

Status of Michigan's Forest Products Industry in the Changing Market Environment

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Abstract

The forest products industry plays a large role in Michigan's economy. It is one of the largest manufacturing sectors in the state, employing more than 29,000 individuals with an annual payroll of \$1.2 billion. However, due to extended economic downturns, the industry is currently facing an adverse business environment, threatening its performance and even the retention of existing mills in some cases. Given this situation, an emerging bioenergy market could provide new opportunities for the struggling industry and help regain its vitality. However, this is possible only if sufficient resources are made available for both the traditional forest products industry, as well as new bioenergy facilities. Failure to do so will weaken already vulnerable forest products sectors. This study uses a mail survey of Michigan's primary forest products industry to provide insight into the state's forest products sector, with the aim of helping stakeholders make informed decisions for promoting bioenergy facilities while strengthening the existing operations within the state. Our findings suggest that there is a positive attitude among Michigan primary mills toward the introduction of wood-energy facilities in their wood basket, and hence there is evidence for a conducive environment for promoting bioenergy. However, careful consideration must be given to existing resource conditions, industry infrastructure, and strategies for maintaining sustained wood availability for promoting bioenergy industry that complements, rather than competes against, the traditional forest products sector.

Forests cover approximately 54 percent of Michigan's land area (US Department of Agriculture [USDA] Forest Service 2008) and play a significant role in the state's economic, environmental, and social well-being. The overall average annual cubic foot growth rate of all live trees on Michigan timberlands is more than two times average annual removals (USDA Forest Service 2008). Given that the national average is 1.7, Michigan is one of the leading states in timber surplus (USDA Forest Service 2009). Despite this abundance of wood fiber, Michigan's forest products industry has been facing difficulty in retaining its business and in profitably running its operations in recent years. The challenges faced by the industry include downturns in the manufacturing sector, high transportation and labor costs, limited timber availability from both private and public lands (growth to removals ratio of all live trees in Michigan private and state forests is 2:1 and in national forests, it is 4:1 [USDA Forest Service 2009]), increased foreign competition, and aging facilities (Berghorn 2005, US Department of Energy, Office of Energy Efficiency and Renewable Energy 2010). An estimated loss of over 30,000 jobs, \$720 million in wages, and 500 individual forest-based businesses occurred within the state from 2000 to 2010 (Korpi 2010). If the trend continues, it is likely to have serious repercussions not only on the forest products

industry and forest-based communities, but also on the retention of overall forest resources in the state. The demand for forest products determines the economic value of forest resources, providing financial incentives for landowners to keep their land in forest rather than convert it to alternative uses.

Currently Michigan's forests support over 2,000 forest products firms and numerous forest-based recreational facilities (Michigan Department of Natural Resources [DNR] 2010). The forest products industry accounts for approximately 5 percent of the state's manufacturing sector jobs (US Census Bureau 2008) and generates almost \$14 billion in direct, indirect, and induced benefits (Korpi 2010). Given this situation, stabilizing the existing forest products industry and promoting new facilities are of utmost importance for maintaining the state's economy.

Globally, there has been an increasing interest in meeting energy demands through renewable resources such as

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woody biomass, and Michigan is no exception. According to the state renewable portfolio standard, 10 percent of total energy production by 2015 must originate from renewable sources (Becker et al. 2009). The large forest resource base, good transportation system, and access to the Great Lakes make the state ideal for promoting wood-based bioenergy. However, ensuring adequate wood supply to meet the needs of both the traditional forest products industry and the emerging bioenergy market is a matter of concern. In order to strengthen the existing facilities and to develop a sustainable bioenergy industry that complements the existing facilities, it is essential to identify and address the challenges currently faced by the forest products industry (Benjamin et al. 2009). This study was an attempt to understand the status of Michigan's forest products industry, its strengths and limitations, and the challenges it faces so that effective policy measures can be established for sustaining and enhancing industry capacity in the future. Information on current wood supply within the state as well as on the perception of the forest products industry toward bioenergy can help potential investors, communities, state agencies, and policy makers choose effective strategies for promoting wood-to-energy facilities within the state. Though the study specifically examined Michigan's forest products industry, the issues identified are likely to have important implications for promoting the forest products industry, including the bioenergy sector, in other states facing a similar situation.

Study Methods

A mail survey of Michigan's primary forest products industry was administered during the spring of 2009. The list of primary mills was obtained from the database of the forest products industry maintained by the Michigan DNR. All 335 primary mills were included in the mailing list. The mail survey was conducted based upon the tailored design method by Dillman (2000). It involved mailing a presurvey postcard and then the survey with a cover letter and business reply envelope to the addresses on the list that appeared to still be valid. Two weeks after sending the initial survey, reminder postcards were sent to the mills. Following this, a full mailing of the survey was sent to the mills that had not yet responded.

The questionnaire focused on mill characteristics, timber availability and utilization, generation and disposition of wood residues, the current business environment, and the coping strategies adopted by the mills, as well as the perception of mills toward the introduction of wood to energy facilities in their wood basket. From the total questionnaires initially mailed, 109 respondents returned the survey, for an initial response rate of 33 percent. Twenty of the 109 respondents returned blank surveys and indicated that they were no longer in business at the time of survey. To check for nonresponse bias, the responses of the early and late respondents were compared using two sample *t* tests and Mann-Whitney *U* tests. No significant differences were observed between the responses of two groups, thus ruling out concern for nonresponse bias.

Since primary mills in Michigan range from small facilities employing fewer than five individuals to those with more than 1,000 employees (Michigan DNR 2010), the respondent mills in our survey were divided into small- and large-sized facilities for analysis. Those mills employing 10 or fewer individuals were coded as small facilities, and the

remaining were coded as large facilities. Nonparametric statistical tests were then conducted to determine if significant differences existed between small and large mills. An alpha level of 5 percent was chosen as a cut-off value for all the statistical tests. Three questions included in the survey used a Likert scale format (with a rating of 1 to 5) for understanding the perception of primary mills toward their business environment, introduction of new wood using facilities in their wood basket, and preference for different wood use types. The nonparametric median tests were applied to these questionnaires to see if significant differences existed between the large and small mills.

Results

Characteristics of primary forest products industry

On average, firms in Michigan's primary forest products industry employed 37 individuals in 2007. Though a large percentage of these industries (46%) had five or fewer employees, 10 percent had more than 100 individuals working for them, indicating the presence of a few large mills and a large number of smaller facilities within the state. On average, the mills operated at 71 percent of their full capacity in 2007. However, in 2008 the operating capacity declined to 63 percent, indicating the adverse business environment for such facilities within the state. The operating capacities of small mills were compared with those of the large-sized mills using Mann-Whitney *U* tests. The results indicated that small mills, comprising 63 percent of the respondents, operated at a significantly lower capacity (61% and 54%) than did the large mills (90% and 78%) in 2007 ($P = 0.000$, Mann-Whitney $U = 266.00$) and 2008 respectively ($P = 0.003$, Mann-Whitney $U = 350.50$). This could be due to the large-sized mills having higher fixed costs compared with their smaller-sized counterparts and hence needing to operate at a higher capacity to achieve profitability. Eighteen percent of the survey respondents indicated that they were no longer in the business.

Nonindustrial private forest lands, comprising 8.8 million acres of Michigan's forest area (Leatherberry et al. 1998), were reported as the major source of wood supply by the state's primary mills in 2007. An estimated 40 percent of the wood used by the respondent mills came from this ownership group. Real Estate Investment Trusts and Timber Management Organizations together contributed 9 percent of wood supply. Likewise, state forest lands contributed 9 percent and national forests contributed 3 percent of the total wood supply used by the primary mills in 2007. A small percentage of the wood supply came from outlying wood yards and other primary forest products mills and 11 percent came from other sources. The large-sized mills obtained a significantly higher percentage of their wood supply from national and state forests as well as Timber Management Organizations and Real Estate Investment Trusts, compared with their smaller-sized counterparts (Table 1).

Production

The primary mills in Michigan consist of sawmills, pulp and paper mills, mills producing oriented strand board, particle board, wood pellet fuel mills, and others. Of the total respondents, 53 mills indicated that they produced hardwood lumber. The median production of those mills

Table 1.—Percentage of timber obtained by primary mills in Michigan by source, 2007.

Source of timber	Average % obtained			Mann-Whitney <i>U</i>	<i>P</i> value ^a
	Large mills	Small mills	All mills		
Nonindustrial private lands	42	39	40	567.50	0.415
State forest lands	16	7	9	335.50	0.000*
Real estate or timber management organizations	14	5	9	459.00	0.010*
Unknown	10	17	15	682.00	0.456
National forest lands	7	2	3	377.00	0.000*
Other forest products mills	4	5	5	567.50	0.218
Outlying wood yards	3	6	5	629.00	0.859
Others	0	14	11	739.50	0.025*

^a * = significant at 5 percent alpha level.

was 800 thousand board feet (MBF) with a range from 3 to 12,575 MBF. Likewise, 35 mills indicated that they produced softwood lumber. The median production of those mills was 260 MBF with a range from 5 to 17,323 MBF.

The large-sized sawmills produced a median volume of 5,388 MBF of hardwood and 4,142 MBF of softwood lumber whereas the smaller-sized facilities produced a median volume of 105 MBF of both hardwood and softwood lumber in 2007. Fourteen primary mills also produced a median volume of 4,800 tons of pulp chips with production ranging from 1,100 to 264,708 tons. The median production for the small mills was 3,725 tons of pulp chips and that for the large mills was 7,952 tons of pulp chips.

The three pulp mills responding produced a median volume of 160,000 tons of wood pulp with their production ranging from 50,000 to 474,000 tons.

Apart from the conventional forest products, two wood pellet fuel mills produced an average volume of 36,500 tons and 12 industrial fuel mills produced a median volume of 7,250 tons with a range from 2,000 tons to 18 million tons in 2007.

Hard maple was the primary species of sawtimber produced followed by pine, other hardwoods, and red and white oak, respectively. The average delivered price of sawtimber ranged from \$173/MBF for softwoods other than pine to \$445/MBF for hard maple. Pine was the primary species of boltwood (a short log of a length suitable for manufacturing turned forest products [i.e., dowels, tooth-picks] or peeling veneer). The average delivered price of boltwood ranged from \$115/MBF to \$150/MBF depending upon the species. Aspen was the primary species used for pulpwood, followed by mixed hardwoods, softwoods other than pine, and pine. The average delivered price of pulpwood ranged from \$54 per cord for mixed hardwoods to \$74 per cord for softwoods other than pine. Hardwoods contributed 67% of the total pulp chips delivered in 2007 with an average delivered price of \$27/ton. The average delivered price for softwood chips was \$42/ton.

Delivery method and distance

Approximately 71 percent of the wood used by the respondent primary mills was obtained from within 90 miles of the mill facility. The larger-sized mills procured a significantly higher percentage of their wood supply from outside a 60-mile radius of their mill compared with the smaller mills (Table 2). Seventy-two percent of the wood used by the respondent mills was delivered using contract trucking, 24 percent was obtained by using company-owned

trucks, and less than 1 percent was obtained through railway facilities. Irrespective of their size, Michigan's primary mills were found to rely heavily on contract trucking for wood delivery.

Mill residue

In 2007, the respondent primary mills produced approximately 1.47 million tons of mill residues as by-products. Of this, 36 percent was retained by the producers for fuel, 38 percent was sold to others for manufacturing purposes, and 23 percent was sold for industrial fuel. Only 3 percent went to landfills or to other disposal facilities. As is the case throughout the United States, a large supply of mill residue is currently not readily available for any other use. However, this situation could change with change in market conditions and relative prices of wood versus other sources of fuel.

Business environment

To gain an improved understanding about the business environment under which the primary forest products industry is operating within Michigan, mill operators were asked to indicate their degree of agreement/disagreement with 10 different statements related to their business condition using a Likert scale rating ranging from 1 (strongly agree) to 5 (strongly disagree).

The results of the nonparametric median tests (Table 3) revealed that, regardless of their size, primary mills in general think that there are enough qualified loggers within the state to meet their timber supply needs. However, mills also agree that logging firms are facing a hard time staying in business and operating profitably in recent years due to

Table 2.—Percentage of wood obtained from various distances from the mill for large (>10 employees) and small (≤10 employees) primary mills in Michigan, 2007.

Distance (mi)	Average % obtained		Mann-Whitney <i>U</i>	<i>P</i> value ^a
	Large mills	Small mills		
<30	23	40	664.50	0.352
30–60	26	27	485.50	0.272
60–90	23	7	199.00	0.000*
90–120	13	6	269.00	0.000*
120–150	7	2	289.50	0.000*
>150	4	4	439.50	0.019*
Don't know	4	12	623.50	0.215

^a * = significant at 5 percent alpha level.

Table 3.—Opinion of Michigan's primary forest products industry toward their business environment.

Statements	Median response		χ^2 value	P value ^a
	Large mills	Small mills		
We can adjust our raw material requirements to more abundant or lower cost timber when supplies of the best timber are limited.	Disagree	Neutral	5.928	0.015*
There is enough timber being made available for harvest.	Disagree	Agree	22.442	0.000*
Higher energy costs have reduced our ability to meet our wood supply needs.	Agree	Agree	0.055	0.815
There is too much competition for wood in our procurement area.	Agree	Neutral	3.375	0.066
Timber supply contracts are a good way to assure a steady supply of timber to our mill.	Agree	Neutral	2.147	0.143
We were able to get the type of timber most desirable for our process in 2007.	Agree	Agree	0.031	0.859
Recent closures of other mills have improved our raw material supply outlook.	Neutral	Neutral	0.7	0.403
Forest certification standards like Forest Stewardship Council or Sustainable Forestry Initiative increase our timber supply costs.	Agree	Neutral	0.448	0.503
There are enough qualified loggers to meet our timber supply needs.	Agree	Agree	0.485	0.486
Loggers are having a hard time with the current economic conditions.	Strongly agree	Agree	0.201	0.654

^a * = significant at 5 percent alpha level.

downturns in the manufacturing sector. Despite this situation, mills were able to obtain the type of timber most desired for their processes in 2007. They did, however, indicate that higher energy costs have reduced their ability to meet their wood supply needs.

Large-sized mills noted that strong competition for timber is prevalent in their procurement area and that third-party forest certification standards, such as those provided by the Forest Stewardship Council or the Sustainable Forestry Initiative, increase their timber supply costs. These mills view long-term timber supply contracts as a good way of assuring a steady supply of timber for their mills. When asked if they could adjust their raw material requirements to more abundant or lower-cost timber in the future, in case supply of the best timber was limited, significant differences were observed in the responses of the large- and small-sized mills. The large mills noted that they would not be able to replace high-quality timber with lower-quality, more abundant material, whereas smaller mills expressed a neutral response to this scenario. Larger mills also expressed concern that not enough timber was being made available for harvest in Michigan. However, the smaller mills had an opposite view. These differing outlooks might be explained by large mills' dependence on federal and state forests for their wood supply and government policy, especially federal, of limiting timber harvests on public lands. When asked if recent mill closures in the state have improved their timber supply outlook, both the large- and small-sized mills expressed a neutral response.

Perception toward the introduction of additional wood-using firms

The primary mills in our survey were asked to rate different wood using facilities as desirable or undesirable additions in their operating area using a 5-point Likert scale ranging from 1 (very desirable) to 5 (very undesirable).

Hardwood and softwood sawmills were identified as undesirable additions by existing mills, irrespective of their size, whereas direct-fired wood power generation and wood-based biofuel manufacturing were seen as desirable additions. The small-sized mills were significantly more supportive of introducing pulp and paper mills as well as wood pellet fuel mills into their wood basket compared with their larger-sized counterparts (Table 4). Neutral responses were observed in the case of veneer mills. Large mills

expressed concern with the addition of new particleboard, oriented strand board, or other panel board mills within their wood basket; whereas, smaller mills were neutral regarding these possible additions.

The mills were further asked to indicate (using Likert scale ranging from 1 to 5) the types of wood use that would be desirable or undesirable for use by new wood-using facilities if they were to open in their wood basket in the future. The results revealed no significant differences in the median response for small versus large mills in the case of all wood use types (Table 5). In general, the smaller mills were supportive of new facilities using four sources of wood: roundwood, nonmerchantable timber, forest residues, and mill residues. By contrast, large mills were supportive of using nonmerchantable timber but expressed neutral response in the case of all other sources of wood (Table 5).

Strategies adopted by the primary mills to improve their wood supplies or to reduce their costs

The primary mills in our survey were asked to share the strategies they had already undertaken or that they were planning to adopt in the future for reducing costs and improving wood supplies to run mill operations. Varied responses were observed, ranging from no strategies adopted by some mills to increasing operating efficiency, diversifying products, and lobbying for increased timber harvesting (Table 6). Some primary mills indicated that they have reduced mill operations and staff, including family members, to deal with tough economic times. Others expressed feelings of helplessness and considered retiring from the business. Still others said they were simply waiting for fuel prices to drop and for market conditions to get better. However, there were some mills that saw the need for improved equipment and operation efficiency. Some indicated the need for new market opportunities and others highlighted the importance of improving communications between the loggers, the mills, and both the private and public landowners. A few mills also mentioned that they were working with the Michigan DNR and the US Forest Service to increase the allowable harvest from public lands. Other strategies included working with reputable loggers, signing long-term supply contracts, purchasing wood from nearby sources, and purchasing low-cost Canadian timber.

Table 4.—Perception of Michigan's primary mills toward the introduction of additional wood-using firms into their wood basket.

Type of wood-using firms	Median response		χ^2 value	P value ^a
	Large mills	Small mills		
Pulp and paper manufacturing	Undesirable	Desirable	6.161	0.013*
Wood pellet fuels	Neutral	Desirable	4.685	0.030*
Hardwood sawmill	Very undesirable	Undesirable	3.223	0.073
Softwood sawmill	Undesirable	Undesirable	1.837	0.175
Veneer manufacturing	Neutral	Neutral	0.171	0.679
Particle board or other panel manufacturing	Undesirable	Neutral	3.354	0.067
Oriented-strand board manufacturing	Undesirable	Neutral	2.777	0.096
Direct-fired wood power generation	Desirable	Desirable	0.031	0.86
Wood-based biofuel manufacturing	Desirable	Desirable	1.39	0.238

^a * = significant at 5 percent alpha level.

Factors influencing the ability of logging industry to meet the wood supply needs of primary mills

Primary mills were also asked what they thought helped or hindered the ability of the logging industry to meet their wood supply needs. In response, a large number of mills (23%) indicated low timber availability, high stumpage prices (20%), and high fuel prices (17%) as major hindrances for logging businesses within the state. Both federal and state government policies were also viewed as a hindrance. The DNR's minimum bid policy and low timber availability for harvest from national forests were thought to be creating problems for the logging sector by 18 percent of the respondents. Likewise, 8 percent noted economic downturn as a problem while others indicated lack of public land management, high maintenance costs, and weight

restrictions on roads as barriers for promoting the logging business within the state.

Effect of recent mill closures on business

In light of a number of mill closures in Michigan in the last decade, the primary mills in our survey were asked to indicate what kind of impact this has exerted on their business. Though many mills stated that they have not been affected much by the mill closures, some noted reduced competition for raw materials leading to increased availability at lower prices. Others expressed concern for the logging sector and were worried about its impact on their business in the long run.

Discussion and Conclusion

Despite possessing large forest acreage (19.8 million acres) and having a high net annual growth, Michigan's primary forest products industry has declined in recent years (Leefer and Vasievich 2010). Our survey results indicate that the state's primary mills are operating below their maximum capacity. The operating capacity of primary mills has declined by 8 percentage points from 2007 to 2008 indicating the hardship that this sector is experiencing. Given this situation, stabilizing Michigan's forest products industry and providing new opportunities for them is of great concern to policy makers, economic development agencies, and forest management organizations. The emerging bioenergy market could provide new opportunities for forest products industries to regain their vitality and strengthen their business. However, there is concern that wood availability to meet the feedstock demands of new and existing facilities could become a challenge in the future. Private woodlands are by far the major suppliers of raw materials for primary forest products industry in Michigan, contributing approximately 40 percent of the total wood used by these facilities in 2007. The composition of this ownership group, however, is constantly changing with a larger number of forest owners holding smaller forest area in recent decades (Butler and Leatherberry 2004), making it difficult to carry out profitable harvesting operations. Also, the majority of the private forest owners emphasize amenity benefits from their forests more than they do financial returns (Leatherberry et al. 1998, Peterson and Potter-Witter 2006, Mueller and Potter-Witter 2010). Future timber sales from smaller woodlands are thus likely to be less intensive, yielding less timber per acre (Rickenbach et al. 2005). The lack of interest in active forest management among private forest owners (Damery et al. 2009) coupled with reduced

Table 5.—Opinion of Michigan's primary mills toward the use of different wood types by possible new wood-using facilities within their wood basket.

Type of wood use	Median response		χ^2 value	P value
	Large mills	Small mills		
Roundwood	Neutral	Desirable	0.001	0.973
Nonmerchantable timber	Desirable	Desirable	0.009	0.922
Forest residue	Neutral	Desirable	0.000	0.988
Mill residue	Neutral	Desirable	0.387	0.534

Table 6.—Strategies adopted by Michigan mills to improve their wood supply or reduce costs.

Strategies adopted by Michigan mills to improve their business	% of respondents
Increasing efficiency of mills	27
Improving communication with landowners and loggers	20
No specific strategy adopted so far	14
Purchasing wood at lower cost and using lower quality material	12
Cutting back on production	6
Diversifying products	6
Lobbying for more timber removal from public lands	6
Exploring new market opportunities	4
Releasing employees to cut back cost	4
Importing Canadian timber	2

harvesting levels from smaller tracts of forests could become a major hindrance for the smooth functioning of forest products industries in the future. Also, limited harvesting from public forests is a matter of concern for forest products industries within the state. This is evident from the high growth to removals ratio on public lands. Some of the respondent mills in our survey have already started lobbying for increased harvesting from public lands.

The findings of our study suggest that primary mills have a positive attitude toward the introduction of wood-to-energy facilities in Michigan. Though primary mills viewed both hardwood and softwood sawmilling facilities as competition, and hence were against the opening of such facilities in their wood basket, they were in favor of introducing wood-to-energy facilities in their operating area. The smaller-sized mills responded that they could also benefit from the opening of additional pulp and paper mills in their wood basket. Management for high-quality sawtimber to supply Michigan's numerous sawmills has historically depended upon markets for small diameter, lower quality wood to make timber stand improvement (e.g., thinning and sanitation harvests) profitable. This could be a potential reason for small mills preference for pulp and paper facilities. Large mills, however, were not supportive of such facilities, and a possible reason could be the perceived competition for raw materials identified by these mills. A number of primary mills indicated that they were working to improve equipment and operations efficiency and seeking to diversify their products.

The larger-sized mills viewed forest residues, mill residues, and nonmerchantable timber as desired wood-use types for new operations over conventional roundwood. This is logical since it does not increase competition for the existing facilities. However, concerned parties should be cognizant of existing harvesting equipment being tailored for working with high value sawlogs and roundwood products and not with harvesting residues and small-diameter trees (Damery et al. 2009). It is likely to take some time before harvesting residues and nonmerchantable timber can be used for generating energy on a large scale. In the mean time, exploring the equipment configurations and investment markets for financing the needs of forest products industry across the state seems necessary to ensure the increased use of these resources in the future. Also, almost all wood residue generated at present is already utilized by the mills themselves or sold to others for manufacturing purposes, leaving little for use by new bioenergy facilities. Hence, mill residues are less likely to form a significant source of raw material for bioenergy facilities unless current mill operations increase significantly in the future. Advances in harvesting equipment and methods and transportation infrastructure could promote the recovery and use of new sources of biomass to some extent.

Hardwood species, particularly aspen, were found to be the major source of pulpwood in the state and the stumpage prices of hardwood species in general were much lower compared with those of softwood species. Therefore, hardwood species seem to be more desirable for bioenergy purposes, at least in the short run. Since pulpwood and bioenergy facilities are likely to require similar feedstocks for their operations, the location of wood to energy facilities near areas providing high pulpwood volume could be beneficial. Alternatively, this could increase competition for the state's pulp and paper industry and may have unintended

impacts if sufficient resources are not made available for all uses. Despite the promising outlook for wood-based bioenergy in Michigan, there are other important issues that need consideration for ensuring the stability of the existing forest products industry and promoting new facilities in the future. Feedback from existing mills suggests that the most pressing issues are increasing harvest levels from private and public lands, improving communication with landowners and loggers, retaining existing logging firms, and improving operating efficiency.

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