 ^b	2	3	4	3	
Hand slashing	90-800	85-175	1	1	1	4	1	
Fire								
Crew/drip torch	40-250	65-100	2	3	1	2	3	
Mass ignition	40-60	65-100	2	3	1	2	3	
Flying drip torch	15-40	65-100	2	3	1	2	4	
Chemical								
Aerial (includes chemical cost)	10-85	85-175	1	1	1	3	3	
Backpack	100-175	85-175	4 ^d	1	1	3	1	
Combinations								
Hack and squirt	50-100	85-175	1	1	1	3	1	
Brown and burn	55-300	65-100	2 ^b	3	1	2	3	
Brown and crush	120-250	85-200	4 ^b	2	3	4	3	
Pile and burn	90-225	65-100	4 ^b	3	4	1	3	
Tractor scarification and spray	80-200	65-100	4 ^b	3	4	2	4	
High-lead scarification and spray	250-375	85-150	3 ^c	4	2	3	4	
Spray-pile-burn	100-300	65-100	5 ^b	3	4	1	4	

Note: See Regenerating Oregon's Forests (Cleary et al. 1978) for definitions or descriptions of alternatives

^aAs of 1981; labor only, 450 trees/acre; lower costs apply to large acreages or contracts.

^bNot recommended at >35-percent slope.

^cRequires >35-percent slope.

^dNot recommended at >65-percent slope.

STEP 5 REFORESTATION PRESCRIPTION

In step 5, the actual prescription process, use the information and alternatives brought together in the first four steps to make final decisions regarding the specific regeneration procedures outlined in steps 5A through 5E. Identifying alternatives and then selecting one that meets both the biological and operational constraints is the best way to ensure successful regeneration.

STEP 5A SELECT HARVEST SYSTEM

Prescribe a harvest system for your site on the basis of information developed in step 2. Consider topography, timber size, and vegetation, as well as cost and operational constraints. Justify your selection by listing the advantages and disadvantages of the alternatives considered.

ALTERNATIVES

- (1) SHELTERWOOD
- (2) CLEARCUT

MAJOR CONSTRAINTS

- (1) HIGHER COST; HARDER TO PROVIDE MAINTENANCE OPERATIONS; HARDER AND MORE EXPENSIVE TO LOG. ENCOURAGES BRUSH DEVELOPMENT IN UNDER STORY.
- (2) ENVIRONMENTAL EXTREMES EMPHASIZED; GREATER WATERSHED DISTURBANCE.

MAJOR ADVANTAGES

- (1) SEEDLING ENVIRONMENT REMAINS MODERATE; WATERSHED DISTURBANCE MINIMIZED.
- (2) LOW COST; EASIER TO LOG; EASY TO MAINTAIN PLANTATION; PROVIDES FULL SITE RESOURCES TO CROP TREES AFTER ESTABLISHMENT.

Preferred harvest system CLEARCUT (2)

Justification SEEDLING ENVIRONMENT; EASE OF
MANAGEMENT; LOW COST.

ALTERNATIVES

MAJOR CONSTRAINTS

MAJOR ADVANTAGES

Preferred harvest system _____

Justification _____

STEP 5B DETERMINE SITE-PREPARATION TREATMENT

On the basis of the material developed in steps 3 and 4, prescribe a site preparation method or combination of methods that best satisfies management objectives. Use Table 3 (p. 21) to help evaluate and prescribe the proper herbicide, if required. (For further information on herbicides, consult the Weed Control Handbook, published annually by the Extension Service, Oregon State University, Corvallis.) Justify the decision by weighing the restrictions and advantages of all alternatives.

ALTERNATIVES

- (1) PILE (SCARIFY) AND BURN PILES ON "CAT" GROUND.
- (2) BROADCAST BURN ENTIRE AREA AFTER SLASHING REMAINING HARDWOODS, BRUSH.
- (3) AERIALY SPRAY ENTIRE AREA - NO "CATS" OR FIRE. FALL: GLYPHOSATE, 1.5 QTS/AC. SPRING: HEXAZINONE, 1LB/AC

MAJOR CONSTRAINTS

- (1) ONLY LIMITED PART OF UNIT (GENTLE SLOPES) TREATED; SOIL EXPOSED TO EROSION; HIGH COST; VEGETATION PARTLY CONTROLLED; SOME ANIMAL HABITAT REMAINS.
- (2) SOIL EXPOSED; VEGETATION ONLY TEMPORARILY CONTROLLED SOMEWHAT OVER ENTIRE AREA; SMOKE MANAGEMENT MAY PREVENT BURNING.
- (3) NO SLASH REMOVED; ONLY SUSCEPTIBLE SPECIES CONTROLLED; BUFFER NEEDED AROUND STREAM; ANIMAL HABITAT STILL INTACT.

MAJOR ADVANTAGES

- (1) PROVIDES CLEAN, EASY-TO-PLANT AREAS (LOWER COSTS); UPROOTS SOME BRUSHY SPECIES; PROVIDES SOME INITIAL VEGETATION CONTROL; EASY ACCESS FOR MAINTENANCE, SURVEY OPERATIONS.
- (2) VEGETATION, SLASH REMOVED OVER ENTIRE AREA; EASY ACCESS FOR MAINTENANCE, PLANTING, SURVEYS; MT. BEAVER & OTHER ANIMAL HABITATS REMOVED.
- (3) NO SOIL DISTURBANCE; TARGET SPECIES CAN BE EFFECTIVELY CONTROLLED.

Preferred site preparation BROADCAST-SLASH-BURN* (2)

Justification ADEQUATE SITE PREPARATION; MODERATE DISTURBANCE; LOW COST.

* FOLLOW UP WITH RELEASE SPRAYS

ALTERNATIVES

MAJOR CONSTRAINTS

MAJOR ADVANTAGES

Preferred site preparation _____

Justification _____

TABLE 3.

SUSCEPTIBILITY OF WESTERN FOREST SPECIES TO MEDIUM RATES OF AERIALLY APPLIED HERBICIDES.^a

TREATMENT	SPECIES																																			
	ANNUAL GRASSES	PERENNIAL GRASS	BROADLEAF HERBS	ALDER	BIGLEAF MAPLE	BITTER CHERRY	H. BLACKBERRY	BRACKEN	CASCARA	ELDERBERRY	HAZEL	OCEAN SPRAY	POISON OAK	SNOWBERRY	SALMONBERRY	THIMBLEBERRY	VINE MAPLE	WHITE OAK	CEANOOTHUS	CHINKAPIN	MADRONE	MANZANITA	RHODOENDRON	SALAL	TANOAK	DOUGLAS-FIR	PONDEROSA PINE	GRAND FIR	NOBLE FIR	S. SPRUCE	W. HEMLOCK					
2,4-D, OIL (SPRING)			●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
2,4-D, WATER (SUMMER)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
2,4-D, EMULSION (FALL)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
2,4,5-T, OIL (SPRING)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
2,4,5-T, WATER (SUMMER)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
2,4,5-T, EMULSION (FALL)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
PICLORAM ESTER+T, OIL			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
PICLORAM + D or T, WATER			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMITROLE (SUMMER)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
ASULAM (SUMMER)																																				
GLYPHOSATE (FALL)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
GLYPHOSATE (SPRING)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
FOSAMINE (FALL)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DICAMBA (SUMMER)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
ATRAZINE (SPRING)			●	●																																
SIMAZINE (FALL)			●																																	
PRONAMIDE (FALL)			●	●																																
HEXAZINONE (SPRING)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
SILVEX, OIL (SPRING)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TRICLOPYR - ESTER, OIL (SPRING)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TRICLOPYR-ESTER, WATER (SUMMER)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DALAPON			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DALAPON AND ATRAZINE			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TRICLOPYR-ESTER, WATER (FALL)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DICHLORPROP, WATER (FALL)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

^a ADAPTED FROM NEWTON AND ROBERTS (1979).

STEP 5C MATCH STOCK TYPE WITH ENVIRONMENT

Prescribe the type of stock and species to be planted on your site on the basis of environmental features and limitations recognized in steps 1 and 2 and the type of environment created after the prescribed site-preparation treatment. Table 4 (p. 25) provides added information regarding the adaptation of conifers to environmental stress. Tell the nursery what type of seedling(s) you need and give any other instructions necessary to ensure production of the right morphological and physiological features.

SEED SOURCE (ZONE) AND ELEVATION 252 - 1500 FT.

STOCK ALTERNATIVES (CONSIDER AT LEAST 3)

SPECIES (SEE TABLE 4)	TYPE	SIZE OBJECTIVES		
		HT (cm)	DIAM (mm)	SHOOT/ROOT RATIO
DOLIGLAS-FIR (DF)	BR	40	6	2.5
GRAND FIR (GF)	BR	30	5	1.5
DOUGLAS-FIR	BR	25	4	2.0
DOUGLAS-FIR	P	25	2.5	1.2

STOCK SELECTION

Species and % composition DF BR, 40-6-2.5, 80%; GF BR, 30-5-1.5, 20%

Justification LARGER SEEDLINGS WILL BETTER WITHSTAND ANIMALS, BRUSH COMPETITION; PLANT MORE GF IN SHADIER, ANIMAL-PRONE AREAS.

NURSERY MANAGEMENT CONSIDERATIONS

Bed density or container size 25/50 FT.

Undercutting or wrenching ~

Irrigation schedule ~

Lifting date JANUARY 25

PMS guidelines^a <5-B BAR DURING LIFTING, PACKING

Culling specifications STANDARD NURSERY PRACTICE

Root pruning length DF, 10 IN.; GF, 8 IN.

Other ~

^aPlant moisture stress guidelines (Cleary and Zaerr 1980).

SEED SOURCE (ZONE) AND ELEVATION _____

STOCK ALTERNATIVES (CONSIDER AT LEAST 3)

SPECIES (SEE TABLE 4)	TYPE	SIZE OBJECTIVES		
		HT (cm)	DIAM (mm)	SHOOT/ROOT RATIO

STOCK SELECTION

Species and % composition _____

Justification _____

NURSERY MANAGEMENT CONSIDERATIONS

Bed density or container size _____

Undercutting or wrenching _____

Irrigation schedule _____

Lifting date _____

PMS guidelines^a _____

Culling specifications _____

Root pruning length _____

Other _____

^aPlant moisture stress guidelines (Cleary and Zaerr 1980).

TABLE 4.

ADAPTATION OF MAJOR CONIFERS IN OREGON TO ENVIRONMENTAL STRESS.^aTolerance level

H = High (capable of survival and growth)

M = Medium

L = Low (incapable of survival)

	Low light	Frost	High heat	Drought	Few nutrients	Animal damage
Pacific silver fir	H	H	L	L	M	H
Grand fir	H	H	M	M	M	H
Noble fir	L	H	L	L	M	H
Shasta red fir	M	H	L	L	M	H
Incense cedar	M	M	H	H	H	M
Engelmann spruce	H	H	L	L	M	H
Sitka spruce	M	L	L	L	M	H
Jeffrey pine	L	H	H	H	H	M
Sugar pine	M	M	M	M	M	H
Ponderosa pine	L	M	H	H	M	M
Western white pine	M	H	L	M	M	H
Lodgepole pine	L	H	M	M	H	M
Douglas-fir	M	M	M	H	M	M
Western red cedar	H	L	L	L	L	M
Western hemlock	H	M	L	L	M	H

^aAdapted from Waring et al. (1975).

STEP 5D SPECIFY SEEDLING HANDLING AND PLANTING PRACTICES

After determining the type of planting stock, be certain to reserve adequate cold-storage facilities for the correct number of seedlings. Also determine stocking level and desired spacing, projected planting date, and type of weather conditions acceptable at the time of planting.

PACKING CONTAINER AND SPECIAL REQUIREMENTS (BOXES, BAGS, PEAT MOSS, LINERS, ETC.) WAXED BOXES ; LINERS IF AVAILABLE.

COLD STORAGE

Capacity needed 18,000 TREES (EST. 350 CU.FT.)

Temperature 34° F SEEDLING TEMPERATURE (31° F COOLER)

Humidity ABOUT 50% , NOT CONTROLLED

Location COOLER NO. 6

PLANTING

Type (hoe, auger, dibble, etc.) HOE Scalp diam. 18 IN.

Trees/acre 435

Spacing 10 X 10 Regular Or microsite

Planting date LATE JANUARY

Weather guidelines STANDARD

CONCURRENT TREATMENTS

Tubing or budcapping ~

Animal repellent ~

Shading ~

Other ~

PACKING CONTAINER AND SPECIAL REQUIREMENTS (BOXES, BAGS, PEAT MOSS,
LINERS, ETC.) _____

COLD STORAGE

Capacity needed _____

Temperature _____

Humidity _____

Location _____

PLANTING

Type (hoe, auger, dibble, etc.) _____ Scalp diam. _____

Trees/acre _____

Spacing _____ Regular _____ Or microsite _____

Planting date _____

Weather guidelines _____

CONCURRENT TREATMENTS

Tubing or budcapping _____

Animal repellent _____

Shading _____

Other _____

STEP 5E IDENTIFY PLANTATION MAINTENANCE OPERATIONS

This final step may be the most important: Providing for plantation maintenance can make the difference between a stocked and nonstocked plantation. Specifying the type of regeneration survey and its timing will help you expose existing problems when they are small. Potential follow-up treatments to control competing vegetation, animals, or disease should also be identified and planned for. Information obtained from steps 1 and 3 can give some indication of the potential severity of these problems.

STOCKING SURVEY

Method

Stocked quadrant

Distance

Plot count

Other

Survey schedule (growing seasons after planting)

1st 2nd 3rd 4th

5th Other

ANTICIPATED VEGETATION TREATMENTS AND DATE

Chemical release BRUSH - GLYPHOSATE / 5/10/A. FALL 1ST - 2ND YR ; GRASS - HEXAZINONE 1/10/A. 1ST YR.

Mechanical release ~

ANTICIPATED ANIMAL-DAMAGE CONTROL AND DATE

Repellent ~

Trapping FOR MT. BEAVER : IN DRAW, IMMEDIATELY AFTER BURNING

Baiting or poisoning ~

Hunting ~

Tubing or budcapping BUDCAPPING MAY BE NECESSARY ON GENTLE SW SLOPES

INSECT AND DISEASE CONTROL

~

OTHER MAINTENANCE OPERATIONS

~

STOCKING SURVEY

Method

_____ Stocked quadrant

_____ Distance

_____ Plot count

_____ Other

Survey schedule (growing seasons after planting)

1st _____ 2nd _____ 3rd _____ 4th _____

5th _____ Other _____

ANTICIPATED VEGETATION TREATMENTS AND DATE

Chemical release _____

Mechanical release _____

ANTICIPATED ANIMAL-DAMAGE CONTROL AND DATE

Repellent _____

Trapping _____

Baiting or poisoning _____

Hunting _____

Tubing or budcapping _____

INSECT AND DISEASE CONTROL

OTHER MAINTENANCE OPERATIONS

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Planning for successful reforestation by planting is difficult because many variables must be integrated to produce a carefully designed and economical plan. Without a systematized approach, essential elements are often neglected or overlooked altogether. This paper presents a method in which planning information is organized step by step and then used as the basis for choosing among possible alternatives. In the first four steps, site information is compiled; harvest systems are analyzed; seedling environment is assessed; and site-preparation alternatives are evaluated. In the fifth and final step—the prescription—the harvest system is selected; the site-preparation method, stock type, and seedling handling and planting practices are determined; and operations for plantation maintenance are identified. A sample prescription illustrates application of this plan to a specific site.

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