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Partial Cutting and Helicopter Yarding on Environmentally Sensitive Floodplains in Old Growth Hemlock/Spruce Forests – Project 2.59

INTRODUCTION

The Naden Harbour area, on the northwest corner of the Queen Charlotte Islands, has high timber and fisheries values. Volumes of merchantable stands typically range between 500 and 1200 m³/ha, with exceptional stands exceeding 1500 m³/ha. Fisheries values are also extremely high in these watersheds. Low gradient rivers and creeks provide critical habitat for steelhead, cutthroat trout and four species of salmon. Many sites with high fisheries and timber values are also environmentally sensitive.

To allow use of the timber resource without compromising fisheries habitat, a sophisticated method of forest harvesting from environmentally sensitive floodplains has been developed. The method is best described as partial cutting, and involves using a heavy lift helicopter for yarding.

DESCRIPTION OF STUDY

Several concerns have been raised about the suitability of this method of harvest in coastal British Columbia. These concerns include:

- lack of suitable yarding equipment
- logger safety
- lack of skilled personnel
- residual tree damage
- windfall of residual trees
- excessive slash levels
- regeneration problems

This memo summarizes the results of ERDA Project 2.59. Specifically, the memo describes the success of protecting fisheries habitat, reviews the concerns listed above, and explains the planning and harvesting procedures used.

Four of 14 partially harvested sites were studied. Based on operational cruise information and a recalculation of the cruise plots after logging, a description of pre- and post-harvesting timber volumes by species and grades was generated for three of the blocks. Timber volume data were not available for one study block, H-8, which did not contain any cruise plots.

The helicopter cutting permits were made up of several blocks. Because statistical requirements are set for each

cutting permit as a whole, it is inappropriate to draw statistical inferences from the data for any individual block. The stand descriptions, however, are adequate for empirical comparisons.

PARTIAL CUTTING AND HELICOPTER YARDING AT NADEN HARBOUR

Partial cutting generally refers to tree removal (other than clearcutting) in which only part of a stand is removed. It is used to describe the silviculture system used in Naden Harbour. Removal of stems ranges from single tree selection to small (half-hectare) clearcut patches. This system has been applied with a variety of harvest objectives, ranging from the removal of all merchantable trees that will not affect the fisheries habitat, to the removal of a specified portion — 30% — of the stand, distributing the cut over the full range of species and grades.

Helicopter yarding operations on both clearcut and partial harvest blocks have been used at Naden Harbour since 1986. Between 1986 and 1989, approximately 67 500 m³ were removed from 14 blocks that were logged by partial cutting. This volume accounts for 25% of the helicopter-yarded volume and 5% of the total volume harvested from the study area in this time period.

Two types of helicopters are used for yarding, the Sikorsky S 61-L and the Sikorsky S 64-E. The S 61-L has a lift capacity of 4000 kg and is only used for yarding clearcuts. Sites harvested with the S 61-L were not included in this study. The lift capacity of the S 64-E is 9000 kg, double the lift of any other helicopter currently used for logging. This great lift capability allows the S 64-E (also known as the Sky-Crane) to lift heavy logs straight up through the canopy. As a result, little yarding damage occurs on the site or in the residual stand. Although expensive to operate, the Sky-Crane can be very efficient. For the partial harvesting blocks, with flight paths either level or slightly uphill and a flight path of about 1 km, normal yarding production averages 175 m³/hr, as compared to typical grapple yarder productivity of about 40 m³/hr.

CASE STUDIES

Table 1 gives a basic description of each site.

Protecting the integrity of fisheries habitat was the prime objective for all partially harvested blocks. Nevertheless, cutting objectives varied according to site-specific conditions:

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TABLE 1. Summary of site information for each block

Block	Harvest year	Area (ha)	No. stream channels	Reach classification	Volume (m ³ /ha)	% Vol. removed	% Stems removed
HN-1	1989	8.4	6	I	723	31	30
HN-5	1987	5.6	5	I	939	67	65
HN-7	1987	7.5	7	III	1071	66	32
H-8	1987	7.3	5	I	—	—	—

Block	Cutting Objective
HN-1	Remove 30% of the volume and distribute the cut over the forest profile.
HN-5	Remove most of the volume from two isolated patches of timber that were uneconomic to harvest conventionally.
HN-7	Remove windfall and larger timber, thereby leaving a younger stand.
H-8	Remove timber from an area inaccessible by conventional methods.

The number and distribution of Class I reaches in HN-1 made road building impractical. Blocks HN-5 and H-8 consisted of two small patches of merchantable timber surrounded by scrub; conventional harvesting was uneconomic. Originally left as a fire break, HN-7 sustained significant blowdown and dieback, resulting in numerous snags and windfall.

In each case, the environmental and cutting objectives were met. Stream habitat protection on these blocks has been excellent; stream banks and in-stream debris were essentially undisturbed. Block HN-1 reflects the most common cutting objectives and procedures still used in Naden Harbour.

Table 2 compares the timber profile on each block, in terms of species, grade and net merchantable volume per tree, before and after logging. More detailed information is provided in FRDA Report 166.

A related study in block HN-5 assessed the residual stand and developed a silviculture treatment regime to ensure that the stand was fully stocked with acceptable, well-spaced seedlings, advance regeneration and mature trees. Treatments included:

- double girdling unacceptable trees (those diseased, poorly formed or damaged)
- spacing advance regeneration
- planting small openings with Cw and Ss

DISCUSSION

In addition to satisfying the environmental considerations, operations at Naden Harbour have addressed most of the concerns raised about partial harvesting with helicopter yarding in coastal British Columbia:

Lack of suitable harvesting equipment The great lift capacity of the S-64-E Sky-Crane makes it ideal for yarding partially harvested blocks.

TABLE 2. Comparison of pre- and post-harvesting stand volumes by timber grade and species. "Peeler/lumber" includes grades A-G, "Sawlog" includes grades H-J, and "Pulp" includes grades K-Y.

	HN-1		HN-5		HN-7	
	Pre	Post	Pre	Post	Pre	Post
Total						
Peeler/lumber (%)	2	2	5	0	22	26
Sawlog (%)	86	91	92	97	74	69
Pulp (%)	12	7	3	3	4	5
Net merch. (m ³ /tree)	6.4	6.3	3.9	3.6	3.7	1.9
Spruce						
Peeler/lumber (%)	7	4	17	0	49	96
Sawlog (%)	90	92	80	96	50	4
Pulp (%)	3	4	3	4	1	0
Net merch. (m ³ /tree)	25.5	25.3	14.4	4.9	31.3	39.0
Hemlock						
Peeler/lumber (%)	0	0	2	0	5	4
Sawlog (%)	84	91	95	96	90	90
Pulp (%)	16	9	3	4	5	6
Net merch. (m ³ /tree)	4.9	4.3	3.0	3.0	2.3	1.4
Redcedar						
Peeler/lumber (%)	0	0	0	0	0	
Sawlog (%)	0	0	79	99	0	
Pulp (%)	0	0	21	1	0	0
Net merch. (m ³ /tree)	0	0	9.1	13.1	0	0

Logger safety To date, helicopter logging has been as safe as conventional logging in Naden Harbour.

Lack of skilled personnel Through several years of operation, the necessary technical and supervisory skills have been developed to allow safe and effective harvesting operations.

Residual tree damage If a high proportion of stems or volume is removed, then residual tree damage can be a problem. However, residual tree damage has been minimized by:

- removing only 30% of the volume and distributing the cut over all diameter classes,
- marking only 15-25% of the volume to be removed, thus giving fallers a greater choice as to which additional stems are to be felled,
- marking potential problem trees to ensure a supervisor is present at falling, and
- using the vertical lift provided by the Sky-Crane.

Residual tree windthrow Considerable windthrow did occur in two blocks harvested in 1986. Since then, however, windthrow has been minimal in most blocks. Methods for maintaining a windfirm stand include:

- distributing the cut over all size classes,
- removing only 30% of the stand volume,
- identifying and clearcutting patches of trees prone to windthrow, and
- ensuring clearcuts are well spaced and small (approximately half a hectare).

Excessive slash Post-logging slash levels in the helicopter-yarded blocks are comparable to those of conventionally yarded blocks. However, the slash is not broken up in the yarding process. This can inhibit planting by impeding walking and reducing the number of plantable spots. Manual site preparation either before or at time of planting will be required on some sites.

Regeneration problems Silviculture concerns include:

- reduced plantable spots and growing area due to the unbroken slash,
- reduced growth rates of Sitka spruce in a shaded environment,
- unsuitability of western hemlock regeneration due to dwarf mistletoe,
- presence of unacceptable (poor quality, diseased or damaged) trees in the residual stands, and
- lack of a long-term cutting schedule.

Most of these regeneration problems can be addressed through manual site preparation and the implementation of the type of silviculture treatment regime developed for block HN-5. Long-term plans for these blocks are essential. Such plans will require more extensive data collection to prepare appropriate stand and stock tables. Also required will be sound growth and yield information.

Silviculture considerations should be incorporated in the development of cutting objectives and procedures. Higher silviculture costs and slower growth rates may be acceptable

if the primary objective is to maintain the integrity of the fish habitat or other environmental values.

CONCLUSIONS

Partial cutting and helicopter yarding has proven to be a safe, environmentally acceptable and economic way to harvest timber from environmentally sensitive floodplains on the Queen Charlotte Islands. Integral to the success of such an operation are:

- intensive planning and supervision through all phases,
- removal of a relatively low proportion (30%) of the stand volume,
- distribution of the cut over all size classes,
- tree marking that ensures windfirmness of the residual stand and provides flexibility to maximize faller safety,
- use of a helicopter with sufficient lift capacity, and
- consultation and co-operation among all parties involved, including those responsible for fisheries, timber and silviculture.

This harvest method appears to be appropriate for environmentally sensitive areas in much of coastal British Columbia. A method for assessing the stocking of partially cut blocks has been developed in the Kamloops Forest Region,¹ and also seems suitable for the coast. Although not tested at the time of this study, the survey method is scheduled for the partially harvested blocks in the summer of 1992.

One unresolved concern that remains is how to incorporate silvicultural objectives with those of environmental protection and timber harvesting. Silvicultural objectives should be reflected in the planning and layout procedures and may be different from the objectives on more conventional sites. Additional research is still required to assist in this planning, and should focus on:

- growth and yield of stands regenerating in the shaded environment of a partially cut stand,
- development of long-term cutting schedules for partially harvested blocks, and
- site preparation techniques that will reduce regeneration problems resulting from the slash left by helicopter yarding.

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¹ Stocking surveys for partial harvesting systems. Ron Newman 1990. Kamloops Forest Region Memo. 955-7-1-4.