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Contents

Salvaging burned timber: operational strategies

Abstract

In 1998, forest fires in central Alberta caused extensive damage to forest land. The local forest industry and the Alberta Land and Forest Service (ALFS) were anxious to salvage as much burned timber as possible. The ALFS contracted the Forest Engineering Research Institute of Canada (FERIC) to organize a workshop on salvaging and processing burned timber, and to conduct and document operational case studies on the recovery and utilization of burned timber. This report summarizes the techniques and strategies that were observed during the case studies to harvest and process burned timber, as well as the results of charcoal and moisture content studies performed on the fire-damaged timber.

Keywords

Burned timber, Salvage logging, Harvesting, Processing, Debarking, Productivity, Utilization.

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Introduction

During the spring and summer of 1998, forest fires in central Alberta damaged nearly 500 000 ha of forest land. The Alberta forest industry was anxious to recover and utilize as much burned timber as possible to maintain timber supplies for existing mills, minimize impacts on annual harvest rates, and allow for timely reforestation. In support of the industry's expeditious recovery of burned timber, the Alberta Land and Forest Service (ALFS) provided regulatory incentives involving both reduced stumpage for burned timber and accelerated cutting approvals. As well, ALFS contracted FERIC to organize a workshop on salvaging and processing burned timber (Sambo 1998) and to conduct a series of operational case studies illustrating the harvesting and milling issues involved in utilizing burned timber. During the contract period, seven Field Notes were published on the recovery and utilization of burned timber in both Alberta and British Columbia (Dyson 1999a–g).

There are three major issues for companies engaged in salvaging burned timber: charcoal contamination of pulp chips, stem moisture loss, and deterioration of the fire-killed timber. Charcoal, if present in the chip furnish, may cause black flecks to appear in the pulp sheet, which reduces grade and value. Stem moisture loss decreases both pulp[1] and lumber[2] quality. Deterioration through insect and fungus attacks reduces lumber grade. FERIC documented the strategies undertaken by forest companies to address these three issues, and sampled chips produced from fire-damaged timber to determine charcoal and moisture contents.

This report summarizes techniques and strategies for salvaging and processing burned timber that were observed during

[1] Pulp is affected by reduced chip yield because of a higher proportion of pins and fines, and reduced pulp strength due to higher incidence of fibre breakage at the chip refiner.

[2] Lumber quality is affected by the checking and splitting of boards sawn from dry logs.

the preparation of the seven published Field Notes, and presents the results of the charcoal and moisture content studies. Six of these Field Notes dealt with conifers (white spruce and lodgepole pine), and one dealt with hardwoods (aspen and cottonwood).

Study methods

During the summer and fall of 1998 and the winter of 1998–99, FERIC researchers visited mills and woodlands operations to document changes in processes and techniques introduced for salvaging and processing burned timber. At operations producing pulp chips, 20-kg samples were collected, sealed in plastic bags (to prevent moisture loss), and shipped to FERIC's research facility in Vancouver for analysis.

From each 20-kg sample, three 7-L sub-samples were passed over a BM & M chip classifier to determine chip size distribution, and over a Testing Machines Inc. Domtar chip thickness classifier for thickness measurements. Each fraction was manually sorted to determine the percentage by weight of charred bark and charred wood fibre. Charred wood fibre on chips was not removed as mill processing systems are not designed to separate charred from non-charred fibre. The charred wood and charred bark were combined when determining the actual percentage of charcoal in the sample. Also from each 20-kg sample, one sub-sample (approximately 500 g) was oven dried to determine moisture content. This procedure was repeated during the winter of 1998–99 to quantify differences in charcoal and moisture content when processing frozen logs.

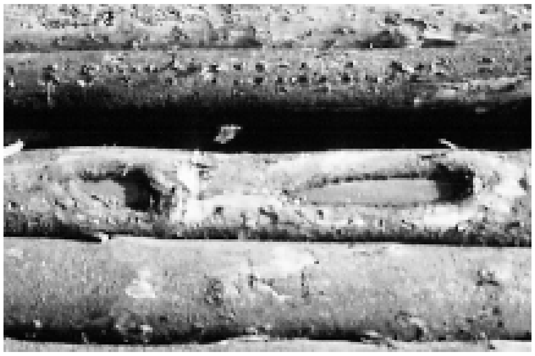
Figure 1. Charred fibre in catfaces.

Results and discussion

The conditions of burned stems, logs, and chips were observed by FERIC researchers during the field visits. Even when the bark was heavily charred during a wildfire, the insulating properties of the bark and the high moisture content in the stem protected the wood fibre from the direct effects of the fire. However, the wood fibre was charred in areas where the bark was absent, e.g., catfaces, scars, and rotten knots (Figure 1). When logs were debarked well, and all the charcoal was removed, charcoal-free chips were produced. Removing all the charcoal, however, was difficult on small diameter logs and where the fire had burned into defects such as scars and rotten knots. Consequently, to ensure that charcoal would not contaminate pulp chips, companies processing burned timber changed procedures and updated equipment both in the woodlands and at the mill. These changes and strategies include utilization specifications, debarking practices, management of charcoal dust, and harvesting and processing alternatives.

Utilization specifications

The focus in the woodlands has been on implementing new utilization specifications and improving log quality. Increasing the acceptable minimum top diameter means small diameter logs are not harvested and thus the subsequent problem of removing

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all the charcoal on these logs is avoided. Improving log quality by removing catfaces, scars, rotten knots, and rotten butts prevents charcoal, which is often present in these defects, from entering the sawmill.

An alternative strategy is log sorting. Sorting can be particularly effective in stands where removing all the defects would cause a large waste of useful fibre. Logs with defects, where debarking is not likely to remove all charcoal, can be sorted from logs with no defects. The defect sort can then be processed separately in the sawmill and the chips would not be used for pulp. The defect-free sort can be processed in the usual method and the chips could be utilized.

Two companies put a priority on harvesting small diameter stands and stands which had been severely burned. This was done because they felt fibre moisture loss would occur first and at a higher rate in the small stems, and heavily fire-damaged timber would be most susceptible to insect attack.

Debarking practices

The focus for sawmills producing chips from residuals has been on upgrading debarking systems by installing double ring debarkers. These debarkers have counter-rotating rings, and are effective in removing charcoal from logs. Four mills were observed using this strategy. Alberta Plywood Ltd.'s[3] Slave Lake veneer plant and Vanderwell Contractors (1971) Ltd.'s Slave Lake sawmill installed Nicholson double ring debarkers, while Millar Western Forest Products Ltd.'s Whitecourt sawmill installed a Valon Kone Brunette double ring debarker. Blue Ridge Lumber (1981) Ltd. approached the solution differently and added one, single-ring Cambio debarker in front of each Nicholson debarker on the two separate debarking lines. The Cambio ring rotates in the opposite direction to the Nicholson ring debarker, creating the same effect as a counter-rotating double ring.

Several operations have found that modifying the type and configuration of tips on the debarker tools can be effective for removing charred bark and charred fibre in catfaces. Staff at Tolko Industries Ltd.'s Merritt sawmill achieved good debarking results when alternating a winter tip with a cutter tip on the front ring of a Valon Kone Brunette Kodiak debarker. Blue Ridge Lumber personnel installed a narrow 2.5-cm tip on a Cambio debarker for more effective charcoal removal.

Two other strategies to aid log debarking are to slow the infeed speed on the debarker line or to provide a means to re-route debarked logs back through the debarker for a second pass. Millar Western's Whitecourt sawmill reduced the infeed speed on one of its two debarking lines by 12%. Vanderwell's Slave Lake sawmill and Tolko's Merritt sawmill both utilized a multiple-pass debarking system. Logs which have gone through the debarker and still have charcoal remaining are prevented from entering the mill. These logs are then routed back through the debarker as many times as necessary to remove all the charcoal.

Seventeen samples were taken from debarking operations where logs were frozen and 45 where logs were not frozen to determine charcoal and moisture contents (Figure 2). FERIC's chip analysis of frozen and unfrozen logs found that 80% of the chip samples contained 0.5% or less charcoal by weight. Pulp chips with charcoal

[3] Alberta Plywood Ltd. was previously Zeidler Forest Industries Ltd.

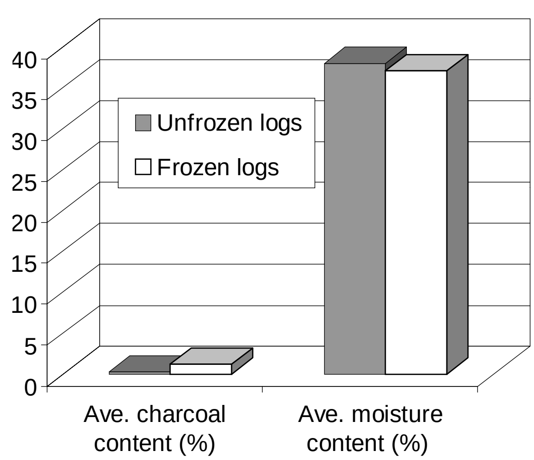

Figure 2. Charcoal and moisture contents in chip samples.

percentages of 0.5% and less are considered acceptable by industry standards.

Management of charcoal dust

The charcoal dust produced when processing burned timber is a health concern as it has been classified as a carcinogen by Alberta Occupational Health and Safety. The dust also causes increased wear to debarking knives, bearings, and saw teeth, and damage to electrical panels and controls. Spraying the logs with water immediately prior to debarking is effective in controlling charcoal dust. However, this method is impractical during freezing winter temperatures. An alternative—installing dust extraction and baffle systems around the debarkers—does not eliminate all charcoal dust, and employees working near debarkers must also wear dust masks. Increased greasing and general maintenance of equipment is necessary where dust is present. A positive pressure system in electrical control rooms helps prevent charcoal dust from affecting electronic circuits.

Harvesting and processing alternatives

Grapple yarding

The need to salvage burned timber has created opportunities for introducing alternative harvesting methods. Grapple yarding had not been used in northern Alberta prior to its introduction in the Virginia Hills by Millar Western's Whitecourt Wood Products Division. Significant volumes of burned timber are located on the steep slopes, abrupt gullies, and riparian zones frequently found in the Virginia Hills. These areas have not been operable using conventional ground-based skidding. However, Millar Western's Woodlands staff and its geotechnical consultants concluded that grapple yarding would be an environmentally acceptable method for harvesting these sensitive areas.

Figure 3. Madill 122 grapple yarder.

In the operation observed by FERIC, a Timberjack 2628 self-levelling feller buncher felled and bunched the timber parallel to the slope. A Madill 122 swing yarder (Figure 3) then grapple yarded the stems to roadside, where they were processed to tree-length logs using a Pierce 230 processor head mounted on a Caterpillar 322 excavator base. The yarder was guyed to a Caterpillar D8 crawler tractor and a Hitachi EX 300 excavator was used as a mobile backspar. Productivity from the yarding crew of one engineer and a spotter was 300–400 m^3 in a 10-h shift (estimated by the contractor). Factors which contributed to the good productivity included large piece size, good deflection, and bunching of stems parallel to the slope.

Using this cable system has enabled Millar Western to salvage volume that would have otherwise been lost. Due to the high site quality, the volume and value of this wood were high.

Portable sawmilling

Alberta forest companies plan to complete salvaging the burned timber within two years of the fires to minimize losses due to fibre deterioration. To do this, they have increased their harvesting rates and processing capacities. Portable sawmilling can be used to meet this short-term increase without expanding permanent sawmill facilities. FERIC researchers observed four portable mills processing burned timber from the Virginia Hills.

Buchanan Lumber operated a chip-and-saw mill in the Virginia Hills to process cut-to-length burned spruce and pine logs 5.5-m long into rough cants. The cants were shipped to Buchanan's mill near High Prairie for further processing, and the residual chips were burned in an on-site open pit. The mill operated two 11-h shifts per day, seven days per week and required six employees for each shift. Buchanan plans to mill 128 000 m^3 of burned timber over 12 months.

At another site in the Virginia Hills, a contractor for Millar Western also milled burned timber using a portable mill. Cut-to-length logs 4.97-m long were fed to a circular saw headrig for initial breakdown. An edger then processed the rough timber into cants, railroad ties and dimension lumber. The residual slabs were burned in an open pit. The mill required six employees per shift and operated two 10-h shifts per day. Total production for five shifts was 139,600 fbm (foot board measure). The portable mill will be processing burned timber for two years.

North of Whitecourt, Millar Western established a satellite logyard where three contractors used portable mills to mill burned timber. Cut-to-length logs 3.6, 4.3, and 4.9 m in length were transported to the yard and then distributed to the individual mills by log loaders. D and L Rehn Contracting operated a Morbark Sawmill Supply Inc. Morbark sawmill, which utilizes a circular saw headrig and edger to produce cants and dimension lumber. The mill operated 10 h per day, six days per week, and total production over 11 days was 342,900 fbm. Another contractor operated a Canadian Mill Systems Ltd. model Economizer Small Log Processor chip-and-saw. Two people ran the mill 10 hours/day, six days/week producing 10 × 10 cm (4 × 4 in.) cants. Production for five shifts was 31,795 fbm. A third contractor assembled a portable scrag mill to produce dimension lumber. However, due to start-up problems, the mill was not operating when FERIC researchers visited the site. Mill residuals such as slabs, trim ends, and chips from the mills were burned in an on-site beehive burner.

One disadvantage of utilizing portable mills is that residuals such as slabs and trim ends cannot be converted easily into pulp chips.

In-woods chipping

Salvaging stands of small diameter burned timber is frequently not economical because of the high percentage of pulp logs in these stands. This, combined with the difficulty in removing the charred bark from small diameter stems using ring debarkers, means alternative processing methods are necessary to be cost effective. In-woods chipping was one method used by a contractor operating with Blue Ridge Lumber. Woodlands staff identified an area composed of small diameter stands in the Virginia Hills suitable for in-woods chipping. Using a feller-buncher, the logging contractor conducted an initial sort at the stump, separating sawlogs from pulp logs. At the landing, the chipper operator removed any remaining sawlogs before feeding the pulp logs to a Peterson Pacific Corporation DDC 5000 portable chip plant (Figure 4). The chips were screened to remove the fines and then transported by truck to a bleached chemithermomechanical pulp (BCTMP) mill in Taylor, B.C.

Figure 4. Peterson DDC 5000 processing burned logs.

Conclusions and implementation strategies

FERIC conducted a series of operational case studies to document the techniques and strategies used to salvage fire-damaged wood. As part of the case studies, samples of chips were collected and analyzed to determine charcoal and moisture contents. Eighty percent of the sampled chips contained 0.5% or less charcoal. The mean moisture content of the chip samples was

38% for the period up to nine months after the fires.

To ensure no charcoal contamination of pulp chips, companies adopted changes in systems and equipment in the woodlands and at the mill. Numerous strategies were employed to achieve the desired pulp chip quality.

Methods to improve log quality:

- Buck out defects such as burned catfaces and scars. Conventional ring debarkers have difficulty in removing all the charcoal from these areas.
- Buck out heavily burned sections, where fire has damaged the fibre beneath the bark.
- Sort the logs based on the extent and severity of the fire damage. Processing options, such as wasting chips from heavily burned logs, can then be implemented.
- Increase the acceptable minimum top diameter. Conventional ring debarkers have difficulty removing charcoal from small diameter logs.

Systems and equipment strategies to remove charcoal at the mill:

- Install double-ring debarkers. The counter-rotating rings are effective in removing charcoal.
- Slow the debarker infeed speed. The slower speed creates better charcoal removal.
- Utilize different debarking tips on ring debarkers. Depending on the season, alternating a cutter tip with a winter tip can be effective.
- Install a multiple-pass debarking system so that logs can be recycled through the debarker.

Techniques for controlling charcoal dust dispersion at the mill:

- Spray the logs with water immediately prior to debarking. This method, however, is impractical during freezing winter temperatures.
- Install vacuum systems and baffles around the debarker.
- Pressurize areas housing electric control panels.

Strategies for the timely recovery of fire damaged timber:

- Secure agency cooperation to allow flexibility with operational planning and prompt processing of cutting authority.
- Grapple yard timber in environmentally sensitive areas.
- Use portable sawmills in the woods or at a satellite logyard.
- Perform in-woods chipping of small diameter stems.

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