RESEARCH NOTE NC-132

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

Folwell Avenue, St. Paul, Minnesota 55101

Shelterwood-Strip Harvesting Pattern With Full-Tree Skidding to Regenerate Red Pine[1]

ABSTRACT. — Describes a harvesting and regeneration pattern for red pine stands to make efficient use of mechanized full-tree harvesting. The system is not just an engineering operation to extract trees, but a forest management operation to harvest mature timber, prepare the site for regeneration, and provide environmental conditions favoring tree growth and multiple-use of the forest.

OXFORD: 221.21:231.3:372TL:908:174.7(776) *Pinus resinosa.* **KEY WORDS: mechanized harvesting, aesthetics, multiple-use, even-aged silviculture, site preparation.**

Forest managers and loggers have been challenged to produce wood more efficiently and to maintain an attractive forest environment. Mechanization of timber harvesting will play a vital part in meeting this challenge. But for intolerant species such as red pine, which grow best in even-aged stands, new harvesting patterns will be needed to improve scenic values during the regeneration process. These paterns should permit efficient removal of mature timber, favor establishment of a new stand, and provide access for silvicultural treatments, while maintaining a forest environment to benefit other uses such as wildlife and recreation. One such pattern being tried in a mature red pine stand has been called a *shelterwood-strip* harvest cut. It was designed to use the mechanized full-tree harvesting system described by Zasada and Brown.[2]. Rubber-tired skidders were used for moving the complete trees, including branches, to a central landing, where they were limbed and then decked as tree-length logs. The system is not just an engineering operation to extract trees but a forest management operation to harvest mature timber, prepare the site for regeneration, and provide environmental conditions favoring all forest uses.

STUDY AREA

A mature, 100-year-old red pine stand in the Chippewa National Forest of northern Minnesota was selected for the study. The stand had an average of 161 merchantable trees per acre ranging from 6 to 18 inches in diameter and averaging 90 feet in height, with a volume of 12 M. bd. ft. There were also 111

[1] *This report is based on a cooperative research study with the University of Minnesota, College of Forestry, and has been assigned Agricultural Experiment Station Scientific Paper 7787. Valuable assistance in carrying out the study was provided by the Chippewa National Forest and the Wheeler Lumber, Bridge and Supply Company.*

[2] *Zasada, Z. A. and B. A. Brown. The machine age and forest management. Conserv. Volunteer (Minn. Conserv. Dep.) 32 (184): 23-29. 1969.*

nonmerchantable or undesirable trees per acre, ranging from 2 to 10 inches in diameter. In addition to the understory of nonmerchantable trees, there were scattered patches of shrubs.

The terrain is level to gently rolling and the soil is a well-drained loamy sand (Menahga series). The site is rated good for red pine averaging about 60 feet (height of dominant trees at 50 years of age).

HARVESTING PATTERN

The harvesting pattern called for clearcut strips 50 feet wide alternated with shelterwood strips of mature timber 16 feet wide (fig. 1). A total of 8.2 acres were clearcut and 2.8 acres were reserved in the 11-acre study area. Strips were cut in both north-south and east-west directions. A second cut will be required to remove the 16-foot-wide strips in about 10 years, or when access is needed to the new seedling stand for cultural operations.

Figure 1. — *Narrow shelterwood strip will provide access to young stand after final cut.*

In this study the strips were set up to take advantage of a nearby landing area developed for another harvesting operation. This landing was 200 feet square (approximately 0.9 acre) and was used for both limbing and decking the tree-length logs. A second temporary landing was used for limbing trees from some of the strips to reduce the distance for dragging complete trees.

The system has several advantages: The residual mature trees will maintain a forested landscape during the regeneration period; wildlife habitat will be provided continuously; the slash is removed leaving a clean seedbed; a new stand can be started without losing any time for site preparation; the seedling stand can develop in the open without any overhead shade and may even benefit from a little side-shade; the residual mature trees can be full-tree harvested, as reported by Zasada and Benzie[3], without damaging the reproduction; removal of slash from the young stand should reduce risk of loss to fire, insects, and disease; the 16-foot cleared strips can then serve as access to the young stand for cultural operations and recreation; as the new stand develops, tree crowns are expected to close over the 16-foot strips so all growing space will be used.

There are also advantages to harvesting: The operation is planned for the logger; felling and skidding patterns are predetermined; skidding routes are free of obstacles; felled timber is concentrated and oriented for skidding, permitting large loads and efficient travel time; limbing is done more safely on a landing and adequate room is provided for storage and loading of timber.

Although the trees in the uncut strips would be more than adequate to seed the area in a good seed year (estimated production up to 250,000 seeds per acre), natural regeneration is not reliable because of the infrequent occurrence of good seed years. Therefore, this study area was regenerated by planting 3-0 red pine seedlings in the spring of 1971.

HARVESTING OPERATION

Harvesting was done in the late fall of 1970 by a commercial operator. The crew of four men included a faller, limber, skidder operator, and working foreman who operated a loading tractor for decking logs and pushing slash into piles. After all felling was completed the faller assisted in limbing at the landings. The limber also bucked small trees that were not suitable for tree-length hauling. The skidder operator choked the trees for skidding and assisted in pushing slash in the piles when needed. Felling was done manually with a chain saw; trees were dropped with their butts in the direction of skidding. Felling started at the back of the strip and progressed toward the landing, and the whole strip was felled

[3] *Zasada, Z. A. and John W. Benzie. Mechanized harvesting for thinning sawtimber red pine. Univ. Minn. Agr. Exp. Sta. Misc. Rep. 99, Forest. Ser. 9, 14 p. 1970.*

before skidding started. All trees, including those unmerchantable, were felled progressively.

Skidding was done with a four-wheel drive, rubber-tired skidder (fig. 2). The average skidding distance was 800 feet, and the maximum was approximately 1,100 feet. Trees from the east-west strips were skidded to the temporary limbing landing, dropped for limbing, picked up after limbing and skidded to the main landing for decking. Trees from some of the north-south strips were skidded directly to the main landing for limbing and decking. Production per day increased sharply when trees were handled only once by the skidder. Dropping and picking up of trees should be avoided in full-tree harvesting.

Figure 2. — *Wheeled skidder moving trees to central landing for limbing.*

Nonmerchantable trees were handled along with the merchantable material in skidding. Small trees were thrown together and choked as a bundle, then skidded as one unit of the total load. Early in the operation it was thought that the small material would be handled separately after the merchantable material was removed, but this was found to be impractical and costly.

The limbing operation at the landing included bucking small trees into posts and pulpwood. While felling was in progress only one man limbed at the landing. He could keep up when the skidder dropped trees at the temporary landing and picked them up, but could not keep up when material was handled only once by the skidder.

The limbs and tree tops were pushed into a pile by either the loading tractor or the skidder, depending on which machine could handle it best when slash needed to be moved. The plan called for burning the slash later, but it could have been burned or chipped during logging.

DISCUSSION

The shelterwood-strip cut is adaptable to mechanized harvesting by the full-tree harvesting system. This pattern permits efficient tree removal with no damage to residual trees, which can be removed in the final strip cut without damage to the established reproduction.

Incorporating the removal of the undesirable and nonmerchantable trees in the main harvesting operation was a low-cost way of getting this work done. The overhead costs of moving in a second crew are eliminated. The work quality is higher than if handled as a second operation. The effect of including this work in the operation had only a minimal effect on production, which averaged 118 merchantable trees per day or the equivalent of 19 cords. The overall harvesting time for this job — felling, skidding, limbing, and decking — was 1.7 man hours plus 0.6 machine hours per cord. At the recommended rates of $4.00 per hour for labor and $6.00 for machines, the cost was $10.40 per cord, including $0.36 for handling the unmerchantable material. The cost of handling the nonmerchantable trees was provided for in the timber appraisal by an allowance of $0.10 per tree for the removal of 910 nonmerchantable trees. This $91.00 or $11.10 per acre is considered the cost of site preparation.

Removal of all trees in the clearcut strips combined with full-tree skidding provided effective site preparation for regeneration by planting. Planting was done soon after logging without loss of a single growing season. Follow-up studies on the growth and development of the pine regeneration will help evaluate some of the environmental effects of the shelterwood-strip.

The next cut will remove the 16-foot-wide strips by directional felling and full-tree skidding. These narrow, clearcut strips will then provide access to the

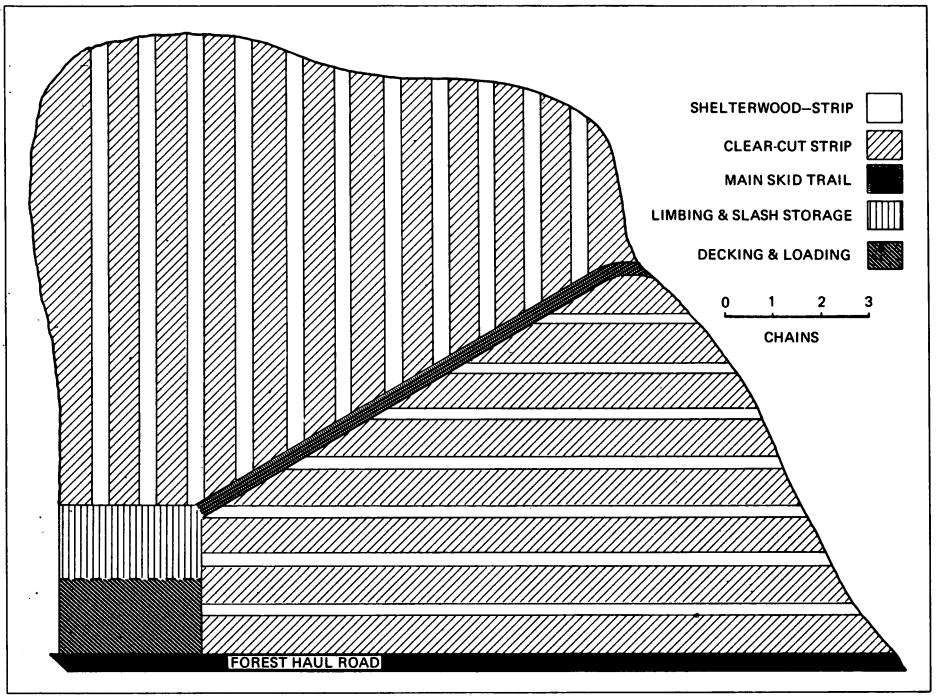

Figure 3. — *Generalized layout for a shelterwood-strip harvesting pattern.*

young sapling stand for mechanized cultural operations and recreational use. They will also provide access throughout the life of the stand for multiple-use. Both the wide strips of the first cut and the narrow strips of the second cut can be laid out so the trees can be skidded to a main skid trail that leads directly to a permanent landing for limbing and loading (fig. 3). One such landing could serve 40 acres easily where rubber-tired skidders could efficiently skid up to 900 feet. If additional permanent openings are desired for wildlife, recreation, or other purposes, landings could be spaced closer. One landing of the size used in this study (0.9 acre) per 40 acres would provide 2.25 percent open space.

This harvesting and regeneration pattern appears to have advantages for many of the present-day uses of red pine forests. The overall planning and layout for future uses as well as for mechanized operations throughout the life of the stand will play an important role in its success.

JOHN W. BENZIE
Principal Silviculturist
Northern Conifers Laboratory
Grand Rapids, Minnesota
Z. A. ZASADA
Research Associate
University of Minnesota
Cloquet Forest Research Center
Cloquet, Minnesota

1972

☆U.S. GOVERNMENT PRINTING OFFICE: 1972–760-433/35
Region 6