FOREST RESEARCH LABORATORY

RESEARCH NOTE 60

vegetation management and its importance in reforestation

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introduction

Most foresters have long recognized that newly planted or seeded trees need ample water, nutrients, and light. In recent years, however, foresters and other land managers have been concerned with multiple land use and pollution prevention—concerns that have prompted them to change reforestation practices in ways that sometimes overlook or compromise the biological requirements of the seedlings.

During their establishment—that is, the time between planting or seeding of new trees and a height of 3 to 4 feet—seedlings are particularly sensitive to moisture and light competition, as well as to mechanical injury from browsing and trampling. Under optimum conditions, establishment generally takes 2 to 4 years; however, excessive stresses during this early stage of development can prolong establishment, sometimes indefinitely. Stress during the establishment period can mean the difference between life and death or between normal and slow growth. Consequently, every effort must be made to minimize these stresses. Land managers must carefully consider the competitive effects of alternative land use practices, and they must modify them to meet the biological requirements of tree seedlings if reforestation is a goal.

Yet land managers often face conflicting objectives. A watershed specialist who wants to stabilize the slopes and reduce surface erosion may recommend grass seeding, or a range manager who wants to increase livestock production may recommend grass seeding so that cattle can then graze on the vegetation. Both practices are possible and even desirable, depending on objectives. But, if the same area is to be reforested as well, these and other land use practices will have to be modified—otherwise the competition by grass and mechanical injury by trampling and browsing can seriously interfere with reforestation.

vegetation as a competitor

During the sensitive establishment period, lack of water most frequently causes the death or slow growth of seedlings. Secondary but still important causes of mortality and lost growth include a lack of food or sugar production (caused by low light), browsing by wildlife and domestic livestock, or a combination of low light and mechanical injury. By providing moisture stress, shading, and animal habitat, competing vegetation contributes to or is responsible for all three factors.

Because water is so critical to seedlings, the quantity of available soil moisture is the most important factor to consider when evaluating the effects of vegetative competition. Most soil moisture is lost as the vegetation transpires. In drier regions, interception and evaporation of moisture off the vegetation or litter may account for a loss of 10 to 25 percent of the total rainfall, particularly when much

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of the rainfall occurs as light showers. Early in the growing season before seedlings have completed their normal growth, grasses effectively deplete moisture from the rooting zone of young conifers. As a result, seedlings make little progress towards establishment, then must survive with negligible moisture for several months. In fact, severe grass competition during the establishment period will eliminate most conifer seedlings.

The impact of other nongrassy vegetation can be significant too. Shrub or brush cover in full leaf can deplete moisture almost as fast as grass, but it tends to do so through a deeper soil profile. Consequently, moisture is more slowly depleted from the rooting zone of newly planted seedlings.

On dry, sunny sites, vegetation provides shade, resulting in a milder microclimate more favorable for the young seedlings. However, where moisture is limited during the growing season, any live vegetation will demand moisture. Thus, despite protection from the sun, seedlings will experience reduced growth and increased mortality. In fact, if moisture stress in seedlings reaches severe levels, the resulting mortality will negate any positive effects of the shade. Shade, protection from deer browse, and other positive "nurse crop" effects come from scattered young plants of native brush species. In contrast, established brush stands provide severe competition for moisture and light and thus, if uncontrolled, remain stable against tree invasion for many years. Furthermore, a brush canopy provides habitat for animals that significantly damage and suppress young trees.

vegetation control to allow seedling establishment

In commercial forestry, vegetation is manipulated primarily for two reasons: (1) to create an environment favorable for establishing seedlings, and (2) to control weeds so a larger and better timber crop can be produced and harvested in a shorter time. Ultimately, vegetation management establishes a well stocked plantation as quickly as possible. Thus, vegetation management must be coordinated with other silvicultural practices, such as proper tree planting and protection from animal damage, to ensure reaching this goal.

Site preparation, that is, vegetation management prior to planting, commonly uses three methods: mechanical removal; prescribed burning; and chemical control. Often combinations of any or all of these methods are necessary to reforest an area. Each method is suitable for specific objectives, so the site preparation technique should match the site's conditions:

Method	Removing debris	Reducing competition	Preparing mineral soil	Reducing compaction	Creating favorable microsites
Mechanical	X	X	X	X	X
Prescribed burning	X	X	X		
Chemical		X			
Prescribed grazing		X	X		
Combination	X	X	X	X	X

After: Wellner, C. A. 1962. The conditions under which site preparation is required and the methods now available. Pages 7-11 *in* Proc. Reforestation Coordinating Committee. West. For. Conserv. Assoc., Portland, Oreg.

Note that this table lists a fourth method, prescribed grazing. Although prescribed grazing meets two objectives of site preparation, remember that vegetation management must be compatible with reforestation objectives. Because of current interest in prescribed grazing, let's consider when it meets the seedlings' biological requirements during the establishment period.

prescribed grazing and reforestation

As a potential site preparation and plantation management tool, prescribed grazing has merit as a special form of mechanical vegetation control. However, prescribed grazing should be done prior to tree planting or after seedling establishment. Heavy grazing before planting creates favorable planting conditions and makes other vegetation control procedures easier and less costly. Occasionally this practice favors the spread of undesirable vegetation such as non-native grasses and weeds that then replace native vegetation. After seedling establishment, prescribed grazing also may have merit if the vegetation is controlled without damage to the site or seedlings. Trials to date indicate that postestablishment grazing probably benefits new plantations, but more data are needed to confirm this.

During the seedling establishment period, however, grazing should be avoided. During this sensitive period, the forester must maximize survival and growth by

controlling vegetation and preventing mechanical damage by wildlife and domestic livestock. Grazing sheep or cattle on a newly planted area will have two negative effects.

First, the animals will reduce competing vegetation on the site. That seems beneficial except that the very presence of vegetation after planting indicates that substantial quantities of available soil moisture already have been consumed by noncrop vegetation and, consequently, control comes much later than needed. Thus site preparation was inadequate.

Second, the animals trample and browse on the seedlings. A recent study of sheep grazing in Oregon's Coast Range demonstrated the magnitude of this problem, even under otherwise favorable conditions (Fig. 1). At this experimental site, survival was not a problem because of high precipitation and the lack of an established plant community after logging. However, grazing reduced growth and prolonged the establishment period by 2 years. Trees on interior sites grazed during the establishment period would have an even lower survival rate and a longer delay in reaching a height of 3 feet. Thus, with very few site-specific exceptions, livestock should not be used to control vegetation on a plantation during the establishment period.

However, a land use manager can successfully combine prescribed grazing and reforestation if the animals are allowed on the site before the seedlings are planted, then permitted to return only after the seedlings are established.

grass seeding and reforestation

Considering that vegetation control is one of the most important factors affecting the success of reforestation, can a reforested area be seeded with grass to control erosion?

Every year many acres of erodable soils on steep slopes are seeded with grass, a practice particularly valuable on cut banks and skid roads after road building and logging operations.* However, because grass competes so intensely with seedlings, grass should be seeded only where it is necessary to control erosion. If an area is to be successfully reforested, erosion control may even have to be postponed until seedlings are established.

In areas where mass failure is the typical erosion pattern, grass does not solve the problem because shallow-rooted vegetation will not prevent such failure. However, grass cover should be considered for stabilization on sites where erodable subsoils of low fertility have been exposed, either mechanically or by deep surface erosion. Where grass is used adjacent to sites with moisture levels critical to seedling survival, a nonseeding species will limit the spread of the grass.

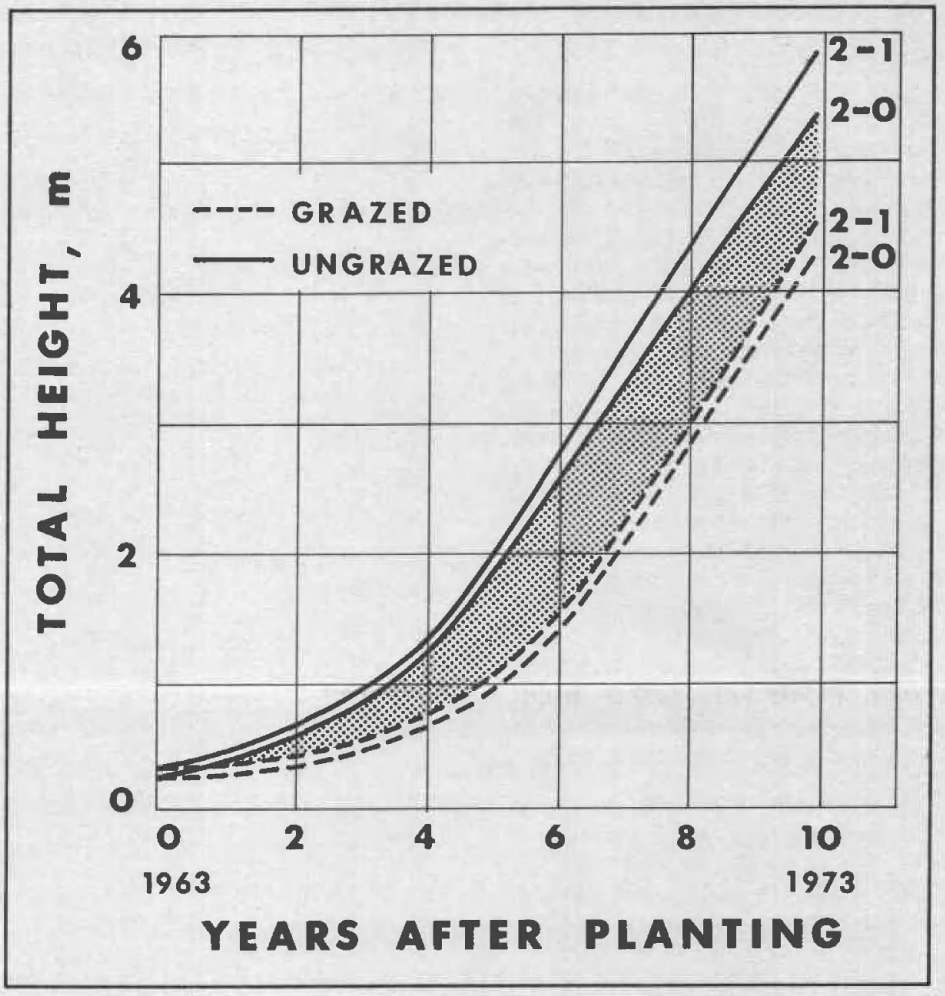

Figure 1.

Height growth of Douglas-fir seedlings grown on grazed sites is stunted until the trees are about 3 feet (1 meter) tall. Thereafter, the growth rate parallels that of trees grown on ungrazed sites.

* Ext. Circular 885, available from any Oregon County extension office, contains many suggestions about specific operational procedures for seeding.

other factors affecting establishment period

The compatibility of other land uses and reforestation hinges on the establishment period of the seedlings. Excessive stress during this period will critically affect the success of reforestation. If that establishment period is known, then the land manager can better plan and integrate diverse uses of the same site. However, many factors affect the length of the establishment period. Some seedlings suffer transplant shock (slow growth after planting) and may require 10 years or even longer to become established and grow at a normal rate. The quality of the planting stock, exposure during the period between lifting and planting, and planting procedures all influence establishment. Consequently, application of the vegetation control and land use principles outlined here will require a site by site analysis of past reforestation efforts. The best indicator of progress towards establishment will be seedling growth. Because establishment in the Pacific Northwest is usually limited by a lack of moisture, eliminating competing vegetation (and thereby making more moisture available to seedlings) should shorten the establishment period.

conclusions

Control of competing vegetation during establishment is one of the key links in the chain of events leading to a new plantation and, ultimately, a productive forest resource. Experience has repeatedly shown that, without adequate site preparation, reforestation efforts almost inevitably will fail. Vegetation control during the establishment period by one or more of the methods described in this note is an important step towards successful renewal of one of our most valuable natural resources.

for more information

An annotated bibliography of selected publications specifically related to this research is available as Research Note 61 from the Forest Research Laboratory, Oregon State University, Corvallis OR 97331.

More general information on the reforestation process is available in *Regenerating Oregon's Forests*, a 278-page manual compiled by Brian Cleary, Robert Greaves, and Richard Hermann. The manual may be purchased ($10 postage paid) from the Extension Service Stock Room, Extension Hall, Oregon State University, Corvallis OR 97331.

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