serves the public interest will be more likely to develop.

The Society of American Foresters has taken a great step forward to improve communication by adopting a set of forest policy statements. Establishing an outright position on ideas set forth by special interest groups is not an effective way for the profession to conduct itself, for then it becomes just another group in an emotional shouting match. Furthermore, it is virtually impossible for the SAF to adopt a concrete position on issues because of internal dissent. Members are often associated with the disputing factions. However, this is no reason for the SAF to give up in despair, and take no active part in policy matters. If this happens, expert opinions rendered by people directly involved with forestry problems will be lacking, and unworkable forest policy will often result.

Instead, the professional society can effectively moderate by recognizing the important ideas of each pressure group. This can be accomplished by identifying basic issues, and explaining them in terms of predicted short and long run effects with respect to present and future needs of society. Such explanations must be backed by scientific studies and data. Our profession must urge competing groups to understand each other, and to compromise in order to reach equitable and beneficial policy decisions.

Specialists can provide scientific information as to the ecological and economic consequences of policy proposals. Then the SAF can synthesize this expert advice to form policy alternatives. By striving to clarify issues the SAF, will promote development of policy

Ponderosa Pine Seed-Tree Remova

Philip M. McDon

ABSTRACT.—After ponderosa pine seed trees were removed on the Challenge Experimental Forest, California, seedling stocking fell by 3.8 percent or about 212 seedlings per acre. This loss is slightly less than that incurred from natural mortality, and one that did not reduce regeneration levels below the minimum standard.

BEFORE the forest manager decides to remove his seed trees he should consider three factors concerning regeneration: (a) percent of stocked milacres and number of seedlings per acre that he will accept, (b) rates of seedling mortality, and (c) amount of reduction in seedlings that will occur from seed-tree removal. This paper reports an evaluation of these factors in a study of seed-tree removal on the Challenge Experimental Forest, Yuba County, Calif.

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Research at Challenge is aimed at management of about 1.5 million acres of highly productive timber land occurring in a long narrow belt along the lower west slope of California's north central Sierra. The silvicultural principles described are applicable both here and wherever the seed-tree method is practiced.

Fig. 1.—Ninety-year-old seed trees. Slash on this cutting unit was disposed of by "pile and burn," August 1959.

through reason. This will be more effective than condemning or supporting pressure groups. In addition, the profession will no longer watch helplessly as settlements are precipitated by groups that can generate emotional support through scare tactics.

Effective Communication

Improving the public's view through communication is one of the greatest challenges to the forester and his profession. The sophisticated language of forestry must be translated into the simpler language of the public and foresters must become highly active in policy formulation.

Society has entrusted management of the forest resource to foresters, so foresters have the responsibility to understand the effects of their management actions on society. The purpose of developing forest policy is to facilitate the proper use of the resource to satisfy the public's needs. Ineffective policies will continue to be approved if the public remains ignorant of the problems. The only way to overcome ignorance is to communicate.

Over the years the goals of forestry have changed from simple forest protection to full multiple-use management. The profession, in recognizing the importance of explaining this "new forestry" to the public, has published advertisements and brochures. But the most effective way to communicate is for the profession to become active as a responsible moderator in development of policy—to communicate the idea that forestry is conservation in the broadest sense of the word. □

educes Stocking Only Slightly

The young-growth stands of the Challenge Experimental Forest are even-aged and were about 90 years old when this study was begun. Most of them are ponderosa pine (*Pinus ponderosa* Laws.), but other conifers also occur. The climate and soils are ideally suited to growing timber. The average site index is 140 feet at 100 years (*1*).

Harvest cuttings in 1959 and 1960[1] left three levels of seed-tree stocking—2, 4, and 8 dominant trees per acre, respectively, were retained for seed production. A related cutting with 10 seed trees per acre was logged in 1958 (Fig. 1). Altogether, about 65 acres were cut in 11 small units.

The only substantial ponderosa pine seed crop between 1958 and 1963 occurred in 1960, when seed fall averaged 24,000 sound seed per acre.

In the 1959 and 1960 cuttings, regeneration was sampled on circular milacre plots. These plots were installed along lines radiating from two randomly located points in each subcompartment. Sampling

[1] U.S. Forest Service research at the Challenge Experimental Forest is conducted in cooperation with the Soper-Wheeler Company, Strawberry Valley, Calif.

Fig. 2.—Stocking of ponderosa pine seedlings on a small landing surrounded by seed trees, December 1963.

varied with the seed-tree stocking intensity as follows:

Seed trees per acre	*Number of plots per cutting unit*
2	80
4	48
8	32

In the two units cut in 1958, thirty milacre plots were located along three randomly located transects in each cutting unit.

We are particularly interested in seedling mortality. Hence regeneration surveys begin early each spring—just as soon as most seeds have germinated. After the next regeneration survey the following spring, we have data to evaluate mortality on a full-year basis rather than for the growing season. Such information is desirable because deer browsing during the winter can kill many seedlings.

Regeneration was evaluated in terms of number of seedlings per acre and stocking percent (percentage of milacre plots having one or more ponderosa pine seedlings). Minimum standards, judged necessary for future stand manipulation and growth rate control, were 50 percent stocking and about 1,375 two-year-old seedlings per acre.

In October 1963, when the seedlings were 29 months old, the standards were met. Stocking ranged from 50 to 83 percent, and number of seedlings from 1,300 to 7,000 per acre (Fig. 2). Seed trees were removed at that time. Special logging procedures were used to safeguard regeneration and advance growth. They included marking the felling direction for each tree, and flagging previous skid trails for reuse. Choker setters were asked to pull winch lines to the logs whenever possible so that logs could be snaked out of the reproduction.

Results

As with other coniferous species at Challenge, the reduction in milacre stocking of ponderosa pine seedlings after harvest cutting was relatively high the first year, ranging from 4 to 36 percent (*2*). The reduction was only 4 to 15 percent the second year, and during the third year it began to level off at 4 to 8 percent.

The seedling loss between the 1963 and 1964 growing seasons resulted from natural mortality and from logging the seed trees. Losses varied by units as follows:

No. units	*Reduction in milacre stocking (percent)*
7	0
1	4
1	7
1	13
1	18

The mean reduction in stocking for the 11 units was 3.8 percent for stocked milacres, and 212 for seedlings per acre, ranging from 0 to 740 per acre. The two heaviest losses occurred where regeneration was most dense. But neither loss reduced stocking below the acceptable standard. In fact, a possible gain may be realized if the reduction in stocking is considered a thinning.

The unit with 7 percent reduction in stocking was the only one where logging damage reduced the stocking level below the acceptable standard. Two factors were responsible for this drop: (1) stocking was at the minimum to begin with, and (2) this low-volume compartment had the steepest slope of all—about 25 percent. The correlation between steeper slopes and greater logging damage is well known. Thus on steeper areas, the forest manager should probably have a "cushion" of regeneration above his minimum standard to allow for greater logging damage associated with steeper slopes.

Stocking percentages before and after seed-tree removal were compared by "t" test. No significant differences were found except for the 18 percent reduction in stocking.

Discussion

The forest manager often cannot quantify the variables necessary for deciding when to remove his seed trees. Fixing a regeneration standard and keying it to two-year-old seedlings is a first step. Knowing expected natural mortality and the losses from logging are the second and third steps, although in practice all three steps are interrelated.

Why base the minimum regeneration standard on two-year-old seedlings? The answer comes from the interaction between natural seedling mortality and susceptibility to destruction by logging. In general, the younger the seedling, the less its chances of being destroyed by logging. In Virginia, for example, one-year-old pine seedlings had the best chance of escaping destruction when seed trees were removed (*3*). Although one-year-old seedlings at Challenge are least damaged by logging seed trees, they often die from other causes. Two-year-old seedlings have a greatly reduced mortality rate from causes other than logging, but only a slightly higher chance for destruction from logging. For this reason two-year-old seedlings seem well suited for the regeneration standard.

To insure the minimum regeneration standard, seed trees should be removed only after the stocking of two-year-old seedlings is at least 58 percent (4 percent for natural mortality and 4 percent for logging destruction, added to the regeneration standard of 50 percent). On steeper compartments, stocking before seed-tree removal probably should be an additional 3 to 5 percent.

Having a regeneration standard for two-year-old seedlings presupposes keeping the seed trees for at least two years. How long should seed trees remain on the area? This paper has not tried to answer that question. The answer would be primarily an economic decision, and work is now in progress on this subject.

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