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COMPARISON OF HARVESTING PHASES IN A CASE STUDY OF PARTIAL-CUTTING SYSTEMS IN SOUTHWESTERN BRITISH COLUMBIA: SUMMARY FIELD NOTE

A joint study of partial-cutting systems was undertaken in 1990-91 by the Vancouver Forest Region of the British Columbia Ministry of Forests, the Boston Bar Division of Fletcher Challenge Canada Limited, and the Forest Engineering Research Institute of Canada (FERIC). The overall objective was to demonstrate the use of clearcutting, seed-tree, and shelterwood systems for harvesting and regenerating dry Douglas-fir ecosystems in the Coast-Interior transition zone of Southwestern British Columbia. The objectives of FERIC's portion of the study were to compare the harvesting activities for the treatments and to test the procedures for studying silvicultural systems. The results have been published by FERIC in Special Report SR-85, *Comparison of Harvesting Phases in a Case Study of Partial-Cutting Systems in Southwestern British Columbia.*

The stand near Boston Bar was primarily Douglas-fir, 100-140 years old. The treatment units ranged from 3.6 to 7.0 ha in size, and within these units preharvest average net volume ranged from 341 to 538 m^3/ha. Average preharvest stem diameter ranged from 42 to 59 cm, and average preharvest tree density from 300 to 484 trees/ha. Four treatments were applied to two blocks: clearcutting, seed-tree, and two levels of shelterwood removal.

CABLE YARDING, LOWER BLOCK

The lower block was moderately steep in slope, at 50-70%, with well-defined draws. This block was harvested by Critical Site Logging Inc. of Vernon, British Columbia, using a Skylead C-40 Model 8000 yarder with a Maki Mini-Mak I carriage. Felling on the cable blocks was done by hand. Two Timberjack line skidders forwarded the stems from the yarder to the landing, and also skidded stems from those portions of the block not accessible to the cable yarder. Stems were yarded tree length where possible; however, some larger diameter stems were bucked at the stump to accommodate the capacity of the yarder.

The Skylead crew consisted of a faller, yarding engineer, chokerman, hooktender, and skidder operator, all of whom rotated jobs throughout the duration of the operation. In the shelterwood units, yarding corridors were clearcut to a width of 7 m and were located at 40-m intervals to accommodate 20-m lateral yarding.

Trees were felled downhill in a herringbone pattern to each yarding corridor except where topography or safety dictated otherwise. When the faller completed falling one or two corridors, he moved to another treatment unit while the yarding was completed. Although the leave trees were marked in this operation, the faller could substitute a tree scheduled for falling if safety or the lean of the tree made it necessary.

In the clearcutting operation, more trees were felled per hour than in the partial-cutting treatments. In the shelterwood treatments, the faller spent a greater proportion of productive time in observing and planning the falling. This is a logical consequence of the additional decisions required in falling the trees safely, preventing damage to leave trees, and aligning the stems for yarding. The higher productivity associated with the shelterwood heavy removal treatment was a consequence of the larger tree size within this unit. The shelterwood light removal had the lowest hourly faller productivity, likely due to a combination of relatively small tree size and increased time spent planning and executing the falling operation.

The detailed timing of the yarding operations on each treatment unit revealed no differences in the proportion of cycle times for each element. Similarly, the difference in average cycle time was 16%, with the seed-tree being highest (due to longer yarding distance) and the shelterwood heavy-removal treatment being lowest. Within the individual elements of the cycle, no clear differences were evident. Overall, productivity was influenced by yarding distance and piece size, and these differences overshadowed any treatment differences.

When the data were standardized to 100 m, and a cycle time calculated for each treatment, the time for shelterwood light removal was the highest, similar to the seed-tree unit. Times for clearcutting and shelterwood heavy removal were lower than other treatments, but similar to each other. The difference between the longest and shortest cycle was 12% on these standardized figures.

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GROUND SKIDDING, UPPER BLOCK

The upper block ranged in slope from 10 to 30%, with benched topography. A ground-skidding system was used by Hunsbedt Logging Ltd., consisting of a Caterpillar 227 feller-buncher with a Koehring 60-cm saw head, Caterpillar D6 and D7 crawlers with chokers, an FMC 220 crawler, and one each of a Caterpillar 518 grapple skidder and line skidder. The D6 and grapple skidder were used most frequently. The crew included one faller, one feller-buncher operator, one buckerman, two skidder operators, one mechanic, and one foreman.

Falling began several days before skidding. Trees greater than 50 cm were hand-felled. Time analysis of the feller-buncher's activities showed a substantial difference in time spent moving between trees, with clearcutting at 24.7% and shelterwood light removal at 35.7%. Numbers of trees cut per hour were greater for the clearcutting and seed-tree treatments, compared to the shelterwood treatments.

Productivity in terms of merchantable volume was influenced by proportion of unmerchantable trees and tree size. The feller-buncher had no difficulty operating in the partial-cutting units. Even with light removal, the distance between leave trees was wide—11 m—and the machine was able to fell and place the trees in bunches without restrictions.

The use of the various skidding machines was complex, and skidding distances for the treatment units were different from each other. Therefore skidding productivity cannot be easily compared. For the grapple skidder, Travel Between Bunches, Position, and Hook elements were greater for the shelterwood treatments than for the clearcutting and seed-tree. This can be attributed to the relatively greater distance between bunches and the need to manoeuvre to grapple the bunches without damaging leave trees.

DISCUSSION AND CONCLUSION

Operational feasibility of the partial-cutting treatments. Carrying out the partial-cutting treatments did not present any major difficulty to either the cable-yarding or ground-skidding contractors. Even at the lightest cut, only a very small number of leave trees remained (106 trees/ha, or basal area of 18 m^2/ha).

Tree marking. With an experienced crew, marking of leave trees for handfalling may not be necessary. Experienced fallers can identify good leave trees and can fell to spacing prescriptions. If quality of leave tree is critical, leave trees must be marked prior to mechanical falling; the operator cannot see the tops of the trees from the machine and has less ability than a handfaller to accurately assess spacing of leave trees.

Falling. Safety is always a concern in a handfalling operation. The faller could substitute leave trees if necessary. In the cable-yarding operation, the trees were felled in a herringbone pattern to improve yarding productivity and reduce damage to leave trees; this was generally achieved. Because the feller-buncher operator can control the direction and speed of falling, damage to leave trees can be reduced, particularly to the crowns, and stems can be positioned more accurately for skidding.

Fewer stems per hour were felled on the shelterwood units than on the clearcutting and seed-tree units. This supports the logic that falling productivity would be negatively affected by the effort required to place stems and to minimize damage to leave trees. Falling in the clearcutting treatments was more productive than in the shelterwood light removal treatments: 40% more productive for the cable yarding block and 25% more productive for the ground-skidding block.

Yarding and skidding. The influence of piece size, terrain, and yarding and skidding distances on productivity appear to override the influence of cutting pattern. When cable-yarding cycle times were standardized to 100 m, a difference of 12% was shown between the shortest cycle (shelterwood heavy removal) and the longest cycle (shelterwood light removal). Number of pieces per turn were somewhat different between treatments, but this was likely more an effect of piece size than treatment.

Limitations of the study. Variables such as yarding and skidding distances, topography, piece size, and machine use were different for each treatment unit. However, the information presented in this report is a data set within a growing database on partial-cutting productivity.

INFORMATION

This report is published solely to disseminate information to FERIC members. It is not intended as an endorsement or approval of any product or service to the exclusion of others that may be suitable. A copy of the full report can be obtained from FERIC, Western Division upon request. More information on the biological component may be obtained from:

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