RESEARCH SUMMARY

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NELSON FOREST REGION

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# CASE STUDY: Partial Cutting to Restore Old-Growth Forest Conditions in the East Kootenay Trench

*By Angela Hawe and Deb DeLong*

- **Volume available without compromising original objectives of old-growth reserve**

## INTRODUCTION

Research shows that prior to European settlement[1] the structure of the old-growth forests in the drier Douglas-fir and ponderosa pine forest types of the Rocky Mountain Trench were quite different than they are today. In pre-settlement times, light ground fires swept through these subzones every 10 to 20 years, resulting in open park-like forests characterized by large, old trees and little regeneration (Arno et al. 1995) (Convington and Moore 1994). The predominant tree species were ponderosa pine and Douglas-fir, as well as western larch on moister sites. The open structure of these forests, and the associated plant communities, supported a number of wildlife species.

In the absence of fire, Douglas-fir has regenerated in abundance on these sites and stocking is much higher. The consequences include changes in wildlife habitat, reduction in forage production, increased susceptibility of trees to insect attack and disease, and increased risk of catastrophic fire due to greater fuel loading and increased fuel laddering.

In 1993, the East Kootenay Trench ecoregion in the Cranbrook Forest District was identified as having several biogeoclimatic subzones with less than 5% old growth.[2] This is considerably less than the 10% recommended by the Protected Area Strategy (PAS) as the minimum level required to maintain biodiversity and old-growth-dependent plant and animal species across the landscape.

To protect remaining old-growth areas, a deferral had been placed on harvesting old growth in the East Kootenay Trench ecoregion. However, simply deferring or preserving old stands will not ensure the maintenance of true old-growth conditions.

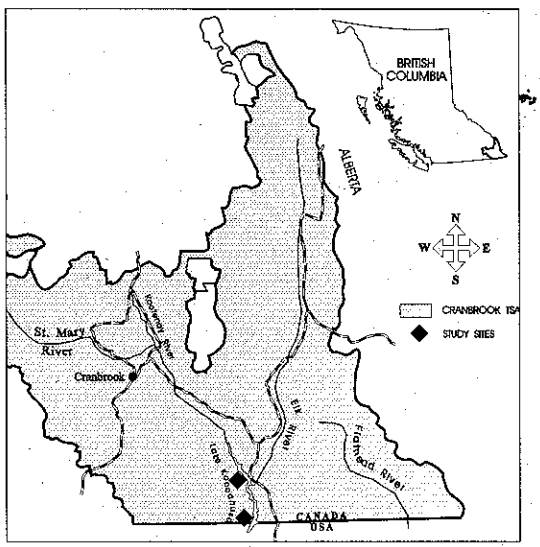


**Figure 1.** Location of study site. Cranbrook Forest District.

In 1995, recognising that management to reduce stocking and re-introduce fire is essential, the Silvicultural Systems Research program in the Nelson Forest Region requested that two stands of old-growth forest in the IDFdm2 subzone within the Trench be released from the harvest deferral. In 1996 the Region implemented a trial and case study to examine the operational, economic, and ecological feasibility of old-growth restoration. The objective of the trial is to modify the stocking levels, species composition, and the forest floor to approximate pre-settlement stand conditions. This will be accomplished by replacing wildfire with a combination of harvesting and prescribed fire on a regular 20-year cycle.

[1] Pre-settlement = pre-1900.

[2] An old-growth stand is defined as one greater than 140 years.

This Research Summary describes the prescription development, harvesting operation, and preliminary study results for one of the stands.

## SITE DESCRIPTION

The study block is located in the southern part of the Cranbrook Forest District, on a mesic site in the IDFdm2 (Interior Douglas-fir dry, mild biogeoclimatic subzone) (Figure 1). The 30-ha stand is within Crestbrook Forest Industries' operating area.

Forest cover ranged from patches of large old ponderosa pine with little understory, to areas of Douglas-fir and ponderosa pine overstory with dense fir understories, to areas of predominantly smaller stems of Douglas-fir and some larch. Overall, species composition was approximately 75% Douglas-fir, 20% ponderosa pine, and 5% larch Figure 2.

Large snags were found throughout most of the stand, and these showed a high degree of wildlife use. Armillaria ostoyae is present throughout the stand.

**Table 1.** Stand descriptions (stems greater than 17.5-cm dbh).

| | Pre-harvest stand | Target residual stand | Actual residual stand |
|---|---|---|---|
| **Species composition** | Fd75Py2Lw.5 | Py4Fd4Lw2 | Fd6Py3Lw1 |
| **Stems/ha** (no.) | 786 | 75 + some thickets of unmerch. stems | 123 + some thickets of unmerch. stems |
| **Basal area/ha** (m2) | 27 | 9-15 | 16 |
| **Avg. diam.** (cm) | 20 | 50 | 41 |
| **Volume** (m3 /ha) | 185 | N/A | 128 |

**Figure 2.** Pre-harvest stand.

## STUDY METHODS

### Prescription development

Because the site had been harvested at least twice over the last 100 years, a stump survey was completed to learn more about pre-settlement species composition (Table 1). Together with the results of the stump survey, current research was consulted to develop a description of the target stand for the prescription (Table 1).

Recent research indicates that, pre-settlement, this type of stand probably had about 9-15m2 of basal area (75 stems/ha at an average 50-cm diameter) (Arno et al. 1995; Covington and Moore 1994; Quesnel 1996). In addition, there would have been small thickets of regeneration in areas skipped by fire. It is likely that these thickets would have covered about 5% of the area.

Using the stand and stock tables provided in the cruise compilation, cutting specifications were developed that would remove most of the excess of smaller diameter stems of Douglas-fir from the stand. All the ponderosa pine, Douglas-fir greater than 35-cm dbh, and larch greater than 17.5-cm dbh were retained. Smaller larch were removed due to consistently poor form and vigour. To achieve and maintain the target stand structure for the site it is necessary to reduce current stocking levels as well as ensure some form of stocking control occurs in the future. With this in mind, a prescription was developed that included slashing of submerchantable stems to provide ground fuels, and understory burning on a regular cycle.

In areas where the number of larger stems was insufficient to achieve the desired stand structure, some smaller stems were retained to avoid substantial gaps and to allow the desired char-

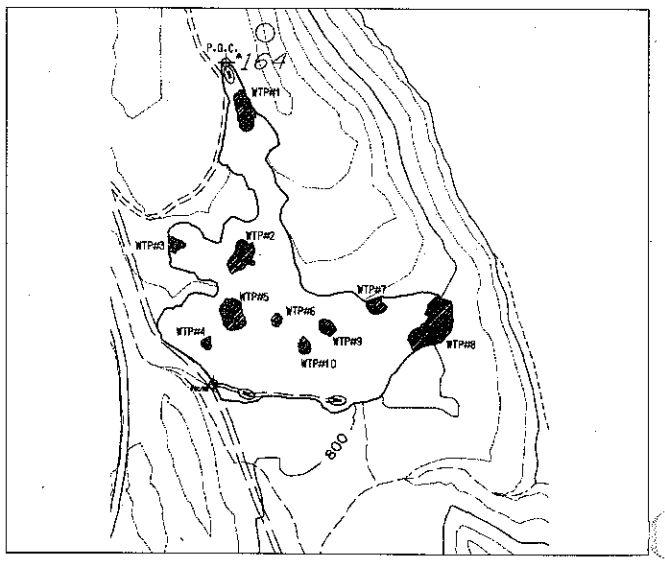


**Figure 3.** Distribution of wildlife tree patches (WPT) within block.

acteristics to develop over time. Some thickets of regeneration were retained within wildlife tree patches. Slashing and burning of the understory were prescribed to be carried out as soon as possible following logging. To keep the stocking levels down, burning and possibly harvesting will be required on a regular 20-year cycle.

In addition to residual trees, ten wildlife tree patches were identified and marked as no-work zones within the cutblock (Figure 3). Some patches include several large snags surrounded by a thicket of understory Douglas-fir regeneration. About 35% of all snags were protected in 10% of the block area. Snags could be protected without substantial reductions to available timber because there were few if any merchantable stems within the patches.

**Figure 5.** Residual stand.

### Harvesting

Harvesting started mid-February 1996 and was completed in seven days. A total of 1600 $m^3$ of sawlogs were removed as well as 68 $m^3$ of pulpwood. The block was harvested with a Caterpillar D4, a 518 Caterpillar skidder, and a John Deere 640 skidder (Figure 4).

This type of operation is best done in winter on frozen ground to reduce costs and to minimize soil disturbance. A key requirement of this initial logging pass was to build up a carpet of ground fuels by topping and delimbing stems where they fell, rather than removing tops and branches at the landing. In frozen conditions, many of the branches were broken on impact and it was quite easy for the skidder to run over each stem to remove any remaining branches prior to hooking. The frozen ground eliminated any potential site disturbance this extra maneuvering might have otherwise created.

**Figure 4.** Harvesting operation.

Residual stems incurred very little damage, and site disturbance was low. Following logging, a slashing crew felled any remaining submerchantable stems so they would contribute to ground fuels.

Crestbrook Forest Industries' harvesting superintendent felt that the open nature of the stand resulted in logging costs that were no higher than if the site had been clearcut. His only concern was the relatively small size of the block, noting a larger area would reduce some of the equipment moving costs. A total of $17,630 in stumpage was paid to the Province of British Columbia.

### Residual stand

The resulting residual stand is substantially more open and than its pre-harvest state. It consists of mainly large diameter stems, distributed singly and in clumps (Figure 5). At 16 m2/ha the basal area of the residual stand was close to the target of 9-15 m2/ha. However, the stand still contains about 48 stems/ha too many (Table 1). This is because the average residual stem is still smaller than ultimately desired (41vs. 50-cm dbh).

More stems than are required were left to ensure that the residual basal area did not drop below 15m2. At the next scheduled entry (in 2016), the average diameter will have increased and more stems can be taken out without the residual basal area dropping below 15m2. Also, the next entry can be used to approach the target species composition by further reducing the amount of Douglas-fir. Given the

[3] A future Research Summary will report on the success of the burn.

improved visibility and the greatly reduced stocking numbers, future harvesting can be done relatively easily on a tree-by-tree basis using a mark-to-cut system.

### Burning

Following harvesting and snow melt, a reconnaissance of the cutblock determined suitability for understory burning. The burn is scheduled for the spring of 1997 to allow coniferous fuels time to cure.[3] This timing will also allow grasses time to grow up around the coniferous fuels to supplement the fuels and provide continuity between patches of slash. Subsequent burning treatments are expected to kill most of any new regeneration that establishes in the next 20-year period. However, it is expected that enough regeneration will survive the burn to provide for future stand replacement (S. Arno, USDA, Missoula, MT. 1995 pers. comm.). The burn is estimated to cost less than $10,000.

## SUMMARY

Initial indications are that partial cutting for old-growth restoration in the IDF biogeoclimatic zone is feasible. By harvesting in this way, key structural elements are retained, forage production should be increased, and a plan is set in motion for the long-term maintenance of these stands. There is also potential to gain wood volume from areas that are currently considered old-growth reserves and unavailable for harvest, without compromising the original objective of an old-growth reserve. And, in landscape units where old growth is under-represented, this treatment could also be used to accelerate old-growth recruitment from younger stands. Yet another benefit of the treatments is long-term fuel reduction which substantially reduces the risk of catastrophic fire.

The economics of a restoration program will be site specific, but for the more marginal sites (i.e. those with smaller stems) the strength of the pulp market will likely be a key factor. While larger block sizes would improve economics, this site contained enough small sawlog material that the harvesting operation provided a positive return to the crown.

## REFERENCES


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## FOR MORE INFORMATION, CONTACT:


Nelson Forest Region:
Deb De Long, Silv. Systems Research Forester
250-354-6285
ddelong@mfor01.for.gov.bc.ca

Ken Streloff, Area Forester
Elko Division, Crestbrook Forest Industries
Cranbrook, B.C.
250-529-7211

Steve Byford, Small Business Forester
Cranbrook Forest District, Cranbrook B.C.
250-426-1700
sbyford@mfor01.for.gov.bc.ca