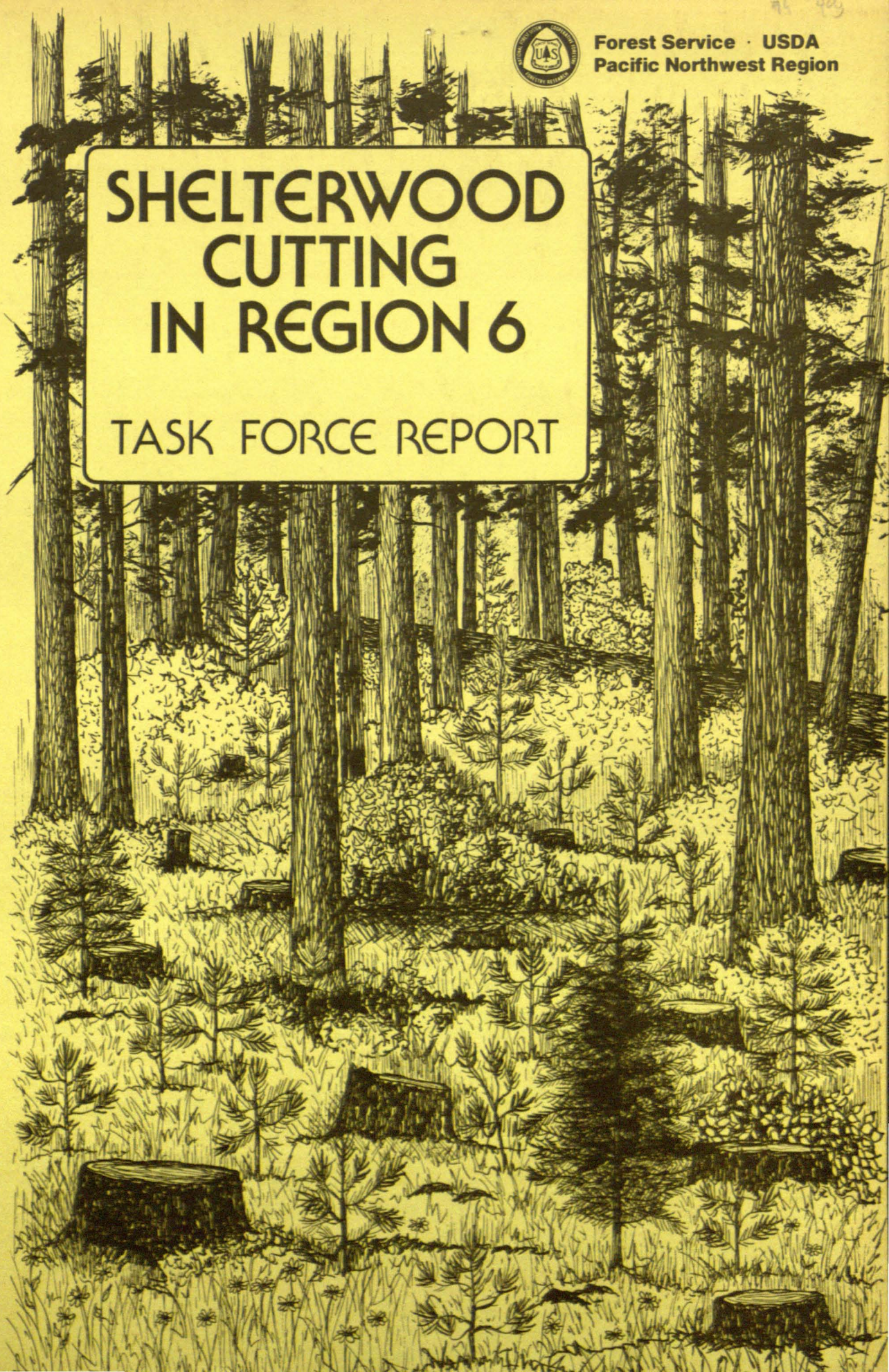
Forest Service · USDA
Pacific Northwest Region

SHELTERWOOD CUTTING IN REGION 6

TASK FORCE REPORT



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August 1979

TABLE OF CONTENTS

INTRODUCTION

Man-made and naturally created shelterwood stands cover more than 1-1/2 million acres of National Forest land in Region 6. It is appropriate at this time to evaluate the degree of success being achieved by this regeneration harvest method, and the Region 6, Director of Timber Management created a Task Force for that purpose in 1978. The objectives were to:

1. Appraise the effectiveness of the shelterwood system.

2. Following a field review describe the methodology which provides success.

3. Determine the circumstances under which the shelterwood system is being prescribed so that guidelines can be developed.

4. Provide specific recommendations regarding use of the shelterwood system in Region 6.

The Task Force included specialists in silviculture, soils, fuels, logging systems, and landscape management. Additional participation was contributed by researchers, Forest and District personnel, and specialists in various resources. Field travel by Task Force members to 74 projects, involved 24 Ranger Districts on 15 National Forests in Region 6.

This report is the result of efforts by the Task Force and a great deal of assistance, enthusiasm, and cooperation by numerous people from Forest and Ranger District organizations. Recommendations from Jerry Gruber of IFA were also considered in this summary.

I

MANAGEMENT DIRECTION AND LAW

Overall direction is provided to National Forest managers for the application of timber regeneration methods by national law, regulations, and policy. Further guidelines are provided to them from the National, Regional, and Forest offices in Manuals and Handbooks.

A. NATIONAL FOREST MANAGEMENT ACT OF 1976 (P.L. 94-588)

This Act directs that the Secretary of Agriculture ". . . shall promulgate regulations, under the principles of the Multiple-Use-Sustained-Yield Act of 1960, that set out the process for the development and revision of the land management plans, and the guidelines and standards prescribed . . ." (Section 6, subsection (g)). The specified guidelines that apply to timber cutting and regeneration methods are found in Sec. 6(g)(3)(E) and (F), which states in part:

> "(E) insure that timber will be harvested from National Forest System lands only where -
>
> "(i) soil, slope, or other watershed conditions will not be irreversibly damaged;
>
> "(ii) there is assurance that such lands can be adequately restocked within 5 years after harvest;

"(iii) Protection is provided for streams, . . . and other bodies of water from detrimental changes . . . where harvests are likely to seriously . . . affect water conditions . . . ; and

"(iv) the harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber; and

"(F) insure that clearcutting, seed tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber will be used as a cutting method on National Forest System lands only where-

"(i) for clearcutting, if it is determined to be the optimum method, and for other such cuts if it is determined to be appropriate, . . . ;

"(ii) . . . the potential environmental, . . . and economic impacts on each advertised sale area have been assessed, ...;

"(iii) cut blocks, patches, or strips are shaped and blended to the extent practicable, . . .;

"(iv) these are established according to geographic areas, forest types, or other suitable classificatons the maximum size limits for areas to be cut in one harvest operation, ...:

> "(v) such cuts are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and esthetic resources, and the regeneration of the timber resource."

A preliminary draft of new regulations conforming to the NFMA currently provides tentative guidance on the application of timber harvesting methods.

B. FOREST SERVICE MANUAL

Washington Office direction for regeneration cutting methods is given in FSM 2471.2:

> 2471.2 - Regeneration Harvests. Regeneration harvests describe any removal of trees intended to assist regeneration already present or to make regeneration possible.
>
> One of the most critical stages of forest management occurs at the end of the rotation when a decision must be made as how to harvest the mature stand and regenerate a new stand. Many factors have to be considered, including adequacy of advance regeneration, light tolerance of species present, stand composition and density, and distribution of age and size classes.
>
> Forest managers have two regeneration harvest options available for establishing forests and controlling composition and growth: even-aged and uneven-aged management.

2471.21 - Harvesting Techniques for Creating or Maintaining Even-Aged Stands. Even-aged silviculture and management is the manipulation of forests for . . . progressive development of harvestable stands to provide sustained yield of forest products. . . . . Regeneration occurs at or near the time of complete harvest when the stand reaches the desired age or size . . .

Three silvicultural systems are available for achieving the objectives of even-aged management: patch, strip, and stand harvesting; shelterwood; and seed-tree system.

1. Patch, Strip, and Stand Harvests. These are essentially designations of the same system, commonly known as clearcutting. . .

. . .

2. Shelterwood and Seed-Tree Harvests. These are variations of the same system. The choice depends on the availability of suitable seed trees, the amount of shade or light needed for regeneration of selected species, and the residual volume necessary for a commercial harvest after the area is restocked.

a. Shelterwood Harvest. The mature stand is usually removed in two or more steps. Regeneration of the new stand occurs under the cover of a partial forest canopy. A final harvest cut removes the canopy and the new stand develops as an even-aged stand. This system provides a continuing cover of either large or small trees. It is especially adapted to species or sites where shelter is needed for the reproduction, or where the shelterwood gives the desired regeneration an advantage over competing vegetation. Enough trees will be left to provide half-shade or more. In some cases, more than the minimum number of trees must be left to prevent windthrow.

b. Seed-Tree Harvest. . . .

c. Shelterwood or Seed-Tree Harvest Steps

(1) Site Preparation and Seed Production. This is the first of two steps. All trees undesirable because of disease, deformity, or other factors, and all merchantable trees are to be harvested in the first cut, except trees to be left to restock the area. The number of trees to be left depends upon the need for shade by the young seedlings.

(2) Removal. The trees left will be removed at the end of the period required for the new crop to reach an above-browse or other suitable height. . . .

. . .

3. Factors to Consider in Harvests of Even-Aged Areas. The major factors which affect the selection of harvest areas can be classed as biological, environmental, esthetic, economic, and management.

. . .

In general, it is necessary to ensure that clearcutting, seed-tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber will be used as a cutting method on National Forest System lands only where:

a. For clearcutting, it is determined to be the optimum method, and for other such cuts, it is determined to be appropriate, to meet the objectives and requirements of the relevant land management plan.

b., c., and d. . . .

. . .

e. Such cuts are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and esthetic resources, and the regeneration of the timber resource.

Shelterwood cutting is further discussed in R-6 FSM 2472.22, and R-6 FSM 2471.23. The shelterwood method is also described in Section 31.2 of the R-6 Silvicultural Examination and Prescription Handbook.

II

SHELTERWOOD TERMINOLOGY AND DESCRIPTION

This Report concentrates on man-made prescribed shelterwood stands, with brief reference to natural shelterwoods, principally when discussing removal cuts. Region 6 has numerous natural shelterwood stands that developed following wildfire, insect epidemics, and forest disease attacks.

Reproduction or regeneration cuttings are normally made to (1) remove mature trees and (2) create environmental conditions favorable for establishment of reproduction (Smith, 1962). The shelterwood system is one of the regeneration methods normally associated with the creation of even-aged forests. Several descriptions of the shelterwood system appear in literature, as follows:

> "The shelterwood method is any regeneration cutting in a mature stand designed to establish a new crop under the protection of the old." (SAF, 1971).

> "The essence of all shelterwood systems is the gradual removal of the timber crop in a period which is a fraction of the whole rotation, but which is long enough to secure the establishment of desired reproduction. The removal of the mature crop is gradual, in a series of steps designed for specific purposes." (Baker, 1934)

The shelterwood system, as applied in Region 6, is typically a two-step method of regeneration. Step one involves the first harvest entry in which designated trees are left to provide seed and improve site conditions for establishment of planted or natural regeneration, especially

in drought areas and frost pockets. Step one will be referred to as the "seed cut." Step two involves removal of the shelter trees after establishment of the understory stand. This will be referred to as the "removal cut." Removal cut in several stages is a recognized, but infrequently used, technique.

Reference to the entire shelterwood regeneration system should always be interpreted to include all entries; in other words, from initial seed cut to a regenerated stand that is free to grow. By definition, in order to be a shelterwood, the effect of the cutting method must be to provide shelter for regeneration.

The pattern of shelterwood cutting may be uniform, in groups or in strips. Uniform cutting refers to evenly spaced shelter trees. Group cutting removes small patches of trees, and strip shelterwood involves narrow openings which receive shelter from the adjacent uncut portion of the stand. A special technique, called irregular shelterwood, exists but is not discussed in this report.

III

STATUS OF SHELTERWOOD CUTTING IN REGION 6

Approximately 400,800 acres of National Forest land in Region 6 have had the first entry of the shelterwood system applied. Of this total 32,500 acres have been regenerated with overstory removal operations completed; 76,900 acres are presently programed for overstory removal, and the remaining 291,400 acres are either inadequately stocked or, if stocked, are not presently programed for overstory removal.

In addition, there are 1,207,000 acres of natural shelterwood (created by fire, insects, etc.) with a manageable understory. Of these 364,000 acres are scheduled for removal cuts and the remaining 843,000 acres are unprogramed.

In Region 6, many shelterwood stands are regenerated by planting. The main reason is to resume timber production rapidly following regeneration cutting. Early planting takes advantage of site preparation resulting from harvest and fuel treatment and allows regeneration to become established before competitive vegetation can take over the site, even during years of poor seed-fall. Planting also allows the use of genetically improved stock and provides control of the composition and structure of the new stand.

Foresters on some Districts have become quite skillfull in the successfull application of the shelterwood system. Using their knowledge, and some of the new statistical analysis methods, they could predict which stands need to be planted and which will regenerate naturally (Braley, 1973). There is evidence that shelterwood trees increase seed production due to improved light conditions after seed cut. Although the Task Force observed shelterwoods on 15 National Forests, only a few examples could

be found of prescribed shelterwood with all steps completed. Most of the areas visited had the seed cut completed, have regenerated, but are in need of the removal cut. In many cases there was no plan for accomplishing this.

There are several reasons for this situation. First, Forests have extensively used the shelterwood method only within the last 7-8 years. Seedlings in these units are still small so the removal of the overstory has not been considered urgent. Second, there is a hesitancy to schedule the removal cut for fear of destroying the regeneration. The statements and recommendations in this report are based mostly on observations of partially completed shelterwoods.

Without a doubt, the skill, coordination, and commitment required to successfully execute a shelterwood from inception of the project through to final accomplishment, is greater than that necessary for other even-aged regeneration methods.

The following photo series, Nos. 1-4 , depicts the phases of a shelterwood operation. It begins with a mature stand prescribed for a regeneration cut and ends with a managed, free-to-grow, regenerated stand.

Shelterwood Sequence

Photo No. 1 - Mature timber stand on a south aspect with shallow soil. The shelterwood regeneration method is prescribed here for the purpose of site amelioration.

Photo No. 2 - Seed cut (initial entry) is accomplished through commercial timber sale followed by fuel treatment, erosion seeding, site preparation, and planting or natural regeneration.

Photo No. 3 - A stand ready for overwood removal (normally 5-10 years after seed cut). The stocking and height of regeneration meet predetermined targets.

Photo No. 4 - Final overstory removal is accomplished. Care is exercised to create the least possible impact to tree stocking and soils. Minimal fuel treatment may be necessary.

IV

WHY SHELTERWOODS ARE USED IN THE REGION

Properly planned and employed, the shelterwood regeneration method can be used to meet land management objectives in visual, soil, watershed, and wildlife management. In addition, shelterwoods are being used effectively to regenerate harsh sites where clearcutting causes unacceptable delay. The Task Force observed innovative and effective applications of shelterwood to meet resource objectives. Reasons for prescribing the shelterwood system vary from biological to social concerns.

A. Biological. The most common reason for installing a shelterwood is to reduce the environmental harshness of a site during the regeneration process. The environmental factors favorably influenced are moisture, temperature, competition, and frost pocket situations. Local reforestation problems with clearcuts were commonly cited as the reason for shelterwood installation.

Policy directives have been published by some Forests directing shelterwood use in certain situations such as on specified soils, specific plant communities, sites where certain plant indicators are present, and areas identified by formal research. Also, local experience and observation of past failures are used to identify areas that are appropriate for shelterwood regeneration.

The Willamette National Forest has published specific guidelines titled A Silvicultural Guide to Using the Shelterwood System on the Willamette National Forest, 1975, in which the reasons for applying shelterwoods and the recommended sites and conditions under which the system should be employed, are fully discussed.

The Deschutes National Forest has found the shelterwood system advantageous in reducing pocket gopher populations in some plant communities. These animals cause severe regeneration losses in certain plant communities if clearcut. District foresters believe that shelterwoods reduce forb production on these sites, thereby creating a less favorable gopher habitat.

Several Forests use specific research publications for guidance in reaching decisions on where to install shelterwoods. For instance, Minore (1972), Pfister (1972), and Hall (1973) have identified plant communities and habitats where site amelioration may be accomplished by shade. Sullivan (1978) also identified habitat types in the Cascade mountain range that are easier to regenerate through shelterwooding than through clearcutting. On many Forests this type of information is not available or applicable for local conditions. However, a substantial amount of investigation is now being carried out which promises future help.

The Task Force did find cases where people may have inappropriately interpreted research advice concerning shelterwoods. The research publications discuss shelterwood <u>for attaining natural regeneration</u> on particular sites, whereas the interpretations were to use shelterwood and plant the site. In these instances, clearcutting and planting could also have met the regeneration objective with less cost.

An excellent analysis was made on the Illinois Valley Ranger District, Siskiyou National Forest, to determine the reasons for past regeneration failures (Wolfson, undated). The document identifies areas where clearcutting should not be attempted and where the shelterwood system or uneven-aged management should be employed.

There are many other reasons for applying shelterwoods to attain regeneration. These include protection from snow damage at high elevations, maintenance of trees to provide transpirtation on areas with a high water table, reduction of excessive solar radiation for species sensitive to this problem, (Ronco, 1970), and reduction of brush invasion on some regeneration sites (Willamson, 1976).

Shelterwoods are used to soften the effects of a harsh environment on seedling establishment.

Photo No. 5 - A heavy shelter was left on this site on the Gifford Pinchot National Forest to protect against frost.

Photo No. 6 - Protection of this site against high temperatures and drought will be provided by shelter trees on a south aspect on the Galice Ranger District, Siskiyou National Forest.

B. Other Resources. Forest land management planning has identified areas where emphasis will be given to visual, range, watershed, and wildlife resources. The Task Force observed cases where shelterwoods were used to meet these objectives. For example, the use of hardwood trees for shelter, by themselves or in combination with conifers, benefit wildlife habitat by providing food and creating variety in the stand.

A substantial amount of partial cutting has been carried out with management of big game habitat as a primary objective and referred to as shelterwood. Only a portion of this activity has produced silviculturally sound treatments meeting shelterwood criteria.

A silviculturally adequate shelterwood regime usually does not meet big game needs on the West Side according to Ed Harshman, the Wildlife Specialist consulted by the Task Force. Wildlife biologists, in analyzing the big game impacts, noted that compared to clearcutting, shelterwoods (1) tended to be larger, (2) did not provide adequate hiding or thermal cover, and (3) subsequent forage production was lower unless the ground was highly disturbed; (Harshman and Jubber, manuscript in preparation).

The optimum thermal cover for elk, in the Blue Mountains, includes a minimum of 70 percent crown closure, and deer require at least 60 percent closure, (Thomas, ed., 1979). Use of the shelterwood system to effectively regenerate timber stands within 5 years will rarely provide the optimum thermal cover requirement.

Scheduling and controlling the size of cutting areas appears to be the best opportunity to meet big game requirements. There is a need for more coordination of the available wildlife and silviculture technology to better meet the objectives of both.

Photo No. 7 - Shelterwood along Highway 62 on the Rogue River National Forest to meet visual objectives.

Expanded use of the shelterwood system in Region 6, during the early 1970's, resulted largely from the hope it would provide timber harvest volume while protecting aesthetic values. The need to remove the shelter trees relatively soon after regeneration to minimize seedling damage and to maintain acceptable growth rates, was not completely recognized. This realization is now fairly universal, however, and shelterwood cutting is assuming a more appropriate place in visual resource management.

It was the consensus of the Task Force members that shelterwoods have considerable potential for management of visual resources. Nevertheless, we need more experience and skill in this practice to meet long-range visual objectives. Emphasis is needed in the designing of visually acceptable treatment unit size and shapes which will anticipate the appearance of units following overwood removal, remembering that a completed shelterwood will resemble a regenerated clearcut. (See Photo No. 4.) The Chief's Office is issuing a Timber chapter of the Visual Resource Management Handbook which makes extensive use of the shelterwood system. Forests are now applying the principals from that guide.

On East Side Forests the shelterwood system is frequently used to maintain the appearance of continuous forest cover. Retention of scattered old-growth trees adds to the effect of a "natural forest." There is a reluctance to remove all of the overwood on regenerated areas and many of these trees will probably be left for wildlife habitat needs.

Shelterwoods are frequently used in streamside management units (SMU's). Most of the people contacted felt that shelterwoods met the short-range objectives, but often did not mention whether or not the long-range objectives would also be met. The Task Force did not resolve this question, and further investigation is needed.

C. Reasons other than Biological or Resource. The shelterwood regeneration system became widely used in the Region after 1970. Several controversies of national significance concerning clearcutting (Bitterroot controversy in Western Montana, 1969-1970; Monongahela in West Virginia, 1971) surfaced about then. A reaction to these and the Chief's Action Plan to the National Forest Management in a Quality Environment was a reduction in the amount of clearcutting in R-6 and use of the shelterwood as a substitute. Unfortunately, in many cases, the need to plan the entire sequence necessary for a successful shelterwood was not understood. The seed cut was planned and executed but the overwood remains in many regenerated stands today with few plans for final removal evident. The acreage figures reported by Forests on Page 10 substantiate this finding.

In the early 1970's, several Forests established directives to restrict the use of clearcutting. Some remain in effect today and require formal approval for clearcutting. These Forests are prescribing many more shelterwoods than Forests without such direction. If a forester must justify or get formal approval for each clearcut, there will be more shelterwoods on that Forest.

There is, within the Region, some uncertainty concerning the direction contained in the National Forest Management Act of 1976 (NFMA) relating to regeneration methods. One interpretation of the Act is that clearcutting can be used only if no other alternative is feasible. A Forest following this interpretation, most frequently uses the shelterwood system as a feasible alternative to clearcutting.

Many people expressed concern over the need to place their programed timber volume on the market each year and to concurrently obtain acceptable regeneration within 5 years of cutting. If doubt exists concerning the attainment of these goals, a shelterwood is often chosen as the solution. In these situations, the decision to utilize the shelterwood system is an attempt to meet broad organization goals rather than a silvicultural decision reached through analysis and determination of site requirements and management objectives.

An analysis of the economic advantages of shelterwoods, such as the potential for attaining natural regeneration at minimum cost and the opportunity to capture growth on shelter trees during the stand establishment period, was never mentioned by the people interviewed as reasons for the use of the system. Likewise, the extra costs associated with shelterwood logging were not considered by any of the people questioned. District personnel reported sale administration costs associated with shelterwood removal cuts, exceeding those for clearcuts by two to three times. The greatest amount of administration is required for tractor yarding and less time is required for cable logging. People on several East and West Side Forests said that a successful removal cut required a minimum of three visits per week, with two hours per visit by the sale administrator.

Undoubtedly, shelterwoods are chosen for a variety of reasons and to satisfy various concerns because the system is a versatile regeneration method. Because it is used for many reasons, the planning and prescription phase should clearly identify WHY the method was chosen and the trade offs. This is necessary to determine the amount of shelter required and the length of time it is needed.

D. Situations Favoring Other Regeneration Methods. The Task Force learned about situations where field people have found the shelterwood system an inappropriate and impractical regeneration method. Some of the coastal Forests (particularly those exposed to high intensity coastal storms during periods of wet soil conditions) rely almost completely on clearcut regeneration. In these areas, blowdown of shelter trees and brush encroachment would make shelterwood a risky system to use. In fact, because of the limited use of the method the Task Force did not travel to the Siuslaw, Olympic, and Mt. Baker-Snoqualmie National Forests. However, on these same Forests, shelterwood has potential to prevent saturated soil conditions where high water tables exists.

On the other extreme, there are some sites so severe that shelterwood would not provide adequate protection for regeneration.

Photo No. 8 - Windthrow limits the use of the shelterwood system in coastal forests and on wet, exposed sites in the Cascade Mountains.

Another situation where shelterwoods have found only limited value is in pure, "old growth" lodgepole pine. Blowdown has been the major problem in this forest type.

In most cases, stands with considerable disease or mistletoe are not being regenerated by the shelterwood system. There were exceptions, and the people responsible are aware of the need to remove the overstory early to prevent infecting the understory.

In a few cases, soil compaction has resulted from the multiple harvest and fuel treatment entries necessary in applying the shelterwood system. If shelterwood is necessary on a highly compactible soil, careful planning and execution of yarding and fuel treatment are necessary.

V

INGREDIENTS OF THE SUCCESSFUL SHELTERWOODS

Effective use of the shelterwood system depends on three factors; direction, prescription, and execution.

A. CLEAR DIRECTION

Line officers play an important role by interpreting laws, regulations, and policies and by providing management direction to the people who prescribe timber harvest practices.

Through the Land Management Planning process, resource allocation decisions are developed for forest land. The environmental analysis (EAR) process relates these allocations to the basic management unit (timber stand).

Land management objectives must be clearly identified if a prescription for a shelterwood or any other silvicultural treatment is to be appropriately made. The Task Force observed inconsistent management direction within the Region as regards to range/timber, soils/reforestation, fuels management, visual, and other directions relating to regeneration harvest practices.

Following are examples of the importance of complete planning in shelterwood operations:

1. Direction to Meet Long-Range Objectives. The Task Force observed examples where the initial entry (seed cut) was made to meet visual objectives. Shelterwoods have also been used to maintain shade along stream courses. In these cases, the short-range objectives were

being met, but in some, long-range problems may result. Will the unit continue to meet visual objectives after final overstory removal; or will a narrow streamside shelterwood withstand windstorms and provide long-term shelter for the stream?

There are opportunities to improve the long range considerations of using shelterwood for resource protection.

2. Meeting Resource Objectives. Some Districts displayed excellent coordination in managing to meet multiple resource objectives. It was evident that where a multidisciplinary approach to planning was used, the resulting shelterwoods were of high quality. The most prominent conflicts in meeting the shelterwood regeneration objectives were excessive grass seeding and fuel treatment.

Photo No. 9 - Heavy grass seeding is in conflict with meeting the 5-year tree-establishment and growth objectives. Excessive grass competition is causing seedling mortality and limiting growth. (This area, recorded as a shelterwood, more closely fits the definition of a seed tree cut.)

Photo No. 10 - Fuel treatment objectives are met, but in the process excess soil disturbance and compaction occurred .

3. Overstory Removal Backlog Records. There is no current in-place inventory system to accurately determine the acreage requiring overstory removal and to insure timely removal before regneration becomes vulnerable to damage. Forest people indicated that the acres requiring overwood removal are increasing. The Task Force feels it is essential to know (a) how much acreage needs overstory removal; and (b) the location of each area. In addition, a scheme is needed to insure timely scheduling of the removal cut.

4. Economic Analysis of Shelterwoods. Usually, economic analysis has not been used to evaluate various regeneration systems where a choice is possible, consistent with multiple resource objectives.

With the exception of using shelterwoods to reduce planting costs and take advantage of natural regeneration, the Task Force found no documented evidence of economic considerations regarding shelterwooding vs. other techniques. The costs of the additional entries and fuel treatments were seldom considered in project proposals.

B. COMPLETE PRESCRIPTIONS

After reviewing 74 projects on 24 Ranger Districts the Task Force concluded that a complete prescription is essential to a successful shelterwood treatment. Prescriptions that were logical and implementable and which described the necessary steps from a mature stand to a free-to-grow regenerated stand were consistently most successful. These prescriptions identify all of the activities or events having an effect on the operation including the physical and economic feasibility of the removal cut. They specify how and when fuel treatment, erosion seeding, site preparation, logging systems, planting, etc., will take place.

As a result of field reviews the Task Force made the following observations concerning prescriptions, design, and layout procedures:

1. Establish Reasons for Shelterwood - The prescription should include the reasons for choosing the shelterwood system; i.e., biological, social, or management objectives. This is a necessary basis for determining the amount of shelter needed. On some Districts the people have developed good local knowledge of where shelter was needed and the amount required to insure regeneration.

2. Prepare Complete Prescriptions - A contributing reason for the backlog of uncompleted shelterwoods is that most prescriptions written to date have included only the seed cut (initial entry) and subsequent regeneration. Very few complete prescriptions through the final overstory removal and subsequent treatments could be found during the field visits by the Task Force.

Photo No. 11 - A light shelter was retained here to provide conditions for excellent natural regeneration on the Colville Ranger District, Colville National Forest.

3. Determine How Long Shelter is Needed on a Unit - The Task Force observed examples of effective, timely action in removing the overstory after regeneration was established. Photograph No. 12 displays prompt action in removing the overstory. In this situation, shelter was no longer necessary and final overstory removal was scheduled when regeneration was less than 3 feet tall.

On any site requiring a shelterwood there is an optimum time period to retain the shelter trees. Protection from frost on one site may require shelter for 15 years, while protection from high surface temperatures on another site may be needed for only 5 years. The key point in either of these situations is to remove the shelter trees as soon as they have served their purpose. The Task Force saw repeated examples of increasing logging damage with increasing regeneration size. Minimum losses occurred in overstory removal operations where reproduction was under 3 feet in height. Experience with the size-damage relationship have been reported by Musser (1979) and Jaszkowski (1978).

The prescription should state how long shelter is needed on the unit and follow-up is necessary to insure the most opportune overwood removal. Social values may dictate leaving the shelter longer than necessary to meet biological constraints.

Photo No. 12 - The final overstory removal has been accomplished on this stand regenerated by the shelterwood method on the Willamette National Forest. The seedlings are less than 2 feet tall. Well-planned and designed logging systems have minimized crop tree losses.

4. Determine Appropriate Size of Regeneration Units. Many of the more recently prescribed shelterwoods reflect adequate consideration of unit size. Currently, District silviculturists are designing units of sizes and shapes to meet other resource objectives.

There is a common understanding that shelterwoods are an even-aged regeneration method and that after the overstory removal it will have the same appearance as a regenerated clearcut. (See Photo No. 4 on Page 15.) It is important to be aware of this when prescribing.

The Task Force saw shelterwoods designed in the early 1970's exceeding 300 acres in size. Districts are now confronted with the problem of extensive removal cuts resembling very large clearcuts. A common solution is to stagger the removal cut, using smaller units, at the risk of damaging regeneration in those treated last.

5. Specify the Distribution, Number, and Type of Trees to Retain as Shelter, and Seed Source Within The Shelterwood Area - Successful prescriptions described distribution, number, and type of trees necessary to provide shelter. Clumpy arrangements usually resulted in a poor distribution of regeneration ranging from understocked to overstocked conditions. A uniform distribution of shelter trees usually resulted in an even distribution of regeneration.

It is important to determine the least number of shelter trees required for site amelioration or other reasons in order to minimize losses of seedlings at the time of overstory removal. Foresters tend to prescribe the retention of more shelter trees than are necessary. Local knowledge and scientific expertise is essential, therefore, to determine the degree of protection needed.

The type of shelter trees is also an important consideration. A problem expressed by personnel of several Forests is their dissatisfaction with leaving large, old-growth trees as shelter, due to the difficulty of removing them after the regeneration is established.

Although the larger trees are genetically most desirable as a seed source, they are the most difficult to remove without damaging reproduction. A solution to this dilemma is possible by leaving smaller trees for shelter and obtaining regeneration by planting seedlings of improved genetic stock.

Several Districts in southwestern Oregon displayed considerable innovation by utilizing hardwoods as shelter trees. The hardwoods are not as large as conifers and the result is less damage to reproduction if they are removed.

6. Identify Desired Stocking Levels and Growth Rates - Target growth rates for regeneration in shelterwood units has had little consideration in the Region. The illustration on the next page displays the effect of shading on the growth and development of Douglas-fir seedlings. Consideration should be given to this problem when the prescription is written.

Successful users of the shelterwood method recommended that the target number of trees following overwood removal and fuel treatment be stated in the prescription. The anticipated losses of crop trees in these operations could then be based on local experience. Some District people reported 20-30 percent losses of crop trees during overwood removal and fuel treatment operations. To partially offset these losses, planting rates could be increased.

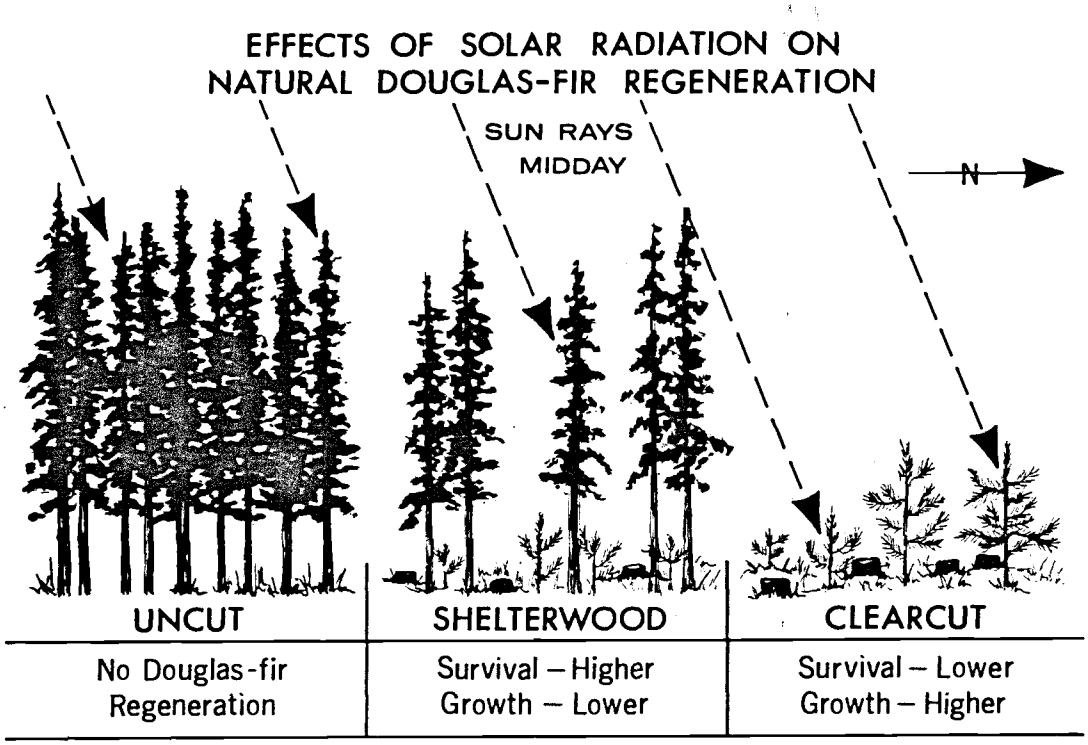

Illustration 1 - Vertical cross section along a north-south axis through a Douglas-fir stand on a xeric site, showing the effect of light intensity on natural Douglas-fir regeneration. The intensity of the cutting, which was made at the same point in time, varies from complete removal on the north to no cutting on the south. In the uncut portion, light is usually inadequate for Douglas-fir reproduction. In the shelterwood, the diffused illumination and protection provided by the remaining shelter favors germination and survival of Douglas-fir seedlings. The response of the regeneration to varying illumination and root competition is indicated by the height growth of the seedlings. The Douglas-fir seedlings in the clearcut have grown more rapidly than the protected seedlings, but their numbers have been reduced by environmental conditions limiting germination and survival. (Adapted from Hawley and Smith.)

7. Coordinate with Other Resources - Not all the prescriptions reviewed by the Task Force included the coordination necessary for success. Fuel treatment, grass seeding for range and soil protection, and logging systems occasionally provided conflicting objectives. When complete prescriptions were prepared through interdisciplinary action, they tended to be very successful.

Several areas were visited during field trips where shelterwood cutting and fuel treatment were carefully coordinated to keep costs reasonable and meet basic objectives. Underburning of shelterwood stands is being done extensively to reduce fuels. More personnel time is required and costs are higher than broadcast burning of clearcuts, but good results are obtained. Limits on people available for slash burning requires controlling the amount of new shelterwood created each year.

In some locations a successful combination of treatments has been made, which begins with a thorough fuel cleanup after the seed cut. Following final removal, the least amount of fuel treatment needed is applied. Due to the fragility of new regeneration, this second fuel treatment is the most expensive. Careful selection of seed trees has also reduced the amount of slash created by the removal cut.

C. TIMELY AND SKILLFULL EXECUTION

The expertise, attitude, and commitment of people who work in timber sale administration, fuels management, and other activities have an important bearing on the success or failure of a shelterwood. Once again close coordination was found to be necessary between various resource disciplines if success was to be attained.

The following items were highlighted by the Task Force as being keys to success in implementing shelterwoods.

1. Skill Levels of Marking Crews and Sale Designers - There is a general tendency for tree marking and sale layout work to be done by inexperienced people. The Task Force recognized this as a source of some shelterwood problems. This is a difficult situation to overcome because problems are not entirely within control of Forest personnel, i.e., personnel ceilings, hiring policies, etc. Increased training and closer supervision are potential sources of relief.

The Task Force observed good results where the marking was carefully monitored. Best results were observed where there was close coordination between the prescriber, marking crews, and layout people.

2. Experience and "Can Do" Attitude - Success was often found to be the result of a "can do" attitude which was displayed on many Forests.

In a few local spots, there is a lack of confidence in the shelterwood system, particularily in the overwood removal phase. In most cases, this hesitancy is a result of past failures. The Task Force concludes that a lack of expertise in logging systems is largely responsible for the past problems.

On the other hand, many bright spots were observed during the Forest visits. Excellent final overstory removal results were often displayed that fully met regeneration objectives. Examples of the good work that is possible through a "can do" attitude along with on-the-ground expertise was very encouraging to see. Further details are available in reports by Musser (1979) and Jaszkowski (1978).

3. Coordination of All People Involved - Success frequently resulted from situations where everyone involved with the activity was aware of and committed to common objectives.

In situations where the sale administrator, fuels management people, range conservationist, and silviculturist clearly understood and agreed to the overall objectives, success usually followed. For example, the Task Force was shown excellent examples of underburning to meet fuels management and silvicultural objectives following seed cuts on the Willamette, Siskiyou, and Rogue River National Forests.

Photo No. 13 - Fuel treatment is being accomplished and the site prepared for planting.

4. Developing and Administering Timber Sale Contract Clauses to Meet Project Objectives - Contractual requirements used on various Forests to meet shelterwood objectives vary considerably.

They include:

a. On-the-snow logging.

b. Directional felling.

c. Predesignated skid roads.

d. Stage logging.

e. Yarding unmerchantable material.

f. Yarding of tops.

Tractor yarding during overstory removal is frequently done with satisfactory survival of regeneration on the East Side. However, on the West Side, tractor yarding often destroys the reproduction. West of the Cascade summit, the most consistently successful approach is skyline yarding, using one-end suspension and requiring a carriage with lateral yarding capability.

Combined with good contract administration, these techniques can provide the margin needed to achieve results. The Task Force found that people on some Ranger Districts had developed skill in successfully using contract clauses to achieve desired results, but this knowledge was not universal and needs to be disseminated more widely. Photograph No. 14 displays good results attained through directional felling and skidding to predesignated skid trails.

Photo No. 14 - Directional felling and skidding to predesignated skid trails minimized crop tree losses in this shelterwood unit on the Prospect Ranger District, Rogue River National Forest.

End-product timber sale contracts have been employed with good results on the Malheur National Forest. Here the timber sale contract specifies the minimum number of crop trees per acre that would be acceptable following overstory removal. The Forest reports excellent cooperation by timber sale contractors though these contract clauses do not specify how the job is to be accomplished. Other successful contractual techniques have been utilized on fully operational and on experimental levels (Barrett, et al., 1976). Some people have been extremely successful in obtaining the logger's cooperation simply by informing him of the objectives and expected results.

D. Additional Observations and Considerations

The review of shelterwood applications revealed many interesting and useful observations which can be a stepping stone toward sound use of shelterwoods in the Region. Our people have developed considerable skill and knowledge in applying the shelterwood system, but the information has not spread to all Forests and Districts.

Improved direction from National and Regional levels concerning the use of regeneration harvest methods is needed. Using the National Forest Management Act of 1976 as an impetus, there is an opportunity to improve prescriptions for cutting practices . Guidelines at the Regional level should address land management objectives as well as stand and site considerations essential in choosing between regeneration systems. These broad guidelines, combined with local site and stand data, would provide the basis for choosing a desirable regeneration method.

Improved Regional guidelines should address the silvicultural prescription and specifically discuss those items needed to successfully carryout regeneration. Caution must be exercised to avoid developing "cookbook" specifics such as "percent of ground to be covered by shade," "numbers and sizes of trees to be left," and "timing and method of overstory removal." These can only be determined on a site-by-site basis.

Unit managers should be accountable for meeting regeneration objectives on each stand assigned to a regeneration harvest. These objectives should include meeting target stocking levels of suitable crop trees as well as predetermined quality and growth rates.

VI

SUMMARY AND RECOMMENDATIONS

Through correspondence and field trips to many Districts on the National Forests of Region 6, the Task Force gained considerable insight into "shelterwooding." Key points of their findings are as follows:

The use of the shelterwood system has been successful in many instances in permitting the attainment of harvest goals on severe sites while assuring regeneration. Shelterwoods have a definite place in the array of cutting practices used in Region 6. Other nontimber resource objectives have also been achieved through properly planned and executed shelterwoods.

Quite a few District people have learned how to use shelterwoods through professional ingenuity and experience. Some units have not had the benefit of these experiences, but now need this expertise to avoid repeating the problems associated with trial-and-error learning.

The Region has an opportunity to disseminate the skills already available on some Forests, but not yet developed universally.

RECOMMENDATION #1

The Region and the Forests should review existing policies on cutting practices. There is an urgent need to clarify FSM direction as soon as the new NFMA regulations have been finalized.

RECOMMENDATION #2

The Region and the Forests should insure compliance with existing policy regarding preperation of silvicultural prescriptions (FSM 2478.4). The shelterwood system is one of the more complex silvicultural techniques and creates long-term impacts. Where there is a shortage of certified silviculturists, the efforts of those available should be concentrated on prescribing for the more sophisticated, high impact activities such as shelterwooding.

RECOMMENDATION #3

The record system and timber sale planning procedures, Region-wide, should be modified to insure timely scheduling of the removal cut for all shelterwoods. The 1,134,000 acres of overstory with established understory should be located and prescriptions should be written for those stands.

RECOMMENDATION #4

Economic analyses should be used as one of the factors in selecting a regeneration harvest method. All of the steps and processes necessary for full completion should be included.

RECOMMENDATION #5

The Region, in cooperation with the Forests, should provide a variety of training on use of the shelterwood system. This can be accomplished in a variety of ways, such as:

a. Developing a technical "How To" guide on the use of shelterwood cutting. Nontimber resource considerations should be included.

b. Conducting a series of field trips to successful shelterwoods.

c. Increase awareness of silvicultural systems in established Regional training programs such as logging systems, fuels management, soils, visual resource, etc.

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THE R-6 SHELTERWOOD TASK FORCE

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In addition the following people participated in the field review:

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