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FIRST-YEAR EFFECTS OF LOGGING ON FORAGE PRODUCTION[1/]

by

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Significant ecological changes that affect range livestock economy are occurring as a result of logging in the 13,000,000 acres of ponderosa pine forest range lands of the Pacific Northwest. These forests provide 90 percent of the summer range area and 70 percent of the summer range grazing capacity in Eastern Oregon and Washington; about 270,000 acres undergo partial cutting each year. In many stands a second cutting is expected in about four decades. Because these cuttings alter the understory plant cover, they are of major concern to livestock owners, big game interests, and range administrators. These groups need to know the effects of logging on forage production so that they can make any necessary adjustments in range management plans.

With that need in mind the Pacific Northwest Forest and Range Experiment Station started in 1945 a study of the effects of logging on range values of the ponderosa pine type. Effects of logging are to be measured over a 14-year period beginning a few months after logging was completed. Most of the data on denudation of soil and accumulation of slash as measured immediately after logging were secured on a series of

1/ A revision of a paper presented at the annual meeting of the Society of American Foresters, Seattle, Washington, October 11-14, 1949.

mile-long temporary transects situated on nine timber sale areas. Observations were made at 5-chain intervals along the transects. These impartially located observation plots sampled an array of logged-over forest conditions. The long transects crossed skid trails, tractor-tread scars, mashed tree reproduction, spur roads, log landings, piled and unpiled slash, small grassland openings, and undisturbed areas. Consequently, a variety of slopes, soils, timber site classes, and types of operations were encountered on the various transects. Data on effects of logging on understory vegetation during the 14-year period are being secured on eleven permanently located transects, each 10 chains long, that are permanently staked out on several of the timber sale areas. In this report only the ground disturbance as measured immediately after logging and the effects on understory vegetation as measured the following year will be presented.

The logging opened up the forest canopy to a considerable extent. Losses in crown density for the various sites studied ranged from 48 to 67 percent. Reduction of some stands approached 70 percent in board-foot volume. Numbers of seedlings and saplings underwent reductions which ranged from 9 to 53 percent.

Ground Disturbance

Denudation of the soil and accumulation of slash accompanied the changes in forest stand. Although considerable variation in magnitude of ground disturbance was observed, ground denuded of grasses, weeds[2/], and shrubs averaged 22 percent, and the area covered by slash averaged 9 percent; nearly one-third of the forage producing area of these logged-over lands was made unavailable for livestock use.

The plowing and burial of vegetation by ground skidding, spur road construction, and other operations constituted the major ground disturbance, but coverage of understory vegetation with slash was also a significant factor in reducing the amount of available forage. Besides obliterating some understory vegetation, the slash acted as a stock barrier around other vegetation that might otherwise have been grazed. Some types of logging debris, such as small accumulations of bark or needle-bearing boughs, should have only a short-time effect on the availability of forage. Other debris, like excavated stumps, culled logs, large branches, and heavy tops, will undoubtedly be a part of the landscape for some time.

2/ Herbaceous plants other than grasses or grasslike plants.

Changes in Understory Vegetation

Losses in total density of understory vegetation the first growing season after logging ranged from 30 to 49 percent. Losses in total density of grasses ranged from 40 to 60 percent. Depending on the species present, reductions in shrub densities ranged from 0 to 60 percent. Losses in total density of weeds were rather low, 10 to 20 percent.

These unequal losses in density greatly altered the floristic composition. On ranges composed mainly of grasses before logging, weeds have become the major component of the understory, at least temporarily, because of their lesser density losses during logging. However, on one area where shrubs were originally prominent, weeds have not quite been able to take first place. Annual grasses and weeds made some increase in numbers subsequent to logging, but no annual species had appreciable density. Percentage reductions in weed densities were generally less than those of shrubs and grasses. Many of the weeds regenerated new tops from fragmented or unsevered rhizomes or stolons. This minimized the effects that logging had on their density changes. On some sale areas, wild strawberry (Fragaria spp.), lupine (Lupinus spp.), heartleaf arnica (Arnica cordifolia), woollyweed (Hieracium scouleri), and western yarrow (Achillea lanulosa) even made small gains in density. Stolons of strawberry moved out from patches of undisturbed plants and invaded denuded areas. Rhizomes of arnica and lupine frequently escaped destruction because they grew deeper than some skidding disturbance; rhizomes of these species were often found 6 or 7 inches below the soil surface.

Shrubs such as serviceberry (Amelanchier alnifolia) and chokecherry (Prunus spp.), which have large sturdy stems and deep roots, showed little change in density as a result of logging disturbance. Less sturdy shrubs, such as pinemat manzanita (Arctostaphylos nevadensis), dwarf blueberry (Vaccinium cespitosum), common snowberry (Symphoricarpos albus), and shinyleaf spirea (Spiraea lucida) showed considerable reduction in density. Because the latter shrubs are rhizomatous, they should make rapid recovery under shallow skidding conditions. Bitterbrush (Purshia tridentata), one of the most valuable shrubs in eastern Oregon and Washington, did not occur on any of the transects measured. Observations, however, show that it is badly injured or killed by logging. Since bitterbrush is not rhizomatous, reestablishment following logging will be slow because new plants can only come from seed.

Grasses, both rhizomatous and bunch-forming, did not display the resistance to logging disturbance that was shown by some weeds and shrubs. Most grass rhizomes grew in the top 2 inches of the soil and skidding readily removed them. Since they were slender and apparently contained only small amounts of stored foods, the

grass rhizomes were regenerative only so long as they were attached to a living plant. Once they were severed, they perished. Bunchgrasses were easily torn out of the soil by skidding. Their roots dried out rapidly and the plants died.

Since perennial grasses are the most valuable and desirable forage plants in many pine ranges, even a temporary loss in their density causes a reduction in grazing capacity. The increase in weeds does not offset the decrease in grasses because the weeds are less desirable range forage plants. They usually have one or more of the undesirable characteristics of low palatability, low productivity, or completion of growth and drying up early in the season. Even on ranges where shrubs form an appreciable part of the understory, there will be at least a temporary reduction in grazing capacity as a result of logging because most of the shrubs are valuable forage plants for livestock and big game. Consequently, on most of the types of ranges east of the Cascades logging almost inevitably results in a reduction in grazing capacity.

Factors Influencing Degree of Disturbance

Type of soil has influenced the extent of logging disturbance. In pumice soil regions, skidding did relatively more damage than the same kind of skidding on heavier soils. Pumice soils seemed more susceptible to displacement than did the heavier soils. As slope increased on a logging show, skidding disturbances by tractors increased because of greater difficulty in maintaining traction. On steep slopes tractors frequently sideslipped, cutting down the understory vegetation and moving soil down-slope.

Other factors influenced the degree of disturbance resulting from skidding. The closeness with which roads were spaced was a factor; where only a few jammer settings were possible, long and heavily used skid trails developed and showed the most severe soil displacement. Skid trails 2 to 4 feet deep were observed. Where arch logging was practiced, the depth to which a given soil was disturbed was less than where the logs were ground-skidded.

The different kinds of slash disposal produced varying effects on understory vegetation. Lopping and scattering of slash seemed to be the least destructive to understory vegetation. Tractor piling increased ground disturbance; the machines denuded additional soil by pushing large snags and culled logs across the range. Burning of slash also added to the disturbance. The fires destroyed or so badly damaged the vital portions of many plants beneath or adjacent to the slash piles that regrowth was impossible.

Summary and Discussion

This report is primarily concerned with the immediate physical effects of logging on range forage production in the Pacific Northwest ponderosa pine forest ranges. By the first year after logging, the amount of understory vegetation available for grazing had been reduced at least 30 percent by such logging disturbances as soil denudation and slash coverage. Furthermore, the valuable forage grasses were subjected to the major losses. This resulted in serious reductions in quality of forage.

Region-wide, the total losses in forage production for any one year are not very great. To the individual range unit or grazing allotment, though, the losses may be serious. Frequently, all or most of an allotment is logged over within a few months.

Watershed values were not intended to be a phase of this investigation; however, they are strongly implicated in the findings. Exposure of raw soil on 22 percent of a timber sale is likely to accelerate soil erosion and rapid runoff. Rate of runoff should be increased by the packed soils of skid trails and spur roads.

A practical solution to these range and watershed problems on areas logged according to present day methods includes a number of measures. Mechanical spreading of concentrated drainage, temporary diversion of livestock from currently logged forest ranges, and reseeding the denuded areas to good grasses[3/] all will assist very effectively in range and watershed rehabilitation following logging disturbance.

3/ Gjertson, J. O. Practical guides for seeding grass on skid roads, trails, and landings, following logging on east-side forests of Washington and Oregon. Pacific Northwest Forest and Range Expt. Sta. Research Notes 49. January 20, 1949.