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A COMPARISON OF TWO LOG SKIDDING STRATEGIES
ON A SELECTION HARVEST OF YOUNG GROWTH REDWOOD

A Progress Report

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Ground skidding with tracked skidding equipment and/or rubber-tired skidders is often the choice of timber operators over skyline, balloon or helicopter systems. While these latter systems may cause less disturbance to soil and residual vegetation, they are also usually more expensive. Logistical problems, such as inadequate deflection, may also dictate the use of ground skidding. However, since soil compaction resulting from the use of ground skidding often results in a soil structure that reduces potential tree growth, it is desirable to develop skidding strategies that minimize areal extent of these trails and number of skids on those that must be built.

The Setting

The study area comprises approximately 200 acres of the 251-acre Hare Creek 1980 Timber Sale (HC '80) on the Jackson Demonstration State Forest. A typical even-aged 80-year-old second growth redwood/Douglas-fir stand, HC '80 is stocked with approximately 75,000 board feet per acre. It was marked to a leave stand basal area of 175 square feet per acre, resulting in a harvest of about 35,000 board feet per acre, or 8.5 million board feet for the entire sale.

Total stand volume consists of approximately 45 percent Douglas-fir (*Pseudotsuga menziesii*), 43 percent redwood (*Sequoia sempervirens*) and 12 percent grand fir (*Abies grandis*). Approximately 50 trees per acre with an average diameter breast height of 26 inches were marked for harvest.

Slopes range up to 50 percent and average between 15 and 20 percent. Predominant soil series present are Hugo and Mendocino. The erosion hazard ratings range from "Moderate" to "high."

The Study

This study was designed to evaluate two skidding strategies by comparing differences in logging time, cost and disturbance to soil and residual vegetation. One strategy utilizes skid trails that were laid out and constructed prior to tree felling. The other strategy, representing a more conventional approach to tractor logging, utilizes skid trails constructed by loggers after trees are felled. In both the "pre-planned" and "logger's choice" skidding areas, individual trees were marked for harvest prior to commencement of logging.

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Four units were delineated, each consisting of approximately 50 acres, and each containing a wide variety of stand densities, slope and soil characteristics and skidding distances.

In the two units designated for pre-planning, trails were laid out in a manner to ensure accessibility to all downed timber while maintaining a safe distance from sensitive areas such as streams, meadows and potential slide areas. In most cases it was possible to lay out main trails along ridges with herringbone-patterned spurs roughly paralleling contours on either side of the ridges so that steep pitches were kept to a minimum. A total of 73 man hours and 13 tractor hours were spent flagging and constructing trails in the two "pre-planned" areas.

Following trail construction, a field meeting was held with the logging contractor, fallers and tractor operators. The fallers were instructed to fell to the lead of the trail whenever possible keeping in mind the ultimate landing destination of the logs and the winching capabilities of the tractors. The tractor operators were reminded not to leave the skid trails under any circumstances in the pre-planned areas.

The other two units were logged in a more conventional manner. Marked trees were felled prior to the entry of skidding equipment. Since skid trails were constructed after trees were felled, this generally involved "pushing trail" through downed timber until an adequate trail system was developed.

In all four units, existing skid trails were used wherever possible.

Work in Progress

Logging on the HC '80 timber sale will continue through the 1981 logging season which ends November 15, 1981. Meanwhile data is being collected on the areal extent of skid trails, volume of timber damaged in felling and skidding operations, and various time and cost factors under the two strategies. Two timekeepers are employed full time to monitor the various pieces of skidding equipment. One timekeeper is stationed on the landing while the other is in the woods at the point of log hook-up. Utilizing two-way radios, stop watches and a clinometer, they record skid distance, slope, time, number of logs per turn, time spent choking logs, positioning tractors, winching, unhooking logs at the landing and delays. At the completion of timber harvest, approximately 1,000 hours of equipment time will have been monitored in this manner.

Preliminary Results

Although final data analysis must await completion of the HC '80 timber sale, some trends are emerging. Most notable of these is that there appears to be significantly less soil disturbance and damage to residual trees in areas where skid trails were constructed prior to felling. As a result, post-harvest stocking will more closely approach the silvicultural prescription in the "pre-planned" areas.

A second trend is that it appears that logging production may be slightly higher in the "logger's choice" areas in the early stages of logging. It seems likely, however, that this cost advantage will be offset by the greater time needed to log damaged timber. This latter stage, or "re-log" operation, is less cost-effective due to longer skidding, positioning and winching times required per turn and results in more frequent use of trails.

A third trend is that it appears that fewer landings are required to log comparable areas and volumes of timber in the "pre-planned" areas.

The Future

Final data will be analyzed during the winter of 1981-82 and one or more California Forestry Notes will be prepared detailing the results.

In the meantime, comments and/or suggestions are welcomed by the author.

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Craig E. Anthony^{2/}

Jackson Demonstration State Forest (JDSF) is in the process of investigating the feasibility of adopting the tariff system for cruising in young growth stands. This study is in its final phases and may have a long-lasting effect on cruising in the redwood region.

What is Tariff Cruising

The essential elements of tariff cruising are "tariff access tables" and local volume tables known as "tariff tables." In tariff cruising a sample of trees is selected representing the diameter breast height (DBH) range of the stand for which a volume estimate is desired. For each sampled tree, measurements are made of the total height (to the nearest foot) and DBH (to the nearest 1/10 inch). The access tables list a "tariff number" for each height/DBH combination (e.g., a Douglas-fir that is 174 feet tall and has a DBH of 26.9 inches may have tariff number 51.8).

The average tariff number for the stand is calculated using the individual tree tariff numbers. For the remainder of the cruise, only that tariff table corresponding to the average tariff number is used. This table represents a local volume table for a given species and yields volume or V-BAR for each one-inch DBH class.

As few as twenty measured tree heights may be required for an even-aged stand. More often, 40 to 50 tree heights may be required. Once this has been done, however, only DBH need be measured on the remaining trees in the cruise. Previously, as many as 200 tree heights were required in a typical cruise. This reduction in time-consuming tree height measurements greatly increases the output of cruising crews.

The successful use of the tariff system depends on the applicability of equations and ratios to convert cubic volume to board foot volume. It is from these ratios that tariff tables are constructed. The available ratios were developed by the Department of Natural Resources (DNR), State of Washington, and Dr. Turnbull of the University of Washington. These ratios were developed for Douglas-fir and have been successfully tested on western hemlock, but have not been adequately tested for redwood.

Tariff Cruising and Redwood

Tariff cruising is currently being used on a limited basis in the redwood region. However, the only redwood tariff access table generally available in this area results in the underestimation of volume.

The DNR has recently published up-dated tariff tables which include refinements of old tables. These previous tariff tables overestimated volume in larger diameter classes and are of limited use for the redwood region. One purpose of this study is to test the tariff ratios developed by DNR for their applicability to redwood. The second purpose is to develop more accurate cubic volume equations to be used in the construction of access tables for the redwood region.

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Data

Tree data was supplied by JDSF, Masonite Corporation, Georgia-Pacific Corporation, and the USFS Pacific Southwest Forest and Range Experiment Station. All tree data was collected in Mendocino County and is being analyzed using an Apple II microcomputer located on JDSF and the Humboldt State University Forestry computer. The computer programs calculate the cubic volume, and the board foot volume for both 16- and 20-foot log lengths. They also test the DNR ratios for each tree. When all available tree data has been analyzed, new regression equations will be constructed for cubic volume and board foot volume. These regressions will be tested with existing regressions to determine the most appropriate for the construction of new tariff access tables.

Trends

Preliminary trends indicate the DNR ratios apply very well for the redwood region. However existing cubic volume equations from which access tables are constructed generally have not proved reliable in this area.

What's Next?

A California Forestry Note is in preparation to report on the adoption of the tariff system for the State Forest. This Note will report the quantitative results of the investigation as well as its method. Using the method developed in the Note will allow other landholders to adapt the tariff system to their needs.

Coming Up.

In our next newsletter we will report on a five-year growth and regeneration study in young growth stands harvested over the past decade. We'll also look at current work on JDSF concerning black stain root disease, as well as some recent engineering projects.