A Survey of Business Attributes, Harvest Capacity and Equipment Infrastructure of Logging Businesses in the Northern Forest

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Abstract

The forest resources industry is an integral part of the economy, ecology, and culture of the Northern Forest region of New York, Vermont, New Hampshire, and Maine. The forest products manufacturing industry provides over 92,000 jobs and $14.4 billion to the region (NEFA 2007b). The logging sector of the forest resources industry provides significant employment to rural communities in addition to harvesting and transporting this valuable and renewable resource to processing facilities. Despite the importance of the logging sector, there have been relatively few studies in recent years that focus on logging businesses, and as noted by Egan et al. (2006), there are many hidden costs in timber harvesting and barriers to production. A labor shortage and an aging workforce have been projected for the logging industry, and numerous studies have been conducted to address recruitment (Pan Atlantic/Irland Group 1999, Egan & Taggart 2004b, Egan 2005, Egan 2009). Based on a survey of logging business owners across the states of the Northern Forest, this report will describe business attributes and harvest operation details with an emphasis on existing logging infrastructure. This study is a baseline for future, periodic surveys that can be used to analyze trends in the logging industry, and a tool for logging contractors, policy makers, or professional organizations to identify areas for improvement in forest operations.

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Acknowledgements

Most importantly, we would like to thank all of the logging contractors who participated in this study. Without their willingness to be open and candid with their responses to our questions and to share information with us, this research would not have been possible. Several industry organizations provided input on survey questions and their membership rosters were used to compile mailing lists. These organizations include: Professional Logging Contractors of Maine, Forest Resources Association, Certified Logging Professional Program, Northeast Master Logger Program, Northeastern Loggers' Association, Empire State Forest Products Association (New York Logger Training), New Hampshire Timber Harvesting Council (New Hampshire Timberland Owners Association), University of New Hampshire Cooperative Extension, Vermont Forests, Parks, and Recreation, Vermont Logger's Education to Advance Professionalism, and Vermont Forest Products Association.

We would also like to thank Dr. Jessica Leahy for help with the survey methodology, Mr. Ian Stone for administering Phase 1 of the survey to logging businesses in Maine, Mr. Richard Root for initial Phase 1 analysis, and the many other students and family members who helped prepare the survey packages.

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Introduction

The Northern Forest

The Northern Forest is a 26 million acre area across New York, Vermont, New Hampshire, and Maine (Figure 1). These four states are some of the most heavily forested in the nation. In fact, 89% of the land base in Maine is forested (NEFA 2007a). The forest resources industry is a substantial contributor to the region's economy and culture. The logging sector of the forest resources industry provides significant employment to rural communities in addition to providing a critical link between landowners and mills by harvesting and transporting timber. Despite the importance of the logging sector, there have been relatively few studies in recent years that focus on logging businesses.

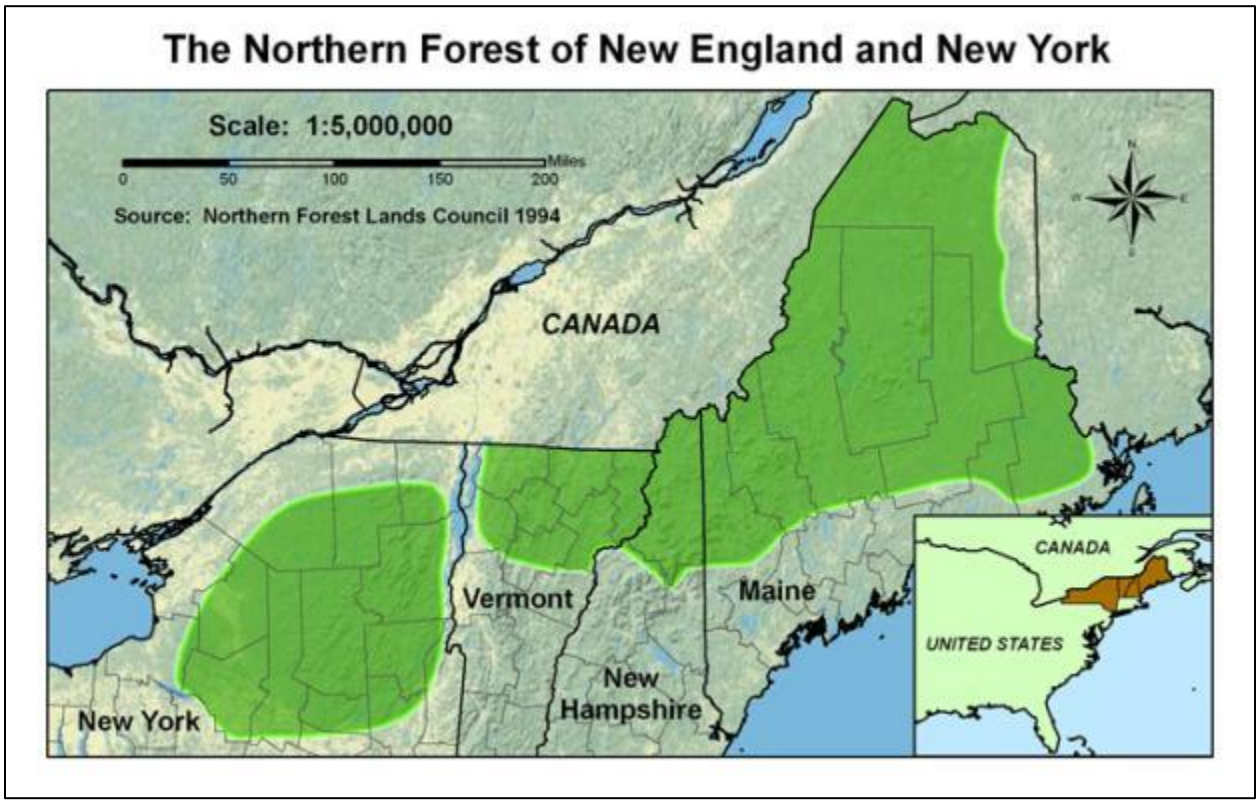

Figure 1: Geographic region of the Northern Forest[1]

Significance of the Logging Industry

Forest-based manufacturing shipments contribute $14.4 billion to the region's economy and employ over 92,000 people (NEFA 2007b). Data from the Northeast State Forester's Association indicate there are approximately 11,000 people employed in the logging sector of the

[1] Northeastern States Research Cooperative (http://nsrcforest.org/about-nsrc, 1/27/2013).

forest resources industry in New York, Vermont, New Hampshire, and Maine. New York has the highest number of loggers in the region at 5923, followed by Maine with 2562, New Hampshire with 1717, and Vermont with 800 individuals. Logging employment in Maine has remained fairly stable for the past fifteen to twenty years since declining from nearly 5000 individuals in the early nineteen eighties (MEDOL 2011). Employment in this sector provides valuable jobs to people in rural communities where other jobs are not always available (Egan and Taggart 2004b).

Maine loggers harvest more than half of all wood products in the region, most likely due to higher levels of mechanization and larger forest tracts in the state (NEFA 2007b). Maine and New Hampshire are the most mechanized of the New England states. Egan's (2005) results indicate that 31% of logging contractors in Maine and New Hampshire are mechanized, while 15% of Vermont logging contractors were found to be mechanized. Previous studies did not compare the number of loggers by harvest system and volume produced. Logging businesses in New York have reported the estimated market value of their equipment (Egan 2009), but particular pieces in operation were not a part of the study. Logging industry studies performed in the Northeast have not been focused on the equipment infrastructure for timber harvesting and transportation.

Related Studies

In 1999, Pan Atlantic Consultants and The Irland Group published a report on the bonded labor movement, logging workforce in Maine, and Canadian loggers in Maine. An important finding was that there was potential for a future shortage of labor in timber harvesting. As part of this study, an equipment inventory was collected from survey respondents of mechanized logging systems. It was predicted that mechanization of the timber harvesting industry would continue in part due to the shortage of labor (Pan Atlantic/Irland Group 1999). Since the Pan Atlantic Consultants/Irland Group report, numerous surveys of loggers have been published focusing on social and economic issues of the workforce (Egan and Taggart 2004a; Egan 2009; Greene et al. 2004).

Surveys of loggers found that this demographic seems to enjoy working in the outdoors, having a sense of independence, and having a sense of accomplishment using skills to perform a task or meet a challenge (Egan and Taggart 2004a, 2009; Egan 2009). The majority of Maine loggers surveyed felt that logging lacked public respect and that it was viewed as an unskilled profession. The majority of respondents to a survey of the general public stated that they would not consider logging as a career because there were better opportunities in their area and that logging was too physically demanding and performed in harsh working conditions. Although loggers reported that their profession was not understood or appreciated by the public, the average public perception of logging was that it involves skilled work (Egan and Taggart 2009). Further, loggers were found to strongly prefer on-the-job training. Logging safety and equipment maintenance were found to be top training priorities for northern New England loggers (Egan

2005). These studies have focused on individual logger demographics and the many issues involved in maintaining a strong forest products work force.

The business environment for logging contractors has also been the subject of previous studies. Loggers were surveyed in 1997 about the regulatory climate in the states of Pennsylvania, New York, Vermont, and Maine (Carroll et al. 2000). Although respondents frequently believed that their home states had more stringent regulatory environments, New York was found to be the strictest regulatory climate for logging companies (Carroll et al. 2000). Despite the level of regulation in New York, loggers in that state did not rank this as a significant barrier to doing business (Egan 2009). Loggers face challenges including volatile fuel costs and increasing equipment costs (Greene et al. 2001). In a study of Northern New England loggers, Egan et al. (2006) found that low mill prices and overly expensive equipment were barriers to maintaining or expanding their businesses and that on average loggers operate at 71% of total logging capacity. Further, poor weather conditions, poor road conditions, breakdowns, and moving equipment were found to be the most prevalent causes of limiting production. Although previous studies have provided some information regarding logging capacity and the proportion of mechanized, conventional, and small-scale logging operations, it does not cover the entire Northern Forest region.

Rationale and Objective

There is no single agency or organization in the Northern Forest region that collects and analyzes data related to logging businesses on a regular basis. Professional logging associations in each state advocate for their members and they undoubtedly collect data about forest operations, but there is not a coordinated effort across the entire region. For example, the Maine Forest Service tracks stumpage prices, wood processors, silvicultural activities, and forest inventory, but it does not address the logging sector in terms of demographics and business attributes, harvest capacity or equipment infrastructure. Further, Maine Forest Service reports do not summarize data by the most basic forest operation category of harvest method (i.e., whole-tree, cut-to-length, or tree-length). In contrast, other states outside this region have been tracking key logging industry metrics for over 25 years. For example, surveys have been administered to Georgia's logging industry on a five-year interval since 1987 and have shown a more productive, though aging, workforce harvesting a similar volume on slightly less timberland (Baker and Greene 2008).

In order to identify trends in key areas for the logging sector in the Northern Forest region, a repeatable, cohesive assessment of logging businesses is needed. A study of logging business owners across the region provides valuable insight into the business attributes, productivity, and limitations of forest operations. The objective of this study is to develop a baseline dataset of logging industry metrics for the Northern Forest region to better understand business attributes, business owner demographics, harvest methods, production and capacity, and equipment infrastructure.

Research Methodology

Survey Design and Distribution

Two mailed surveys were administered and combined to provide the results for the Northern Forest region in this report. The first phase, the Maine Logging Industry Assessment (ME2011), consisted of a survey developed in collaboration with the following four industry organizations: Professional Logging Contractors of Maine, Forest Resources Association, Certified Logging Professional Program, and Northeast Master Logger Program. The second phase, the Northern Forest Logging Industry Assessment 2012 (NF2012), was distributed to logging contractors in New York, Vermont, and New Hampshire to complete the coverage of the Northern Forest region. The NF2012 survey was adapted from the ME2011 survey according to advice from leaders of professional logging organizations outside of Maine. In addition to the organizations listed above, the following organizations endorsed the NF2012 survey: Northeastern Loggers' Association, Empire State Forest Products Association (New York Logger Training), New Hampshire Timber Harvesting Council (New Hampshire Timberland Owners Association), University of New Hampshire Cooperative Extension, Vermont Forests, Parks, and Recreation, Vermont Logger's Education to Advance Professionalism, and Vermont Forest Products Association. The membership rosters from these organizations were used to assemble mailing lists.

Both surveys, ME2011 and NF2012, were designed following the Dillman Tailored Design Method which involves a series of four mailings (Dillman et al. 2008). First, a postcard was mailed to the recipients to inform them that they had been selected to participate in the survey. Second, a survey packet with cover letter and return envelope were mailed a week later. Next, another postcard was mailed two weeks after the surveys with a reminder to complete and return the survey if the recipient had not already done so, or to thank the respondent if he or she had returned the survey. Finally, a second survey packet was mailed two weeks after the reminder postcards to those who did not respond. The final survey mailing included another cover letter requesting cooperation in the study and another survey in case the first one had been misplaced.

Question design was intended to ensure comparability to previously distributed surveys and repeatability for future studies. Multiple choice, Likert scale, and check list questions were used to minimize written responses, shorten time to complete the survey, and enable quantitative analysis of responses. Open-ended, written response questions were included to gather individual qualitative information that would not otherwise be available through the preceding question types.

Data Analysis

Survey data was coded and compiled for summary and analysis. Harvest method for each response was inferred based on the suite of equipment listed. Annual production for each system was calculated based on productive weeks (i.e., scheduled weeks minus reported weeks for mud season) multiplied by average weekly production in tons. Results were omitted for systems in which duration of mud season exceeded scheduled weeks.

Non-Response Bias

One challenge in conducting a mail survey is addressing potential bias in the data due to significant differences between responders and non-responders. Non-response bias is a particular problem in studies with low response rates which has often been the case when surveying individuals in the logging professions. For example, response rates for other mail surveys of loggers in Maine have ranged from 20-30 percent (Egan and Taggart 2004b, Egan et al. 2006, Egan et al. 2007). Non-responders have been shown to share similar characteristics with late responders as opposed to early responders (Armstrong and Overton 1977). Therefore, late responders were used as a proxy for non-responders. Non-response bias may be found negligible by conducting a chi-squared test on the variation between answers given by early and late responders.

Outliers and Terminology

In analyzing production numbers, outliers were excluded for responses that, based on professional experience, were judged unreasonable. For example, an individual with a cable skidder would not produce wood in the millions of tons per year. Proper terminology is important in terms of attributing production data to different harvest methods. Using a list of the contractor's equipment, responses were recoded when necessary to match the established definitions for harvest method. For example, if a respondent recorded a tree-length system as a feller buncher, stroke delimber, and grapple skidder, harvest method was recoded as whole tree (Figure 2). A cable skidder and a manual feller was described as a tree-length method because the form of wood brought to the yard is a tree-length stem with limbs left in the woods (Figure 3). The third harvest method analyzed in this study was cut-to-length which generally utilizes a harvesting system consisting of a processor and a forwarder (Figure 4).

Feller Buncher

Grapple skidder

Stroke delimber

Figure 2: Whole tree (WT) harvesting system.
(Photos courtesy of Jeffrey Benjamin)

Cable skidder

Manual feller with chainsaw

Figure 3: Tree-length (TL) harvesting system.
(Photos courtesy of University Forests Office, UMaine)

Processor

Forwarder

Figure 4: Cut-to-length (CTL) harvesting system.
(Photos courtesy of Jeffrey Benjamin)

Results and Discussion

Response Rate

Survey response rates were consistent with other studies of the logging industry. The highest response received in recent surveys of loggers in the Northeast was 29% (Egan and Taggart 2004a) and more recently a survey of Michigan loggers published results with a response rate of 6% (Shivan and Potter-Witter 2011). In this study, the response rate of logging contractors by state varied from 9% to 20%, with an overall rate of 17% (Table 1). Response rate is reported by state because each mailing list was sourced from a different database by state-specific professional organizations.

Table 1: Response rates by state.

State	ME	NH	VT	NY	All
Number of Respondents	209	22	99	94	424
Response rate	20%	17%	13%	9%	17%

Mailing lists were found to be out of date in many cases. Despite removing addresses of those not in the logging business and duplicate addresses, many surveys were returned indicating that the recipient was not in the logging business, had left the logging business, or had passed away. Surveys were also returned with invalid addresses. Generally, it could not be determined from the mailing list whether an individual was an owner of a logging business or an employee. Given these factors and that only the business owners were instructed to complete the survey rather than all loggers, this study may have better participation than is readily apparent by the response rate

Response Bias Tests

Phase 1 – ME2011

As previously summarized by Stone (2011), non-response bias was determined by statistical tests between early and late responses (Armstrong and Overton 1977). Chi-square tests were used on survey questions with dichotomous responses and ANOVA analyses were used on questions with continuous variables to compare these two groups. ANOVA analyses performed on total annual production, number of employees, and number of preceding generations in the logging industry were all non-significant (α=0.05).

Phase 2 – NF2012

All comparisons of early respondents (surveys received within three weeks of the first survey mailed, n=81) and late respondents (surveys received greater than two weeks after the second survey was mailed, n=70) were non-significant at an alpha level of 0.05. Variables used in one-way ANOVA tests were total annual production (p=0.83) and number of employees (p=0.71).

Chi squared tests were used for questions regarding mechanization (p=0.88) and whether contractors thought there were sufficient markets (p=0.31).

State Representation

Logging contractors reported operating in the majority of counties throughout the four states. All counties in Maine and Vermont, 80% of counties in New Hampshire, and 69% of counties in New York were operated in by responding contractors (Table 2).

Table 2: Top three counties for each state based on number of contractors operating in that county.

Rank	Number of counties represented			
	ME, n=252 16 of 16	NH, n=29 8 of 10	VT, n=85 14 of 14	NY, n=112 43 of 62
1.	Franklin; n=29	Grafton; n=5	Orange; n=13	Cortland; n=6
2.	Oxford; n=28	Carroll; n=4	Windham; n=6	Lewis; n=5
3.	Penobscot; n=26	Coos; n=3	Windsor; n=6	Chenango; n=5

Demographics and Business Attributes

Age of Logging Business Owners

More than 60% of logging business owners were found to be over fifty years old (Figure 5). In 1999 and 2004, the average age of Maine loggers was found to be 40.3 and 44.3 (Egan and Taggart 2004a; PAC and Irland 1999), while the average found in this survey was in the low fifties.[2] It is important to remember that this study targeted business owners rather than employees or individual loggers. This percentage is quite high compared to a 2002 U.S. Census survey of over twenty million business owners nationwide in which only 31% of respondents were over the age of fifty-five (U.S. Census Bureau 2006). Approximately 15% of logging business owners were found to be between 20 and 40, which is much lower than results from the Census survey (12% of owners were 25-34, and 24% were 35-44).

[2] An exact average cannot be determined because in this study age was collected as a categorical range, not a distinct integer.

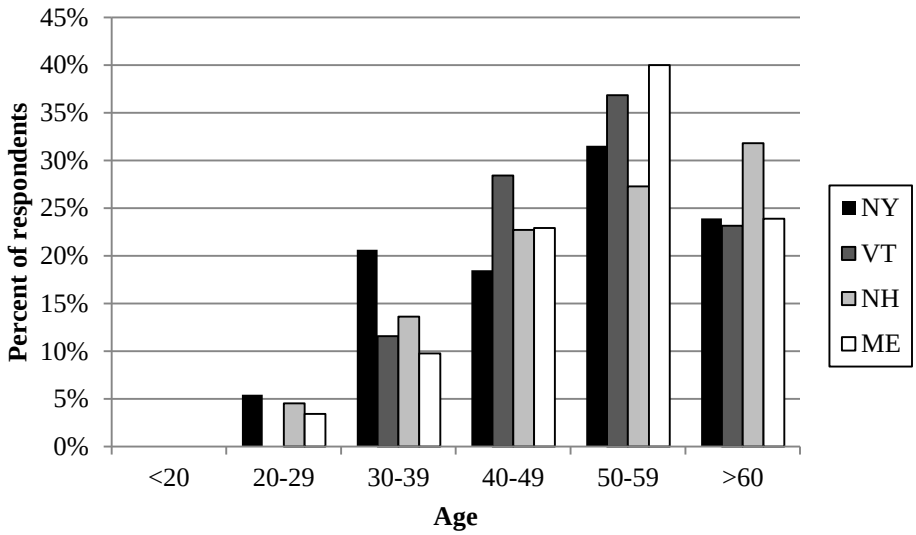

Figure 5: Distribution of logging business owner age by state.

Years in the Logging Industry and Year of Business Establishment

Since years in the logging industry is somewhat related to age of loggers and business owners, it is not surprising that 53% of business owners have worked more than thirty years in the logging industry (Figure 6). It is surprising to see that 20% of respondents established their logging business since 2000 (Figure 7). These trends were similar across all states in the region so results are presented in aggregate form.

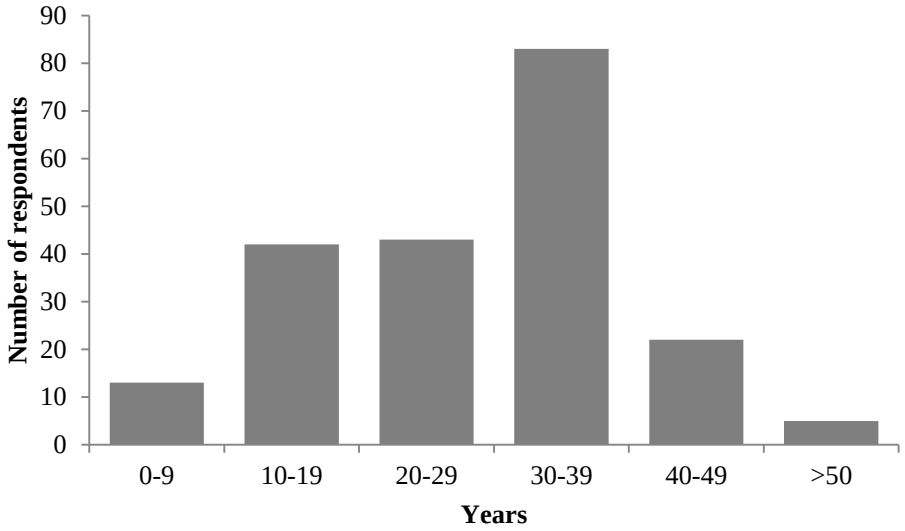

Figure 6: Years in the logging industry for logging business owners.

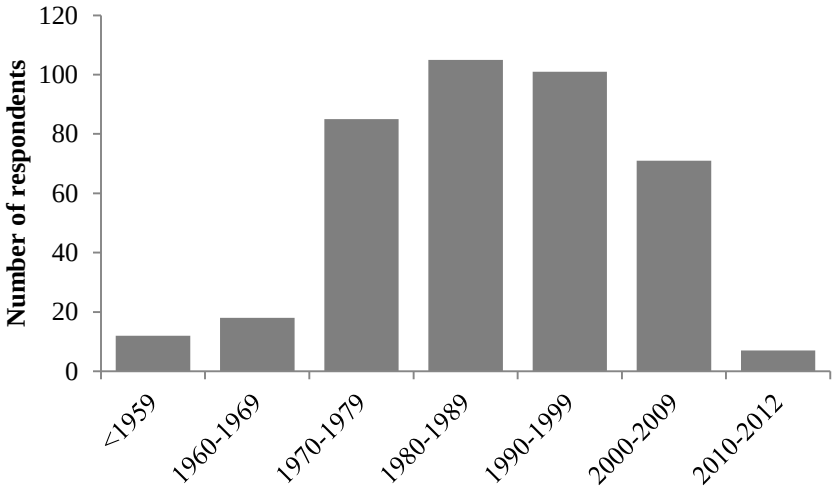

Figure 7: Distribution of establishment year for logging businesses.

Familial Attachment

Approximately 60% of logging business owners had at least one preceding generation working in the industry (Figure 8). This is similar to Egan and Taggart (2004a) who reported that 71% of loggers had previous generations in the logging industry. Figure 9 shows that 55% of logging businesses established after 2000 and 59% established prior to 2000 had preceding generations working in the industry. There was no statistical difference between the two groups. Further, in Maine, the proportion of logging business owners with preceding generations were nearly the same: 69% for those established after 2000 and 68% for those established prior to 2000. No difference was found between year of establishment for those with preceding generations in the industry and those without for the whole region (Figure 10). These observations were consistent across the Northern Forest region.

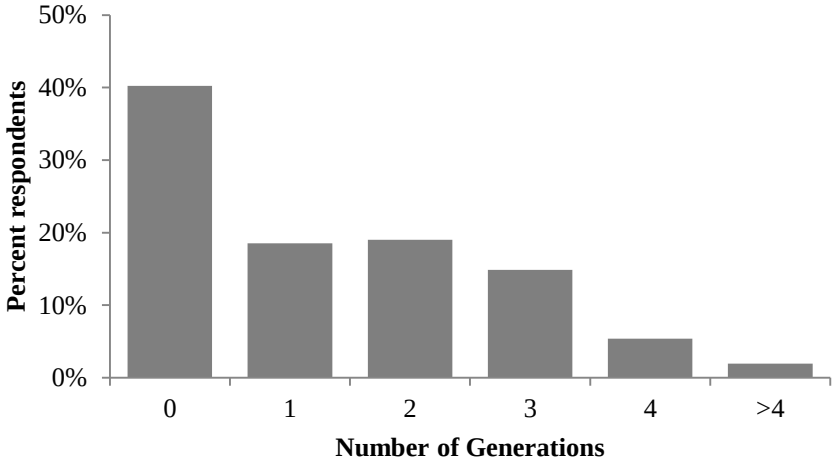

Figure 8: Percent of logging business owners with previous generations of family members in the industry.

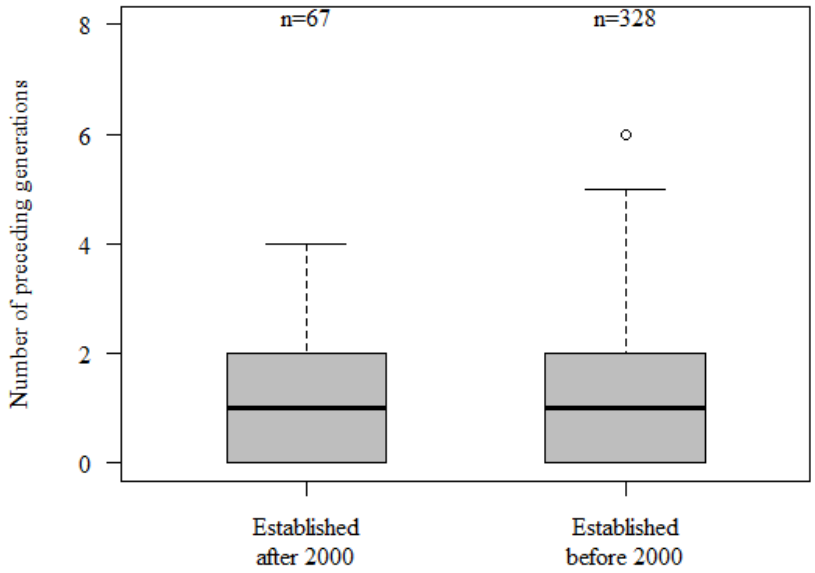

Figure 9: Distribution of preceding generations for logging businesses established since 2000 and those established before 2000. (Bold lines represent median values.)

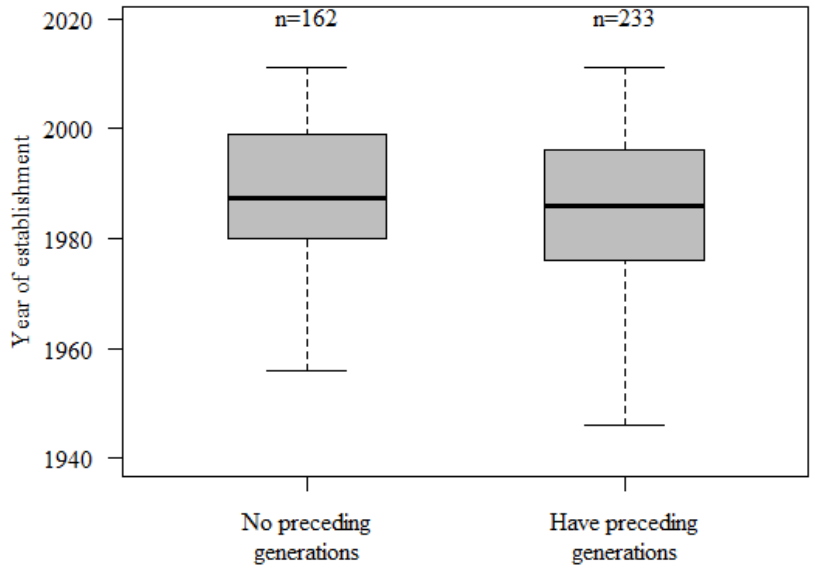

Figure 10: Distribution of establishment year for groups with and without preceding generations in the logging industry. (Bold lines represent median values.)

Reasons for Working in the Logging Industry

Survey participants were asked to evaluate their reasons for being in the logging business using 11 pre-determined responses. Across all states logging business owners identified most with enjoyment of the work, desire for independence, and being one's own boss (Figure 11). The remaining reasons were neutral on average. It is interesting to note that on average no respondents strongly disagreed with the reasons listed. These results agree with previous surveys

of loggers that found similar results for wanting to work in the logging industry: the top three cited were working outdoors, independence, and sense of accomplishment (Egan and Taggart 2004a).

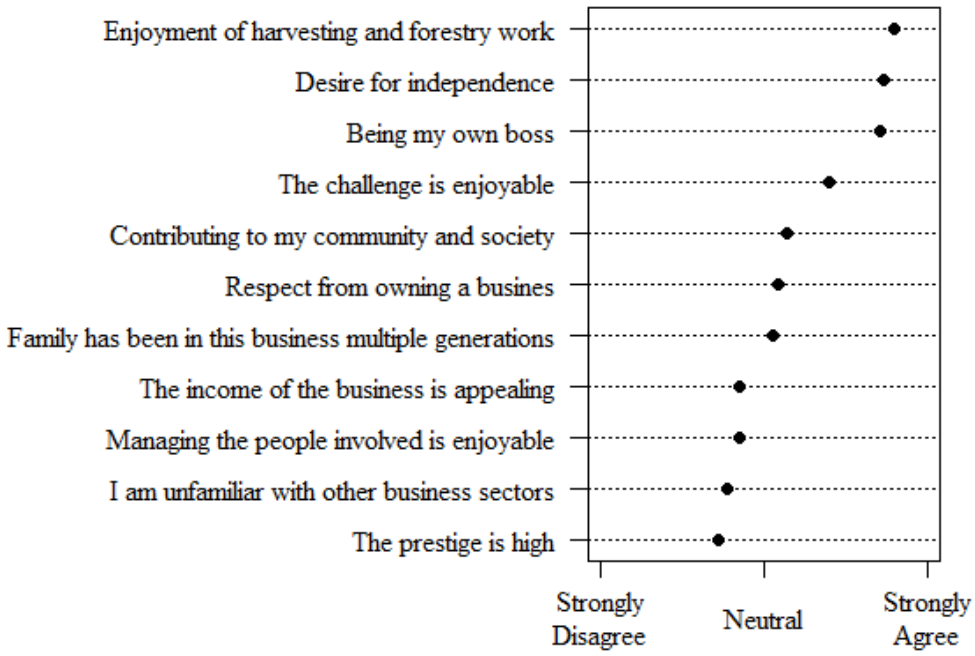

Figure 11: Reasons for being in the logging business.

Number of Employees

The logging industry is dominated by businesses with fewer than five employees. In fact, 86% of respondents had either no employees or one to five employees (Figure 12). Number of employees was used as an indicator of logging business size and it has been used in comparisons of logging businesses below. The percentage of logging businesses with greater than five employees is similar in New Hampshire, New York, and Vermont while about twice as high in Maine (Figure 13). In fact, of the 19 respondents with greater than 15 employees, 16 were from Maine.

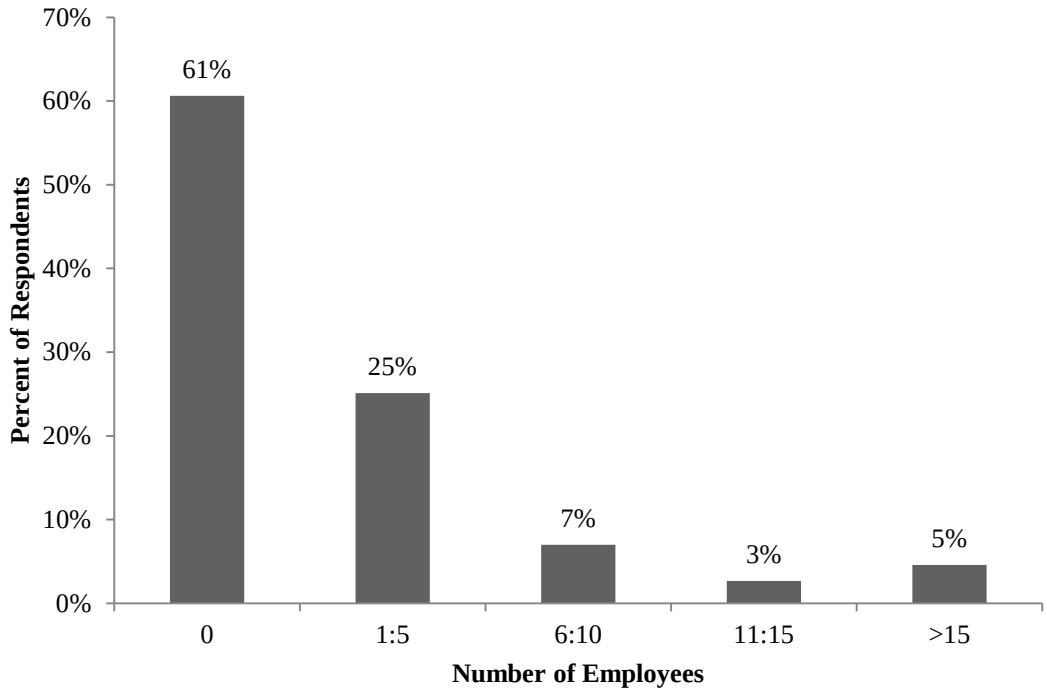

Figure 12: Distribution of logging businesses by number of employees.

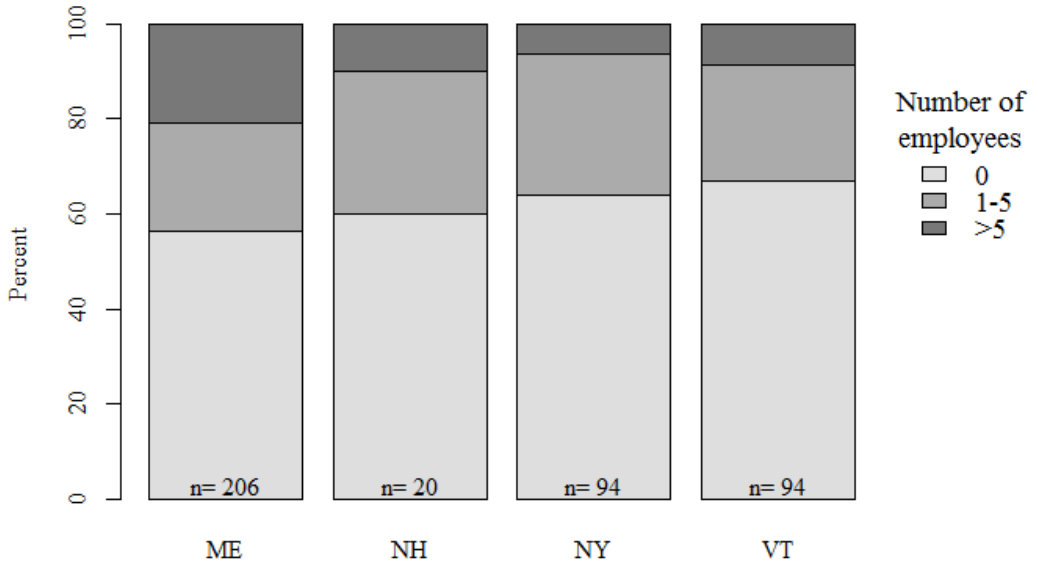

Figure 13: Percentage of logging businesses in each state with 0, 1-5, or >5 employees.

Business Structure

Many of the logging business owners reported being owner-operators (41%) or sole-proprietors (27%) (Figure 14). Those whose businesses were incorporated made up 17% of respondents, while subcontractors and those associated with partners made up 8% each. Of the contractors associated with partners, 90% reported having only one or two partners (Figure 15). The mean number of partners is 1.7 and the maximum number of partners reported is seven.

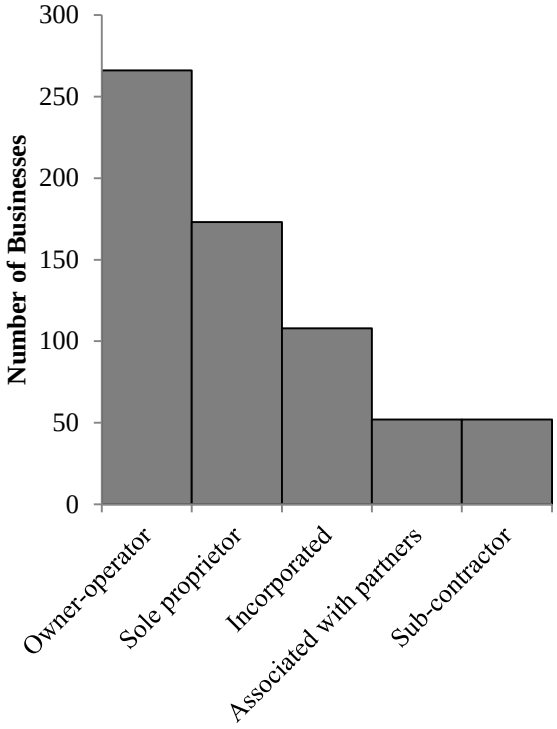

Figure 14: Distribution of logging business structures across all states.

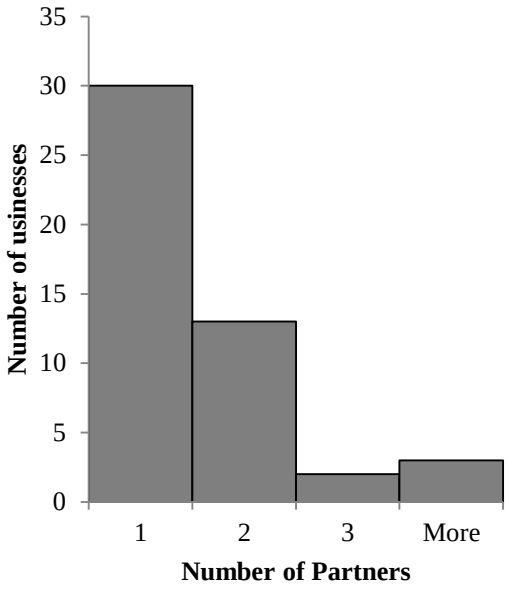

Figure 15: Distribution of number of partners associated with logging businesses across all states.

Professional Organization Involvement and Certification

Many logging contractors were found to hold memberships with multiple professional forest resources organizations (Table 3). Although many organizations were specific to individual states, of those that were regional or national in scope, the Northeastern Loggers' Association had the most substantial membership across the Northern Forest Region.

Table 3: State-level summary of membership in professional forest resources organizations.

Organization	ME (n=309)	NH (n=44)	VT (n=86)	NY (n=97)
Northeastern Loggers' Association	29	13	27	43
Northeast Master Logger Certification Program	44	2	4	1
Forest Resources Association	18	3	1	1
Maine Certified Logging Professional	168	1	-	-
Professional Logging Contractors of Maine	34	-	-	-
New Hampshire Timber Harvesting Council	-	19	2	-
Logger Education to Advance Professionalism	-	1	30	4
Vermont Woodlands Association	-	-	9	-
Empire State Forest Products Association	-	-	1	33
Other	16	5	12	15

Certification was increasingly popular among logging contractors from the 1980s to 2000s (Figure 16). From 2000 to 2004, there was a decrease in the number of logging contractors first becoming certified, but it increased again from 2005 to 2009. This trend appears to continue in recent years, especially since the final grouping represents only a three year period.

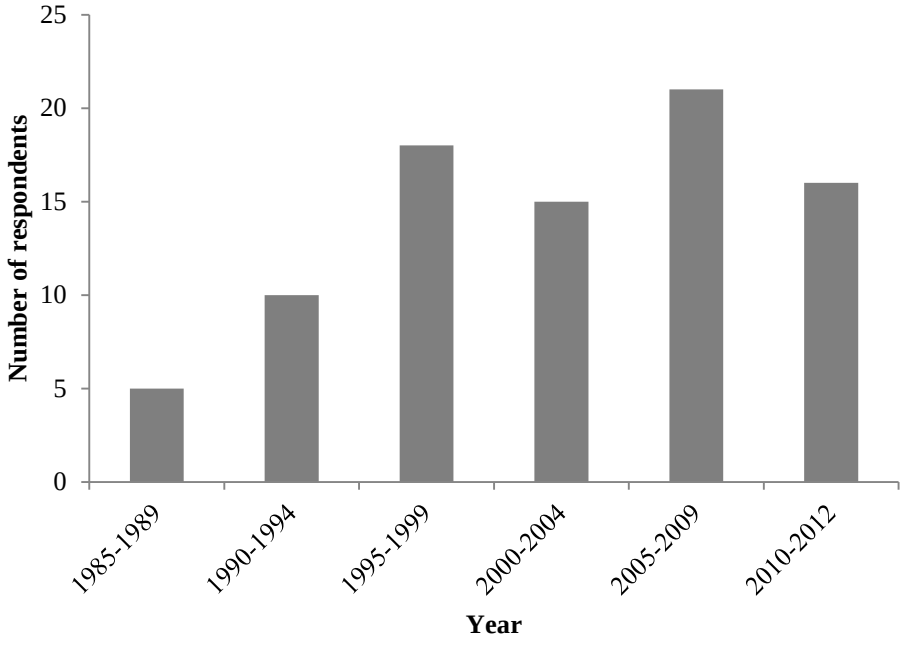

Figure 16: Distribution of certification year for logging businesses.

Performance Measures

A list of performance measures was presented in the survey to explore how logging business owners track their operations. Respondents were asked to check off whether or not each performance measure was used in their operation. Figure 17 shows the response rate for each performance measure based on harvest method with similar observations across all states. Rank of performance measures, based on those most used, had a similar trend for all harvest methods; however, the response of contractors utilizing tree-length harvest method was generally much lower for most performance measures. Tree-length operators may use fewer performance measures than those of the other two harvest methods because they tend to be the smaller operators with less capital investment in their equipment. Personal reputation was the most often used performance metric by nearly all contractors regardless of harvest method. It is interesting that the tree-length operators had low response rates for quality of work, customer satisfaction, and post-harvest stand condition in comparison to the mechanized contractors.

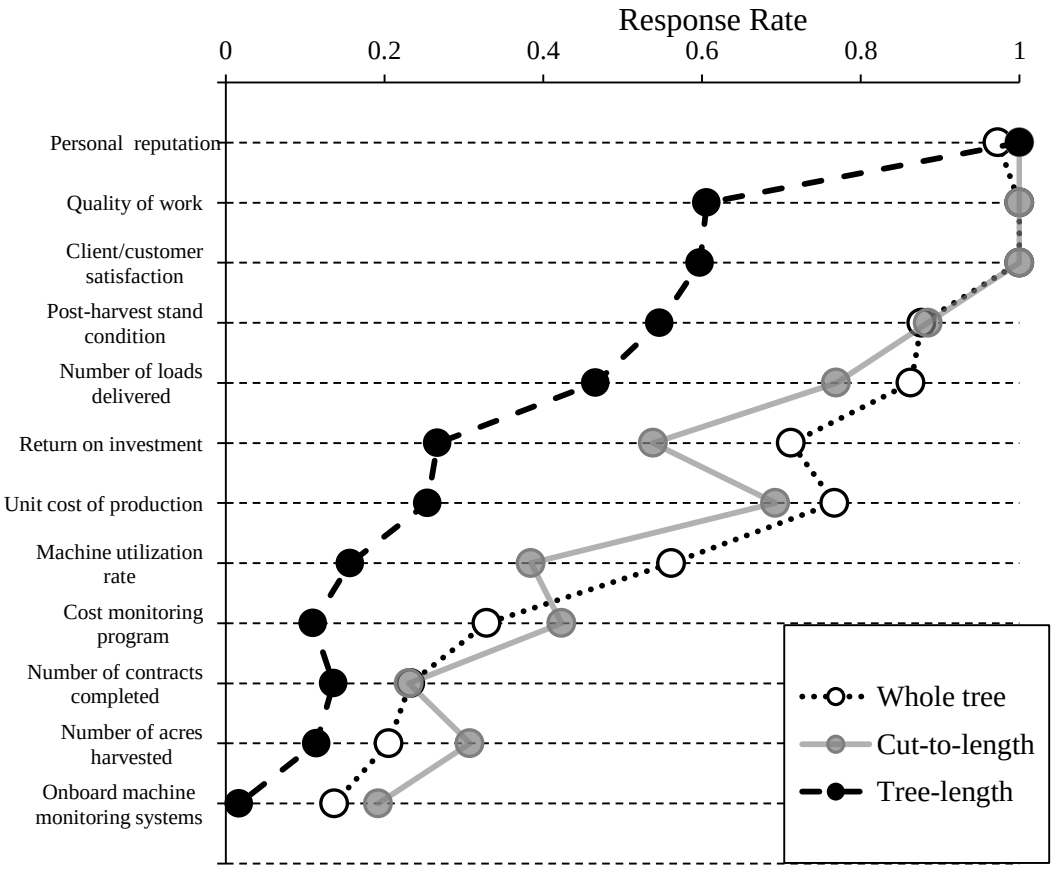

Figure 17: Performance measures ranked by response rate.

Trucking

Considering the significant cost of on-road transportation of wood products to wood processing centers, data were collected concerning whether wood was transported by the logging business or subcontracted, and how far it was transported[3]. Nearly 75% of logging businesses subcontracted some proportion of their trucking services. The overall average trucking distance was 46 miles, one way and the average reported maximum trucking distance was 124 miles (Table 4).

Table 4: On-road transport distance to mills.

Distance to Mill	**Average**	**Minimum**	**Maximum**	**Standard Deviation**
Average (miles)	46	3	400	42
Maximum (miles)	124	20	600	87

Harvest Production and Capacity

Harvest Method

Two hundred sixty respondent companies operated a total of 348 harvest systems. Tree-length harvesting was the most common harvest method making up nearly 50% of the systems (178). Vermont and New York were found to have the highest percentage of contractors utilizing tree-length systems (Figure 18). There were 132 whole-tree systems and 38 cut-to-length systems. Over 95% (245) of the respondents operated a single harvest method.

[3] The trucking section of the survey was an addition to Phase 2 of this project, so results do not include data from Maine.

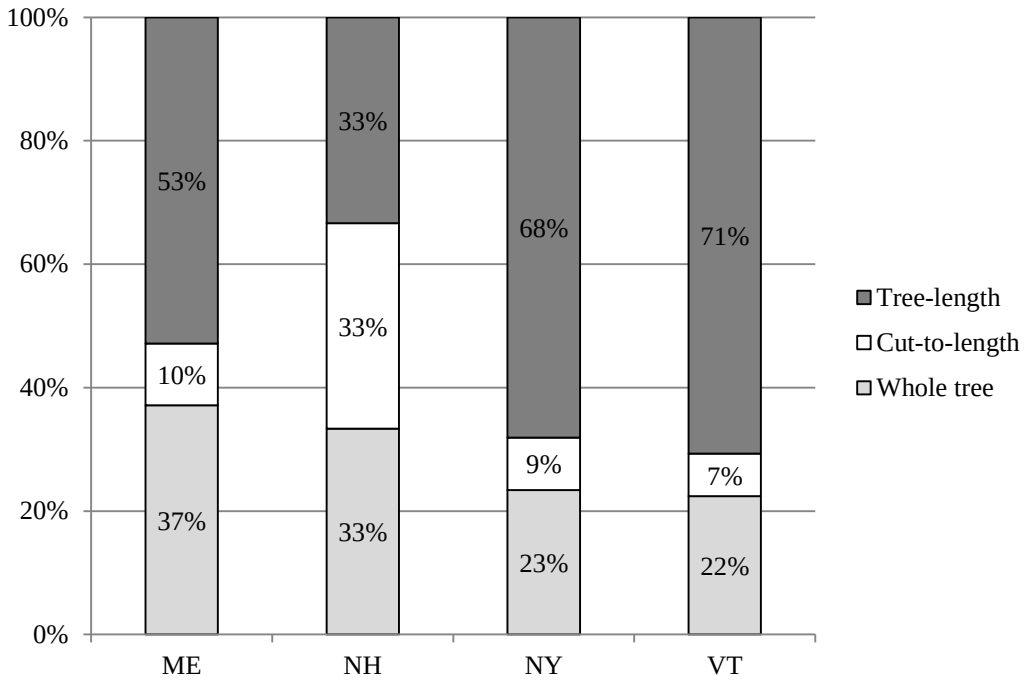

Figure 18: State-level summary of harvest method proportion by response percentage.

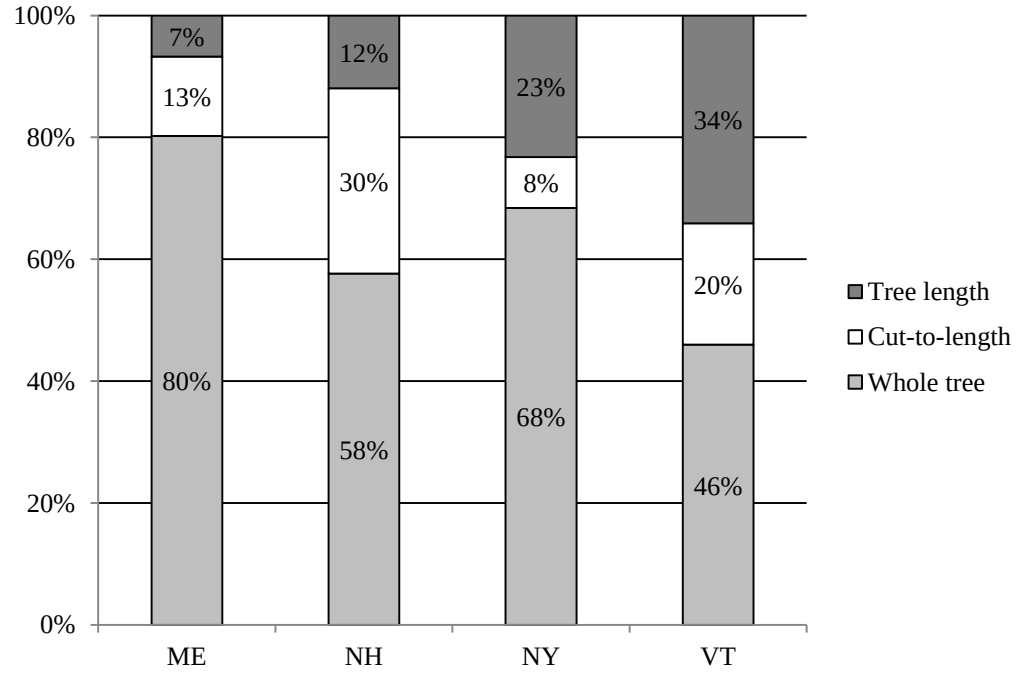

Figure 19: State-level summary of harvest method proportion by timber production percentage.

Production

Whole tree harvesting accounted for a higher proportion of timber volume in each state than any other harvest method (Figure 19). In all states except Vermont, more than half of each state's timber production was harvested by the whole tree method. New Hampshire and Vermont stand out in regard to the higher proportion of timber harvested by cut-to-length systems. Average weekly production was found to be significantly different among all three harvest methods (Figure 20). Tree-length operations harvest much less than mechanized systems. Summary statistics of average weekly production for each harvest method is provided in Table 5. No differences were found among harvest methods of the same type from one state to another.

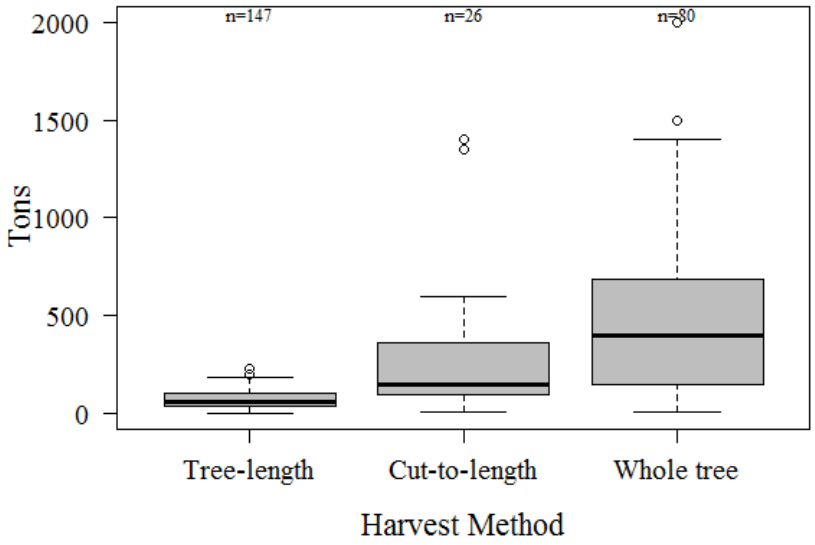

Figure 20: Distribution of weekly production by harvest method. (Bold lines represent median values.)

Table 5: Summary statistics of weekly production by harvest method.

Harvest Method	Production, tons/week (cords/week)		
	Average	Median	Standard Deviation
Tree-Length	81 (33)	60 (24)	49 (20)
Cut-to-Length	256 (102)	150 (60)	182 (73)
Whole-Tree	306 (123)	400 (160)	241 (96)

Limitations to Achieving Maximum Production

Logging business owners were asked to rate the importance of 15 reasons that may limit their ability to attain maximum production. Limitations were rated on a five point Likert scale from Very Important to Not Important (Figure 21). Different sized businesses were compared based on number of employees (0, 1-5, and >5). The most important limitation for all groups was *weather conditions* and there was close agreement in regard to the top five rated limitations.

Ratings for *weather conditions, mechanical breakdowns, mill quotas, timely access to repair parts, access to qualified labor, tract size, movement of equipment, productivity issues with existing labor,* and *access to qualified service technicians* among the groups of logging businesses were all statistically different. The gap between large and small businesses was most noticeable in terms of trucking, which is a significant expense incurred taking wood products to market. *Access to trucking* was not rated very important to large contractors in relation to small contractors, however the difference was not statistically significant at the 95% confidence interval (α=0.05).

Limitations to maximum production were compared among different states (Figure 22). There were no statistical differences among the four states with respect to *weather conditions, market price, road conditions, tract size, access to qualified labor, productivity issues with existing labor,* or *access to trucking*. Vermont had the most significant differences in rating production limitations from other states. For example, *mechanical breakdowns* were rated as less important in Vermont than in Maine, New Hampshire, and New York and *timely access to repair parts* as less important in Vermont compared to New Hampshire and New York.

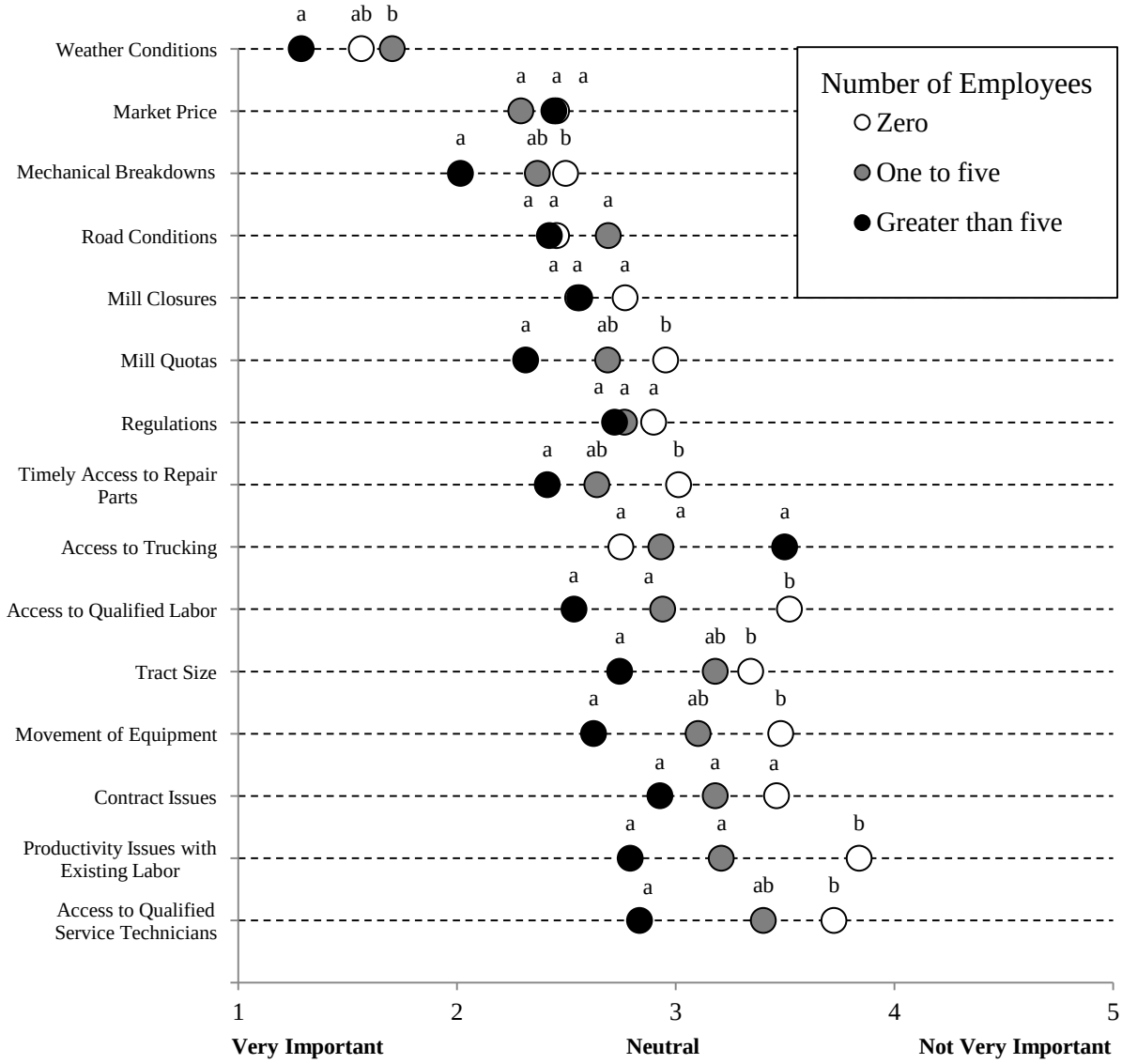

Figure 21: Limitations to attain maximum production based on size of logging business[4].

[4] *Access to Trucking* and *Contract Issues* were not included on the Phase 1 survey in Maine. Groups labeled with similar letters are not statistically different based on Tukey's HSD test (α=0.05).

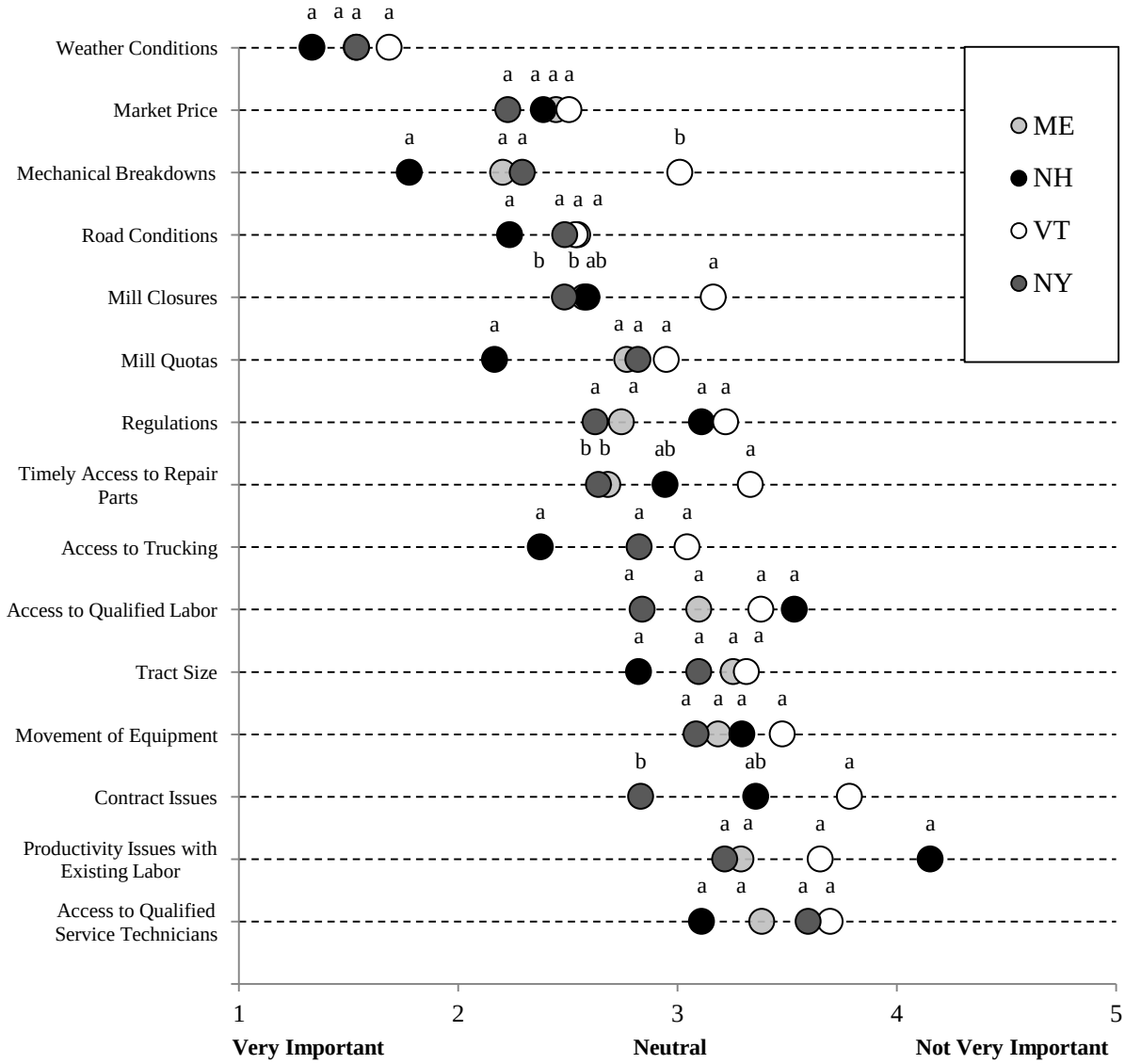

Figure 22: State-level comparison of limitations to attain maximum production[5].

[5] *Access to Trucking* and *Contract Issues* were not included on the Phase 1 survey in Maine. Groups labeled with similar letters are not statistically different based on Tukey's HSD test (α=0.05).

Access to Qualified Labor

Respondents did not cite access to qualified labor as a primary limitation to production. Previous studies have predicted that there may be a shortage of loggers (Egan and Taggart 2004a; PAC and Irland 1999), but the results from this study suggest that logging contractors do not consider access to labor as an important limitation at this time. This may be due to increased availability of labor due to the recent economic downturn or there may be some mobility between equipment operators from construction industries.

The Phase 1 survey to Maine logging business owners specifically asked if 1) they had access to qualified loggers and equipment operators and 2) there is a need for entry-level training for in-woods workers. Sixty-five percent of respondents felt they had access to qualified workers based on the reputation of their companies, the benefits they provide for employees, as well as their personal management style and work ethic. Many respondents also stated that it was an advantage to have family members as employees in their business. Reasons cited for not having access to qualified labor included low pay, long work hours, regulations and certification, as well as lack of technical skills and character issues with potential employees. It is interesting to note that the response to this question was not uniform across all harvest methods. Less than 40% of cut-to-length contractors felt they had access to qualified workers, whereas the majority of whole-tree (73%) and tree-length (60%) contractors felt they had access to qualified workers.

There was overwhelming support (70% of respondents) for entry-level training for in-woods workers. In fact, close to 90% of cut-to-length contractors indicated that there was a need for such training compared to 70% of whole-tree and tree-length contractors. Respondents felt training initiatives should build on the success of the Certified Logging Professional program and include training on different types of equipment and basic forestry skills. These questions were further investigated by the Maine Logging Education Alliance in the fall of 2012 through a separate training needs assessment survey (Townsend and Benjamin 2013).

Logging Equipment Infrastructure

As part of the Phase 2 survey in New York, Vermont, and New Hampshire, logging business owners were asked to evaluate their current logging equipment in terms of machine age (total machine hours at time of survey) and repair and maintenance costs for 2011[6]. Figure 23 and Figure 24 provide the distribution of machine hours and repair and maintenance costs for each machine type respectively. This was the most detailed and time intensive question in the survey since it was essentially asking for an inventory of logging equipment from each business.

[6] A similar question regarding logging equipment inventory was asked in Phase 1 for Maine logging businesses, but it focused on the entire harvest system replacement cost and did not explicitly request individual machine hours. Response to the question was very low and results between the two surveys cannot be compared.

Although many respondents skipped this question and the sample size for some equipment types is not as high as expected, the results do show the high degree of variability in machine age and repair and maintenance costs within each machine type. In fact there is no statistical difference in machine hours among the machine types investigated ($p>0.05$). Clearly machine hours for chippers was affected by the outlier at approximately 22,000 hours.

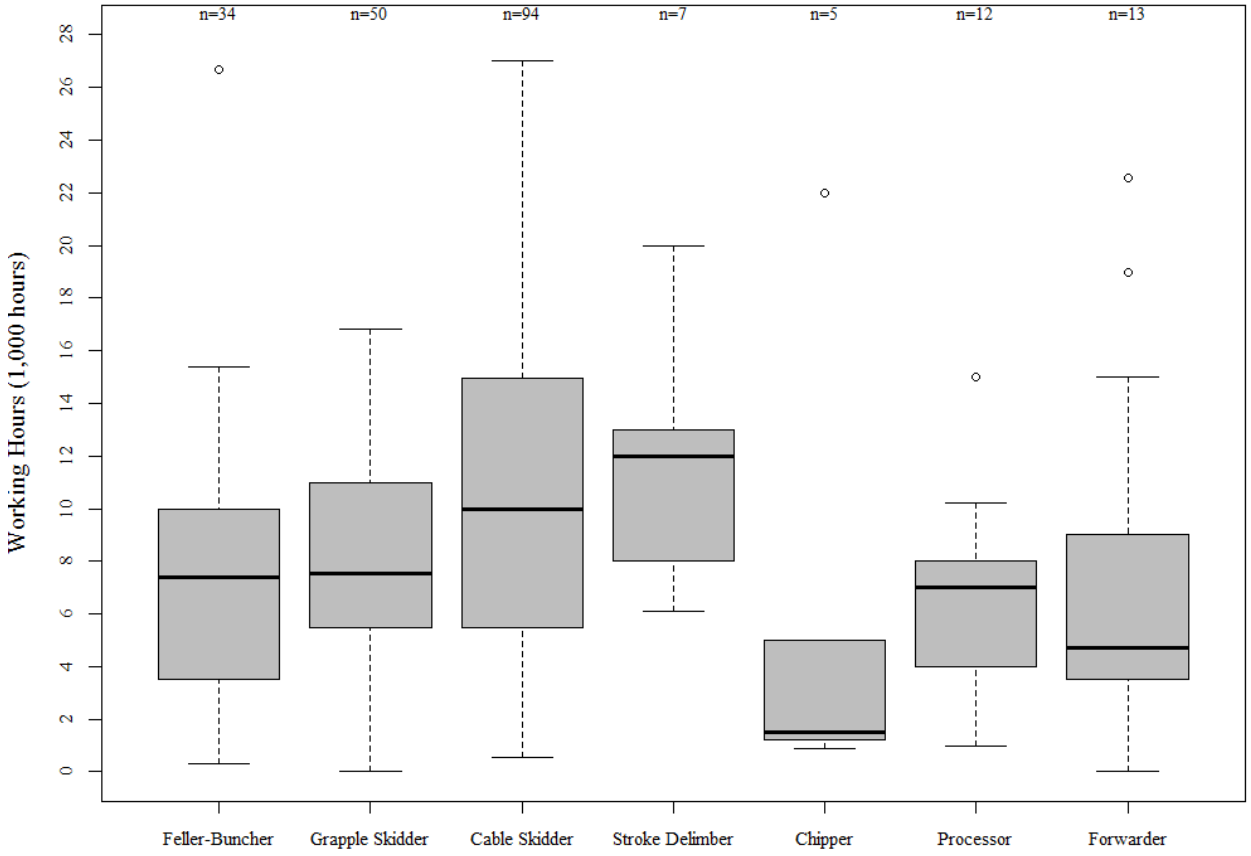

Figure 23. Distribution of machine hours by type of logging equipment. (Bold lines represent median values.)

Each type of logging equipment from this survey, with the exception of the stroke delimber, includes machines with less than 1000 hours. These machines can be considered less than one year old at the time of the survey. Although it is encouraging to find that at least some contractors have been able to reinvest into their businesses through significant capital purchases, the average machine hours for each type of equipment tells a different story. For example, harvesting machines have close to 7000 hours on average (7560 for feller-bunchers and 6750 for processors) and primary transportation equipment have over 10000 hours on average (11620 for cable skidders, 8480 for grapple skidders, and 7750 for forwarders). Even under an optimistic estimate of 2000 productive hours per year, it is clear that the logging businesses included in this survey are using equipment that is at least four to five years old on average.

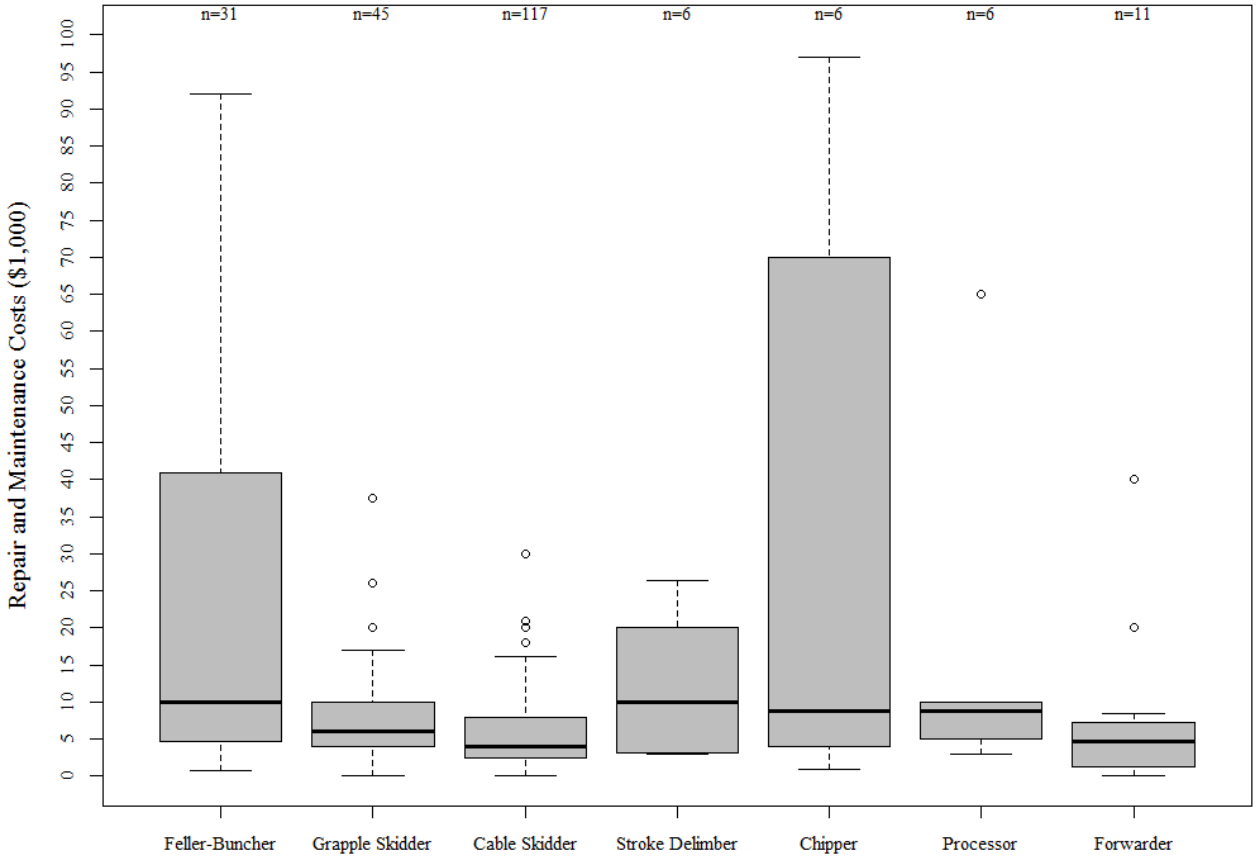

Figure 24. Distribution of 2011 repair and maintenance costs by type of logging equipment. (Bold lines represent median values.)

The very nature of repairs and maintenance on logging equipment is unpredictable and this is clearly shown in Figure 24. Although repair costs are expected to increase with machine hours, no such trend could be detected from the data collected in this study. Analysis by machine type did not find a significant relationship between machine hours and repair costs. feller-bunchers and chippers had the widest range for repair and maintenance costs and they also had significantly higher costs than transportation equipment. For example, feller-bunchers ($22,700) were significantly more expensive to maintain and repair compared to cable skidders ($11,620), grapple skidders ($8,480), and forwarders ($7,750) ($p<0.05$).

Conclusions

This report summarizes baseline data for the logging industry with respect to business attributes, business owner demographics, harvest production and capacity, and equipment infrastructure. Key findings include:

Business Attributes and Business Owner Demographics

- Logging businesses tend to be small companies and the business owners tend to be in a mature demographic. Across all states in this study 86% of logging businesses had five or fewer employees, 60% of business owners were greater than 50 years old, and over 50% of business owners have been in the logging industry for at least 30 years.
- Approximately 40% of business owners entered the industry without any familial attachment to logging and 20% of logging businesses were established since 2000.
- Business owners have a strong desire for independence and they enjoy their work, although many cited significant challenges associated with managing people and making a living in the logging industry. They judged their performance by their reputation in the industry, the quality of their work, and satisfaction of their clients.

Harvest Production and Capacity

- Tree-length harvest systems (chainsaw, cable skidder) are the most common system throughout the region in terms of frequency, but they rank last in total production. In contrast, whole-tree harvest systems (feller buncher, grapple skidder, stroke delimber) account for almost 40% of harvest systems reported, but they rank first in total production.
- Production by harvest system is not uniform across the region. For example, 80% of production in Maine is by whole-tree systems compared to only 46% in Vermont. Further, only 7% of Maine's production is by tree-length systems, compared to 34% in Vermont.
- Average weekly production, in tons, was found to be significantly different among all three harvest methods (Tree-Length <100, Cut-to-Length >250, Whole-Tree >300) across all four states.
- Weather conditions were overwhelmingly cited as the most important limitation to achieving maximum production across all states and all business sizes. There was close agreement in regard to other top-rated limitations such as market price, mechanical breakdowns, road conditions, and mill closures and quotas.
- Labor issues (access to qualified labor, productivity issues with existing labor, and access to qualified service technicians) were much less important to achieving maximum production across states even though there were apparent differences by size of business.

Equipment Infrastructure

- Some logging businesses have made significant capital investments in new logging equipment, but on average harvesting machines have close to 7,000 hours and primary transportation equipment have over 10,000 hours. Using an optimistic estimate of 2,000 productive hours per year, it is clear this means that a lot of equipment in the industry is at least four to five years old. Repair and maintenance costs for logging equipment are highly variable and they are a function of more than simply machine hours.

In closing, the logging sector is a critical component of the forest resources industry in the Northern Forest region. It is expected that results from this study will help policy makers, landowners, and loggers address challenges faced by the logging industry as a whole. The long-term goal of this research is to periodically reassess the industry in the same manner to identify trends in the key metrics over time.

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