

Perceptions of and Adaptation to Changing Winter Weather by Logging Business Owners in Northern Minnesota

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Approximately one-third of Minnesota is forested, with the densest forest cover occurring in the northern part of the state. The forest industry is the fifth largest manufacturing sector in Minnesota by employment, with most of the industry based in the northern part of the state. About 53% of the annual volume harvested is produced during the winter when soils are frozen or can be frozen by packing down or removing snow to facilitate frost penetration (Blinn & Nolle, 2023).

Winter weather in northern Minnesota has been reported to be changing. For example, the state is getting warmer, especially in the northern part of the state, where daily average minimum temperatures during winter (Dec-Feb) have increased by 7.3 degrees Fahrenheit from 1895-2021 (Minnesota PCA, 2023). The frequency of a temperature of -35° F or lower in northern Minnesota has fallen by up to 90% since 1970 (Minnesota DNR 2024). Minnesota lakes have lost an average of 10 to 14 days of ice cover in the past 50 years 2021 (Minnesota PCA, 2023).

In a recent survey of Minnesota logging business owners, which included the question, "Have recent weather patterns impacted your logging operations?", 53% indicated "Yes," 41% indicated "No," and 6% reported that they "Didn't know" (Blinn & Nolle, 2023).

STUDY FOCUS

Given the importance of the logging industry in the state and documented changes in winter weather in the state, the authors were interested in exploring how winter weather may be affecting winter logging operations in the northern part of the state.

APPROACH

Data was collected through focus groups with northern Minnesota logging business owners who had a long history of being in the logging business. Study participants were instructed to think about winter temperatures and winter logging operations over the course of their careers. Owners were recruited from the Minnesota Logger Education Program (MLEP) membership database based on their length of membership and production volume. Thirty-six loggers participated in six focus groups that were conducted in March and April 2023. Focus groups were organized according to a business' annual wood production, with three focus groups consisting of loggers whose production was below the state average (approximately 10,000 cords/year) and three focus groups whose participants whose production was greater than the state average. Each focus group lasted approximately 40-50 minutes and was recorded using Zoom.

The audio-recorded focus groups were automatically transcribed via Zoom. After reading the transcripts and listening to each recording, the authors identified and reached a consensus about the major themes and sub-themes that emerged from the focus groups.

RESULTS

On average, the average participant had been a logger for 34 years, harvested 66 percent of their volume during the winter, and had aspen as an important component of their annual harvest (Table 1). While most of the loggers used a conventional system with a feller-buncher and grapple skidder, nine businesses reported that they use a CTL processor and forwarder either as an additional crew to their conventional operation or as their sole way to fell and transport timber.

Table 1. Descriptive information for the focus group participants.

Factor	Statistic			
	Mean	Maximum	Minimum	Count
Years logging	34.5	56	8	36
Annual production (cords)	20,328	200,000	500	34
Winter production (%)	66.4	100	50	34
Winter crews (number)	1.9	8	1	25
Winter in-woods employees (number)	5.5	24	1	24
Aspen harvest (%)	59.4	95	15	35
Other hardwoods (%)	21.6	70	5	35
Softwood harvest (%)	19.0	60	0	35

Four themes and several sub-themes emerged from the data. Each theme with its sub-themes is reported below.

Theme 1: Perceived winter weather changes

Temperature Changes

Their comments highlighted three major ideas regarding winter air temperature. The first was that winter air temperatures seem milder now to them than when they first started logging. Second, the onset of the very cold temperatures needed to freeze the soil seemed to be occurring later than in the past. The last major idea was that extended periods of very cold temperatures do not seem to last as long as they used to.

Precipitation changes

While several participants noted that the amount of snow each winter seems to be less than in the past, many felt that the onset of very cold temperatures was occurring after the first large snow event, which impacted the timing and depth of frost. Others reported that there is more rain during the winter logging season.

No perceived changes

Some participants stated they had not observed changes or trends in winter weather patterns over time. While some reported a general lack of changes in winter weather, others felt that there were not any long-term patterns or trends but variability from year to year.

Theme 2: Impacts of weather changes on winter logging operations

Adverse Impacts

Winter logging season

Several participants felt that there were fewer operable days (i.e., when the soil is frozen) than in the past, with the shortened season due to the delay of the beginning of winter logging operations as opposed to the end when the spring thaw occurs. Several loggers attributed the reduction in the number of operable winter logging days to changes in logging equipment and not weather. Specifically, they noted that today's logging equipment is much heavier and requires greater frost depth to operate without rutting a site than the older equipment, which is considerably lighter.

Winter logging infrastructure

A common sentiment expressed was that loggers are spending more time and effort to freeze roads. Several felt that the increased frequency of having a large snow event before the ground is frozen requires them to spend considerably more time packing down and/or removing snow from their winter access roads in order to get them sufficiently frozen. This additional work equates to greater operating expenses and reduced productivity.

Some noted that the lack of extended, very cold periods was making it more difficult to build ice bridges to cross streams and creating the need to use more slash mats to cross soft areas. Some loggers also noted that timber sales are less accessible today than in the past, requiring more road building and time spent clearing snow from their winter roads.

Winter logging productivity

A range of impacts, including additional time spent freezing down infrastructure and the need to create slash mats across unfrozen soils and deeper snows, were contributing to decreased productivity of their winter operations.

Beneficial Impacts

Several participants described how warmer winters are having a beneficial effect on their logging business. One beneficial effect mentioned by many was how the more moderate winter temperatures were not as hard on their logging equipment. Others mentioned that moderate winters saved them money on costly weather-related equipment repairs and downtime.

Some participants noted that milder winters positively affected their logging productivity. For example, heavy rains followed by cold weather can help freeze the ground. In addition, felled wood was less likely to freeze to the ground. Warmer temperatures also reduced fuel consumption, and there was less reliance on #1 diesel fuel, which is a more expensive blend of diesel fuel.

Theme 3: Logger adaptations to changing winter weather conditions

Equipment purchases

Focus group participants identified a range of modifications they have made to their logging equipment to adapt to changing winter weather conditions. The most commonly mentioned change was the use of different tires and tracks (e.g., wider tires, dual tires, and tracks) on current equipment to reduce ground pressure (psi), which may enable them to operate for a longer period when the ground is not completely frozen. While the wider contact area associated with different tires and tracks allowed earlier entry into winter sales and required fewer passes to pack down their infrastructure, it was an additional cost to purchase and operate due to increased fuel consumption.

While some participants purchased graders and wider bulldozers, others preferred using older logging equipment that was lighter weight as it gave them more opportunities to operate in less-than-ideal winter conditions.

Changes to timber sale portfolios

Several participants stated they were being more selective about the types of timber tracts they were purchasing. This included a preference for sales that could be harvested year-round if winter ground conditions restrict access or tracts with closer access to existing roads. To provide them with more options, some indicated they are holding a larger number of timber sale permits during the winter logging season than in the past to ensure they are able to keep their crews working. In addition, several noted the uncertainty regarding winter soil conditions was forcing them to target tracts where the probability of being able to harvest the stand was the greatest.

Planning winter operations

Several loggers indicated that they were spending more time planning their winter logging season than in the past. This included paying more attention to weather forecasts and being more entrepreneurial by looking for market niches and providing additional services to private landowners.

Theme 4: External impacts on winter logging

Regulatory and administrative impacts

Loggers felt public agency foresters are more inclined today to shut down a winter timber sale due to concerns over soil compaction and rutting than in the past. Several attributed this increased scrutiny to foresters who were relatively new to the profession. Participants also felt that the characteristics of public agency timber tracts have affected their winter operations in that sales are smaller today (necessitating moving to more tracts), have more regulations, and require more road building and winter maintenance to access.

Evolution of logging equipment

Several loggers attributed the reduction in the number of operable winter logging days to changes in logging equipment rather than any changes to winter weather. They noted that today's logging equipment is much heavier and requires

greater frost depth to operate than the older equipment, which is considerably lighter.

Loggers also indicated that today's equipment is more reliable, technologically advanced, can be started in any temperature, and can fell and process trees faster than the older logging equipment.

Workforce availability

Some firms may add employees to help them be more productive during the winter, so workforce availability was an issue for some participants, although it is not a factor caused by changing weather.

SUMMARY

The logging industry is inherently sensitive to and influenced by weather conditions. The focus groups highlighted that many northern Minnesota logging business owners perceive changing winter weather conditions as related to temperatures and precipitation amount, type, and timing. These changes, for the most part, are resulting in additional challenges to their winter logging operations. Reduced and/or inconsistent periods of frozen ground are creating difficulties for loggers to access harvest sites, as well as additional time and cost to freeze down access roads and infrastructure within the harvest site.

There was no consensus that shifting weather conditions are the sole driver of the observed changes to winter logging, but an acknowledgement that their operations have changed over time due to a variety of factors. Several loggers cited various non-weather factors (e.g., larger and heavier logging equipment, increased pressure from timber sale administrators to minimize site impacts) which are driving the changes they have observed. Many of them felt these non-weather changes influence the perception that changing weather conditions are driving alterations to their winter logging operations.

Regardless of whether loggers acknowledge or agree that winter weather conditions are changing, both weather and non-weather changes have made winter logging more challenging now than in the past. The combined effect of these changes may begin to have a deleterious effect on the wood supply chain during winter in northern latitude states where a substantial percentage of wood is harvested during frozen ground conditions.

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