Research on Logging Slash Disposal by Fire

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SLASH accumulation is a prime obstacle to the regeneration of pine on clearcut lands in the Southeast. If an area is to be regenerated by either natural or direct seeding methods, mineral soil must be exposed and competition from undesirable species reduced to ensure adequate stocking. Moreover, heavy concentrations of logging debris physically impede both men and equipment engaged in planting or direct seeding activities. Logging residues may prevent adequate germination and satisfactory seedling growth for 5 years following cutting. Even though the slash may decay in less time, plant communities which hinder pine reproduction often become established in the slashings. Fire hazard also increases with the addition of logging debris and may reach a critical level. Clearcutting a well-stocked stand of 40-year-old loblolly pine (*Pinus taeda*) on an average site would produce about 24,000 lbs. of logging slash per acre.

Heretofore in the Southeast, much of the second-growth pine has become established on abandoned farm land. Logging debris was not a problem; the land was in an ideal condition for the establishment of pine. However, as large tracts of land are put on a sustained yield

basis, succeeding generations of pine will have to be started on cut-over land. An estimated 1.5 million acres were clearcut in the South in 1967 and projected figures indicate that the cut will approach 3.5 million by the year 2000. Assuming 12 tons of slash per acre, one can get an indication of the enormous quantity of slash which must be dealt with. The economics of today make it imperative that land should be kept in continuous production. The short rotations commonly practiced in southern pine management make even a few years' wait between harvest and regeneration costly.

Prescribed fire is one means of alleviating these problems. Its cost may average less than one-tenth the cost of other site preparation treatments. In addition, it may be one of the few alternatives acceptable in hilly terrain where soil movement is an important consideration. However, adequate burning guidelines for slash disposal must be developed if its full potential is to be realized. How soon after logging should the burning be done? Is there an optimum waiting period? Does this waiting period vary with season of cutting? Are certain firing techniques suitable for some accumulations and not for others? Our research efforts are being directed toward answering questions such as these.

We felt, as a start, that we should develop a simple means of estimating the quantity of slash on the ground. Field sampling was entirely too time consuming. A strong correlation was found to exist between loblolly pine crown weight and dbh. A prediction equation was thus developed for estimating slash weight from standing loblolly pine. If up-to-date cruise data are not available, a good rule of thumb is to assume ¼ ton of slash (ovendry weight) is deposited for every cord harvested in well-stocked stands. About 35 percent of the total slash accumulation is in what we might consider the available fuel category, or material under ½-inch diameter. These are the fine fuels—those that dictate the desirability and ease of burning. They exert a pronounced effect on fire intensity and behavior.

Estimates of slash weights determined by either of these methods enable the field man to make reasonable judgments of fuel continuity, distribution, and arrangment. From this assessment, he is in a much better position to plan his burning operation than he would be without it.

Our findings to date are limited to loblolly pine stands harvested to a 4-inch top—the common utilization standard in practice in Georgia and other southern states. Minor adjustments may be necessary for other pine species and utilization standards.

Effects of some of the variables influencing the drying rate of logging slash in the Georgia Piedmont were studied. Shade, aspect, and precipitation were found to have little effect on the drying rate until the moisture content of the slash reaches the fiber saturation point, which occurs at about 32 percent. Once it passes this point, it reacts to weather changes as other dead fuels do. Season of cutting was the major determinant of slash drying. Loblolly pine cut from November to February required 1 to 3 months to reach a moisture content of 20 percent, while pine cut during the other 8 months took less than 4 weeks. This knowledge should assist forest managers in scheduling slash burns according to season of cutting and the desired objectives.

If the main objective of slash disposal on a particular area is to reduce the wildfire hazard, the area can be burned before the slash dries to 20 percent moisture content. Atmospheric conditions, particularly relative humidity, must, however, be suitable for burning. The fine fuels will be consumed by most low-intensity fires. Generally, slash should be burned the first year after cutting because needle loss begins during this time. Although successful burns can be achieved at later dates, the longer the wait, the fewer the benefits derived.

Firing techniques will differ with the objective of the burn. The shape, size, and location of the area; amount and condition of the fuel; presence of an overstory; and the weather conditions at the time of the burn are all important factors. Slash disposal for hazard reduction in a thinned plantation (Fig. 1) would require a fairly low-intensity fire with minimum heating of the live crowns. This objective could be met with a backfire on a cool (below 70°F.), windy (10 to 20 mph) day. If the area had been prescribed burned before thinning, fine fuel moisture contents of 10 to 15 percent would be acceptable. However, if the area had not been previously burned, the lower litter should be wet (over 50 percent moisture content) and the fine fuels in the upper litter and slash should average about

FIG. 1. A 20-year-old slash pine (*Pinus elliottii*) plantation after thinning to one-half its orginal basal area. Approximately 8 tons of ground fuel per acre are present.

FIG. 2. The same plantation after prescribed burning. Elimination of the fine fuels has reduced fire hazard considerably.

FIG. 3. A 3-acre loblolly pine clearcut prior to burning for wildlife habitat improvement. Total ground fuel was estimated to be 12 to 13 tons per acre.

FIG. 4. Prescribed fire has increased both the quantity and availability of food and improved the habitat for quail, turkeys, and doves.

35 percent. This condition would more than likely permit the consumption of most of the fine fuels without developing intensities damaging to the overstory (Fig. 2).

On the other hand, burning for wildlife habitat improvement in small clearcut openings (Fig. 3) warrants generation of an intense fire. Center firing followed by ringing (what we call keyhole burning) creates intensities great enough to consume much of the slash and helps to contain the fire by creating a drawing effect along the clearcut perimeter. The specific objectives here might be to increase the number of legumes, promote sprouting, and increase the availability of seed (Fig. 4). Survival of any "whips" or small hardwoods left after logging would be immaterial. The main criterion in firing such an area would be in creating a fire hot enough to consume most of the logging debris without jeopardizing fire control. The fewer the number of "dogs legs" in the boundary, the easier fire control would be. Moisture contents of slash and other fine fuels should be less than 20 percent with relative humidities below 50 percent and winds light.

CONCLUSION

We must face up to the problems created by heavy slash accumulations following cutting operations. Intensive management demands prompt and adequate slash disposal. Even-aged management, particularly in the form of plantations, is being adopted more and more thoughout the pine lands of the South. As a result, the problem is being magnified.

We believe that prescribed fire offers the possibility of a prompt, adequate, and economical means of solving this problem. We are, in fact, giving this problem high priority in our research program at the Southern Forest Fire Laboratory. In this brief discussion, I have highlighted some of the work that has been done in connection with logging slash weights, drying and decomposition rates, and their effects on fire behavior.