



The Logging Sector in Minnesota and Wisconsin: Status, Issues, and Challenges in 2021

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Abstract

To update our knowledge about the logging sector in Minnesota and Wisconsin, coordinated mail surveys were conducted during the spring of 2022. The surveys collected data on harvest systems, production volumes, profitability, production capacity, business demographics, capital investment, trucking, stumpage sources, timber products harvested, emerging issues, and more. The average age of logging business owners and their equipment is trending older. Harvest production is trending downward. Stumpage sources are trending away from public lands and relying more on private lands. Delivery is becoming more of an issue due to a shortage of truckers. Mill closures and the pandemic negatively impacted many firms. Many of the negative trends noted impacted small businesses more than larger businesses.

Keywords Minnesota · Wisconsin · Logger · Harvest · Production · Profitability · Demographics · Investment · Trucking

Study implications Loggers implement forest management on the landscape, provide raw material for value added manufacturers and provide a myriad of environmental and economic benefits. Thus, understanding the logging industry is essential for policymakers, foresters, landowners, and the forest products industry to help sustain and strengthen the wood supply chain. This study examines logging firms in Minnesota and Wisconsin using data from the 2021 calendar year and comparing it with a similar study conducted in 2016. Recent events have taken a toll on the logging sectors in the two states, including the pandemic and the closure of large pulp and paper mills.

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Introduction

Forests cover 33% of Minnesota and 46% of Wisconsin, for a total of 34 million acres (USDA Forest Service 2021a, b). These forests constitute a vital element of the regional economy in the Lake States. The forest products industry employs 84,000 people and generates an economic output exceeding \$34.8 billion across the two states (IMPLAN, 2021 data). Logging is a key component of this intricately linked supply chain. It plays a pivotal role in providing jobs with direct and indirect positive impacts on local economies, connecting forest resources with mills, implementing sustainable forest management practices during timber harvesting, and contributing to the delivery of ecosystem services. Despite these critical contributions, loggers and the logging sector encounter formidable challenges. The substantial costs associated with modern logging equipment, often exceeding \$500,000 per piece of equipment, pose a financial barrier to entry and expansion of operations (Conrad et al. 2017). The evolving market dynamics marked by mill closures, restricted access to capital, changing land ownership, price uncertainties, and lack of long-term supply agreements add further uncertainties. The aging demographic of logging business owners raises concerns about business continuity and recruitment of new proprietors (Rickenbach et al. 2015). Key factors that impacted the logging sector in the past and will likely impact it in the future are industry and owner demographics, production and equipment, stumpage sources and delivery, and evolving markets (Rickenbach et al. 2015).

Because of their importance in the wood supply chain, logging business owners are surveyed in some states to assess the status and challenges being faced within that sector. While some assessments are conducted periodically, other states have a long history of conducting assessments. For example, Georgia has been conducting surveys every five years since 1987. Common questions across many of the studies relate to owner and equipment age, capital requirements, stumpage sources, annual productivity, profitability, the future of the business, and current challenges.

Recent assessments in other regions of the country include Vaughan et al. 2022; Bailey and Crawley 2023; Bowman et al. 2023; Khadka 2023; and Conrad et al. 2024 (Table 1). Every study reports the average age of business owners continues to increase over time. About one-third of the respondents don't expect to be in business in 5 years. Businesses tend to be highly mechanized with feller-bunchers and grapple skidders. Common concerns include high operating costs, labor availability, and issues with markets (e.g., limited quotas, closures, delivered price).

Logging business information has been collected and summarized for the three Lake States (Michigan, Minnesota and Wisconsin) over time. In Michigan, four statewide surveys of logging businesses were conducted between 2003 and 2017. In Minnesota, seven statewide surveys were conducted between 1978 and 2017. In Wisconsin, three statewide surveys were conducted between 2003 and 2017. The 2017 survey was coordinated between the three states with some of the findings summarized in Gc et al. 2020.

There were two primary objectives for this study. The first was to update our knowledge about the status, issues, and challenges of the logging industry in the

Table 1 Summary of various factors from recent state surveys of logging businesses

Factor	State(s)			
	Alabama (Bowman et al. 2023)	Arizona, Colorado, New Mexico (Vaughn et al. 2022)	Florida (FL) and Georgia (GA) (Conrad et al. 2024)	Maine (Bailey and Crawley 2023)
				North Carolina (NC) and South Carolina (SC) Khadka (2023)
Owner age	56 years (average)	35.9% older than 60 years with none younger than 30	FL: 58 years (median) GA: 56 years (median)	NR NC: 50 years (average) SC: 50 years (average)
Expect to be out of business in 5 years (%)	35%	NR	FL: 38% GA: 31%	NC: 27% SC: 20%
Have a succession plan (%)	14% of the respondents expecting to leave the industry did not list a plan for succession or termination of the company	NR	29% of the owners in both states expected the business to cease to exist when the owner retires	In both states, more than two-thirds that expect to leave the business in 5 years expect their business to cease to exist
Volume harvested	NR	On average, 5.2 twenty-five ton truckloads/day	FL: On average, 2,619 tons/week GA: On average, 1,956 tons/week	SC: Median of 35 loads/week NC Median of 55 loads/week
Felling method or harvest system/products	100% delivered tree-length material to the landing	NR	FL: 81% used feller-buncher/grapple skidder systems, 9% used chippers and 9% used manual/chainsaw systems GA: 77% used feller-buncher/grapple skidder systems, 18% used chippers and 5% used manual/chainsaw systems	NC ¹ : 78% reported harvesting tree-length material and 90% reported harvesting log-length material SC ¹ : 93% reported harvesting tree-length material and 86% reported harvesting log-length material

Table 1 (continued)

Factor	State(s)			
	Alabama (Bowman et al. 2023)	Arizona, Colorado, New Mexico (Vaughn et al. 2022)	Florida (FL) and Georgia (GA) (Conrad et al. 2024)	Maine (Bailey and Crawley 2023)
				North Carolina (NC) and South Carolina (SC) Khadka (2023)
Equipment age (years)	NR	NR	FL and GA: Feller-bunchers and grapple skidders – between 5 and 6	NR
Stumpage source	28%	NR	FL: Around 60% GA: 40%	NR
Top issues and greatest challenges	Operating costs (fuel and wages), labor availability, equipment costs, trucker availability, and mill issues (quota, speed, and outages)	Finding skilled workers, limited markets, limited contract availability, high transportation costs, lack appropriate equipment	FL and GA: Fuel costs, labor, trucking, and insurance	Inflation and business costs, mill closures, access to qualified labor, market price, timely access to repair parts
Reported profitability	A little less than average or break-even	NR	FL: Broke-even – 27%, Good – 43%, Excellent – 7% GA: Broke-even – 50%, Good – 24%, Excellent – 2%	NR
Average capital investment	NR	Under \$100,000	GA: \$2.02 million	NR
NR – Not reported				NC: \$945,989 SC: \$1.3 million

¹Multiple responses were possible

Lake States region. This updated knowledge was also compared across time since the last regional study in 2017. Target data included logging firm metrics, owner demographics, logging equipment metrics, harvest metrics, and business climate metrics. The second objective was to compare the logging sectors between states through coordinated questionnaire development.

To achieve these objectives, coordinated mail surveys were conducted during spring 2022. Those assessments were modeled after similar efforts conducted in 2017 (Gc et al. 2020). While Michigan also participated in the coordinated survey in 2022, their response rate was low and survey administrators in that state decided to not analyze their data. The remainder of this article focuses on Minnesota and Wisconsin data.

Methodology

Survey design and administration

Coordinated mail surveys targeted logging business owners in Minnesota and Wisconsin. Study researchers coordinated questionnaire development both within and between the two states. Within each state, researchers solicited and received input from public and private entities that helped identify past questions to delete and new questions to incorporate. Researchers in the two states frequently met over Zoom to share information about questionnaire development within their state (e.g., indicate which past questions were deleted and new questions added) and to create consistent wording across shared questions to facilitate cross-state data comparison. The surveys covered diverse areas such as harvest systems, production volumes, profitability, production capacity, business demographics, capital investment, trucking, travel distances, seasonality, stumpage sources, timber products harvested, and emerging issues such as recent mill closures, pandemic impacts, and trucker shortages. Each questionnaire was limited to twelve letter sized pages. This allowed for a folded booklet to be produced from three 11 × 17 inch pages. Question format included yes/no, multiple choice, fill in number values, and some open-ended questions.

Business lists were compiled from data maintained by the Wisconsin DNR, Forest Industry Safety and Training Alliance (FISTA), Great Lakes Timber Professionals Association (GLTPA) and the Minnesota Logger Education Program (MLEP). The GLTPA and Minnesota Timber Producers Association included announcements about the surveys in their magazines. Institutional Review Boards at the University of Minnesota and the University of Wisconsin reviewed the project protocol and determined it was exempt from further review.

Questionnaires were mailed in spring 2022, asking about business operations in 2021. Each state employed Dillman's tailored design method for survey administration (Dillman et al. 2014), involving presurvey notification postcard, mailed questionnaire with cover letter and reply envelopes, reminder postcard, second mailed questionnaire with cover letter, and a final reminder postcard to enhance response rates. Minnesota sent a final letter in place of the final reminder postcard and a VoiceShot® automated reminder phone call to non-respondents

to encourage participation. To encourage a response, Wisconsin included a \$5 bill with their initial questionnaire mailing and Minnesota conducted a drawing to award one-year subscriptions to onX Hunt (onX Hunt 2024), an online and mobile mapping software, to 10 respondents. To protect anonymity of respondents, the Minnesota survey was double-blind (mailed by one entity and received by another with a code on each questionnaire used to track responses for subsequent mailings). The Wisconsin survey was administered by the University of Wisconsin Survey Center.

There was one survey in each state. Eight hundred questionnaires were mailed in Wisconsin and 321 questionnaires were mailed in Minnesota.

Respondent data were entered into spreadsheets. Each returned survey was fully error checked with appropriate corrections made. Businesses that harvested less than 100 cords of timber were excluded from subsequent analysis. Data from several of the questions with consistent wording between Minnesota and Wisconsin were analyzed and are presented below. To standardize volume comparisons, MBF and tons were converted to cord equivalents using the following conversions: 1 MBF = 2 cords and 2.25 green tons = 1 cord. As many respondents provided written comments in response to an open-ended question at the end of each survey, some of those comments are reported here. Where appropriate, comparisons are made to the 2017 survey which was conducted in both states to understand operations in 2016 (Gc et al. 2020).

Data were analyzed using descriptive and inferential statistical methods in Excel and SAS 9.4. For comparisons of continuous variables across size classes and states, analysis of variance (ANOVA) followed by Tukey's honestly significant difference (HSD) test was employed for normally distributed data, while the Kruskal-Wallis test with subsequent Mann-Whitney U tests and Bonferroni correction was utilized for non-normally distributed variables. Chi-square tests of independence were conducted for categorical variables. Dichotomous choice questions were analyzed using the Wilson-Score interval in SAS. Wilson-score calculation methods are described and discussed in Brown et al. (2001). All statistical tests were considered significant at the $\alpha = 0.05$ level.

Results and discussion

For Minnesota, a total of 167 responses were received (52.0% overall response rate) of which 162 provided usable information for the survey (50.5% usable response rate). In Wisconsin, a total of 373 responses were received (46.7% overall response rate) of which 346 provided usable information for the survey (43.7% usable response rate).

Industry and owner demographics

Minnesota and Wisconsin logging firms are often a family business. In Minnesota 76% of respondents identified as a family business compared to 63% in

Wisconsin. The average logging business has been in operation for 31 years in Minnesota and 29 years in Wisconsin. While some firms have multiple owners, the average age of the first owner listed was 55 years (Table 2) in Minnesota and Wisconsin. In addition, Age of owner by size of operation is significantly different at $\alpha=0.05$ for both Minnesota and Wisconsin (Table 2). The average age of the first owner did change since the previous study year in 2016 (Gc et al. 2020) – increasing by one year from 54 to 55 years old in both Minnesota and Wisconsin.

As the average age of logging business owners trends older than other industries in each state (Fernholz et al. 2024), it is important to know the plans of business owners. Only 41% of owners in Minnesota and 35% in Wisconsin thought a family member would take over their business in the future. Most had no succession plan with 56% of respondents in Minnesota and 61% in Wisconsin stating that nobody was taking over their business or they didn't know who would take it over. Adding to this concern is that 28% of Minnesota logging firms and 30% of Wisconsin logging firms don't expect to be in business in 5 years. The general lack of succession planning combined with an aging ownership raise concerns about an uncertain future for the logging sector and the continuity of raw material flow within the wood supply chain. In 2016, 27% of Minnesota logging firms and 28% of Wisconsin logging firms didn't expect to be in business in 5 years. One logger commented "I am a 3rd generation logger. My grandfather did it for 45 years till his death. My father has and is still doing it for 47 years and counting. I will do this for 45+ years as well. Logging is hard work that requires millions of dollars in capital to get such small amounts of return, it's gotten to the point to where it's no longer worth it." Smaller logging firms, which also represented the oldest set of owners (Table 2), were the least likely to indicate they would be in business in 5 years (Fig. 1).

Production level and equipment used

The average volume harvested in Minnesota was 10,264 cords and 7,117 cords in Wisconsin. This is down from 11,267 cords in Minnesota in 2016 and 7,389 cords in Wisconsin (Fig. 2). In both Minnesota and Wisconsin, the largest percentage of firms produce between 1,001 and 5,000 cords annually.

Felling methods in Minnesota and Wisconsin consist of four harvest systems. Hand felling systems rely on manual felling and processing, employing cable skidders or forwarders for transporting felled trees to the landing. In contrast, the feller buncher system utilizes a specialized machine for both felling and piling standing trees, subsequently employing a grapple skidder to transport them to the landing. Following this, a delimber and slasher further process the trees into sawlogs, bolts, and pulpwood, occasionally consolidated into a single process for limbing and bucking. The cut-to-length (CTL) system opts for harvesters to conduct in-woods processing, with forwarders then transporting processed material to the landing. Notably, certain businesses adopt a hybrid approach utilizing both feller-buncher and cut-to-length systems based on the needs of the landowner or

job optimization. The survey asked what percentage of harvest volume was felled by each method. Minnesota and Wisconsin have consistently had different preferences for harvesting systems (Blinn et al. 2015; Rickenbach et al. 2015; Gc et al. 2020). Wisconsin utilizes more chainsaws (17%) and cut-to-length systems (60%) than Minnesota (1% and 28% respectively). Minnesota relies on feller-bunchers for most of its harvested volume (71% Minnesota vs. 23% for Wisconsin). The smallest logging firms harvest a high percentage of their volume using chainsaws (Fig. 3).

Logging firms were asked to indicate the number of pieces and age of their newest piece of equipment for various in-woods types of equipment. Cable skidders were the oldest and chainsaws the newest (Table 3). Heavy equipment has a lifespan that is generally based on hours of operation with some pieces of equipment operating for one, two, three or more decades. From an accounting perspective, old equipment is normally debt free and fully depreciated. Since the cost of a new CTL harvester or a feller-buncher is more than \$500,000, it is not surprising that some loggers choose to operate their equipment for as many years as mechanically possible, even though it is fully depreciated. When compared to the previous survey (Gc et al. 2020), equipment age is trending older with some pieces averaging 20+ years old. The smallest logging firms maintain the oldest equipment.

Stumpage sources

Various landownership categories contribute to the timber supply. Non-industrial private forest (NIPF) landowners are important in both states with 43% and 58% of the forest land owned by those individuals in Minnesota and Wisconsin, respectively (USDA Forest Service, 2024). Wisconsin loggers harvest most of their volume on NIPF lands but both states increased the percentage of volume harvested from NIPF lands from 2016 to 2021 (Table 4). Significant differences were found between states in volume harvested with Wisconsin being more reliant on NIPF and Minnesota being more reliant on state and county/municipal ownerships (Table 4). Interestingly, harvests from public lands decreased from 2016 to 2021 in all cases except a small increase in state land harvests in Minnesota. These survey results closely match FIA data trends (USDA Forest Service, 2024). It is possible that the pandemic played a role with work restrictions limiting sale administration on public lands given the restrictions placed upon federal, state, and county workers. Sale administration on private lands would have seen fewer of these restrictions. Another reason federal sales fell in Wisconsin was related to the “good neighbor authority,” where foresters working for the Wisconsin Department of Natural Resources were able to set up and administer federal timber sales. The first phase of this program was winding down by 2021, adding to the drop in volume harvested from federal forest lands.

The size of the operation has an impact on the ownership preferred. Smaller firms harvested most of their volume on NIPF lands while larger firms were more likely to harvest from public lands (Fig. 4). Larger firms may have the capital, equipment and

Table 2 Average age of the primary owner in years and percentage of respondents by total cord equivalent volume of wood harvested in 2021

Volume of wood harvested in 2021 (cord equivalents)	Minnesota		Wisconsin	
	Average age	Median age	Average age	Median age
More than 15,000	57	56	53	52
10,001–15,000	53	55	51	52
5,001–10,000	53	53	53	54
1,001–5,000	56	53	57	57
100–1,000	62	60	57	61
State average	55		55	

Age of owner by size of operation is significantly different at $\alpha=0.05$, p -value 0.0376 for MN and 0.0254 for WI

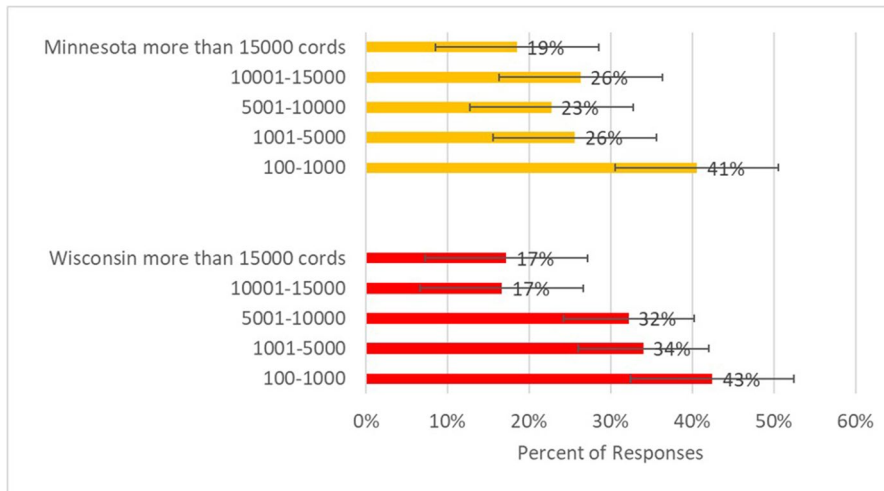


Fig. 1 Percent of logging firms that do not expect to be in business in 5 years by size of logging operation with 95% confidence intervals

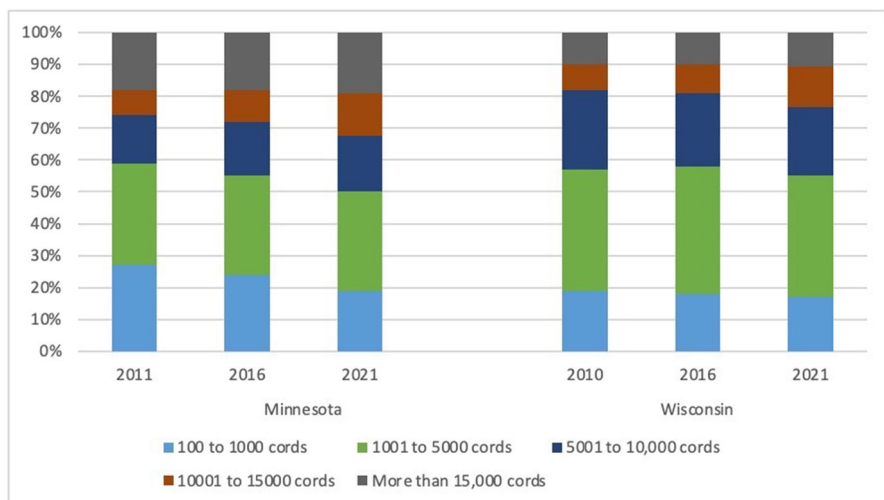


Fig. 2 Percent of Minnesota and Wisconsin reporting firms by level of annual production (cord equivalents) in 2021

staff time to navigate the complexities of harvesting and administration of public timber sales.

While both mills and logging businesses purchase timber sales to ensure a steady supply of harvest volume for their business, a mill will ultimately contract with a logger to harvest their purchased timber. In Minnesota 79% was purchased by the

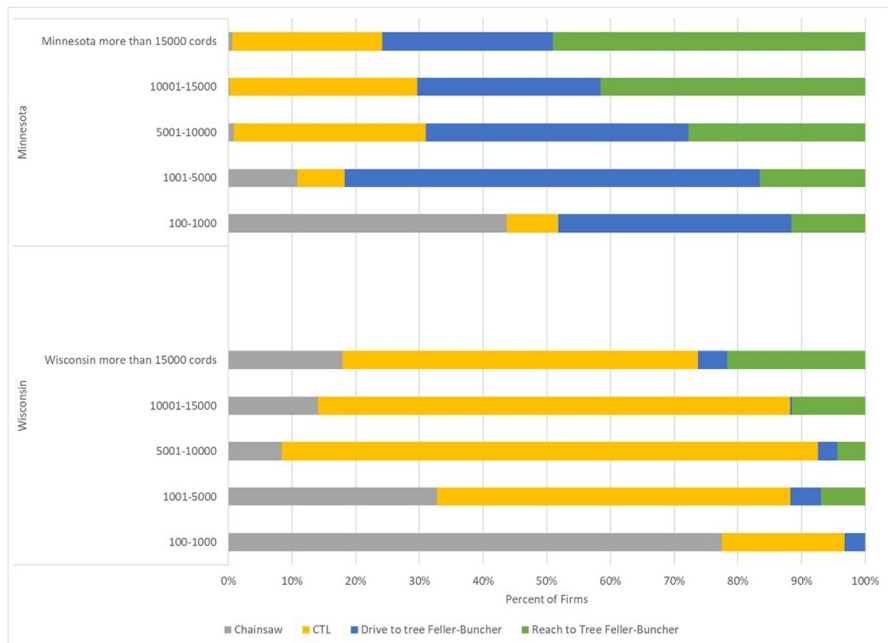


Fig. 3 Felling method in Minnesota and Wisconsin in 2021 by size of logging operation

Table 3 Type of equipment used and average age of newest piece

Equipment	Pieces per firm				Age of newest piece (years)			
	MN		WI		MN		WI	
	Average	Median	Average	Median	Average	Median	Average	Median
Chainsaw	3.6	3.0	3.7	3.0	3.8	2.0	4.0	3.0
Cut-to-length harvester	1.6	1.0	1.6	1.0	8.5	7.0	10.8	7.0
Feller-buncher	1.5	1.0	2.9	1.0	17.6	15.0	16.4	13.0
Cable skidder	1.4	1.0	2.1	1.0	39.4	41.0	37.4	38.0
Grapple skidder	2.0	2.0	1.6	1.0	17.9	10.0	20.9	21.0
Forwarder	2.7	1.0	1.5	1.0	13.0	11.0	17.1	13.0
Mechanical Limber	1.8	1.0	1.5	2.0	15.3	8.0	20.0	20.0
Chipper	4.1	1.0	1.7	2.0	12.0	8.0	14.1	10.0
Grinder	2.0	1.0	1.0	1.0	7.5	7.0	16.0	12.0
Slasher	1.7	1.0	1.3	1.0	15.4	10.0	27.4	32.0
Flail debarker	5.3	1.0	1.0	1.0	7.7	5.0	11.0	11.0
Loader	2.3	2.0	1.5	1.0	20.5	16.0	19.8	18.0
Bulldozer	1.5	1.0	1.4	1.0	23.3	17.0	21.9	16.0

logging firm and 67% in Wisconsin. In some cases, logging firms and mills may bid on the same timber sales. Even if the logging firm loses the sale bid to the mill, the mill may hire the logging firm to harvest the sale. One logger in Minnesota commented “get rid of the mills at the auction sales. That’s all bull*@ so the loggers have a chance and can make a living again”.

Impact of mill closures, trucking shortages, and the pandemic

Recent mill closures impacted logging businesses in the two states. A pulp and paper mill in Wisconsin Rapids, Wisconsin which consumed approximately 25% of the pulpwood produced in that state closed in 2020. There were also regional impacts from the closure of pulp and paper mills in Duluth, Minnesota (closed 2020) and Park Falls, Wisconsin (closed 2021). Mill closures had a much larger negative impact on the Wisconsin logging industry with 74% of firms saying the closures had a strong negative impact on their business (Fig. 5). Loggers from Wisconsin commented that the closures “almost destroyed logging,” “pretty much put loggers out of work,” and “every mill helps.” Because of the loss of these important markets, inflation-adjusted pulpwood delivered prices have remained low in the Lake States since 2020 (Forisk 2024). The size of the business did not seem to make a difference on the impact of mill closures (Fig. 6).

A pervasive shortage of truck drivers continues to exert its impact across diverse industries nationwide. The forest products industry, along with other industries in the Lake States, are facing a workforce shortage of truckers. Survey data reveals that, in 2021, 54% of respondents from Minnesota and 52% from Wisconsin experienced adverse effects on their business attributable to this deficiency. Survey respondents were asked to identify causes for the shortage with answers ranging from retirements, a dearth of individuals entering the field, the allure of better paying employment opportunities elsewhere with accompanying benefits, the economic consequences of the pandemic, and a perceived shift in work ethos.

Trucking ownership was examined by company size in each state. As shown in Table 5, contract trucking by size of operation is significantly different for both Minnesota and Wisconsin at $\alpha=0.05$. Contracted trucking represented the majority in

Table 4 Percent of total volume harvested by landownership

Ownership category	Minnesota		Wisconsin		P-value
	2016	2021	2016	2021	
Non-Industrial Private Forest (NIPF)	20%	37%*	52%	66%*	0.0418
Industrial	15%	3%	4%	5%	0.3129
Federal	7%	4%	6%	3%	0.1234
State	27%	29%*	10%	6%*	0.0001
County/Municipal	30%	25%*	27%	19%*	0.0431
Tribal	1%	2%	1%	1%	0.2614

*Indicates a significant difference between states at $\alpha=0.05$ level

both states. In addition, smaller firms in both states were more reliant on contracted trucking than larger firms.

Mill closures and trucking shortages caused economic impacts for the industry but the biggest impact for most firms was the impact of the pandemic. Respondent insights into the pandemic's impact on profitability indicate a minimal number of logging companies experienced increased profits in 2021. In Minnesota, 47% of the respondents reported no change in profits. In Wisconsin, 24% reported no change while 64% experienced a decline in profits. The confluence of the pandemic and mill closures in Wisconsin Rapids raises the possibility of conflated data in Wisconsin, attributable to both pandemic-related and mill closure factors. The smallest operators indicated the least negative impacts from the pandemic (Fig. 7).

In response to the pandemic, various business relief programs were swiftly implemented. A majority of respondents who applied received funding. In Minnesota, 53% of respondents sought assistance from the Paycheck Protection Program (PPP) (US Small Business Administration 2024) with 95% receiving funding. In Wisconsin, companies exhibited a 52% application rate with 93% of applications approved. Significant difference between states were found for the Pandemic Assistance for Timber Harvesters & Haulers (PATHH) at $\alpha=0.05$ level with Wisconsin having more successful applicants than Minnesota (Table 6). Several companies reported that they weren't eligible for grants with one respondent noting that they received "a \$5,000 grant (WI Tomorrow Small Bus. Recovery Grant)" and because of their business status they weren't eligible for PPP but



Fig. 4 Percent of timber sourced from various landowners in 2021 by size of logging operation

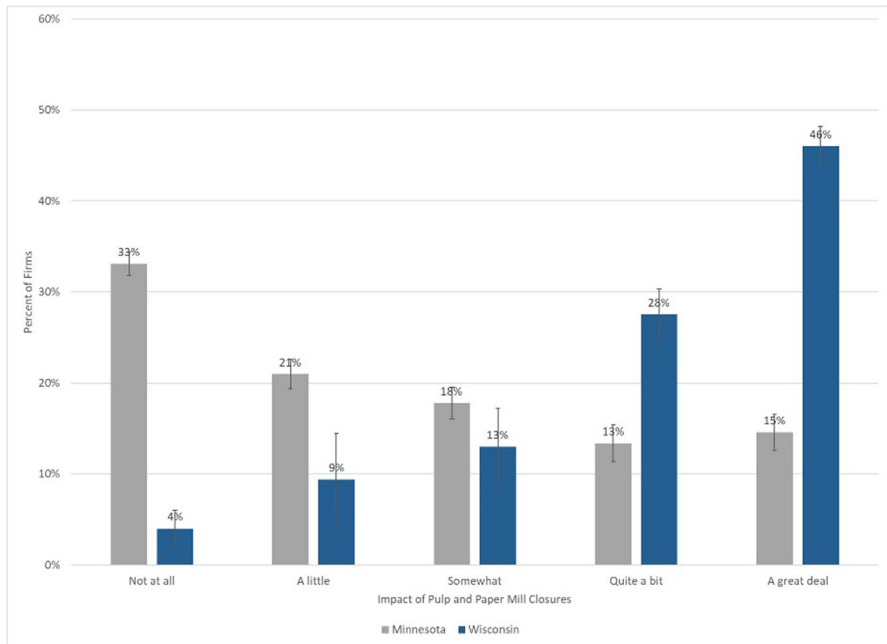


Fig. 5 Impact of pulp and paper mills closures in Duluth (MN), Park Falls (WI), and Wisconsin Rapids (WI) on logging business in 2021 with 95% confidence intervals

“When PATHH came about, I was [eligible], but money was gone by the time I got my app in.” PATHH was Pandemic Assistance for Timber Harvesters and Haulers (USDA 2024). PPP and PATHH funding may have helped some firms stay in business during and after the pandemic.

Carbon and chips

Forest management changes and evolving markets may cause loggers to modify their business model. The survey asked logging business owners, “If a whole-tree chip market developed in the next 5 years, would you invest in specialized equipment and/or add employees to take advantage of it?”. In Minnesota only 19% would invest in specialized equipment and 15% would add employees while in Wisconsin 23% would invest in specialized equipment and 17% would add employees. There was much greater interest in new markets from operations that harvest 10,001–15,000 cords annually (Fig. 8). Many loggers feel that they are taking most of the financial risk in the supply chain for investing in new markets. Respondents commented that, “this was pushed on us 15–18 years ago and it wasn’t good then” and “needs to be profitable/not \$22/ton” and “if guaranteed prices and volumes long term.”

Loggers may take more of the risk when investing in new equipment, but changing forest management also impacts their operations. An emerging issue in forestry is carbon credits for forest carbon offset projects (Fernholz et al. 2021). The survey asked if they

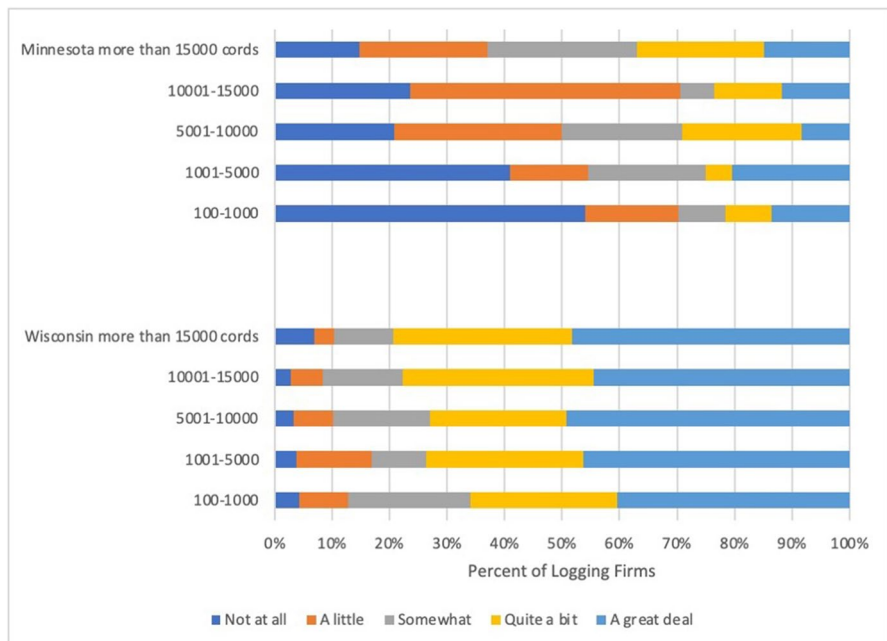


Fig. 6 Impact of pulp and paper mill closures in 2021 by size of logging operation

Table 5 Owned vs contracted trucking by size of logging operation

Annual Cords Harvested	Minnesota		Wisconsin	
	Owned	Contracted	Owned	Contracted
more than 15,000	46%	54%	41%	59%
10,001–15,000	44%	56%	38%	62%
5,001–10,000	45%	55%	22%	78%
1,001–5,000	52%	48%	17%	83%
100–1,000	39%	61%	13%	87%

Contract trucking by size of operation is significantly different at $\alpha=0.05$, p -value 0.0481 for MN and 0.0018 for WI

feel forestry can play a role in reducing atmospheric carbon (Fig. 9) and if they think that carbon markets are good for the future of the industry (Fig. 10). While most respondents thought forestry can play a role in reducing atmospheric carbon, most were unsure of the importance of carbon markets for the industry. In Minnesota, 68% of respondents thought forestry can play a role in reducing atmospheric carbon but only 19% thought that carbon credits were good for the future of the industry. In Wisconsin 64% agreed with the role of forestry in reducing atmospheric carbon but only 14% thought carbon credits were good for the future of the industry. In Minnesota, the middle-sized operations were most favorable towards carbon credits (Fig. 9). Respondents had a range of responses to this question from, “It’s all about managing forest-correctly. Healthy trees

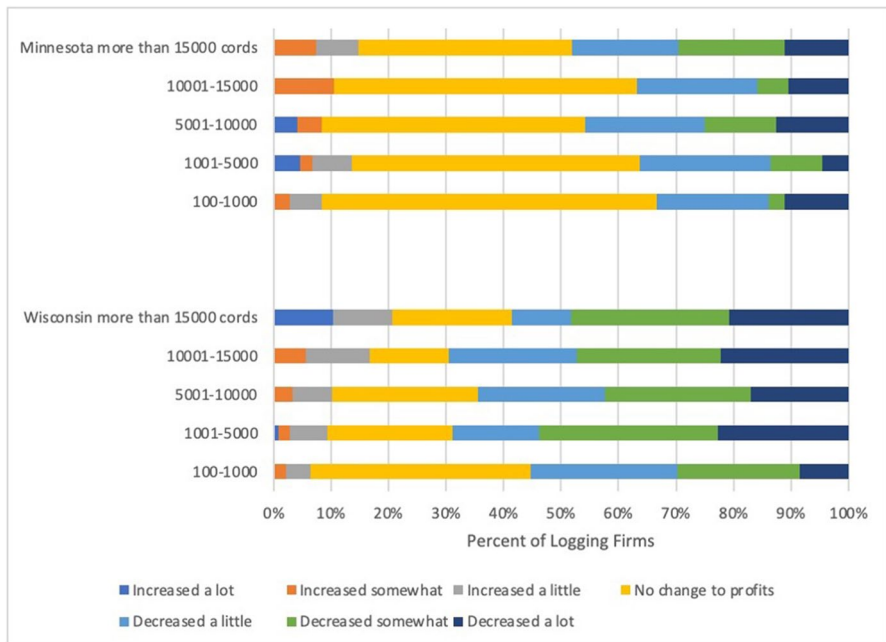


Fig. 7 The extent that the pandemic impacted businesses profitability in 2021 by size of logging operation

make more and store more carbon” to “will allow big business to pollute more” to “absolutely stupid, all a bunch of B.S.!!!” In both states, a number of respondents did indicate “don’t know” suggesting there is ample room for continuing education on carbon credits.

Profit levels and level of capital investment

Loggers were asked to qualitatively assess their businesses profitability in 2021. Responses ranged from very poor to excellent. In both states only 1% of businesses

Table 6 Pandemic business relief programs – applied vs received by state

Pandemic relief program	Minnesota		Wisconsin		P values	
	Applied	Received	Applied	Received	Applied	Received
Paycheck Protection Program (PPP)	53%	95%	52%	93%	0.9111	0.4279
Pandemic Assistance for Timber Harvesters & Haulers (PATHH)	21%*	80%*	33%*	84%*	0.0188	0.0036
Economic Injury Disaster Loan	7%	67%	10%	89%	0.3797	0.0834
SBA Express Loan Bridge	2%	50%	4%	63%	0.1318	0.0972
SBA Debt Relief	5%	75%	5%	70%	0.2336	0.1752
Coronavirus Food Assistance Program	1%	100%	1%	100%	0.6022	0.4848

*Indicates a significant difference between states at $\alpha=0.05$ level

said profitability was excellent and 5% answered very poor (Table 7). There was no significant difference in profitability ratings between states in 2016 or 2021 at $\alpha=0.05$. Most firms in both states reported profitability was good or average. Despite the negative impacts of mill closures, truck driver shortages and the pandemic, the trend was that a higher percentage of businesses reported that they broke even or did better in 2021 than in 2016. Governmental PPP and PATHH programs may have helped businesses not only survive but be profitable in 2021.

Profitability by size of operation revealed that larger firms in both states were more likely to be profitable but the largest firms in both states were the most likely to report that they were very unprofitable in 2021 (Fig. 11). 10% of firms in Minnesota and 7% percent of firms in Wisconsin that harvest more than 15,000 cords in 2021 reported being very unprofitable. The profitability of the firm may depend on the products they harvest with one logger commenting “chips profitable, roundwood (pulp) not profitable”. And “profitable but much worse than past years” and “Without major price increases no one will survive...New equipment prices are ridiculous with wait times up to 2 years. Pretty silly to continue with a money losing situation!!!”

Capital is needed for equipment and the purchase of stumpage. On average, firms in Minnesota had \$313,825 of capital investment compared to \$239,882 in Wisconsin. Almost half the investment (48%) was in harvesting equipment with more than a quarter (29%) in stumpage. The rest was in off-road transport and over the road hauling equipment. One logger commented that “Major challenges for the logging

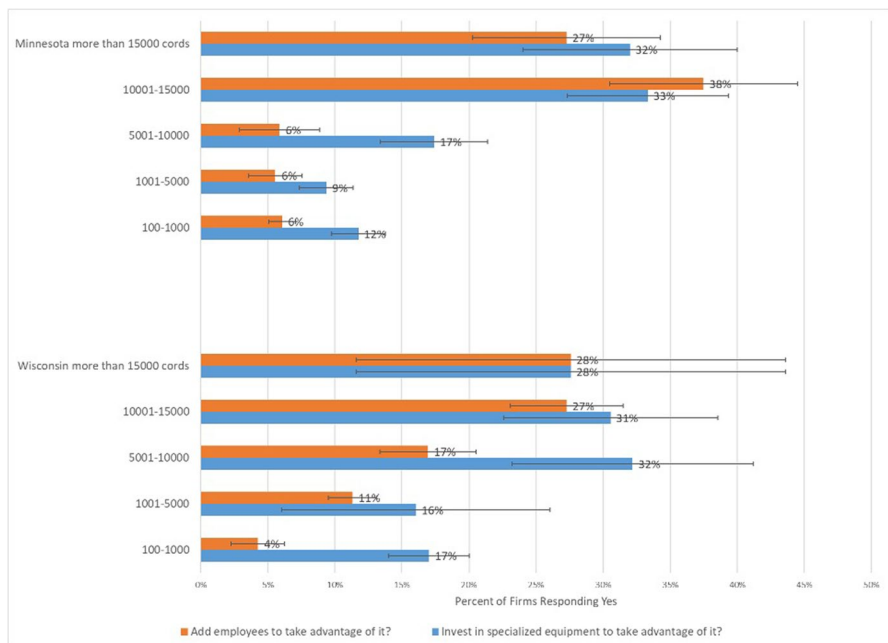


Fig. 8 Interest in investing in new equipment or employees if a whole tree chip market develops by size of logging operation with 95% confidence intervals

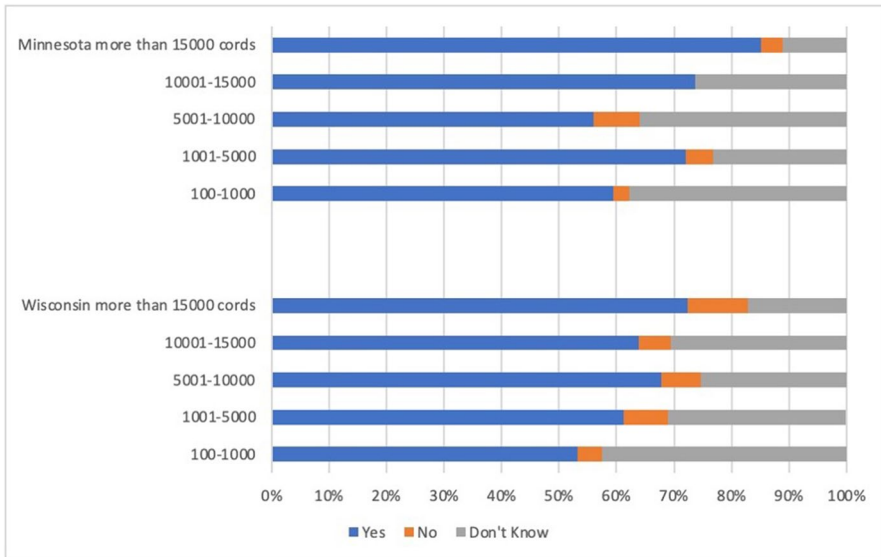


Fig. 9 Respondents that believe forestry can play a role in reducing atmospheric carbon by size of logging operation

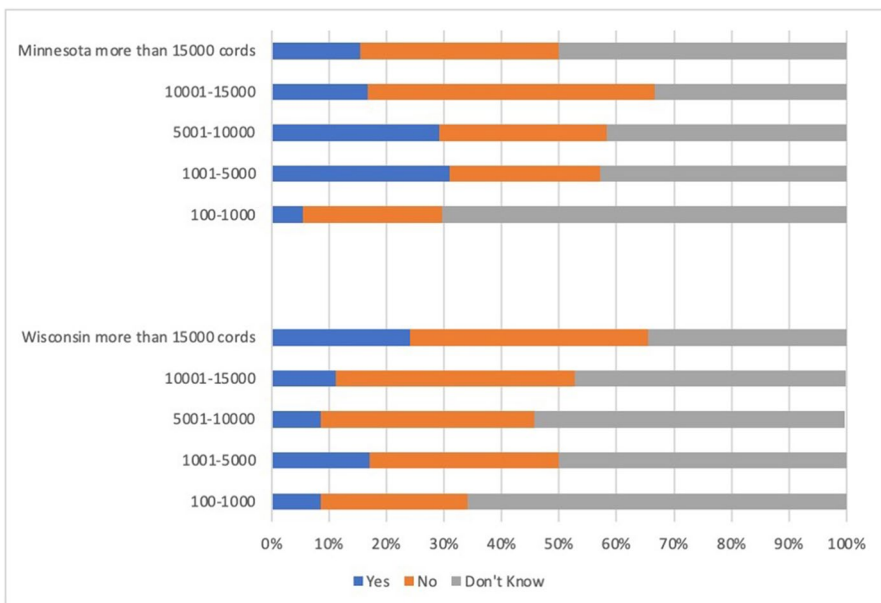


Fig. 10 Percent of respondents that carbon markets and carbon credits are good for the future of the industry by size of logging operation

industry are shrinking wood markets...Too high of a capital investment for anybody to start up in the industry.” Given that the age of the newest piece of equipment is, on average, more than its depreciable life, its value was relatively low in 2021.

Conclusions

Our study’s first objective was to update our knowledge about the status, issues and challenges of the logging industry in the Lake States region. The second objective was to compare the logging sectors between Minnesota and Wisconsin by using coordinated questionnaire development. The study identified four key factors that have impacted the logging sectors in Wisconsin and Minnesota including (1) aging logging ownership and their equipment, (2) harvest volume reductions and shifts away from public lands, (3) trucking shortages, (4) market pressures due to mill closures and the pandemic.

Interestingly, all four of these key factors identified in this Minnesota and Wisconsin study were also identified in full or in part by the recent logger studies in the southwest, southeast, and northeastern United States (Table 1). These trends are common across regions, and some are troubling. Following national trends, the average age of logging business owners in Minnesota and Wisconsin, a high percentage of which are family-owned, is trending older. The percentage of businesses who indicated that they would leave the business in 5 years is within the range from other regions. Wisconsin is different from other regions within the United States with their heavy use of CTL system. Equipment age in Minnesota and Wisconsin is trending older than in the southeast with some equipment types averaging 20+ years old. Annual production and capitalization are higher in the southeastern United States. Other national concerns include high operating costs, labor availability, and issues with markets, were also identified in Minnesota and Wisconsin.

There were many more similarities between the Minnesota and Wisconsin logging businesses than there were differences. On average, some of the similarities include the average age of the first owner is 55 which represents an increase of one year since the last survey, about 29% don’t expect to be in business in 5 years, businesses increased the percentage of volume harvested from non-industrial

Table 7 Rating of profitability of Minnesota and Wisconsin logging firms in 2016 and 2021

Profitability rating	Minnesota		Wisconsin	
	2016	2021	2016	2021
Very Poor	7%	5%	12%	5%
Poor	19%	15%	14%	15%
Average (broke even)	35%	40%	35%	28%
Good	36%	41%	37%	51%
Excellent	3%	1%	2%	1%

No significant difference in profitability ratings between states in 2021 at $\alpha=0.05$

p-value 0.1778

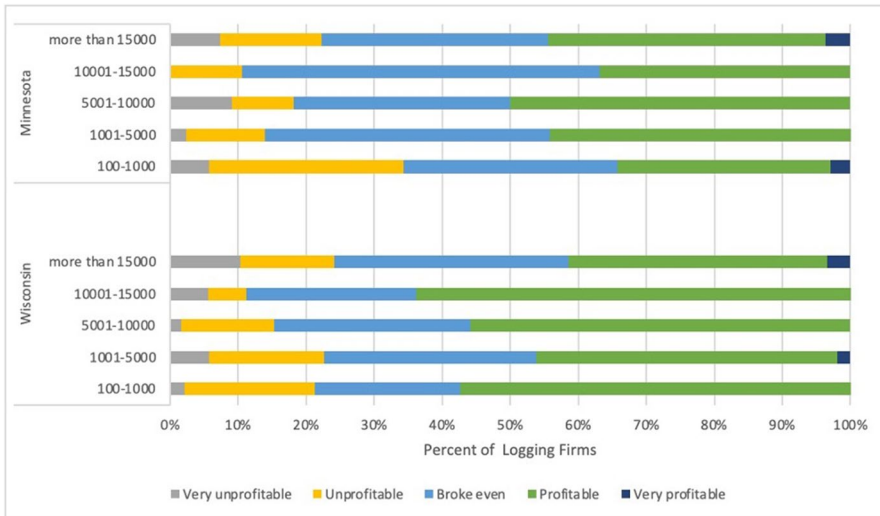


Fig. 11 Profitability in 2021 by size of logging operation

private forest lands as compared to the previous survey, at least two thirds of the harvested volume was purchased by logging businesses and wasn't purchased by others, truck driver shortages caused adverse effects on about 50% of the businesses, a high percentage of businesses that applied for PPP funding received it in response to the pandemic, there is generally little interest in modifying their business models to invest in specialized equipment or to add labor if a chip market developed, and most firms reported that their profitability was either good or average.

In terms of differences between the average business in the two states, Minnesota businesses produce more volume annually and are more likely to use feller-buncher and skidder to harvest timber. Wisconsin businesses were more impacted by mill closures that occurred within the two states. Finally, the use of contracted trucking was significantly higher in Wisconsin.

Firm size also showed interesting trends. The smallest volume producers were more reliant on contracted trucking and NIPF lands, had the oldest owners and equipment, were least likely to be in business in 5 years, were most heavily impacted by the pandemic, and generally showed higher levels of being unprofitable. The potential loss of smaller businesses may have the greatest impact on harvests of NIPF tracts given the focus of those businesses.

The logging businesses in Minnesota and Wisconsin fill a critical role in the wood supply chain in both states. While loggers generally tend to be a resilient group, the health and viability of the sector, and thus the wood supply chain, is a concern in the two states.

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