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Economic aspects of wood storage under snow

Abstract

The storage of wood under snow was implemented on small, moderate, and large scales during 2004 in hardwood (lumber, veneer) and softwood (lumber, pulp) operations. The present report describes these applications, presents a cost analysis, and provides suggestions to facilitate the implementation.

Keywords:

Wood, Inventory, Storage, Snow, Freshness, Quality, Cost analysis, Benefits.

Introduction

Past trials that FERIC participated in confirmed that wood stored under snow retains the properties of fresh wood (Nader 2003), and as a result, several member companies have integrated this approach within their inventory management process. During 2004, FERIC monitored these operations so as to better evaluate the costs and to provide recommendations that would facilitate implementation. An overview of the potential savings is also provided.

Observations

The companies created piles of different sizes and shapes to meet their individual needs. At each location, the methods and materials used to cover the piles varied, depending on the availability of equipment and materials. Table 1 summarizes the main characteristics of the piles and of the insulating materials.

All the piles were built in early 2004 from freshly harvested wood during the winter as per the usual guidelines provided for wood storage by the managers of each mill's wood yard. However, the spaces around the piles were expanded to provide room for the snow and insulating materials.

At each location, we recorded the key findings concerning the storage of wood under snow and the operational aspects during recovery of the wood. A summary of the benefits obtained from storage is also presented.

Site 1: Maple logs for lumber (350 m³)

Key findings:

- The small volumes that were stored limited the pile height to 2 m. There was minimal collapse (slumping) of the snow sidewalls and few logs in the upper row were exposed to air.
- Good drainage of the site was provided by a nearby ditch, which prevented the accumulation of meltwater around the pile, thereby facilitating movement by wood-yard machines and reducing con-

Table 1. Characteristics of the piles and of the insulating materials

Site	1	2	3	4
Company	Sylvio Brunet & Fils Ltée	Columbia Forest Products	Columbia Forest Products	Tembec Industries Inc.
Location	Fassett, QC	Hearst, ON	Nipigon, ON	Pine Falls, MB
Date of pile construction	Feb.–March 2004	Jan.–Feb. 2004	Feb.–March 2004	Feb.–March 2004
Pile opening date	June 2004	Nov. 2004 (in part)[a]	Sept. 2004	Sept. 2004
Type of wood				
Species	maple	aspen	aspen	black spruce
Length	10 to 16 ft	8 ft	8 ft	8 ft
Utilization	lumber	veneer	veneer	pulp
Pile characteristics				
Volume	350 m^3	14 000 m^3	3 840 m^3	3 410 m^3
Length	40 m	100 m	variable	75 m
Width	15 m	35 m	7.5 m	20 m
Height	2 m	6 m	2 to 3 m	3.5 m
Thickness of snow	80 to 100 cm	100 to 150 cm	60 to 120 cm	60 to 80 cm
Type and thickness of insulator	bark 40 to 50 cm	bark 50 to 100 cm	unchipped debris 30 to 70 cm	sawdust and fines 30 to 60 cm

[a] In response to an unanticipated order, the mill recovered one-quarter of the pile in November 2004, for a total of 3500 m^3; the remaining volume is expected to be used in 2005.

tamination of wood in the lower rows by the insulating material.

Reported benefits:

- Storing this wood under the snow allowed the mill to avoid purchasing additional furnish at a high price in June, even though opening of the pile was not expected before September.
- The mill used fresh wood with high moisture content, thereby facilitating debarking and sawing, without having to resort to watering of the wood during storage.

Site 2: Aspen veneer logs (14 000 m^3)

Key findings:

- Because of the large size of the pile, both in height and in width, a snowblower was needed to rapidly cover the pile with snow (Figure 1) and a front-end loader was used to spread the snow uniformly over the pile. As a result, the snow coverage was thick, ranging from 100 to 150 cm. An excavator and front-end loader were used to add the insulating material. Travel by

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these machines on the snow and insulator helped to compact these materials, thereby reducing the losses of snow during the storage period.
- At the end of September, no loss of the cover materials was apparent.
- An attempt to recover the logs in October was unsuccessful because the wood was still frozen into the pile and was thus difficult to extract. In November, the need to recover the wood forced the mill to use heavy equipment to free the wood from the ice.
- Large piles thus offer an advantage in terms of preserving fiber freshness, but can make it more difficult to recover the wood.

Reported benefits:

- The mill reported that the storage provided rapid access to fresh fiber, which let it respond to unexpected orders and thus protect its market share.

Site 3: Aspen veneer logs (3800 m³ in several piles)

Key findings:

- The presence of coarse debris within the layer of insulating material accelerated the loss of snow cover by allowing water penetration within the pile. This loss of cover was quite significant, and the two upper rows of the piles were exposed to the air by early July, leading to discoloration of the cut ends of the logs (Figure 2).
- Mold was observed on the surface of the last logs to be used in each pile.
- Building several independent piles minimized problems by allowing the mill to keep unused piles covered.

Reported benefits:

- With the exception of exposed logs in the upper rows, the wood retained its whiteness and high moisture content.
- During certain periods of the year, the poor condition of the roads prevented access to the forest; the use of wood stored under snow thus allowed the mill to avoid the high costs of transportation during these periods.

Site 4: Spruce pulp logs (3400 m³)

Key findings:

- Using a thick layer of sawdust as the insulator reduced the loss of snow cover.
- The control pile, which was left uncovered, showed discoloration at the ends of the logs and the beginning of decay in the form of brown ring rot.
- The moisture content of chips produced from the wood stored under snow was identical to that of freshly cut wood.

Figure 1. (*left*) Use of a snowblower to cover the pile with snow.

Figure 2. (*right*) Loss of snow cover in the upper rows of a pile.

Reported benefits:

- For the company's forestry operations, the availability of wood stored under snow reduced the road maintenance costs during the wet season.
- The high moisture content and absence of discoloration in the chips provided savings in terms of reduced use of bleaching agents by the mill.

Costs and benefits

The costs that arise from the preservation of wood under snow relate to the costs of construction and covering of the piles, plus recovery costs for the wood. In general, the parameters that affect the construction and coverage costs are the following: the shape of the pile, its location, the thickness of the coverage, and the availability and proximity of snow and of insulating materials. Thus, for a given volume of wood, the pile should be relatively compact in shape but as high as possible (within the limits of the machines used to build the pile) so as to minimize the amounts of snow and insulator that are required.

Economic benefits arise in both the forestry operations and at the mill. In the latter case, the costs depend on the products that will be produced.

The main benefits for the forestry operations are that managers can maximize the use of winter transportation and thereby reduce the costs of maintaining the forest roads and of transportation during the summer and fall.

The benefits obtained by the mills result primarily from access to fresher fiber that has been well preserved. For sawmills, fresh wood facilitates debarking, reduces the energy consumed during sawing, and prolongs the saw's working life. For pulp mills, fresher chips require less energy during processing and less bleaching agent. For hardwood mills, storage under snow minimizes discoloration of the wood and offers an interesting alternative to expensive sprinkler systems. This technique also lets mills market their products during a period when such products would generally be unavailable (and thus potentially high priced), particularly for species such as white birch and white pine, which are difficult to preserve in warm weather, and particularly during the summer.

Table 2 summarizes the costs and benefits of storing wood under snow, based on data provided by the mills that used this approach during 2004. Depending on the situation, the net benefit obtained ranged from \$1.10 to \$2.60 per m³.

Table 2. Summary of costs and benefits – 2004 trials

Situation	1	2[a]	3	4
Construction cost (\$/m³)	3.20	1.20	3.30	2.80
Recovery cost (\$/m³)	1.10	1.20	0.60	0.30
Estimated savings and profits (\$/m³)	6.10	5.00	5.00	5.70
Net benefit (loss) (\$/m³)	1.80	2.60	1.10	2.60

[a] For the volume used during the current year.

Implementation

The storage of wood under snow involves several stages. Our observations at the various study sites and the corrective measures that were taken are summarized in this section.

Site preparation and construction of the pile

- **ground surface**: Provide a sufficiently large area to hold the piles, their snow and insulating cover, and provide enough room for machine travel around the piles. For example, for a pile height of 4 m, allow an additional 2 to 4 m all around the pile for snow and insulator (Figure 3) in addition to any space required to permit travel by the yard equipment.

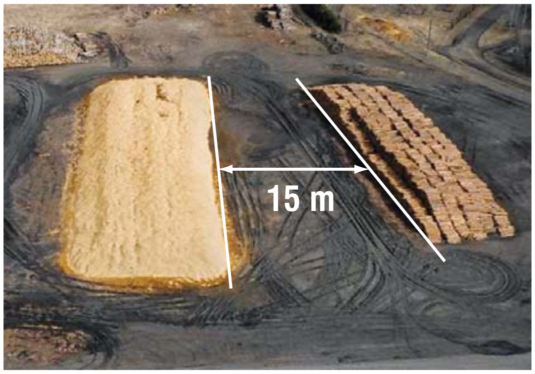

Figure 3. (*left*) Spacing between piles.

Figure 4. (*right*) Optimization of the pile volume.

- **location of the pile**: Because the wood stored under snow will not be used immediately, it should be located where it will not interfere with movement of the equipment used to feed the mill.
- **flow of meltwater**: Plan to remove meltwater using drains and ditches, particularly if the soil is impermeable (e.g., clay).
- **pile size**: Plan for a pile shape and height that will accommodate the capabilities of the available machines (front-end loader, excavator, snowblower, snow-making equipment, etc.), particularly if it is necessary to reach the center of the pile without requiring the machines to climb onto the pile. The pile height should accommodate the capabilities of the machines that must cover the pile with snow and insulating material.
- **choice of logs**: Because the upper rows are at greatest risk of becoming uncovered towards the end of the summer, place the lowest-quality logs in the uppermost rows. As a result, any degradation of these logs will produce a lower economic loss than would be the case with high-value logs.
- **volume optimization**: Consider the possibility of adding logs laterally against the vertical faces of the pile (Figure 4) to create a pyramid shape that will reduce the volume of snow required to cover the sides of the pile. (Subsequently, this will also reduce the amount of ice that must be removed.)

Coverage with snow

- **thickness of snow**: The required thickness of snow will depend on the expected storage duration and on the quality of the insulating material. Nonetheless, the minimum thickness should typically be around 1 m.
- **upper corners**: Increase the thickness of the snow around the upper corners of the pile, since these almost always become uncovered as a result of their larger exposed area and because of collapse of the snow walls due to melting at their base.
- **artificial snow**: Although the use of artificial snow to cover the wood piles is technically possible, this approach was not tested by any of the companies that

participated in this study. In any event, natural snow produced by snow-removal activities in the mill's wood yard will typically be less expensive.

Coverage with the insulating material

The insulator is the most important element in the wood preservation process, since its role is to protect the snow against rain and heat. Thus:

- **thickness of the insulator**: The required thickness will depend on the storage duration and the quality of the insulator; for example, plan for a minimum thickness of 60 cm with softwood bark.
- **nature of the insulator**: Avoid coarse debris in the insulating material, since these materials increase the risk of conducting water and heat into the interior of the pile.
- **homogeneity and compaction of the insulator**: Ensure that the insulator is homogeneous and compact the material to force the particles to spread horizontally.

Recovery of the insulator

- **clearing the top of the pile**: It's preferable to remove the insulating layer before recovering the wood so as to avoid hauling bark and debris into the mill. In addition, some materials that are more resistant to decay (e.g., cedar bark) can potentially be reused. However, clearing debris from the top of the pile can be difficult if the snow has completely melted and the insulator has become mixed with the logs.
- **conservation of the material**: Provide a location for storing the insulator if it will be reused.

Recovery of the logs

- **opening of the piles**: Plan the time when you will open the piles and the method that will be used accounting for weather conditions. As such, the insulating layer should be removed 4 to 6 days before recovery of the wood to allow ice to melt and to facilitate removal of the logs, but allow for a longer time interval at lower temperatures.
- **utilization delays**: Use the logs most vulnerable to deterioration first; these include hardwood species and white pine.
- **debarking and sawing**:
  - Debarking can be performed as if you were working with fresh wood, since the external temperature of the log will be around 0°C and the bark will be soft, having absorbed meltwater from the snow.
  - The sawing equipment should be adjusted to account for the higher moisture content of the wood.

Environmental impact

No provincial regulations in Quebec, Ontario, or Manitoba governed disposal of the water around the wood piles at the time of our study. However, mill yard operations will be facilitated if the meltwater is directed into a ditch or drain, particularly when opening the piles during a rainy period.

Additional material available from FERIC

To help you plan an operation with wood storage under snow, we have made the following tools available to members:

- a spreadsheet that helps you to evaluate the construction and wood recovery costs for the piles as a function of their size and shape;
- a collection of photos and graphics that illustrate the recommendations in this report.

Acknowledgments

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