

Michigan Woody Biomass Supply Snapshot
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Executive Summary

In 2009, the Michigan Economic Development Corporation distributed \$1.4 million in funding from the U.S. Department of Energy to create the Forestry Biofuel Statewide Collaborative Center (FBSCC). The goal of the FBSCC is to “find solutions to the complex problem of supplying woody feedstocks to the bioenergy industry for the production of renewable energy, chemicals, and fuels, such as ethanol” (Forestry Biofuel Statewide Collaborative Center, 2009). Specifically, this report was commissioned to identify woody biomass supply and availability throughout the State of Michigan.

Michigan contains approximately 19.3 million acres of timber land which is capable of producing wood biomass for industrial purposes (Forest Inventory and Analysis, 2009). The majority (63.4%) of this land is owned by private individuals, followed by the state and local government (23.1%) and the remaining 13.4% is under the ownership of the federal government (Figure 1) (Forest Inventory and Analysis, 2005-2009). Michigan timberland grows 763 million cubic feet of live trees annually of which 378 million cubic feet is removed, leaving 385 million cubic feet of accumulated growth on timberland across the state (Table 1) (Forest Inventory and Analysis, 2000-2004 to 2005-2009).

Wood removals from Michigan timberlands are determined in part by government agency planning and by the state, regional and international timber markets. National and State forests utilize written management plans which specify removal targets as well as limits to removals on certain timberland or types of timberland. Private timberlands include corporate, tribal, Real-Estate Investment Trusts (REITs), timber management organizations (TIMOs) and non-industrial private forest ownership (NIPF). Timberland in TIMO ownership is guided by forest management plans in which timber markets are a large factor. Most NIPF lands are not managed according to an explicit management plan and harvest on these lands are determined by owner preferences, beliefs and attitudes much more than timber markets.

A 2008 survey of Michigan logging firms indicate that the logging firms were running at 82% capacity in 2007 (G.C. and Potter-Witter, unpublished data). Of these firms, 75% were willing to expand their operations. Logging firm owners said that they were generally supportive of new wood product industries with the exception of particleboard manufacturing (G.C. and Potter-Witter, unpublished data). In the same survey, 83% of the respondent loggers reported leaving harvest residue on site (G.C. and Potter-Witter).

As much as 95.7 million cubic feet of the logging residue is currently being removed from MI forests (Timber Product Output reports, 1996, 2001, 2006) and our assumption is that this amount may be available to those willing to collect and process it in the future as well, if not increase. Re-tooling or further capital development may be necessary in order to access this resource (Peterson, 2005). However, if Michigan woody-biomass retention

guidelines are followed (Michigan Department of Natural Resources and Environment, 2010), which suggest an average retention of 25%, this number is reduced to 71.8 million cubic feet (Table 1).

There are approximately 315 primary manufacturing facilities and 1294 secondary manufacturing facilities in Michigan (Michigan DNR, 2010). A 2009 survey of the MI primary mills revealed that these facilities operated at an average of 71% capacity in 2007 (G.C. and Potter-Witter 2010, unpublished data). This dropped to 63% in 2008 (G.C. and Potter-Witter 2010, unpublished data). Michigan contains many small mill operations and a few key large ones (G.C. and Potter-Witter 2010, unpublished data). If market conditions improve, current producers said that they are willing and able to increase the output.

An estimated 115.1 million cubic feet of mill residue (bark and wood) is produced annually within the state (Timber Product Output Reports 1996, 2001, 2006). The vast majority (99%) of this resource is currently utilized, however an estimated 1.6 million cubic feet of mill residue remains unused (Table 1) (Timber Product Output Reports 1996, 2001, 2006). Prices for these residues range from \$26-32 per green ton (Kuipers and Potter-Witter 2010, unpublished data).

Availability of wood fiber resources depend on many factors such as landowners' willingness or plans to harvest, accessibility of the resource, and market conditions. These challenges may be mitigated through targeted market facilitation and outreach programs. Regardless, current estimates indicate that Michigan has as much as 458.2 million cubic feet of unused annual growth and residues (Table 1). This number represents a snapshot in time of Michigan's woody-biomass resource. As demand changes and Michigan's wood product industry develops new uses, this number is likely to change.

Introduction

Forest land covers approximately 54% of Michigan's land area (Forest Inventory and Analysis, 2009). Of this forest land, 19.3 million acres are capable of producing more than 20 ft³ per acre of industrial wood resource a year and are known as "timberlands" (Forest Inventory and Analysis, 2009). The majority of these timberlands (63.4%) are under private ownership followed by the state and the local government as well as the federal government (Figure 1) (Forest Inventory and Analysis, 2005-2009).

The Federal government maintains and manages 2.6 million acres of timberland in Michigan (Table 2). The vast majority is controlled and managed by the Forest Service, with the remainder in National Park Service, Fish and Wildlife Service or other federal agencies (Forest Inventory and Analysis, 2005-2009). There are three national forests in the State of Michigan. The Ottawa National Forest contains 1.0 million acres of land in the Western Upper Peninsula (WUP) of which 488.0 thousand acres is available for timber production (Table 3) (Ottawa National Forest Land and Resource Management Plan, 2006). The Hiawatha National Forest is split into two units within the Eastern Upper Peninsula (EUP). The forest comprises 1.3 million acres of land of which 578.5 thousand acres is available for timber production (Hiawatha National Forest Plan, 2006). The Huron-

Manistee Forest is split into two units in the Northern Lower Peninsula (NLP). This forest is 976.0 thousand acres in area of which 401.1 thousand acres are available for timber production (Huron-Manistee National Forest Land and Resource Management Plan, 2006).

The State of Michigan and local governments actively manage a network of timberlands that cover an area of 4.5 million acres (Table 2) (Forest Inventory and Analysis, 2005-2009). The state of Michigan manages the largest dedicated state forest system in the nation with 3.9 million acres (Michigan State Forest Management Plan, 2008). There are 797.8 thousand acres of timberland managed by state and local governments in the WUP, 1141.8 thousand acres in the EUP, a total of 2,027.0 thousand in the NLP and 492.7 thousand acres in the Southern Lower Peninsula (SLP) (Table 2).

The majority of Michigan timberland is owned by private individuals and corporations. These owners manage 12.2 million acres or 63.4% of timberland in the State (Table 2) (Forest Inventory and Analysis, 2005-2009). Private forest owners control approximately 3.0 million acres of land in the WUP, 2.1 million acres in the EUP, 4.3 million acres in the NLP, and 2.8 million acres in the SLP. These landowners have purchased and manage their land for a variety of reasons which can be difficult to determine or predict and are discussed below.

Growth and Removals in MI timberlands

The average annual net growth of wood in Michigan timberlands is 763.2 million cubic feet of live trees (all trees at least one inch in diameter), of which 378.4 million cubic feet is removed, leaving an unutilized resource of approximately 384.8 million cubic feet per year (Table 4) (Forest Inventory and Analysis, 2000-2004 to 2005-2009). The NLP has the largest annual net growth at 320.5 million cubic feet of live trees whereas the EUP has the lowest at 115.6 million cubic feet annually. The WUP removes the largest percentage of net growth at 83.3 % or an annual volume of 108.1 million cubic feet, whereas the SLP removes the lowest percentage at 29.9% or 59.1 million cubic feet (Table 4).

The USDA Forest Service manages its 2.6 million acres of forest land for multiple uses. Specific amounts of this acreage have been set aside for habitat restoration, unique ecosystem preservation, or recreation. Each national forest in Michigan has a specific limit of allowable harvest which is detailed in their management plans. The Ottawa National Forest has determined that a long-term sustainable annual harvest will not exceed 134,500 MBF (thousand board feet) per year (Table 5) (Ottawa National Forest Land and Resource Management Plan, 2006). The Hiawatha National Forest has determined a long-term annual yield of 108,516 MBF/year (Hiawatha National Forest Land and Resource Management Plan, 2006). The Huron-Manistee national forest allowable long-term annual harvest will not exceed 91,000 MBF/year (Huron-Manistee National Forest Land and Resource Management Plan, 2006). Combined allowable annual harvest volume of pulpwood and sawtimber from these national forests totals 334,016 MBF/year or, using a conversion of one thousand board feet equals 158 cubic feet (Leatherberry and Spencer, 1993) approximately 52.8 million cubic feet. Current annual harvests of 19.1 million cubic feet of live trees (Forest Inventory and Analysis, 2000-2004 to 2005-2009) indicate that

allowable harvests are not reached. The national forests are currently harvesting only 36% of their stated allowable sale quantity and an additional 33.7 million cubic feet of wood resources are available as determined by allowed removals on these forests (Table 5). Current growth to removals ratio of all live trees in Michigan national forests is 4.43 indicating that the growth is more than four times the removals in these forests (Table 5) (Forest Inventory and Analysis, 2000-2004 to 2005-2009).

The Michigan Department of Natural Resources and Environment has a target of 53,000 acres of timberland offered for sale from the state forests annually (Cara Boucher, personal communication, 2010). Each year, the state forest grows on average 123.8 million cubic feet of live trees (Forest Inventory and Analysis, 2000-2004 to 2005-2009). Of this volume, 61.4 million cubic feet is removed, leaving 62.4 million cubic feet of growth in excess of removals (Table 6) (Forest Inventory and Analysis, 2000-2004 to 2005-2009). Average annual growth on state forest in the WUP is 16.9 million cubic feet, of which 11.5 million cubic feet is removed (Forest Inventory and Analysis, 2000-2004 to 2005-2009). In the EUP, 21.8 million cubic feet is grown of which 14.7 million cubic feet is removed and in the NLP, 67.3 million cubic feet is grown, of which 33.1 million cubic feet is removed (Forest Inventory and Analysis, 2000-2004 to 2005-2009). In the SLP, 17.9 million cubic feet is grown, of which 2.0 million cubic feet is removed (Forest Inventory and Analysis, 2000-2004 to 2005-2009). The WUP removes the highest percentage of annual growth from the state forests at 68.0%, the EUP removes 67.4%, the NLP 49.2% and the SLP 11.2% respectively (Forest Inventory and Analysis, 2000-2004 to 2005-2009). Current growth to removals ratio of all live trees in these state forests by region is presented in table 6.

Private lands grow an estimated 533.7 million cubic feet of live trees annually (Table 7) (Forest Inventory and Analysis, 2000-2004 to 2005-2009). This equals 69.9% of all annual growth across the state of Michigan. Of this growth, 255.7 million cubic feet of live tree volume is removed annually retaining a growth of 278.0 million cubic feet of unused wood resources (Forest Inventory and Analysis, 2000-2004 to 2005-2009). Approximately 10.4 million cubic feet of unused wood fiber is located in the WUP, 12.9 million cubic feet in the EUP, 125.2 million cubic feet in the NLP, and 129.4 million cubic feet in the SLP respectively. Current growth to removals ratio of all live trees in private forests indicate that the lower peninsula grows substantially more wood than is removed compared to the upper peninsula (Table 7).

Factors affecting wood harvest

Management plans are regularly developed for national and state forest lands. These plans dictate harvest expectations and allowable removals. For the most part, these plans are static and any changes must occur during the planning process. For all intents and purposes, the allowable or predicted harvest limits is what is presented.

In 2007, nonindustrial private forest lands formed the major source of wood supply for Michigan's primary forest products industry. They supplied 28 to 47 percent of the wood used by the primary mills in different geographic regions of the state (Table 8) (G.C. and

Potter-Witter 2010, unpublished data). With respect to harvesting decisions, private landowners' behavior tends to be more variable as many different factors affect their willingness to cut timber. Much research has been dedicated to determine factors which increase a landowner's likelihood of conducting timber harvests. Suggested factors include size of forest parcel (Straka et al., 1984; Cleaves and Bennett, 1995; Mueller and Potter-Witter, 2010 unpublished data), primary residence (Conway et al., 2003; Vokoun et al., 2006; Mueller and Potter-Witter, unpublished data), use for hunting (Conway et al., 2003) and participation in ownership associations and government incentive programs (Potter-Witter, 2005).

Specific to Michigan, Mueller and Potter-Witter analyzed a survey of 457 non-industrial private forest owners conducted in 2003 (unpublished data). Demographic factors, such as age, gender, and socio-economic status are not significant in determining management practices (Peterson and Potter-Witter, 2006; Mueller and Potter-Witter, 2010 unpublished data).

The EUP contains the largest average parcels, and more respondents in this region have harvested timber (Figure 2) (Mueller and Potter-Witter, 2010 unpublished data). The SLP contains the least amount of respondents who have harvested timber in the past. Additionally, the SLP contains a larger degree of small forest parcels and higher association with agriculture. SLP residents are less often absent from their forested parcel compared to other regions. WUP and NLP respondents live an average of 103 and 83 miles from their nearest parcel respectively.

NIPF landowners across the state tend to cite non-economic factors as most important reason for owning the forested land (Mueller and Potter-Witter, 2010 unpublished data). The most frequently cited reasons for owning forest land are "to enjoy beauty or scenery", "to protect nature and biologic diversity", "as part of my home, vacation home, farm, or ranch", "for privacy", or "for hunting or fishing" (Table 9) (Mueller and Potter-Witter, 2010 unpublished data).

Landowners in the EUP and NLP tend to consider hunting and fishing "very important" reasons for owning their property while those in the SLP consider protecting nature and biologic diversity as more important reasons than counterparts in other regions (Mueller and Potter-Witter, 2010 unpublished data).

Reasons for owning forestland commonly affect motivations for and decisions to conduct forest management operations (Janota and Broussard, 2008). Further, reasons for forest ownership may influence response to programs and policies (Mueller and Potter-Witter, unpublished data). Certain landowner sub-populations may exist who consider timber management more important than others. Knowing where these landowners exist and how to reach them could provide opportunities for increased harvest levels.

Michigan Forest Harvest Operations

The availability of woody biomass is determined to a large extent by the capacity of the logging sector and forest products industry within the state. Logging firms are responsible for commercial harvest of timber and form a bridge between forest resources and wood based industries. They not only help meet society's demand for wood products, but also assist forest owners in realizing varied management objectives. During this course, loggers shape the structure and composition of forests determining not only present, but also future productivity of the regions' forests (Rickenbach et al. 2005). Hence, they play an indispensable role in the maintenance of overall forest health and productivity.

Identifying the status of existing forest products sector, their strengths, limitations, and the challenges they face are critical for exploring both current and future role of these sectors in bioenergy supply chain. To understand this, a mail survey of all MI logging firms and primary forest products industry was conducted in the fall of 2008, and spring of 2009 respectively using the Tailored Design Method by Dillman (2000). The overall response rates were 33% for the mill survey and 12% for the loggers' survey.

Harvesting Capacity

If timber harvests are to be increased or if the recovery of logging residues is to be expanded, it is necessary to produce the increased output. A 2008 survey of Michigan loggers estimates that logging firms in Michigan operated at 82% capacity in 2007 (G.C. and Potter-Witter, 2010 unpublished data). This indicates that firms could respond to a demand for higher timber output. Additionally, 75% of the firms indicated a willingness to expand their operations if market conditions were favorable. Loggers in general indicated support for any new wood using firm with the exception of particleboard or other panel manufacturing (Table 10).

In the same survey, 83% of respondents indicated leaving logging residues on site (G.C. and Potter-Witter, 2010 unpublished data). This data suggests the lack of a developed market for accepting harvest residues. Additionally, Michigan has recently experienced a series of mill closures (Korpi, 2010, Leefers and Vasievich, 2010). Across the state, 49% of the logging firms claimed their business has remained unaffected while others said that they have been forced to travel larger distances, downsize, or restructure to avoid closure (G.C. and Potter-Witter, 2010 unpublished data). Due to limited sample size this information cannot be broken into sub-regions.

Harvest Residue

Harvest residue is debris, slash, mostly tops limbs and unmerchantable timber left on-site following a harvesting operation. Currently, Michigan has few facilities willing to process or accept harvest residues (Kuipers and Potter-Witter, 2010 unpublished data). Across the state, an estimated 95.7 million cubic feet of logging residue is removed annually (Table 11) (Timber Product Output Reports, 1996, 2001, and 2006). A total of 21.7 million cubic feet of this resource is removed from the EUP, 33.8 million cubic feet from the WUP, 33.3 million cubic feet from the NLP, and 6.9 million cubic feet from the SLP.

The Michigan Department of Natural Resources and Environment has developed woody biomass harvesting guidelines (2010). While not required, these guidelines are suggested best management practices. Current guidelines recommend retaining between 1/3 and 1/6 of logging residues to ensure site sustainability. If an average retention of 25% is assumed, the availability of logging residue is reduced from 95.7 million cubic feet to 71.8 million cubic feet (Table 11).

Another limitation to the collection of harvest residues is the capacity of current operations to do so. Cut-to-length operations may face considerable costs in attempts to collect residues (Peterson, 2005). Harvesting equipment is currently configured for working with high value sawlogs and pulpwood and not designed for handling small-diameter trees and residue (Damery et al., 2009). Some degree of change will be necessary in order to collect and utilize residues left by harvest operations, especially for cut-to-length operating systems.

Specific information regarding the distribution of logging residue and equipment configurations in use across the state of Michigan should be available through a 2010 statewide logger survey (Dalia Abbas, personal communication, 2010).

Challenges faced by the logging sector

The loggers surveyed indicated several challenges to increasing timber output. High stumpage and low mill prices have been suggested as major barriers to expansion (Table 12) (G.C. and Potter-Witter, 2010 unpublished data). Timber availability especially that from federal lands was named by 11 percent as a limiting factor to increased production (G.C. and Potter-Witter, 2010 unpublished data).

As indicated, most harvest operators (75%) are willing to expand and re-tool under favorable market conditions (G.C. and Potter-Witter, 2010 unpublished data). Investment capital will be necessary in conjunction with market conditions in order for producers to expand and purchase new equipment, especially if forced to change harvest practices. If this is unavailable, it may be exceedingly difficult to create new markets. As such, it may be important to examine or encourage credit and loan availability where markets are desired.

Michigan Mills and Processing

Wood product processing facilities are found throughout the state of Michigan (Table 13). A 2009 survey of Michigan primary mills (G.C. and Potter-Witter, 2010 unpublished data) indicates that the state's forest product industry is operating beneath capacity. Survey results show that in 2007, mills operated on average at 71% capacity (Figure 3). In 2008, this number dropped to 63%. The Eastern Upper Peninsula and the Southern Lower Peninsula were reported as being hardest hit by reductions in capacity.

Forty-six percent of the respondent mills said that they employ five or less individuals whereas 10% of mills have more than 100 employees (Figure 4) (G.C. and Potter-Witter,

2010 unpublished data). More mills are found throughout the NLP and SLP, but a smaller amount of these are primary processing facilities, especially in regards to the SLP (Table 13) (Michigan DNRE, 2010).

Mill Residue

The USDA Timber Product Output report estimates that Michigan produces 115.1 million cubic feet of mill residue annually (Table 14) (Timber product output reports 1996, 2001, and 2006). Of this volume, approximately 1.6 million cubic feet (or 1%) goes unused at present (Timber product output reports 1996, 2001, and 2006). Of the small amount of unutilized residue, 0.04 million cubic feet is located in the EUP, 1.0 million cubic feet in the WUP, 0.5 million cubic feet in the NLP, and 0.1 million cubic feet in the SLP respectively (Timber product output report, 1996, 2001, and 2006).

According to the 2009 survey of Michigan primary mills, 97% of the mill residue generated in 2007 by the primary mills was utilized in some way or the other. Approximately 61% of the mill residue was sold to outside sources and 36% retained by the producers for fuel (G.C. and Potter-Witter, 2010 unpublished data). All these information suggest that a large supply of waste material is already utilized in Michigan.

Current data indicates pellet manufacturers and other biomass industries in Michigan will all utilize mill residue (Kuipers and Potter-Witter, 2010 unpublished data). Many secondary producers view mill residue as an ideal component to their product as it is generally free of bark and dirt. However, limited availability of these materials could be a constraint for their expanded use in the future. Current prices for mill residue range from \$28-32 for green chips used in paper mills, or \$26-30 specific to pellet mills (Kuipers and Potter-Witter, unpublished data).

Competition

Current industry sees competition, reduced supplies from fewer timber sales and high resource prices as challenges in Michigan's economic environment. Some primary forest products industry have adopted strategies including diversifying products, improving communication with landowners and loggers, and lobbying for more timber removals on public land. Further mills have cut costs by releasing employees lowering the purchase price of raw materials, increasing efficiency etc. (Table 15) (G.C. and Potter-Witter, 2010 unpublished data).

Michigan mills had 59% of their wood delivered from within a 60 mile radius of their facility (Table 16) (G.C. and Potter-Witter, 2010 unpublished data). Competition may be steeper in situations where two mills are situated within each other's supply areas. In some cases, primary forest products industry indicated recent mill closures have reduced competition for wood. Regardless, many producers view the addition of forest or mill residue utilizing facilities as positive (Table 17) (G.C. and Potter-Witter, 2010 unpublished data). As such, while competition is an issue in the current market, there is room for those willing to utilize residue from current facilities to create bioenergy products.

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Tables and Figures

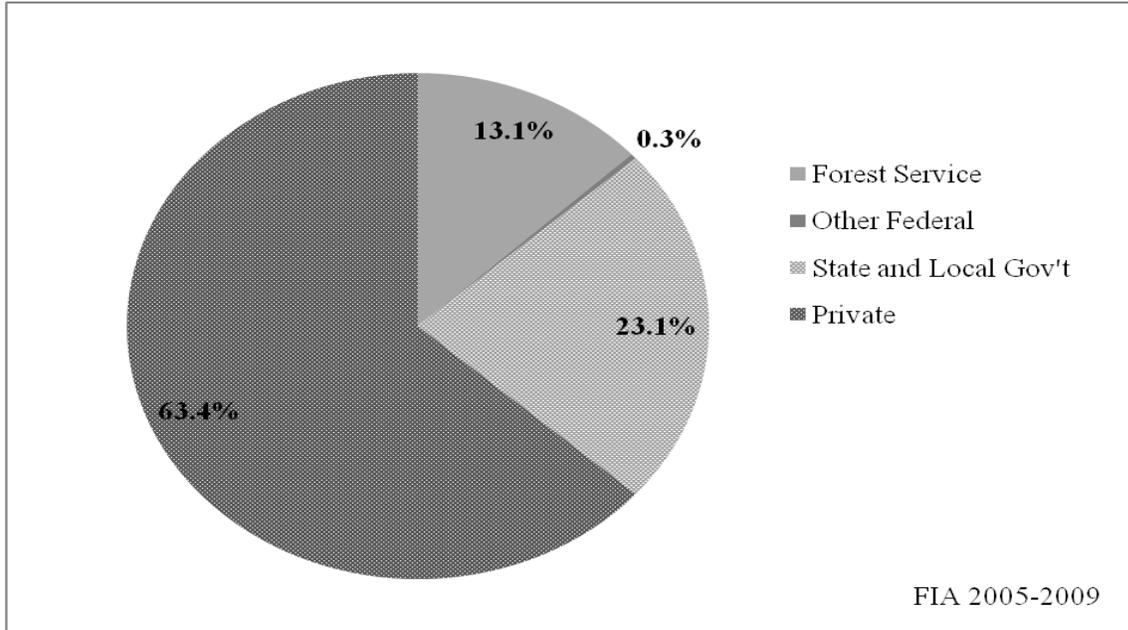


Figure 1. Percentage of Michigan timberland under each ownership group.
Source (FIA 2005-2009)

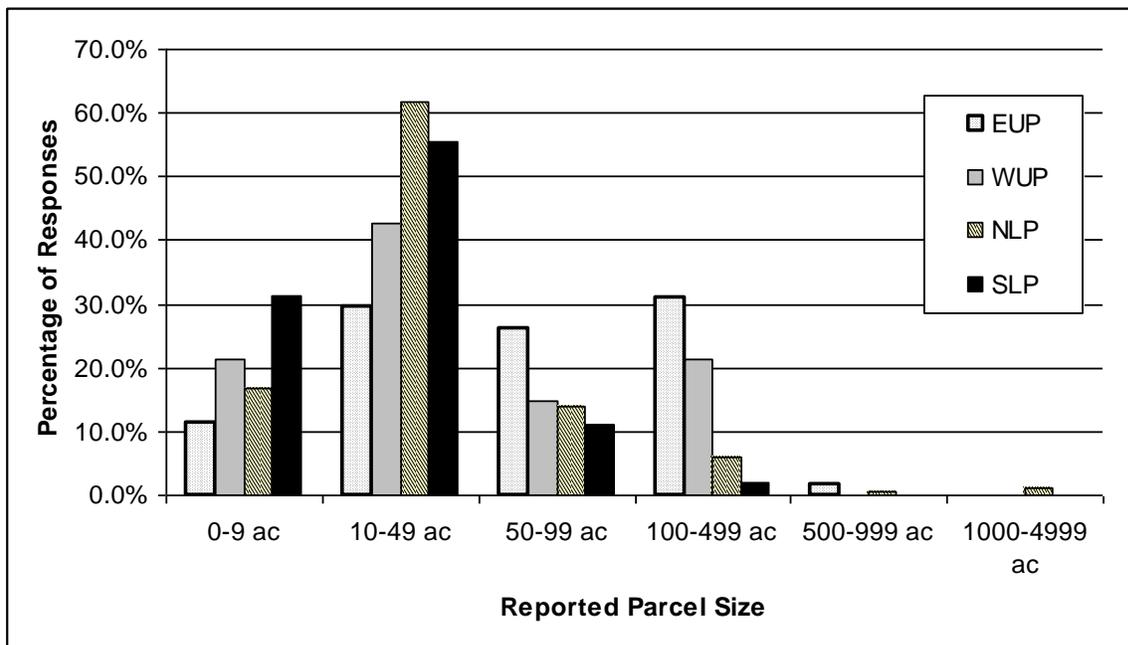


Figure 2. Forest parcel size, percent of respondents, by region from 2003 landowner survey.
Source: (Nonindustrial Private Forest Owner Survey, 2003)

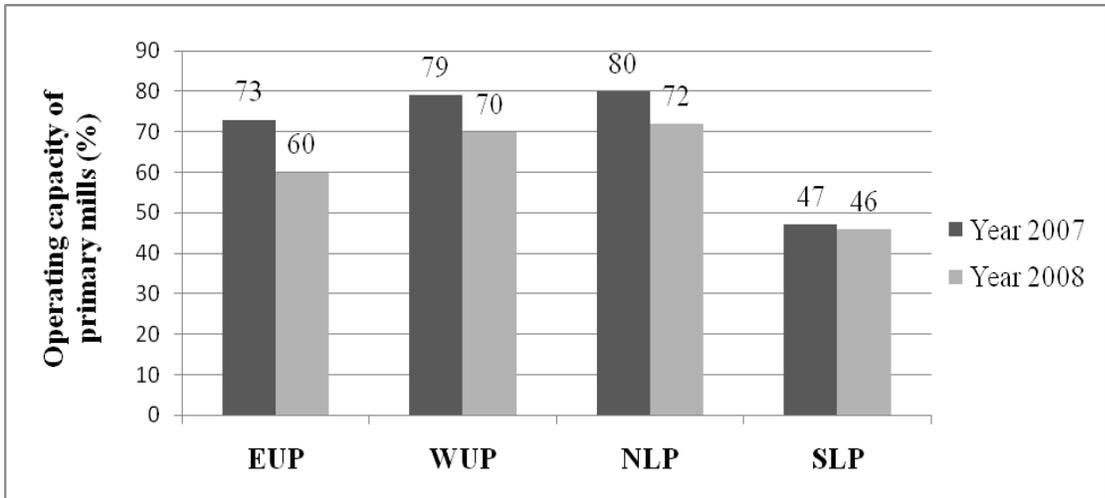


Figure 3. Operating capacity of MI primary mills in percent, by year and region.
 Source: (Michigan Primary Mills Survey, 2009)

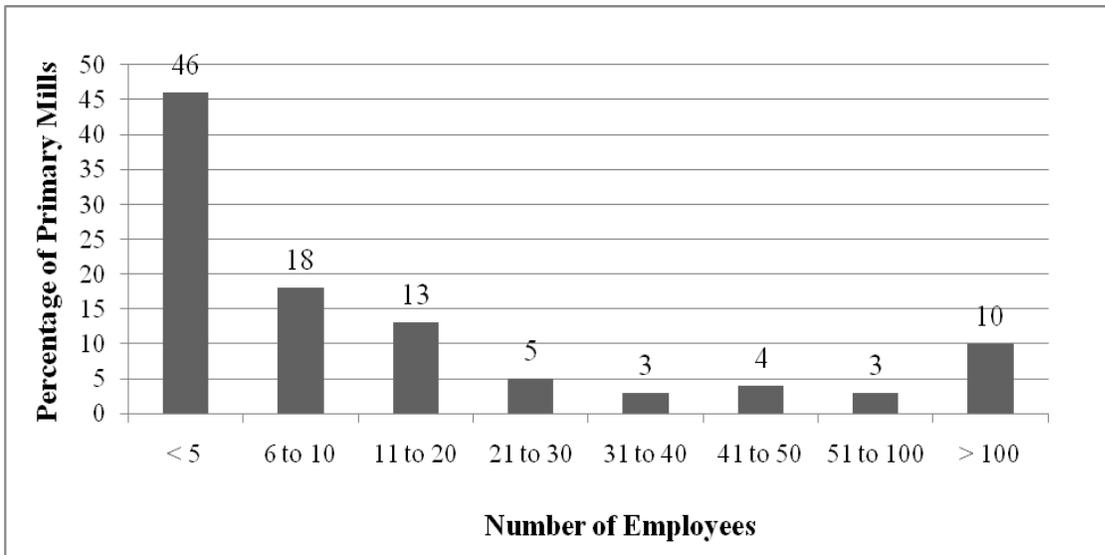


Figure 4. Number of employees employed by MI primary mills in 2007.
 Source: (Michigan Primary Mills Survey, 2009)

Table 1. Unused wood biomass volume, in million cubic feet, by source.

| Biomass Resource | | | | | | | Total Available volume (Unused growth + recoverable logging residue + unused mill residue) |
|-----------------------------------------|---------------------------------------|---------------|-------------------------------------------------|-----------------------------------------------------------------|----------------------|---------------------|-----------------------------------------------------------------------------------------------|
| Average annual net growth of live trees | Average annual removals of live trees | Unused growth | Average logging residue removed from MI forests | Logging residue that can be recovered after retaining 25% of it | Average mill residue | Unused mill residue | |
| Million Cubic Feet | | | | | | | |
| 763.2 | 378.4 | 384.8 | 95.7 | 71.8 | 115.1 | 1.6 | 458.2 |

Source:

Unused Growth (FIA 2000-2009)

Logging Residue (TPO Reports 1996, 2001, 2006 and MI woody biomass retention guidelines, DNRE 2010)

Unused Mill Residue (TPO Reports 1996, 2001, 2006)

Table 2. MI timberland, in acres, by region and ownership.

| Region | Ownership | | | | | | | | |
|--------------------------|------------------|-------------|---------------|------------|----------------------------|-------------|-------------------|-------------|-------------------|
| | Forest Service | | Other Federal | | State and Local Government | | Private | | Total |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | acres |
| Western Upper Peninsula | 864,558 | 18.6 | 6,112 | 0.1 | 797,813 | 17.1 | 2,991,017 | 64.2 | 4,659,500 |
| Eastern Upper Peninsula | 780,653 | 19.3 | 31,186 | 0.8 | 1,141,790 | 28.2 | 2,101,318 | 51.8 | 4,054,947 |
| Northern Lower Peninsula | 867,615 | 12.0 | 23,087 | 0.3 | 2,026,968 | 28.1 | 4,307,223 | 59.6 | 7,224,893 |
| Southern Lower Peninsula | 13,397 | 0.4 | 6,778 | 0.2 | 492,669 | 14.7 | 2,836,484 | 84.7 | 3,349,328 |
| Total | 2,526,222 | 13.1 | 67,163 | 0.3 | 4,459,240 | 23.1 | 12,236,043 | 63.4 | 19,288,668 |

Source: FIA (2005-2009)

Table 3. Total land, timberland, and land open to timber harvest, in thousands of acres, on Michigan national forests.

| National Forest | Total Land | Timberland | Open to timber harvest |
|--------------------------------|------------------------|---------------|------------------------|
| | Thousand Acres of Land | | |
| Ottawa National Forest | 1,000.0 | 864.6 | 488.0 |
| Hiawatha National Forest | 1,300.0 | 780.6 | 578.5 |
| Huron-Manistee National Forest | 976.0 | 867.6 | 401.1 |
| Total | 3,276.0 | 2512.8 | 1,467.6 |

Source:

Ottawa National Forest Land and Resource Management Plan, 2006

Hiawatha National Forest Plan, 2006

Huron-Manistee National Forest Land and Resource Management Plan, 2006

FIA (2005-2009)

Table 4. Growth and removals in MI timberland (million cubic feet) by region.

| Region | Average annual net growth of live trees | Average annual removals of live trees | Growth in excess of removals | Growth to removals ratio |
|--------------------------|-----------------------------------------|---------------------------------------|------------------------------|--------------------------|
| | Million Cubic Feet | | | |
| Western Upper Peninsula | 129.7 | 108.1 | 21.6 | 1.2 |
| Eastern Upper Peninsula | 115.6 | 77.6 | 38.0 | 1.5 |
| Northern Lower Peninsula | 320.5 | 133.6 | 186.9 | 2.4 |
| Southern Lower Peninsula | 197.4 | 59.1 | 138.3 | 3.3 |
| Total | 763.2 | 378.4 | 384.8 | 2.0 |

Source: FIA (2000-2004 & 2005-2009)

Table 5. Allowable annual removals, in thousand board feet (MBF) and million cubic feet, annual removals, in million cubic feet, and calculated difference, in million cubic feet, on Michigan national forests.

| National Forest | Allowable sale quantity per year | Allowable sale quantity per year | Average annual removals of live trees | Difference (Allowable sale quantity-average annual removals) | Average annual net growth of live trees | Current growth to removals ratio of live trees |
|--------------------------------|----------------------------------|----------------------------------|---------------------------------------|--------------------------------------------------------------|-----------------------------------------|------------------------------------------------|
| | MBF | Million cubic feet | Million cubic feet | Million cubic feet | Million cubic feet | |
| Hiawatha National Forest | 108,516 | 17.1 | 7.4 | 9.7 | 26.4 | 3.6 |
| Ottawa National Forest | 134,500 | 21.3 | 8.8 | 12.5 | 21.0 | 2.4 |
| Huron-Manistee National Forest | 91,000 | 14.4 | 2.9 | 11.5 | 36.9 | 12.7 |
| Total | 334,016 | 52.8 | 19.1 | 33.7 | 84.3 | 4.4 |

Source:

Ottawa National Forest Land and Resource Management Plan, 2006

Hiawatha National Forest Plan, 2006

Huron-Manistee National Forest Land and Resource Management Plan, 2006

FIA (2000-2004 & 2005-2009)

Table 6. Growth and removals, in million cubic feet, on state forests of Michigan by region.

| Region | Average annual net growth of live trees | Average annual removals of live trees | Growth in excess of removals | Current growth to removals ratio of live trees |
|--------------------------|-----------------------------------------|---------------------------------------|------------------------------|------------------------------------------------|
| | Million Cubic Feet | | | |
| Western Upper Peninsula | 16.9 | 11.5 | 5.4 | 1.5 |
| Eastern Upper Peninsula | 21.8 | 14.7 | 7.1 | 1.5 |
| Northern Lower Peninsula | 67.3 | 33.1 | 34.2 | 2.0 |
| Southern Lower Peninsula | 17.9 | 2.0 | 15.9 | 9.0 |
| Statewide Total | 123.8 | 61.4 | 62.4 | 2.0 |

Source: (FIA 2000-2004 & 2005-2009)

Table 7. Growth and removals, in million cubic feet, on MI private lands by region.

| Region | Average annual net growth of live trees | Average annual removals of live trees | Growth in excess of removals | Current growth to removals ratio of live trees |
|--------------------------|-----------------------------------------|---------------------------------------|------------------------------|------------------------------------------------|
| | Million Cubic Feet | | | |
| Western Upper Peninsula | 88.8 | 78.4 | 10.4 | 1.1 |
| Eastern Upper Peninsula | 65.9 | 53.0 | 12.9 | 1.2 |
| Northern Lower Peninsula | 210.3 | 85.1 | 125.2 | 2.5 |
| Southern Lower Peninsula | 168.8 | 39.2 | 129.4 | 4.3 |
| Statewide Total | 533.7 | 255.7 | 278.0 | 2.1 |

Source: (FIA 2000-2004 & 2005-2009)

Table 8. Amount of wood, in percent, delivered to MI primary mills from specified source, by region.

| Source | Region | | | |
|------------------------------------------------|-------------------------|-------------------------|--------------------------|--------------------------|
| | Eastern Upper Peninsula | Western Upper Peninsula | Northern Lower Peninsula | Southern Lower Peninsula |
| Outlying wood yards | 1% | 13% | 4% | 2% |
| Other forest products mills | 3% | 7% | 6% | 2% |
| Nonindustrial private forest lands | 37% | 28% | 47% | 41% |
| Real estate or timber management organizations | 10% | 28% | 6% | 2% |
| State forest lands | 26% | 12% | 9% | 0% |
| National forest lands | 9% | 5% | 3% | 0% |
| Others | 0% | 7% | 4% | 32% |

Source: (Michigan Primary Mills Survey, 2009)

Table 9. Reasons for owning private forested property, median importance, by region, from 2003 survey of landowners.

| Reason for owning forested land | Southern Lower Peninsula | Northern Lower Peninsula | Eastern Upper Peninsula | Western Upper Peninsula |
|--------------------------------------------------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|
| To enjoy beauty or scenery | Very Important | Very Important | Very Important | Very Important |
| To protect nature and biologic diversity | Very Important | Very Important | Somewhat Important | Very Important |
| For land investment | Somewhat Important | Somewhat Important | Somewhat Important | Somewhat Important |
| As part of my home, vacation home, farm, or ranch | Very Important | Very Important | Very Important | Very Important |
| For privacy | Very Important | Very Important | Very Important | Very Important |
| To pass land on to my children or other heirs | Somewhat Important | Somewhat Important | Somewhat Important | Somewhat Important |
| For cultivation/collection of non timber forest products | Neutral | Somewhat Unimportant | Neutral | Neutral |
| For production of firewood or biofuel (energy) | Neutral | Neutral | Neutral | Somewhat Unimportant |
| For production of sawlogs, pulpwood or other timber products | Somewhat Unimportant | Somewhat Unimportant | Neutral | Somewhat Unimportant |
| For hunting or fishing | Somewhat Important | Very Important | Very Important | Somewhat Important |
| For recreation, other than hunting or fishing | Somewhat Important | Somewhat Important | Somewhat Important | Somewhat Important |

Source: (Nonindustrial Private Forest Owner Survey, 2003)

Table 10. Loggers perception, by percent of responses, of the introduction of new wood-using firms in Michigan, from 2009 survey.

| Type of wood using firms | Percentage of respondents | | |
|---------------------------------------------|---------------------------|---------|-------------|
| | Desirable | Neutral | Undesirable |
| Hardwood Sawmill | 34% | 15% | 12% |
| Softwood Sawmill | 41% | 13% | 11% |
| Veneer Manufacturing | 28% | 19% | 6% |
| Pulp and Paper Manufacturing | 54% | 7% | 9% |
| Particle board or other panel manufacturing | 24% | 26% | 6% |
| OSB Manufacturing | 32% | 19% | 4% |
| Wood pellet fuels | 46% | 11% | 9% |
| Direct-fired Wood Power Generation | 39% | 13% | 10% |
| Wood-based Biofuel Manufacturing | 50% | 7% | 11% |

Source: (Michigan Logging Sector Survey, 2008)

Table 11. Harvest residue removed annually in million cubic feet, by region in Michigan.

| Region | Harvest Residue | DNRE Guideline Adjusted Residue |
|--------------------------|--------------------|---------------------------------|
| | Million Cubic Feet | Million Cubic Feet |
| Western Upper Peninsula | 33.8 | 25.4 |
| Eastern Upper Peninsula | 21.7 | 16.3 |
| Northern Lower Peninsula | 33.3 | 25.0 |
| Southern Lower Peninsula | 6.9 | 5.2 |
| Total | 95.7 | 71.8 |

Source:
TPO Reports 1996, 2001, 2006 and
MI woody biomass retention guidelines, DNRE 2010

Table 12. Challenges facing loggers in Michigan to increase in harvesting, percent of respondent, from 2009 survey.

| Challenges to increased harvesting in Michigan | Percent of respondents |
|-------------------------------------------------|------------------------|
| High stumpage price | 18% |
| Labor | 16% |
| Competition for stumpage | 13% |
| Insufficient Timber Supply | 11% |
| Insufficient sale from government owned forests | 11% |
| Fuel prices | 9% |
| Competition from big companies | 7% |
| Low mill price | 4% |
| Cost of doing business in MI | 4% |
| Poor road condition | 2% |
| Parcelization (property splits) | 2% |
| Financing for equipment | 2% |

Source: (Michigan Logging Sector Survey, 2008)

Table 13. Number of primary and secondary wood product manufacturers in Michigan by region.

| Region | Number of primary manufacturers | Number of secondary manufacturers |
|--------------------------|---------------------------------|-----------------------------------|
| Eastern Upper Peninsula | 41 | 62 |
| Western Upper Peninsula | 25 | 46 |
| Northern Lower Peninsula | 138 | 194 |
| Southern Lower Peninsula | 111 | 992 |
| Statewide Total | 315 | 1294 |

Source: (Michigan Department of Natural Resources and Environment, 2010)

Table 14. Mill residue produced by MI mills, in million cubic feet, by region.

| Region | Average mill residue produced (million cubic feet) |
|--------------------------|-------------------------------------------------------|
| Western Upper Peninsula | 32.4 |
| Eastern Upper Peninsula | 23.5 |
| Northern Lower Peninsula | 44.4 |
| Southern Lower Peninsula | 14.8 |
| Statewide Total | 115.1 |

TPO Reports 1996, 2001, 2006

Table 15. Strategies adopted by Michigan mills to promote business, percent of respondents, from 2009 survey.

| Strategies adopted by Michigan mills | Percent 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% |

Source: (Michigan Primary Mills Survey, 2009)

Table 16. Amount of wood delivered, percent, by distance from primary mills in Michigan regions, from 2009 survey

| Region | Less than 30 miles | 30 to 60 miles | 60 to 90 miles | 90 to 120 miles | 120 to 150 miles | Greater than 150 miles |
|--------------------------|---------------------------|----------------|----------------|-----------------|------------------|------------------------|
| | Percent of wood delivered | | | | | |
| Western Upper Peninsula | 43% | 31% | 17% | 7% | 2% | 1% |
| Eastern Upper Peninsula | 21% | 28% | 20% | 14% | 8% | 9% |
| Northern Lower Peninsula | 30% | 28% | 13% | 8% | 3% | 5% |
| Southern Lower Peninsula | 42% | 13% | 4% | 10% | 5% | 1% |

Source: (Michigan Primary Mills Survey, 2009)

Table 17. Mill owners perceptions of new facilities, in percent, in Michigan, from 2009 survey.

| Type of wood using firms | Percentage of the respondents | | |
|---------------------------------------------|-------------------------------|---------|-------------|
| | Desirable | Neutral | Undesirable |
| Hardwood sawmill | 13% | 15% | 51% |
| Softwood sawmill | 11% | 20% | 50% |
| Veneer manufacturing | 26% | 33% | 17% |
| Pulp & paper manufacturing | 39% | 16% | 30% |
| Particle board or other panel manufacturing | 34% | 20% | 29% |
| OSB manufacturing | 31% | 23% | 27% |
| Wood pellet fuels | 49% | 23% | 11% |
| Direct-fired wood power generation | 50% | 20% | 16% |
| Wood-based biofuel manufacturing | 51% | 16% | 16% |

Source: (Michigan Primary Mills Survey, 2009)