TECHNICAL NOTES

Predicting Cattle Damage in First-Year Loblolly Pine Plantations

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Highlight: Pine damage and survival were correlated with forage utilization. Damage can be predicted from forage utilization but survival is affected by many other factors and cannot be predicted precisely. A regression is presented which will allow a range manager to predict the amount of pine damage to expect in first-year loblolly pine plantations from forage utilization data.

The demand for grazing forest range ecosystems is predicted to increase 50% by the year 2000 (Forest Range Task Force 1972). Increased open range grazing in Arkansas and Oklahoma has already created problems with even-aged loblolly pine regeneration. The need for forage in these states and a history of open range grazing make it necessary to determine the compatibility of grazing with intensive pine management. In the longleaf-slash pine range there is considerable knowledge about forest range grazing and its impact on pine survival and growth (Boyer 1967, Pearson *et al.* 1971, and Hughes 1976). Grazing capacities in the loblolly shortleaf pine range have not been precisely determined (Wolters and Wilhite 1974).

Pearson *et al.* (1971) found that light and moderate grazing (33 and 47% forage utilization) did not affect planted or seeded slash pine during their first 5 years. Heavy grazing (56% forest utilization) did however, reduce first-year survival. Boyer (1958) found that first-year survival of naturally seeded longleaf pine was unaffected by moderate grazing, but after 5 years of grazing both survival and growth were reduced (Boyer 1967). Pine mortality and growth varied directly with forage utilization.

In this study pine damage and survival were correlated with forage utilization on intensively prepared sites of first-year, loblolly pine plantations. An equation is presented which predicts damage and survival from forage utilization. With it a range manager can determine an acceptable cattle stocking level for first-year plantations. Whether or not this stocking level is being exceeded can also be estimated with forage utilization sampling.

Method

Eight plantations, between 80 and 160 ha in size, were selected for study. Site preparation was conducted in the summer and fall of 1974 and varied from aerial herbicide spraying with subsequent broadcast burning to scalping with a special dozer blade followed by piling and burning of debris. One-year-old loblolly pine seedlings were planted during the 1974-75 winter. All plantations were in the annual weed stage of plant succession during their first

growing season. Four sets of 20 by 20 m paired plots were randomly located on each plantation, and one plot of each pair was fenced shortly after planting to exclude free-ranging cattle which graze the area year round. Number of surviving trees, as determined on 262.4 m² circular subplots just after study establishment, ranged from 568 to 1,581 per hectare. At the end of the first growing season the plots were again visited to determine numbers of undamaged trees as well as number of trees damaged by browsing and trampling. In July of the same year all green and dry above-ground biomass was clipped and weighed from three randomly located square-meter subplots within each major plot. Forage utilization was measured as the difference between biomass on the ungrazed and grazed subplots.

Results and Discussion

Regressions were computed to predict change in percent survival

Fig. 1. Equation to predict the percentage of damaged trees from percent forage utilization in first year plantations. Confidence bands on the population mean and a single value are also shown at the 0.05 probability level.

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(ungrazed to grazed) and the change in the percent of undamaged trees. Percent forage use was the predictor variable. First-year survival is affected by many factors other than forage use, such as dry weather and poor planting. Therefore, it cannot be predicted as well as damage. Survival was significantly reduced with increased forage use ($r = .592$, $n = 22$) but the regression, $Y = 3.8430 + .5083 X$, accounts for only 35% of the variation. On the other hand, change in the percent of undamaged trees (increase in damage associated with grazing) correlated closely with percent forage use ($r = .771$, $n = 22$). The regression, $Y = 1.7397 + .7715 X$, explains 59 % of the variation. Thus, forage use is a good predictor of the increase in the percent of trees damaged as a result of grazing (Fig. 1).

The regression of damage on forage use (Fig. 1) indicates that even light grazing on first-year plantations will result in some damage. Thirty percent forage use will result in about 20% of the trees being damaged. Whether or not this damage is ultimately translated into growth reduction must await further study. Hughes (1976) found that it took combinations of different types of damage to reduce growth of slash pine. The major source of damage in our study was trampling.

These results are applicable only to plantations where site preparation was intensive and where plant succession is in the annual weed stage. The predominant forage plants on our study areas were horseweed (*Erigeron canadensis*) and other unpalatable annuals. Thirty percent total forage use might be quite high

in this plant community and in order to achieve it cattle may have to travel extensively in search of palatable plants. Pearson *et al.* (1971) found that only heavy grazing (57% forage use) reduced first-year survival in slash pine, but the seedlings were planted on a climax bluestem grass community. The amount of damage one might expect in first-year plantations is not only related to the number of cattle and percent forage use but also the stage of plant succession and the amount of good forage available. An increase in the amount of palatable forage might be expected to reduce cattle damage to pine plantations and lower the slope of the regression presented.

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