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Needed: Guidelines for Defining Acceptable Advance Regeneration

Dennis E. Ferguson[1]

ABSTRACT

Advance regeneration is an important component in many stands scheduled for harvesting. Properly managed, such regeneration can contribute to a healthy, new stand, but too often trees do not quickly respond to the new environment or take too long to adjust. Definitions of acceptable advance regeneration are needed for pre- and postharvest inventories. The author discusses how to develop criteria for acceptable advance regeneration and guidelines for conducting inventories.

KEYWORDS: succession, Northern Rocky Mountains, reproduction, inventory

Advance regeneration becomes established naturally before the harvesting of a stand of mature timber. This regeneration can reduce the length of the next rotation and can reduce or eliminate costly site preparation and artificial regeneration efforts. Advance regeneration sometimes provides the species composition desired for the next rotation—species that may be difficult to regenerate subsequent to the harvest.

But advance growth can be relied on only if the trees respond well to release from overstory competition. Many things can prevent good response to release including physiological shock, severe suppression, small root systems, small crowns, broken tops, stem scars, deformed boles, wrenched roots, and soil compaction.

Advance regeneration does not always quickly respond to overstory removal. Trees can remain stagnant too long, neither growing rapidly nor dying (fig. 1). Although minimum stocking requirements could be met by leaving advance regeneration and conducting a stocking

***Figure 1.**—Despite epicormic branching and 10 years time since release, this advance grand fir failed to respond well following overstory removal. This tree should not be included in determining if minimum stocking requirements have been met.*

[1]Research forester, located at Intermountain Station's Forestry Sciences Laboratory, Moscow, Idaho.

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inventory within a few years of the harvest, such an inventory would produce an erroneous picture of future forest productivity. Advance regeneration that is not capable of growing well after release or takes too long to adjust does not meet the intent the National Forest Management Act of 1976, State forestry practices acts, or minimum stocking standards adopted by private companies.

The inventory must provide detail about tree and stand conditions so that logical decisions can be made about future management of the stand. Areas that are potentially unproductive need to be identified as early as possible so that other methods can be scheduled to obtain healthy regeneration. Conversely, early identification of advance regeneration that will become a vigorous, new stand releases manpower and money for higher priority jobs.

Deciding which trees are cull and which should be kept is not easy because trees will range from obvious culls to high quality individuals. Nevertheless, these decisions must be made. The increasing emphasis of meeting specific stocking goals within a specified time demands that we define what is acceptable regeneration and what is not. Regeneration should no longer be tallied as being alive or dead, present or absent. Foresters need to consider a tree's condition and ability to grow well. This paper tells how to establish criteria for acceptable advance regeneration and provides guidelines for conducting inventories.

ADVANCE REGENERATION IN THE NORTHERN ROCKY MOUNTAINS

A substantial body of literature now shows that advance regeneration is a large component of stocking in recently harvested stands of the Northern Rocky Mountains. Six studies used a stratified random sample to retrospectively survey regeneration. Results vary by study location, site preparation, residual overstory density, the ecological community classification, and so on; however, they clearly show the potential management problem.

In 1975 and 1976 Ferguson, Stage, and Boyd (1984) sampled 4,964 1/300-acre plots in the grand fir-cedar-hemlock ecosystem of northern Idaho and adjacent portions of Montana and Washington. A wide range of overstory densities and site preparations was covered. Overall, 46 percent of all stocked plots had at least one advance conifer.

Seidel (1979) sampled mixed conifer clearcuts in the Blue Mountains of northeastern Oregon in 1976 and 1977. Here advance regeneration did not play a very important role because site preparation was thorough. Nevertheless, advance regeneration was present on 11 percent of the stocked milacre plots.

Carlson (1984) surveyed regeneration cuts in the western half of Montana during 1979-82. A total of 2,981 1/300-acre plots were sampled over a wide range of ecological and silvicultural conditions. At least one advance tree was present on 40 percent of stocked plots.

Ferguson (1984), sampling in central Idaho in 1979-82, used the same study design as Ferguson, Stage, and Boyd (1984). From 2,032 1/300-acre plots on the Payette and Boise National Forests, 40 percent of 716 stocked plots had at least one advance conifer present.

Seidel and Head (1983) sampled mixed conifer partial cuttings in the Blue Mountains of Oregon and Washington during 1980 and 1981. Advance regeneration comprised 20 percent of the total number of seedlings. Based on milacre stocking, advance regeneration was present on about one-third of stocked plots.

Dolezal (1982) sampled partial cuts in northeastern Oregon and central Washington in 1981. A total of 797 1/300-acre plots were installed. Advance grand fir (*Abies grandis*) was present on 41 percent of stocked plots, advance lodgepole pine (*Pinus contorta*) present on 14 percent of stocked plots, and advance Douglas-fir (*Pseudotsuga menziesii*) present on 13 percent of stocked plots. More than one advance tree species could occur on the same plot, so the percentages are not additive.

In a seventh study that did not use random stand selection, Smith and Wass (1976) looked at 9,361 milacre plots in clearcuts during 1974 and 1975. The study area was the Nelson Forest District of British Columbia. Unburned plots between roads had 77 percent advance regeneration on stocked plots. Burned plots had 28 percent advance regeneration on stocked plots.

INVENTORY CONSIDERATIONS

At least three inventories should be taken during the course of releasing advance regeneration. The first, and most important, is a preharvest inventory (fig. 2). Here the amount and condition of advance growth can be assessed. This inventory provides clues to postharvest response.

A second inventory should follow the harvest by a few years. The number of surviving trees will be important. Logging damage can also be assessed along with early indicators of growth response.

The third inventory is recommended to check the growth rate of released trees about 5 to 10 years after the harvest (fig. 3). Some trees may again become suppressed, this time by shrubs or undesirable tree species.

The key to defining acceptable advance regeneration is to integrate commonsense forestry and research findings into the inventory design. Guidelines may be needed for various geographic regions and ownerships due to differences in ownership goals, growing conditions, species of interest, and so on. Responses of released trees are described in research publications for both the United States and Canada. Table 1 summarizes research findings on releasing advance regeneration in the Northern Rocky Mountain area. Gravelle (1977) reviews current literature on the subjects of response to release, logging damage, and decay incidence, much of it pertaining to species in the Northern Rocky Mountains. Other literature is available on regeneration systems, logging damage, physiology of released trees, disease and insect considerations, and other species or geographic areas.

Figure 2.—Preharvest inventories should indicate the amount and condition of advance regeneration. This inventory is important in predicting response following harvest.

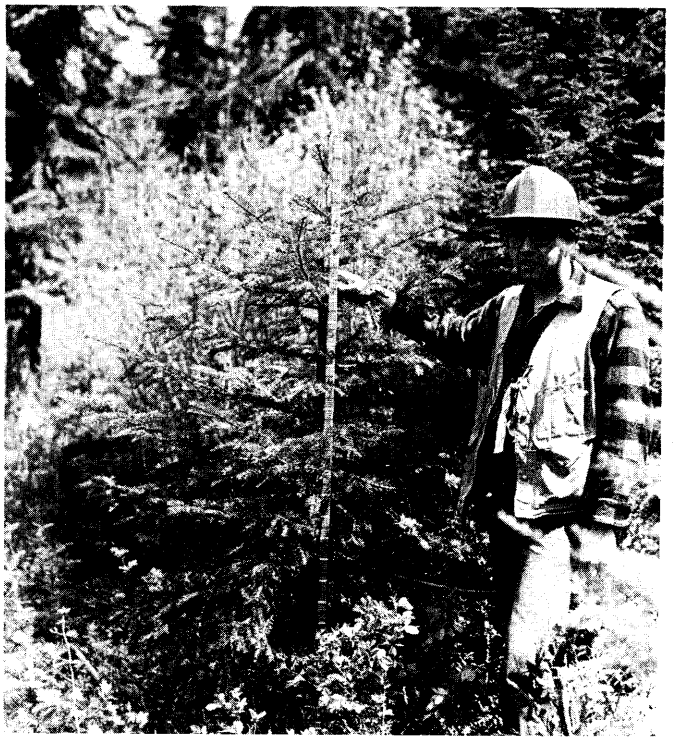

Figure 3.— The inventory design or instructions to field crews provide the basis for deciding the fate of advance regeneration. Field crews can be trained to make the decision in the field, or to record the tree and site characteristics that lead to a decision in the office.

Table 1.—Selected readings on releasing advance regeneration in the Northern Rocky Mountain area

Reference	Study location	Study species
Ferguson and Adams 1980	northern Idaho	*Abies grandis*
Herring 1977	interior British Columbia, Canada	*Abies lasiocarpa*
Herring and McMinn 1980	interior British Columbia, Canada	*Abies lasiocarpa, Picea engelmannii*
Johnstone 1978	west-central Alberta, Canada	*Abies lasiocarpa, Picea glauca, Picea mariana*
McCaughey and Schmidt 1982	central Idaho, Utah, northwestern Wyoming	*Abies lasiocarpa, Picea engelmannii*
Seidel 1977	central Oregon	*Abies grandis, Abies magnifica*
Seidel 1980a	central Oregon	*Abies grandis*
Seidel 1980b	n.a.	n.a.
Seidel 1983	central Oregon	*Abies grandis, Abies magnifica*

Begin by reading pertinent literature and compiling a list of variables that may be important in deciding which trees to keep. Frisque, Weetman, and Clemmer (1978) provided the following list of criteria to define "best specimen" trees on milacre plots:

"a) live more than 50 years,
b) be adapted to the site,
c) be one of the tallest . . . ,
d) not have any disease, breakage, or insects,
e) have no obviously defective root system, and finally,
f) be of a species able to form naturally more than 25% of an adult stand."

Some other potentially important factors to consider are as follows:

Preharvest Inventories:

1. Number of trees. Large numbers of advance regeneration increase the odds that a sufficient number will respond to release.
2. Species. Some species may be more desirable than others, depending on site suitability, commercial value, insect/disease problems, and so on.
3. Healthy and vigorous appearance.
4. Crown ratio.
5. Needle color or needle length.

6. Age. Older trees may not respond as well as younger trees, depending on species, growing conditions, and height at release. Some trees beyond a certain age should be culled simply because they may be infected with dormant rot fungi.

7. Height increment before release. Generally, a tree growing well before release should respond well to overstory removal. Height increment prior to release is an indication of the degree of suppression.

8. Relationship between total tree height and height increment. Tall trees with small height increments may be poorer candidates for release than shorter trees having the same height increment.

Postharvest Inventories:

1. Height growth following release. This variable shows how each tree is responding to release. Species with preformed shoots probably have an additional 1-year lag in responding to release. See Ferguson and Adams (1980) for a more detailed discussion concerning preformed shoots and released trees.

2. Logging damage. A tree injured during logging can suffer a broken top, stem scars, bole deformities, severe lean, wrenched roots, and soil compaction around the roots. If the soil is compacted, the roots of released trees will have difficulty expanding. Root rots are also a possibility.

3. Numbers of surviving trees of desirable species.

4. Appearance.

5. Crown ratio.

6. Needle color or needle length.

7. Finally, consider the alternatives. If the stand has been harvested and advance trees are responding slowly, would other regeneration alternatives be expected to do better? Advance regeneration does provide stocking, and perhaps a 5- or 10-year delay in response by advance regeneration is preferable to low probabilities of obtaining stocking by natural or artificial regeneration. (Early identification of this potential problem is why the preharvest inventory is so important.)

After listing variables, choose those of most importance. If possible, select those easiest to use in the field and those that are the least subjective. For example, it is easier and less subjective to measure height increment following release than it is to judge whether a tree will live or die in the next 50 years.

Finally, field crews must be provided with guidelines for inventorying regeneration. Regeneration not meeting minimum standards can still be tallied as long as the crew identifies such trees as culls. Be as specific as possible, especially for subjective decisions. If crews record variables that can be measured directly in the field, minimum standards can be changed after the inventory is completed. For example, suppose that for each tree the 5-year height increment before release was recorded. A minimum standard of 1.0 foot would result in a certain inventory of trees. Should it be desirable to change this minimum increment to 1.5 feet, the inventory could be recompiled in the office.

The inventory guidelines could also be put to other uses. Some of the guidelines might be applied to subsequent regeneration or they might be helpful in choosing leave trees in precommercial thinnings.

Whether the land manager is dealing with Federal, State, corporate, or private land matters little—the goal of a regeneration harvest is a vigorous new stand. Advance regeneration can help achieve such a stand. By developing standards for acceptable advance regeneration and guidelines to aid field crews conducting regeneration surveys, foresters will insure that they are meeting the intent of the National Forest Management Act, State forestry practices acts, and corporate or private ownership goals.

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