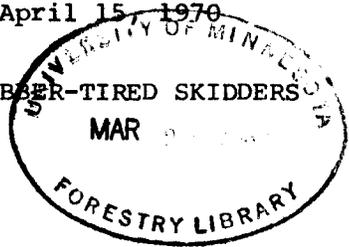




COPY 2

Minnesota Forestry Research Notes

No. 214
April 15, 1970



SOIL COMPACTION DUE TO TREE LENGTH AND FULL TREE SKIDDING WITH RUBBER-TIRED SKIDDERS

Arnett C. Mace, Jr.^{1/}

INTRODUCTION

The use of mechanized harvesting systems is expanding in the harvest of timber crops in northern Minnesota. The School of Forestry, University of Minnesota has undertaken a research program to determine the various impacts that mechanized harvesting will have on the forest. During the summer of 1969, a study was made in Itasca County^{2/} to test the use of tree length and full tree logging systems in strip thinning red pine. The red pine stand was in the 90 to 100-year age class on a sandy soil and the trees averaged almost 14 inches in diameter breast high and 75 feet in height. Felling of the timber was done manually with a chain saw, while skidding was done with a 4-wheel drive rubber-tired skidder.

The effects of present and future mechanized logging equipment on soil physical properties are unknown. Also, the effects may decrease the production of water, wildlife, and timber, by reducing infiltration and percolation, increasing surface runoff and erosion, and reducing site quality. The degree of compaction and deterioration of the site by mechanized logging will depend on numerous factors such as type of equipment and logging method, frequency of travel, and such site factors as soil texture and moisture.

STUDY OBJECTIVES

In view of lack of information on the effects of mechanized thinning, a study of soil compaction was initiated to test the hypotheses that: (1) full tree and tree length logging systems result in soil compaction; (2) soil compaction occurs only in areas in contact with the equipment or timber; and (3) frequency of travel over an area increases soil compaction.

^{1/}Assistant Professor, School of Forestry

^{2/}Acknowledgement - Cooperation was received from the U. S. Forest Service North Central Forest Experiment Station and Chippewa National Forest, who made a study area available and to the Wheeler Lumber Bridge and Supply Company, Cass Lake, who did the timber harvesting.

STUDY SITE AND METHODS

A 90 to 100-year old red pine stand growing on a sandy soil was thinned in 16-foot strips radiating from a central receiving, bucking and loading zone. One-half of the strips were logged by a tree length system while a full tree system was used on the other half. (Figures 1 and 2 respectively)

One hundred and sixty-eight bulk density samples were taken from a randomly selected strip in each logging system. Each strip was broken into four areas denoted as blocks 1, 2, 3, and 4 which represented the frequency of travel. Block 1 was located nearest the yarding area and was the most frequently traveled, while blocks 2, 3, and 4 were traveled with decreasing frequency.

Two replications of bulk density at three depths (0-2, 2-4, and 4-6 inches) were taken at seven points, designated as A through G, perpendicular to the thinned strips. Points A and G represent undisturbed areas and were utilized as controls. Points B and F represented areas which were beneath the tracks of the mechanized equipment. Points C and E were located between the equipment tracks and point D the center of the strip where the trees or logs were skidded.

Undisturbed soil core samples with a volume of 134.9 cc were taken manually, dried at 110° C, and bulk densities computed on a dry weight basis.



Figure 1. Full tree thinning system. Note the lack of slash under the log.



Figure 2. Tree length thinning system. Note the logs suspended upon slash from the cutting operation.

RESULTS AND DISCUSSION

Bulk densities were significantly increased by both mechanized thinning systems except for the 0-2 inch zone under the tree length system (Table 1). Non-significant soil compaction in this zone may be attributed to: (1) large amounts of slash upon which the tree length logs were skidded (Figure 3); (2) disturbance and removal of organic matter was less in the tree length than in the full tree system which may reduce surface compaction (Figure 4); and (3) direct contact of mechanical equipment may have been prevented by the large amounts of slash.

"Sightseeing" was ranked either first or second by the city park samples for visiting state parks, while it was consistently ranked sixth by state park samples. Camping as a "family or group social activity" was ranked third by St. Croix and Whitewater samples, while it was ranked fifth by the Scenic sample.

Although there is some degree of overlap, it appears that the Twin Cities resident state park camper and city park picnicker differ in many ways. While 88% of state park campers visit large city parks at least once a year, most city park picnickers are not state park campers. Only 21% of city park picnickers camp at Minnesota state parks at least once a year, and their median number of annual visits is only two. Forty percent of city park picnickers indicated that they were unfamiliar with any of Minnesota's state parks. The main reason state park campers visit city parks is for specific recreation activities. Other reasons, in order of importance, are "family or group social activity", "to get outside; to get some fresh air", "enjoyment of nature", and "a change in the routine pattern of living". From first to fifth most important, this order was consistent for state park samples. "Sightseeing" and "to rest and relax" were least important reasons why Twin Cities state park campers visit Twin Cities large municipal parks.

Information gained from other parts of the study suggests some explanations for differences in the ranking of camping values by the three state park samples. To a large degree, each of the three state parks attracts a segment of the Twin Cities camping population, differing from the others in a number of characteristics.

Compared to other state park campers, the typical Scenic camper is older, has less education, and is more likely to be a blue collar worker. The majority of Scenic campers spent their last vacation in Minnesota, in a public area. Often, this public area was a state park, frequently Scenic. The Scenic camper has a longer length of stay, and is more likely to visit other state parks before returning home. He is least likely to visit Twin Cities municipal parks.

The typical St. Croix camper from the Twin Cities is more likely to be a weekend camper, and is more likely to spend only one night at the park. He has a shorter length of stay, and is less likely to be going elsewhere on this outing. He is most likely to be a frequent visitor to Twin Cities municipal parks. He spends his vacation out of state, in a non-public area.

Compared to other campers studied, the Whitewater camper is more likely to reside in the suburbs of the Twin Cities, is younger, has more education, and is more likely to fall into the professional-technical-managerial occupational classification. Whitewater campers are more likely than St. Croix campers to vacation in Minnesota and in a public area, but they are less likely than Scenic campers to do so. They are least concerned about a vacation in natural environment areas. Their length of stay in the state park is longer than that of St. Croix campers, and shorter than that of Scenic campers.

Implications for State Park Management

"Enjoyment of nature" is an important reason campers visit the state parks studied. For many camping is principally a change in routine or a chance to rest and relax. That they choose to do so in a natural environment such as Scenic Park implies the importance of the natural environment in satisfying these needs. For other campers, the primary reason for camping is social or recreational, and while these campers want an aesthetic environment, naturalness is not essential.

Two factors point to the opportunity for an interpretation program at Scenic Park. First, the park trails through Scenic's virgin forests are poorly marked and seldom used. Yet, there is a great potential for expanding the variety of visitor experience with signed and interpreted trails. The trails are not publicized, and there is no interpretation. Therefore, except for boating and fishing, campers rarely leave the campground area. Secondly, the relatively long length of stay of Scenic campers is much more conducive to an interpretation program than the extremely short length of stay of many St. Croix campers. The median length of stay for Twin Cities at Scenic was four days. The long length of stay makes it feasible for one naturalist to divide his time between Scenic and another nearby park such as McCarthy Beach. The interpretive program would not necessarily increase use but would enhance experience quality for those present at state parks.

It would seem important that a better channel of communication be established between the camper and manager. Interpretation of the park is a self-acknowledged objective of the Minnesota Parks and Recreation Division. Yet only a few parks employ a staff member in an interpretive capacity. Whitewater and St. Croix parks employ a naturalist during the summer months. Typical naturalist programs at these parks include tours of points of interest in or near the park, singalongs, and films dealing with some aspect of conservation, biology, or ecology. These programs could also convey information concerning park creation, general management goals of each park, and what the park contributes to the system as a whole.

Twin Cities campers who use the Minnesota state parks system may be divided into a number of segments, each with somewhat different characteristics and preferences, each seeking a different meaning from the camping experience. They seem to differ from city park users. To meet this expanding population of urban campers, the present system should provide greater diversity of environments, each of which has different management objectives regarding services and uses offered to the public.

Literature Cited

1. West, Patrick C. 1968. *Camping and Cohesiveness: A Sociological Study of the Effect of Outdoor Recreation on Family Solidarity*, Unpublished M.S. thesis, University of Minnesota.
2. Brown, Tommy L. 1969. *A Study of Twin Cities Users of Three Minnesota State Parks and Two Minneapolis-St. Paul Municipal Parks*, Unpublished M.S. Plan B paper, University of Minnesota.