Michigan Department of Natural Resources

www.michigan.gov/dnr

FOREST PRODUCTS INDUSTRIES' ECONOMIC CONTRIBUTIONS TO MICHIGAN'S ECONOMY: 2016 UPDATE

Larry A. Leefers, Associate Professor Emeritus

Department of Forestry, Michigan State University

August 2016

Available online at www.michigan.gov/forestproducts

Forest Resources Division

IC4008-1 (08/23/2016)

MICHIGAN DEPARTMENT OF NATURAL RESOURCES MISSION STATEMENT

"The Michigan Department of Natural Resources is committed to the conservation, protection, management, use and enjoyment of the State's natural and cultural resources for current and future generations."

NATURAL RESOURCES COMMISSION STATEMENT

The Natural Resources Commission, as the governing body for the Michigan Department of Natural Resources, provides a strategic framework for the DNR to effectively manage your resources. The NRC holds monthly, public meetings throughout Michigan, working closely with its constituencies in establishing and improving natural resources management policy.

EXECUTIVE SUMMARY

At the Governor's 2013 Forest Products Summit, the Michigan Department of Natural Resources (DNR) and the Governor-appointed Timber Advisory Council developed five goals to encourage growth of the industries by 2018:

- Increase the economic impact of the timber industry to $20 billion.
- Increase exports of value-added forest products by 50 percent.
- Increase forest products jobs by 10 percent.
- Support existing industry.
- Encourage regionally based industry development.

This report updates a baseline assessment of industries' contributions in 2012 using **2014 IMPLAN** data, the latest economic data available. The report is the second in a series designed to help monitor progress toward the first three goals.

Progress Toward Five-Year Goals

The numeric targets for the first three goals are listed in the table below. Significant progress was made in 2014 – compared to 2012 values, total output (or sales), international exports, and number of direct jobs increased by 16 percent, 4 percent, and 12 percent respectively.

GOAL	2012 BASELINE	2014 NOMINAL	2018 TARGET
Increasing economic impacts to $20 billion ($)	$17.5 billion	$20.3 billion	**$20 billion**
Increasing Int'l value-added exports by 50% ($)	$484 million	$505 million	**$726 million**
Increasing forest products-related employment by 10% (# of jobs)	34,204	38,291	**37,624**

**2014 dollar values are not adjusted for inflation*

- The 2018 goals for increasing the forest products industry total output, and the number of direct forest products industry jobs have been met.
- International value-added exports have increased by 4 percent since 2012; however, the current strong U.S. dollar hampers efforts to increase international exports.
- Forest products industries provided 5.5 percent of manufacturing jobs in Michigan.
- In the Upper Peninsula, over one-third of manufacturing jobs were in these industries.

Among Industries:

- Wood furniture had the largest number of direct jobs (9,943) in 2014 and the third-largest direct output ($2.02 billion).
- Secondary paper and paperboard products had the second-highest number of direct jobs (8,084), and the highest direct output ($3.68 billion).

At the Individual Sector Level:

- The most jobs were in the paperboard container manufacturing, commercial logging, wood office furniture manufacturing, and sawmill mill sectors, respectively. Combined, they had over 17,000 direct jobs in 2014.
- Michigan's wood office furniture and institutional furniture manufacturing sectors were among the top sectors in all U.S. states in number of jobs and annual wages.
- The top four sectors in output (or sales) were paperboard container manufacturing, paper mills, wood office furniture, and sawmills with $6.3 billion in direct output.

International Trade Flows:

- In 2015, forest products were about 2 percent of Michigan's total international exports, valued at $54 billion.
- International exports totaled about $1.05 billion from the wood furniture, wood products, paper, and paper product sectors in 2015, down slightly from $1.15 billion in 2014.
- International imports were about twice the value of exports for these sectors. Notably, furniture imports have increased steadily since 2009.
- Michigan's largest international export markets are Canada, Mexico and China.

- Canada accounted for about 56 percent of our forest products exports in 2015.
- Exports to China had the fastest growth in recent years.
- Compared to other states' international trade, Michigan ranked 3rd nationally in furniture exports, 17th in wood products exports, and 20th in paper products.
- All three sectors have shown modest growth over the past five years.

Domestic Exports:

- Domestic exports in wood product and paper industries are a much larger portion of Michigan's output than international exports.
- In 2012, Michigan was a net exporter of wood products, paper and furniture to domestic markets.

SECTOR	INTERNATIONAL (2015)		DOMESTIC (2012) (MILLIONS)
	EXPORTS	IMPORTS	EXPORTS
NAICS* 321 - Wood Products	$165.9	$496.6	$1,445.0
NAICS 322 - Paper	$339.2	$479.6	$3,745.0
NAICS 337 - Furniture & Fixtures	$549.8	$1,032.5	*na*
Total	$1,054.9	$2,008.7	*na*

**North American Industry Classification System*

Comparison of the Forest Products Industry with Other Michigan Industries:
The forest products industries provide more direct employment than: (1) commercial fishing, hunting and trapping; (2) mining and oil and gas production; and (3) agricultural production. However, agricultural production industries had the highest value-added; that is, they contributed the most to Michigan's gross state product.

Conclusions:

- The Governor's Summit goals of increasing forest products industry output to $20 billion and number of direct jobs by 10 percent have been met.
- Import substitution provides another opportunity for expanding Michigan's forest products industries (e.g., replacing imported products with local products).

Michigan's forest products industry compares favorably with other natural resource-based industries in Michigan: commercial fishing, hunting and trapping, mining, oil and gas production, and agricultural production.

ACKNOWLEDGEMENTS

The author thanks Mr. David Neumann for his guidance and coordination on this project. This study was completed with financial support from the Michigan Department of Natural Resources, Forest Resources Division.

Suggested citation format:

Michigan Department of Natural Resources. 2015. Forest Products Industries' Economic Contributions to Michigan's Economy in 2013. L. Leefers, author. Michigan Department of Natural Resources, Forest Resources Division, Lansing.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

Forests and forest products industries are central for the transition to a greener and more sustainable economy. And a green goods and services economy relies on the sustainable use of natural resources. Of course, Michigan's forest products industries are tightly bound to forests and the goods and ecosystem services that they provide (e.g., wildlife habitat, watershed protection, etc.).

The contributions of Michigan's forests can increase with expanded emphasis on the use of wood-based products, adoption of modern wood energy technology, and clear linkages to ecosystem services. On April 23, 2013, the Governor's Forest Products Summit was convened to explore ideas and options for growing the state's forest products industries (http://www.mich.gov/dnr/0,4570,7-153-30301_30505_64883---,00.html).

The Michigan Department of Natural Resources (MDNR) and the Governor-appointed Timber Advisory Council developed five-year (2018) goals related to the industries; they are:

- Increasing the economic impact of the timber industry on state and regional economies from $14 billion to $20 billion;
- Increasing the export of value-added forest products by 50 percent;
- Increasing forest products-related careers by 10 percent;
- Supporting existing industry; and
- Encouraging regionally based industry development.

The purpose of this report is to provide circa 2014-15 data and information to update earlier assessments (Leefers et. al. 2015, MDNR 2015) on progress toward meeting the first three goals above (i.e., increasing economic impact, exports and jobs). This report is organized into five sections. The introduction is followed by the methods section, which broadly describes the approach used in developing this report. Third, recent data reflecting the economic contributions of the forest products industries for 2014 are presented. Fourth, international trade flows are examined using the most recent data available (2015); national trade data are from 2012. And finally, an assessment of progress toward the five-year (2018) goals is made.

2.0 METHODS

This report is based on compiling data published by the federal government and from commercially available IMPLAN data (IMPLAN Group LLC, www.implan.com). The report and related documents provide a documented approach that can be used to update this assessment as needed in future years.

The section on the economic contributions of Michigan's forest products industries relied on 2014 IMPLAN software and data. IMPLAN is a widely used economic input-output model that focuses on the interdependence among various producing and consuming sectors in the economy. IMPLAN data are compiled and linked by the IMPLAN software (Version 3.1.1001.12); data come from various government agencies including the U.S. Census Bureau, the U.S. Bureau of Labor Statistics, and the U.S. Bureau of Economic Analysis. Economic measures in IMPLAN include employment, labor income, value added, output or sales and others. The economic values are reported in nominal dollars, except when deflated to make them comparable to previously reported 2012 and 2013 data (in Table 12).

IMPLAN was used to examine the current status of the forest products industry and to provide a basis for estimating progress in meeting several goals of the 2013 Governor's Forest Products Summit. For this report, thirty-one IMPLAN sectors were identified as forest products sectors. They were aggregated into seven larger industries for ease of communication and analysis. The industries are: Forestry, Logging, Primary Solid Wood Products and Wood-based Power, Secondary Solid Wood Products, Wood Furniture, Primary Paper and Paperboard Products, and Secondary Paper and Paperboard Products.

The section on international and national trade flows was based on International Trade Administration data (tse.export.gov) and the U.S. Census Bureau's Commodity Flow Survey. The importance of domestic and international exports in economic growth warrants a separate report section, and it is directly linked to one of the goals of the Governor's Forest Products Summit.

The final section of the report focuses on progress toward three goals of the Governor's Forest Products Summit: increasing economic impacts to $20 billion, increasing value-added exports by 50%, and increasing forest products-related employment by 10%. Previously reported IMPLAN data from 2012 were used as the base year for this section, and 2018 was used as the target year for achieving the Summit's goals. The first goal of $20 billion in economic contributions (in terms of output or sales) was monitored by estimating total contributions using IMPLAN multipliers applied to direct contributions of all forest industries. The second goal related to increasing value-added (international) exports by 50% was evaluated based on published export data from forestry and logging, wood product manufacturing and paper industries. The third goal of increasing employment by 10% was calculated using IMPLAN-based estimates of direct employment in all forest industries.

3.0 Economic Contributions of the Forest Products Industries to Michigan's Economy

There has been concern over the status and future of the forest products industries in Michigan and throughout the U.S. This concern has been driven, in part, by the significant economic downturn during the recession of 2007 to 2009 (Woodall et. al. 2012). Global competitiveness with related offshoring of production, an increase in use of electronic media and a decline in U.S. housing markets are seen as causes of the long-term decline in wood products and paper manufacturing industries.

In Michigan, there have been significant declines in employment in the forest products industries since 1990 (Table 1, Figure 1). The forestry and logging industry has fared best, with an increase of 14 percent since 2000. The wood products manufacturing and paper manufacturing industries have declined 24 percent and 43 percent respectively over the same period. Although not presented in Table 1 due to the mix of wood and non-wood subsectors, the furniture industry, with a sizable wood furniture component, has declined 45 percent.

Table 1 - Total Full-Time and Part-Time Employment in Selected Forest Products Industries, 1990-2014

Industry	Year								
	1990	1995	2000	2005	2010	2011	2012	2013	2014
Forestry and Logging	3,953	4,416	4,256	4,469	3,521	3,759	4,469	4,530	4,869
Wood Product Mfg	13,374	15,613	15,730	13,458	9,562	9,907	10,145	10,905	11,915
Paper Mfg	20,596	21,017	19,708	14,685	11,567	11,382	11,334	11,158	11,150
TOTAL	**37,923**	**41,046**	**39,694**	**32,612**	**24,650**	**25,048**	**25,948**	**26,593**	**27,934**

Source: Bureau of Economic Analysis, Regional Economic Accounts, Table SA25N.

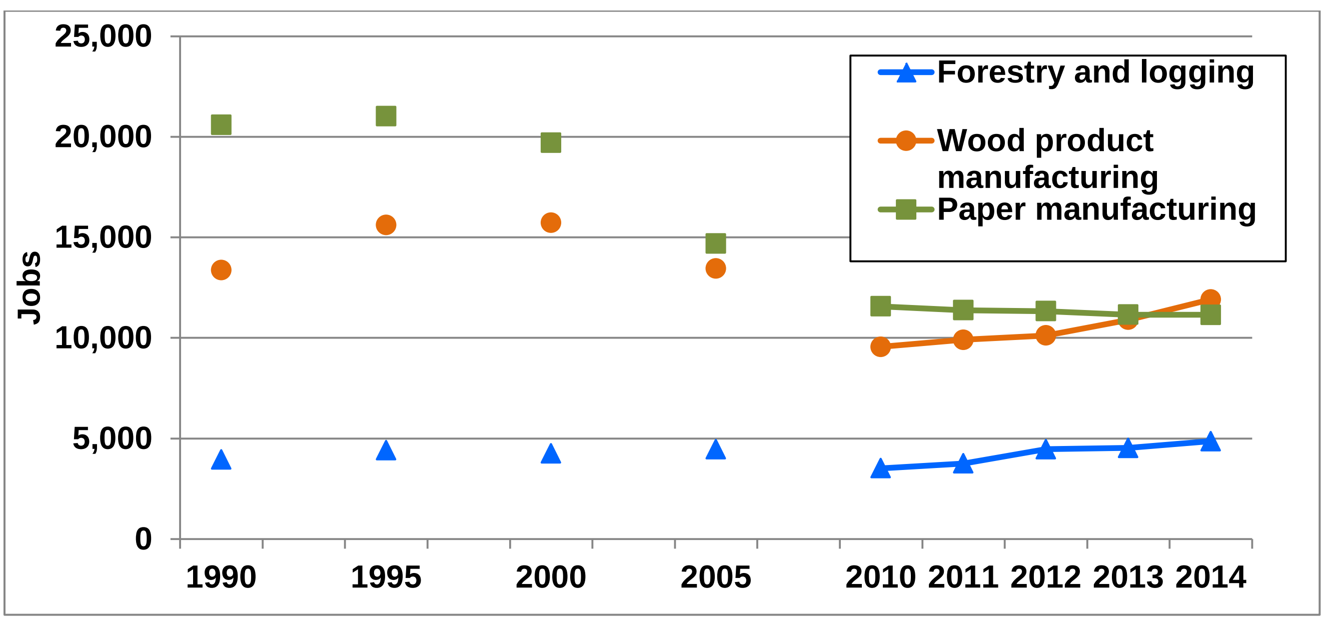

Figure 1 - Total Full-Time and Part-Time Employment in Selected Forest Products Industries, 1990-2014

Two goals related to the forest products industries' economic contributions emerged from the 2013 Governor's Forest Products Summit: increasing the economic impact of the timber industry on state and regional economies to $20 billion, and increasing forest products-related careers by 10 percent. This report section provides a more detailed examination of the structure of the forest products industries in Michigan using recent IMPLAN and government data, mostly from 2014. Descriptive statistics regarding the economic contributions of the forest products industries to Michigan's economy are presented.

3.1 Economic Contributions Defined

The economic contributions of the forest products industries is a snapshot of direct economic activity associated with given industries and other economic activities linked to those industries. An introduction to some economic terminology is helpful in describing the concept of economic contributions.

Economic contributions are defined as "the changes in a region's existing economy that can be attributed to a given industry" (Watson et. al. 2007). Hence, economic contributions define the role of an industry within a state or region. Several terms are used to describe economic effects (Table 2).

Table 2 - Terms Used To Describe Economic Contributions

Term	Description
Output	The dollar measure of production within an area; it is also viewed as sales.
Employment	The number of full-time and part-time jobs associated with an industry.
Labor income	The dollar total of employee compensation and proprietor income; the latter is associated with self-employed individuals.
Value added	The sum labor income, other property income (e.g., rents and profits) and indirect business taxes (e.g., excise and sales taxes). It is the difference between an industry's total output and the cost of its intermediate inputs. The sum of value added for all economic sectors within the state equals the Gross State Product.
Direct effects	The economic activities (e.g., output, employment, labor income, and value added) associated with an industry or sector in the study area. These can describe the current economic sectors or changes to those sectors.
Indirect effects	The impact of local industries purchasing goods and services from other industries leading to others' outputs, employment and labor income.
Induced effects	The impact of labor income (employee compensation and proprietor income) via goods and services purchased due to the direct and indirect spending by industries.
Total effects	Sum of direct, indirect and induced effects.
Social Accounting Matrix (SAM) multipliers	These multipliers are derived by dividing the sum of direct, indirect and induced effects by the direct effects. The social accounts include payments made between households, households and government, etc. These are available for output, employment, labor income, and value added and are used to assess effects of changes in industry activity (i.e., "ripple effects").

Source: www.implan.com/

Contributions can be in terms of value added, output, employment and/or labor income. Value added is commonly used to describe the economic contributions of an industry. It is a conservative measure of economic contributions. Value added is the difference between an industry's output or sales and the costs of intermediate inputs. When a sawmill sells a board, the value of the log and other inputs is not counted in value added because they were counted when produced by loggers and others. Thus only new additions to value (e.g., labor income, etc.) are included. Labor income is the major component of value added and includes employee compensation and proprietor income. Value added, summed across all sectors, is equal to the gross state product. Another measure of economic contribution is industry output or sales. For example, if a log is sold to a sawmill and the sawmill sells boards, both sales are counted as part of the overall region's sales or output - they are important economic activities. Another measure, employment, includes both full-time and part-time jobs. As the number of sectors in an analysis increases, there can be overlap in the number of part-time jobs across sectors. Summit goals focused on output and employment, which are the main statistics reported in this section.

3.2 Using IMPLAN to Estimate Economic Contributions

Impact Analysis for Planning (IMPLAN) was used to estimate economic contributions of the forest products industries (IMPLAN Group, LLC 2013). It is a widely used input-output model comprised of economic data and software. Input-output (IO) models characterize financial linkages among industries, households and institutions. Within IO models, various industries have production functions which show the value of inputs used in production of industry outputs. Michigan's economy was represented by 426 sectors or industries in 2012, the base year for analysis. The number of sectors increased to 536 in 2013 with a change in the North American Industrial Classification System (NAICS). Economic values for 2014 were used, except when deflated to 2012 dollars using deflators provided by the IMPLAN Group, LLC (see Table 12).

Counties provide the building blocks for a state, and Michigan's 83 counties were included in IMPLAN modeling for this report. Given IMPLAN's structure, sub-state analyses can be developed, too (e.g., for MDNR regions).

To more compactly describe the economic contribution of the forest products industries, 31 economic sectors were aggregated into 7 broad industries (Table 3): Forestry, Logging, Primary Solid Wood Products and Wood-based Power, Secondary Solid Wood Products, Wood Furniture, Primary Paper and Paperboard Products, and Secondary Paper and Paperboard Products. Detailed descriptions of the sectors are presented in Appendix 1.

Several sectors included wood and non-wood products (e.g., institutional furniture manufacturing); output and other measures were reduced to better reflect the wood-only component (Appendix 1). Primary industries (e.g., sawmills, OSB [reconstituted wood product], and power plants) use wood directly from the forest, including roundwood, chips or similar forms. Secondary industries (e.g., trusses and furniture) use one or more primary forest products (e.g., lumber and paper) in their manufacturing processes.

Table 3 - Aggregated Forest Products Industries and IMPLAN Component Sectors

IMPLAN Sector	SECTOR NAME
	Forestry
15	Forestry, forest products, and timber tract production
19	Support activities for forestry*
	Logging
16	Commercial logging
	Primary Solid Wood Products and Wood-based Power
47	Electric Power Generation - Biomass
134	Sawmills
135	Wood preservation
136	Veneer and plywood manufacturing
138	Reconstituted wood product manufacturing
	Secondary Solid Wood Products
137	Engineered wood member and truss manufacturing
139	Wood windows and doors manufacturing
140	Cut Stock, resawing lumber, and planing
141	Other millwork, including flooring
142	Wood Container and Pallet Manufacturing
143	Manufactured home (mobile home) manufacturing
144	Prefabricated wood building manufacturing
145	All other miscellaneous wood product manufacturing
	Wood Furniture
368	Wood kitchen cabinet and countertop manufacturing
369	Upholstered household furniture manufacturing
370	Nonupholstered wood household furniture manufacturing
372	Institutional wood furniture manufacturing*
373	Wood office furniture manufacturing
374	Custom architectural woodwork and millwork manufacturing
376	Showcase, partition, shelving, and locker manufacturing*
	Primary Paper and Paperboard Products
146	Pulp mills
147	Paper mills
148	Paperboard Mills
	Secondary Paper and Paperboard Products
149	Paperboard container manufacturing
150	Paper bag and coated and treated paper manufacturing
151	Stationery product manufacturing
152	Sanitary paper product manufacturing
153	All other converted paper product manufacturing

Note: Sectors with an "" indicate that only a portion of the sector is included in the forest products industries.*

3.3 ECONOMIC CONTRIBUTION RESULTS

A number of IMPLAN-based studies across the U.S. have examined the economic contributions of the forest products industries for states or regions, including studies in Illinois, Minnesota, Texas, Virginia, and the southern U.S. (Deckard and Skurla 2011, Henderson and Munn 2012, Rephann 2013, Joshi et. al. 2014, and Brandeis and Hodges 2015). Some similar work has been completed in Michigan (Chappelle et. al. 1986, Pedersen and Chappelle 1990, Potter-Witter et. al. 2000, Leefers 2007, and Leefers et. al. 2015). Results presented in this section expand and update these earlier efforts.

The direct contributions of Michigan's forest products industries in 2014 were $11.6 billion in output (2014 dollars), 38,291 jobs and $2.3 billion in labor income (Table 4). Total contributions, including direct, indirect and induced effects, were $20.3 billion in output, 96,623 jobs and $5.2 billion in labor income. All of these measures exceeded the 2012 estimates (see report section 5.0) and highlight positive growth in aggregate. Detailed contributions for the 31 economic sectors are presented in Appendix 2 (Direct) and Appendix 3 (Total). These contributions vary by region within Michigan. For example, 5.5 percent of manufacturing jobs in Michigan were in the forest products industries, but over one-third of manufacturing jobs in the Upper Peninsula were in these industries.

Multipliers can be used to assess expected changes in total impacts associated with changes in direct effects. For example, if output (i.e., change in final demand) for the Secondary Paper and Paperboard Products industry increased by $1.00 million, the total contribution would be $1.60 million in output (i.e., the original $1.00 million multiplied by 1.60). On average in the forest products industries, one new job creates 1.60 additional jobs (multiplier = 2.60). The Primary Paper and Paperboard Products industry had the highest employment and second highest labor income multipliers; the Forestry and Logging industries had the lowest employment multipliers.

The Secondary Paper and Paperboard Products had the highest direct output and second highest direct employment contributions (Figures 2 and 3). Two sectors within the industry provided the highest level of employment and output: (1) Paperboard Container Manufacturing, and (2) Paper Bag and Coated and Treated Paper Manufacturing (see Appendix 2). The Wood Furniture industry had the largest direct jobs and labor income contributions, but third largest contribution in direct output (Figure 4). The Wood Office Furniture sector is the largest component of this industry. The Forestry industry, which includes nurseries, consulting foresters, and other forestry support establishments, had the lowest level of output and jobs. At the aggregate level, there is little indication of heavy economic concentration across industries. However, at the individual sector level, the highest numbers of jobs were in the Paperboard Container Manufacturing, Commercial Logging, Wood Office Furniture Manufacturing, and Sawmill sectors, respectively; combined they had over 17,000 direct jobs in 2014 (Appendix 2). The top four sectors in terms of output or sales were the Paperboard Container Manufacturing, Paper Mills, Wood Office Furniture and Sawmill sectors, respectively; combined they had over $6.3 billion in direct output.

Table 4 - Direct Contributions, Total Contributions and SAM Multipliers For Seven Aggregated Forest Products Industries, 2014

FOREST PRODUCTS INDUSTRIES		Employment	Output	Labor Income
		(Jobs)	(Millions of 2014 Dollars)	
Direct Contributions				
	Forestry	678	$45.2	$20.4
	Logging	4,402	402.4	160.9
	Primary Solid Wood Products and Wood-based Power	5,022	1,693.6	280.7
	Secondary Solid Wood Products	6,874	1,157.7	320.5
	Wood Furniture	9,943	2,017.1	628.2
	Primary Paper and Paperboard Products	3,288	2,603.4	332.0
	Secondary Paper and Paperboard Products	8,084	3,682.0	554.9
	Grand Total	**38,291**	**$11,601.3**	**$2,297.6**
Total Contributions				
	Forestry	1,019	$79.8	$33.2
	Logging	7,076	689.5	260.5
	Primary Solid Wood Products and Wood-based Power	17,197	3,399.7	847.4
	Secondary Solid Wood Products	14,049	2,225.0	669.5
	Wood Furniture	20,076	3,498.9	1,113.2
	Primary Paper and Paperboard Products	15,318	4,566.7	959.4
	Secondary Paper and Paperboard Products	21,888	5,874.6	1,266.7
	Grand Total	**96,623**	**$20,334.1**	**$5,150.1**
SAM Multiplier		**Ratios (Total Contributions/Direct Contributions)**		
	Forestry	1.50	1.77	1.62
	Logging	1.61	1.71	1.62
	Primary Solid Wood Products and Wood-based Power	3.42	2.01	3.02
	Secondary Solid Wood Products	2.04	1.92	1.81
	Wood Furniture	2.02	1.73	1.25
	Primary Paper and Paperboard Products	4.66	1.75	2.89
	Secondary Paper and Paperboard Products	2.71	1.60	2.28
	Grand Total	**2.52**	**1.75**	**2.24**

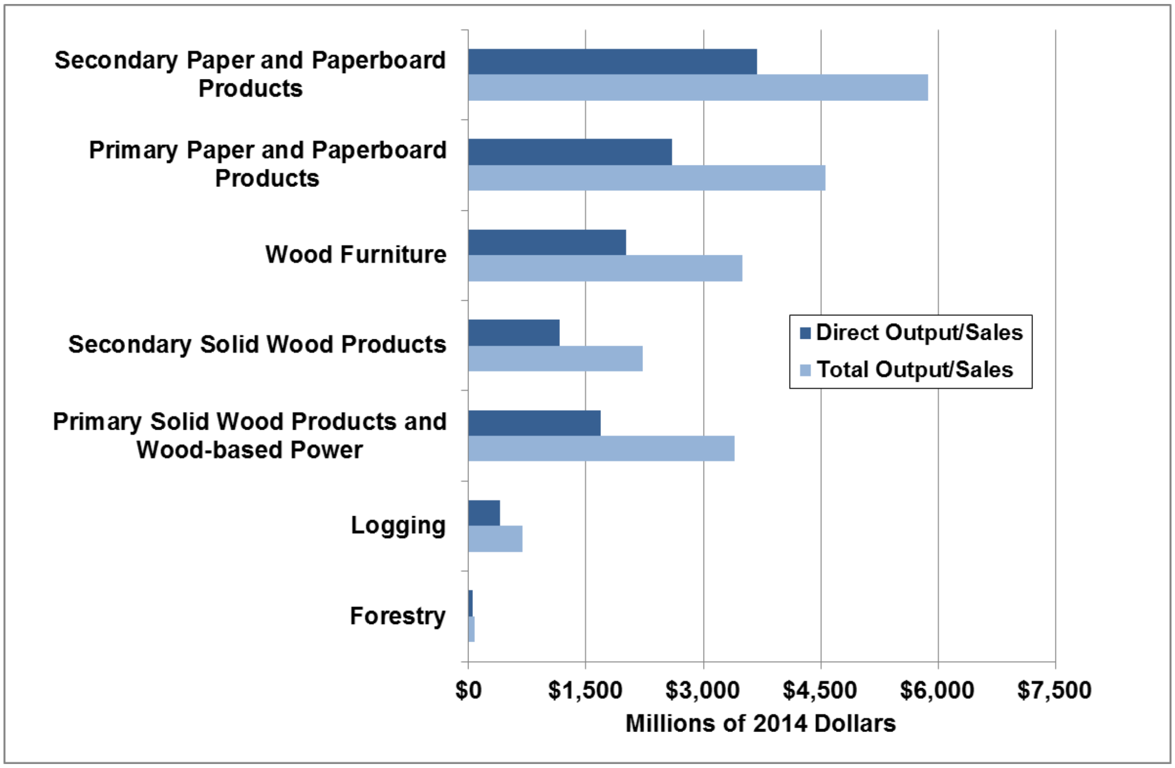

Figure 2 - Michigan direct and total output (in millions of 2014 dollars) by forest products industry, 2014

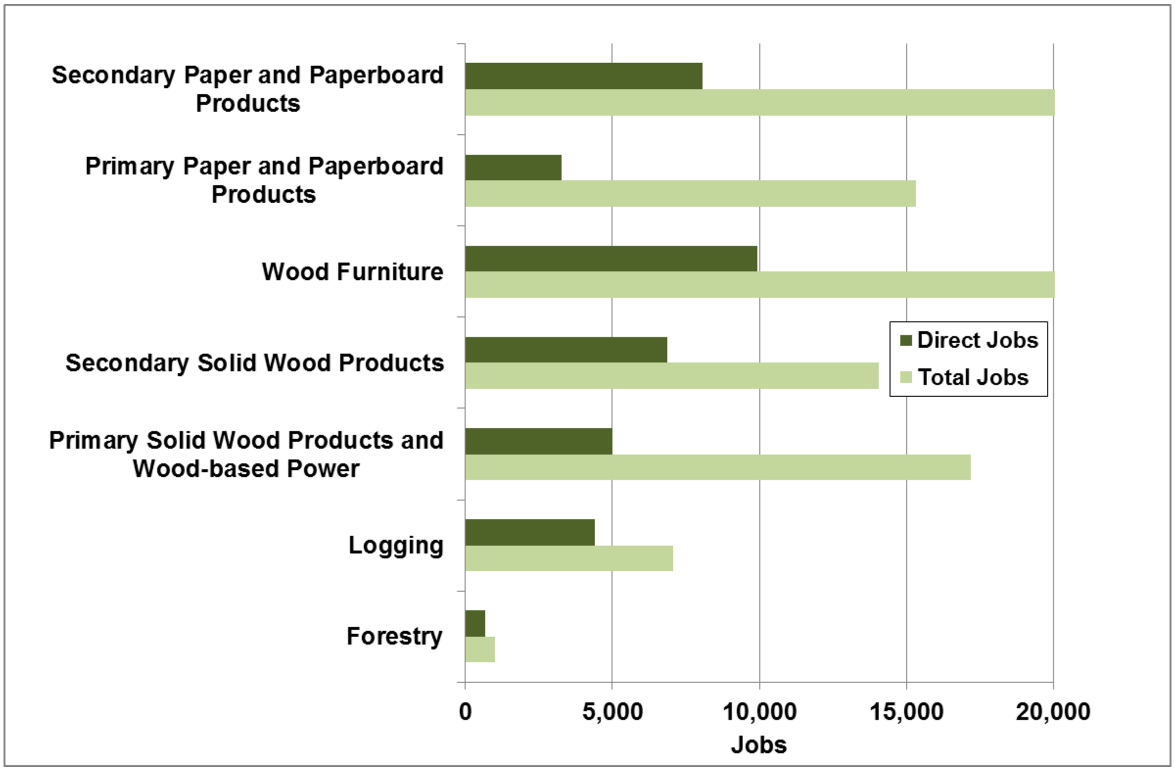

Figure 3 - Michigan direct and total employment by forest products industry, 2014

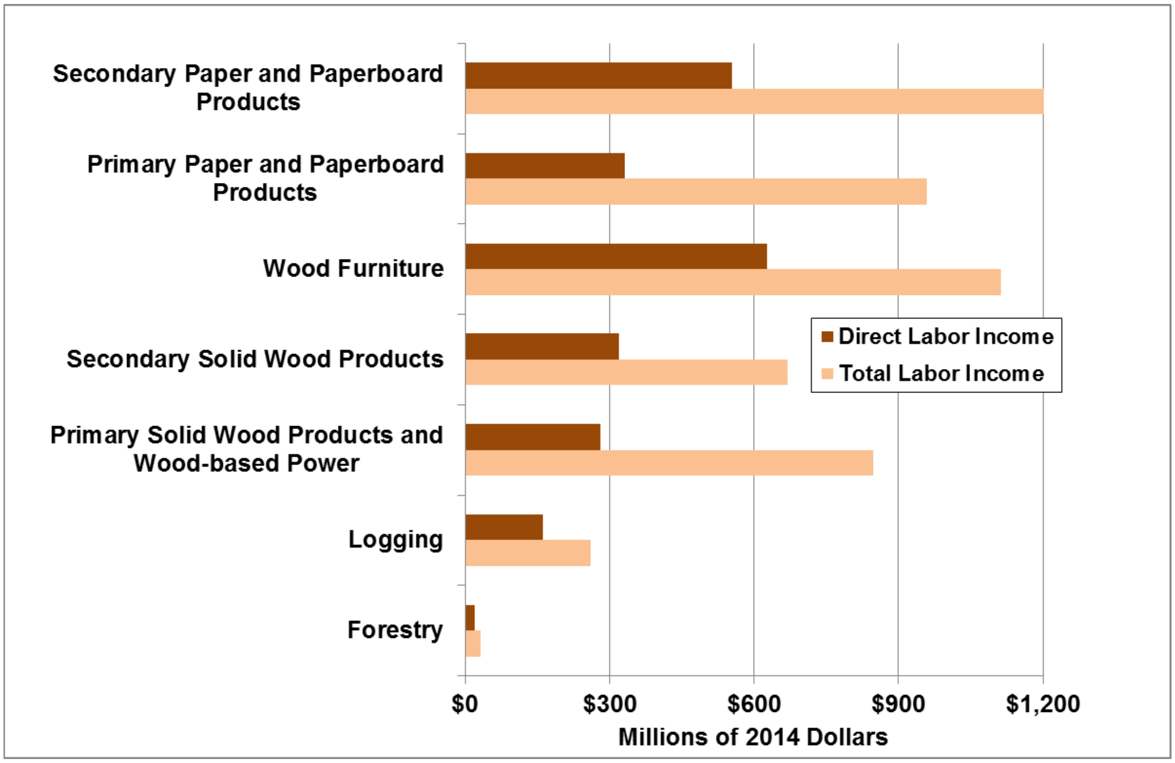

Figure 4 - Michigan direct and total labor income (in millions of 2014 dollars) by forest products industry, 2014

To provide a broader context, it is useful to examine the relative importance of various forest industry sectors within Michigan and relative to other states (Table 5, Appendix 2). The Bureau of Labor Statistics tracks employment and annual wages for all sectors across the U.S. The highest ranked sectors in Michigan relative to other states are the Wood Office Furniture, the Institutional Furniture Manufacturing, and the Showcase, Partition, Shelving, and Locker Manufacturing sectors. Though these sectors are below their historic highs, they are still important sectors within Michigan and nationally.

It is also useful to compare the contribution of Michigan's forest products industries with other industries. Natural resources and agricultural industries make important contributions to the diversity of economic activities within Michigan's $454.5 billion Gross State Product (Figure 5). The forest products industries provide more direct employment than the (1) commercial fishing, hunting and trapping, (2) mining and oil & gas production, and (3) agricultural production [plant crop and animal] industries (Figure 5). However, agricultural production industries had the highest value added; that is, they contributed the most to the Gross State Product (GSP). Michigan's forest products industries comprised 0.7% of the GSP in 2014. In a recent study of forest sector contributions in the southern U.S., the percent of value added relative to GSP ranged from less than 1% in Florida, Oklahoma and Texas to more than 4% for Alabama, Arkansas and Mississippi (Brandeis and Hodges 2015). In general, larger economies, such as Michigan's, had lower percentages of GSP associated with forest products industries. Although not examined for this report, food processing and manufacturing industries and outdoor-based tourism industries add considerably to the economic contributions of natural resources and agriculture in Michigan.

Table 5 - Forest Industry Sector Rankings by Employment (Top 11 Listed) and Sales Within Michigan and by Employment and Annual Wages Within the US, 2014

Sector Name	Within Michigan Ranking in:		U.S. Ranking in:	
	Employment	Output or Sales	Employment	Annual Wages
Paperboard Container Manufacturing	1	1	8	10
Commercial Logging	2	8	14	15
Wood Office Furniture Manufacturing	3	3	1	1
Sawmills	4	4	14	14
Paper Mills	5	2	Not disclosed	Not disclosed
Wood Container and Pallet Manufacturing	6	11	13	13
Institutional Furniture Manufacturing	7	10	3	2
Wood Kitchen Cabinet and Countertop Manufacturing	8	14	26	23
Other Millwork, including Flooring	9	15	16	15
Showcase, partition, shelving, and locker manufacturing	10	13	4	1
Paper Bag and Coated and Treated Paper Manufacturing	11	6	19	18

Source: Appendix 2 and Bureau of Labor Statistics (www.bls.gov/blb/)

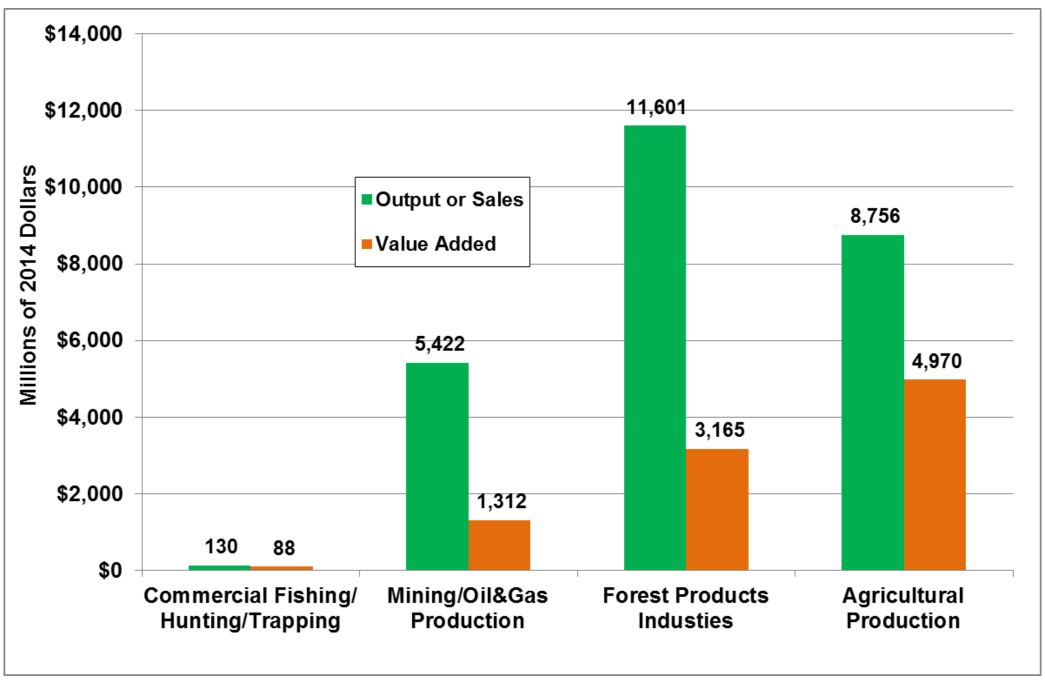

Figure 5 - Michigan direct output and value added (in millions of 2014 dollars) for selected industries, 2014

3.4 SUMMARY

Employment in Michigan's forest products industries has declined in recent decades, but has rebounded since 2010. The U.S. and Michigan economic recovery will provide opportunities for continued growth in these industries. Moreover, policies aimed at encouraging existing firms to remain and grow in Michigan and new firms to locate in Michigan will provide additional growth in the forest products industries.

Total direct contributions for 2014 were $11.6 billion in output, over 38,000 jobs, $2.3 billion in labor income, and $3.2 billion in value added. Using a simple Social Accounting Matrix (SAM) multipliers, total contributions (includes "ripple effects") were estimated. Total contributions were $20.3 billion in output, over 96,000 jobs, $5.2 billion in labor income and $7.7 billion in value added.

Michigan's Wood Office Furniture sector had the highest employment and annual wages of any state in 2014. The Showcase, Partition, Shelving, and Locker Manufacturing sector ranked first in annual wages nationally. Similarly, the Institutional Furniture Manufacturing sector was estimated to be the third largest in the U.S. in terms of employment and second in annual wages. Most of Michigan's top-10 sectors rank between 10th and 19th nationally.

A detailed examination of forest products sectors highlights the relative economic contributions each sector provides. However, a broader analysis of the economic contributions of natural resources is beyond the scope of this report. Nonetheless, the forest products industries compare favorably to the commercial fishing, hunting and trapping industries and the mining, oil, and gas production industries.

4.0 INTERNATIONAL AND NATIONAL TRADE FLOWS

One goal set by the MDNR and the Governor's Timber Advisory Council was to increase "the export of value-added forest products by 50 percent" by the end of 2018. This section provides a more detailed examination of trends in international and domestic trade in wood products (NAICS 321) and paper (NAICS 322).

The phrase "value added" has different interpretations. In regional economics (and IMPLAN), it is the sum of wages, rents, interest and profits. In more common discourse, it refers to higher stages in the production process (e.g., wooden tables are further along in the production process than lumber). For purposes of this goal, the focus is on products beyond the logging stage of production; value is added to the logs as they are processed. Lumber, pallets, medium density fiberboard, cardboard, paper and wood furniture are examples of value-added products. Notably, the furniture and fixtures industry (NAICS 337) is addressed initially in this section, but dropped from later discussions due to the difficulty of separating exports of wood-based furniture from other furniture component materials (e.g., metal and plastic) under the 3-digit NAICS classes (e.g., NAICS 337). Regardless, it remains an important part in Michigan's diverse forest products industries. So, the principal focus in this section is on solid wood products and paper.

For policy makers and others, the term "export" evokes the notion of international markets. However, economists consider any products shipped out of Michigan to be exports, whether they are going to international or domestic markets. In fact, domestic wood products and paper exports far exceed international exports. Exports sold outside of Michigan bring revenues to the companies within the state and support employment in them.

Much of Michigan's forest products industries' economic output is shipped out of state (Figure 6). The most recent (2012) commodity flow survey data from the U.S. Census Bureau and international trade data from the U.S. Department of Commerce provided an output estimate for wood products and paper of $7.8 billion in Michigan. The combined output in solid wood and paper products (excluding furniture, forestry and logging) based on 2012 IMPLAN estimates was $7.8 billion as well. The Department of Commerce data distribution was skewed more toward solid wood products, however. Approximately 70 percent of this value was shipped out of Michigan to international and domestic markets in 2012.

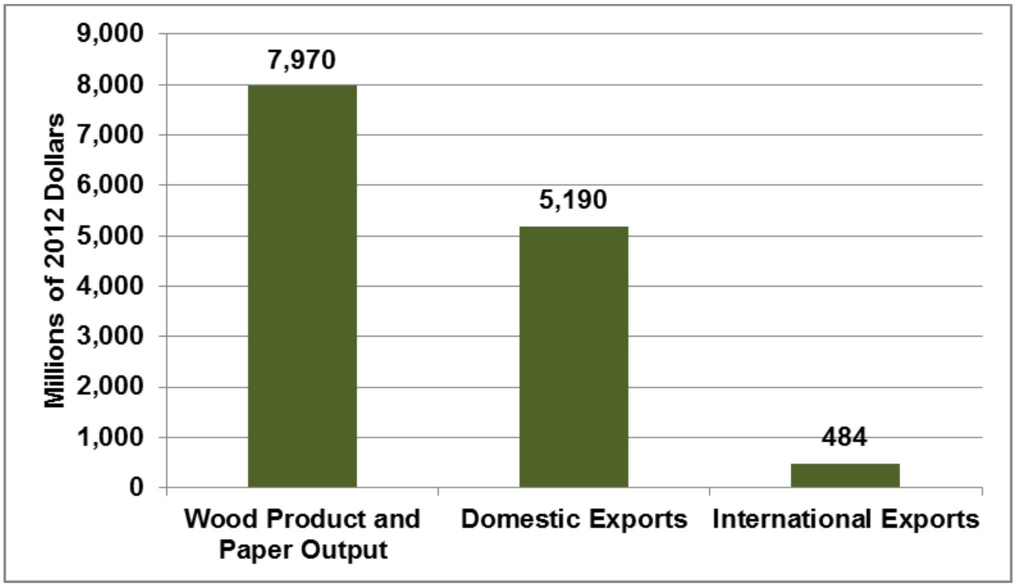

Figure 6 - Michigan direct wood product and paper output, domestic exports and international exports (in millions of 2012 dollars), 2012

Source: 2012 IMPLAN data; US Department of Commerce, International Trade Administration; and US Census Bureau, Commodity Flow Survey.

4.1 International Exports

The U.S. Department of Commerce estimated the value of Michigan's 2015 total international exports at $54.0 billion. Forest products exports were a small part of this total. Historic export data are published in nominal dollars (not adjusted to reflect inflation). Although producer price inflation for forest products industries was about 2 percent per year from 2008 through 2015, no adjustment is made for this report given the focus on 2015 exports, the most recent year available.

With an annual international export value of $549.8 million in 2015, Michigan ranked 3rd to the top states of California and Texas in furniture exports (Table 6, Figure 7). However, Michigan has not fared well in exporting other forest products—wood products and paper. In 2015, Michigan's exports of wood products were valued at $165.9 million (ranked 17th among the states), which came close to achieving the export level of 2008, considering inflation, before the economic recession. The recession hit the housing industry particularly hard, and this in turn depressed the wood products industry across the U.S. Michigan's export of paper products in 2015 was $339.2 million and ranked 20th in the country. All three industries have shown growth and decline over the past five years.

Table 6 - Value of International Exports from Michigan for NAICS 321, 322 And 337, in Millions of Nominal Dollars, 2008-2015

	NAICS 321 - Wood Products	NAICS 322 - Paper	NAICS 337 - Furniture & Fixtures
Year	Millions of Dollars (Nominal)		
2008	159.8	343.4	502.9
2009	113.0	279.3	399.4
2010	138.2	341.4	469.6
2011	129.6	367.7	536.9
2012	146.4	337.6	654.5
2013	154.4	365.4	650.5
2014	166.6	349.4	636.5
2015	165.9	339.2	549.8

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/). Downloaded 7/14/16.

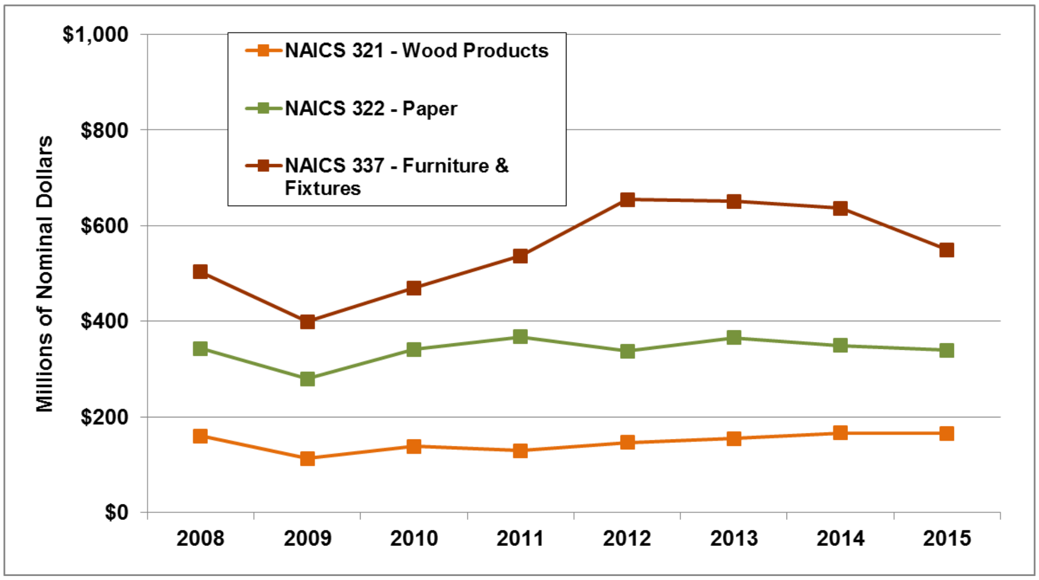

Figure 7 - Value of International Exports from Michigan for NAICS 321, 322 and 337, in Millions of Nominal Dollars, 2008-2015

Like exports, imports have fluctuated. Furniture imports, however, have mostly increased. Specifically, imports of wood products, paper and furniture were, respectively, $496.6 million, $479.6 million and $1,032.5 million in 2015 (Table 7, Figure 8). Notably, the state is a net importer of wood products, paper and furniture. Consequently, import substitution provides an opportunity for expanding Michigan's forest products industries. Goods produced in Michigan need to outcompete similar imported goods in terms of price, quality or cachet for import substitution to succeed.

In 2015, China was the largest exporting destination for wood products and paper combined after the U.S.'s two North American neighbors—Canada and Mexico (Tables 8 and 9, Figures 9 and 10). Exporting to China has shown the fastest growth in recent years. Similarly, imports from China are the largest other than Canada and Mexico, and importing from China has witnessed significant growth in recent years.

Table 7 - Value of international imports to Michigan for NAICS 321, 322 and 337, in millions of nominal dollars, 2008-2015

	NAICS 321 - Wood Products	NAICS 322 - Paper	NAICS 337 - Furniture & Fixtures
Year	Millions of Dollars (Nominal)		
2008	385.4	633.4	536.8
2009	279.1	422.8	426.9
2010	339.4	519.5	540.8
2011	314.2	567.4	621.5
2012	391.9	498.9	790.0
2013	489.3	540.9	842.9
2014	554.6	504.9	908.9
2015	496.6	479.6	1,032.5

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/stateimports/). Downloaded 7/14/16.

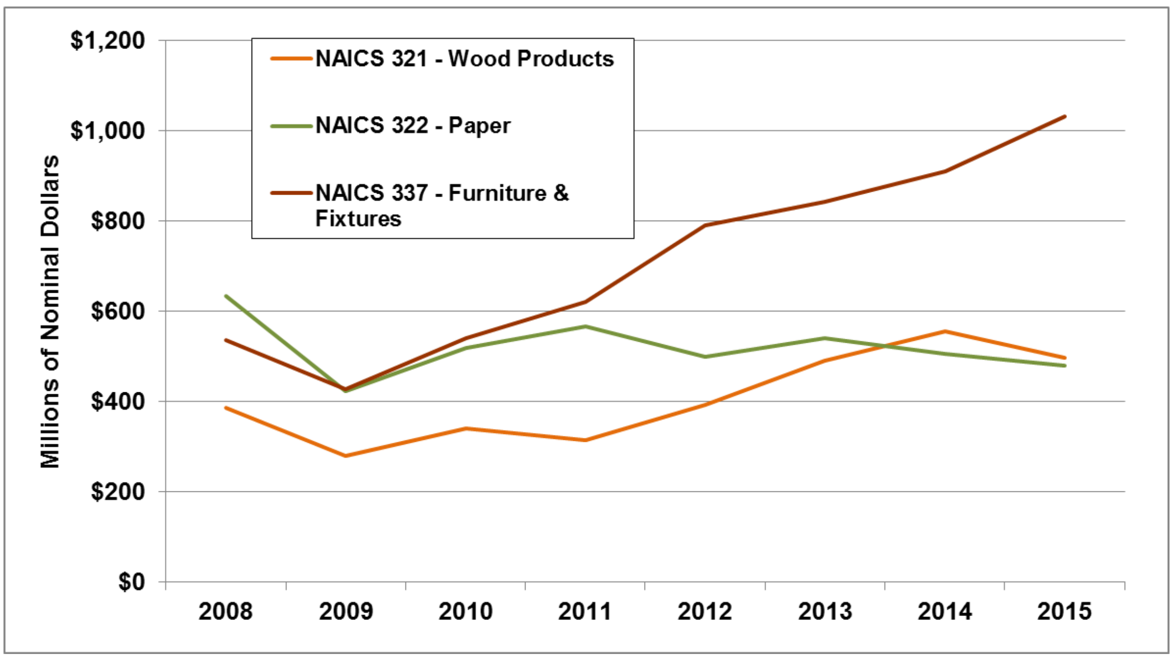

Figure 8 - Value of International Imports from Michigan for NAICS 321, 322 and 337, in Millions of Nominal Dollars, 2008-2015

Table 8 - Value of International Exports from Michigan for NAICS 321-Wood Products in Total and for the Top Five Importing Countries, in Millions of Nominal Dollars, 2015

Country	NAICS 321 - Wood Products	
	Millions of Dollars	% of Total
World	165.9	100
Canada	82.7	50
China	24.0	14
Germany	12.0	7
Japan	7.2	4
Australia	6.2	4

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/stateimports/). Downloaded 6/14/16.

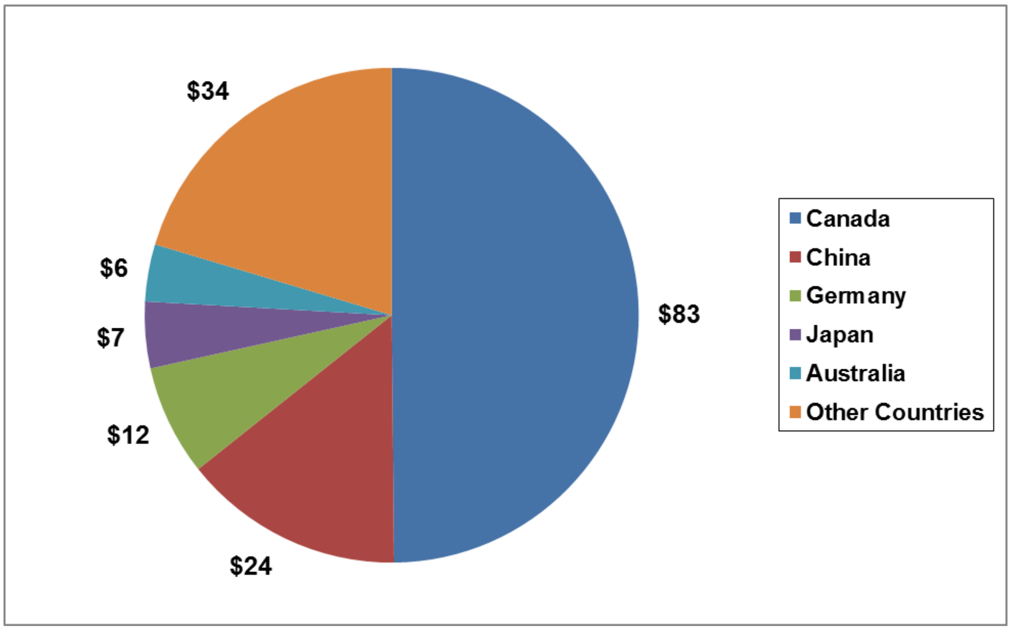

Figure 9 - Value of International Exports from Michigan for NAICS 321-Wood Products for the Top Five Importing Countries, in Millions of Nominal Dollars, 2015

Table 9 - Value of International Exports from Michigan for NAICS 322-Paper in Total and for the Top Five Importing Countries, in Millions of Nominal Dollars, 2015

Country	NAICS 322 - Paper	
	Millions of Dollars	% of Total
World	339.2	100
Canada	200.2	59
Mexico	57.5	17
China	23.3	7
U.K.	10.4	3
Germany	7.3	2

Source: U.S. Department of Commerce, International Trade Administration (tse.export.gov/). Downloaded 7/14/16.

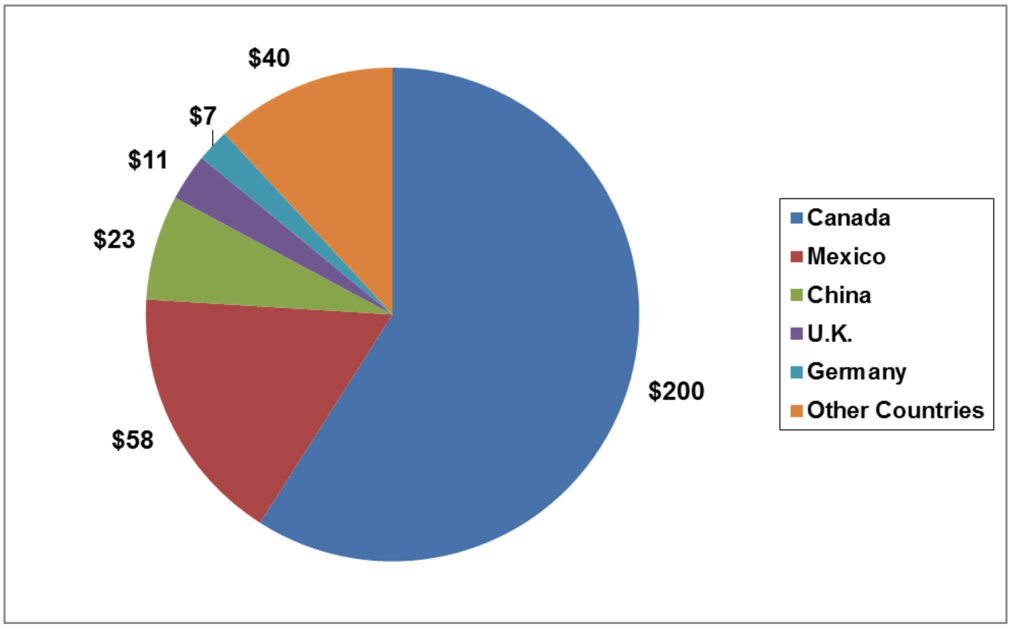

Figure 10 - Value of International Exports from Michigan for NAICS 322-Paper for the Top Five Importing Countries, in Millions of Nominal Dollars, 2015

4.2 Domestic Exports

Domestic trade data are collected by the U.S. Census Bureau every five years; 2007 and 2012 are the most recent survey years. Based on the value of shipment data provided from the U.S. Census Bureau's 2012 Commodity Flow Survey, $1.4 billion in wood products and $3.7 billion in paper was sent to other states in 2012 (Tables 10 and 11, Figures 11 and 12). The top six states accounted for approximately 60 percent of domestic exports.

Table 10 - Value of Domestic Exports from Michigan for NAICS 321-Wood Products in Total and for the Top Six Importing States, in Millions of Nominal Dollars, 2007 and 2012

State	NAICS 321 - Wood Products (2007)		NAICS 321 - Wood Products (2012)	
	Million $	% of Total	Million $	% of Total
USA (excl. MI)	1,455	100	1,445	100
Indiana	182	13	282	20
Wisconsin	200	14	206	14
Illinois	160	11	178	12
Ohio	104	7	91	6
New York	38	3	66	5
Pennsylvania	54	4	38	3

Source: U.S Census Bureau, Commodity Flow Survey (www.census.gov/econ/cfs/).

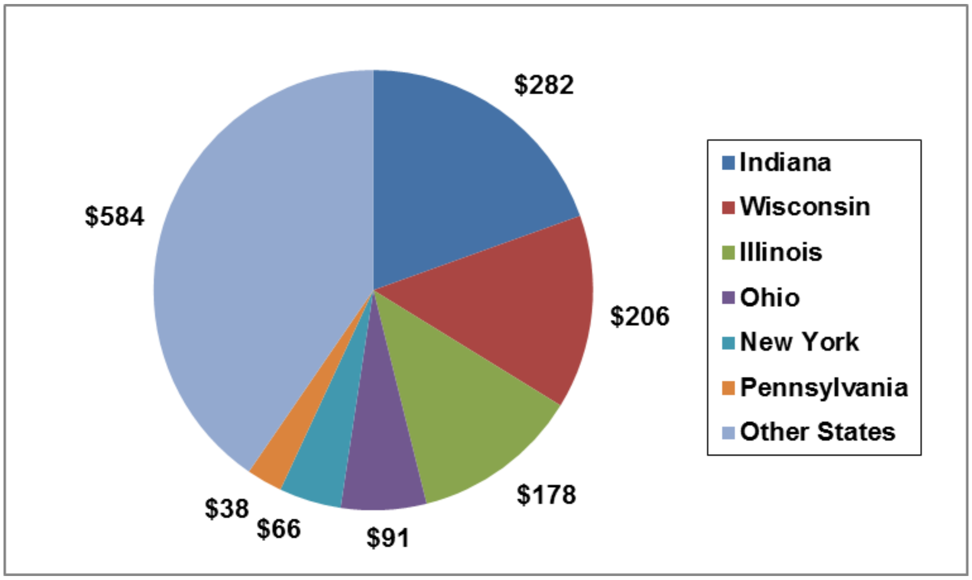

Figure 11 - Value of Domestic Exports from Michigan for NAICS 321-Wood Products for the Top Six Importing States, in Millions of Nominal Dollars, 2012

The top six importing (or export-destination) states were mostly nearby states (i.e., Wisconsin, Illinois, Indiana and Ohio). Like Canada internationally, these are important markets. In 2012, the top importing state for each industry exceeded the total international exports for the industries. The economic impact in Michigan associated with $100 million in domestic exports or the same amount in international exports likely yields similar employment and sales impacts within Michigan, though the transportation industry impacts may be distributed differently. This reinforces the need to consider expanding domestic exports along with international exports.

Table 11 - Value of Domestic Exports from Michigan for NAICS 322-Paper in Total and for the Top Six Importing States, in Millions of Nominal Dollars, 2007 and 2012

State	NAICS 322 - Paper (2007)		NAICS 322 - Paper (2012)	
	Million $	% of Total	Million $	% of Total
USA (excl. MI)	3,432	100	3,745	100
Wisconsin	401	12	556	15
Ohio	383	11	462	12
Indiana	320	9	409	11
Illinois	342	10	331	9
Pennsylvania	111	3	195	5
Texas	187	5	179	5

Source: U.S Census Bureau, Commodity Flow Survey (http://www.census.gov/econ/cfs/).

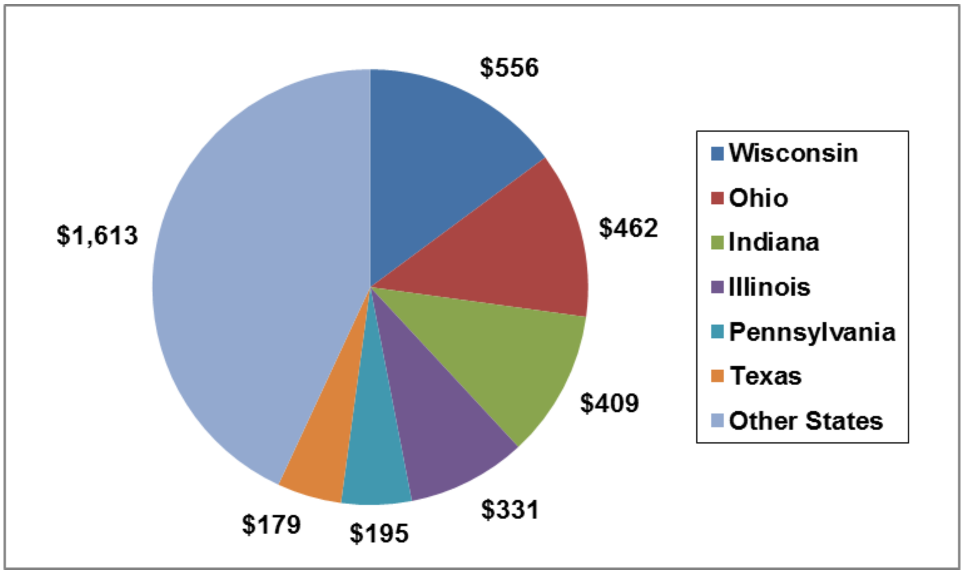

Figure 12 - Value of Domestic Exports from Michigan for NAICS 322-Paper for the Top Six Importing States, in Millions of Nominal Dollars, 2012

4.3 Summary

Overall, forest products were a fairly small component of Michigan's 2015 total international exports valued at $54.0 billion. Nonetheless, forest products exports have increased since 2009, when the recession ended. Prospects for more exports will improve as the economies of U.S. and its trading partners continue to expand and as policies are implemented to encourage exports.

Canada is clearly the largest international market for wood products and paper, accounting for about 56 percent of exports. The top five importing countries for each industry account for approximately 85 percent of the industries' exports. So, there are clearly established international markets for Michigan's forest products. Although not included in this analysis, the furniture and fixtures industry provides additional opportunities for value-added exports.

Discussion surrounding increasing exports traditionally implies international exports, but in fact, domestic exports exceed international exports significantly and may provide excellent opportunities for expansion as well. Michigan's forest products industries will thrive, if domestic and international exports can be expanded. Given the high level of forest products imports, import substitution is another area that may yield markets for Michigan's forest products.

5.0 FIVE-YEAR (2018) GOALS REVISITED

The focus of this final section is on monitoring economic progress toward three goals set at the Governor's Forest Products Summit in 2013. Specifically, the goals are:

- Increasing the economic impact of the timber industry on state and regional economies from $14 billion to $20 billion;
- Increasing the export of value-added forest products by 50 percent; and
- Increasing forest products-related careers by 10 percent.

The other goals, supporting existing industry and encouraging regionally based industry development can be assessed over time by examining the public and private policies, programs and investments aimed at supporting the forest products industries.

5.1 GOAL 1: INCREASING TOTAL ECONOMIC IMPACTS TO $20 BILLION

Prior to the Governor's Forest Products Summit, an initial estimate of the economic contributions by the forest products industries to Michigan's economy was $14.0 billion, based on 2011 IMPLAN data; the Wood Furniture industry was not included in the initial estimate. The estimate was increased to $17.5 billion using 2012 IMPLAN data and expanded forest industry sectors (Appendix 4; Leefers et. al. 2015). The revised estimate provided the baseline for assessing progress toward the goal of $20 billion (in 2012 dollars) in total contributions to Michigan's economy.

After accounting for inflation, the 2014 level of output contributions was considerably higher than the 2012 baseline and 2013 levels (Table 12). This estimate, consistent with the method used in previous reports, applied sectoral multipliers to each sector resulting in an estimate of $19.602 billion, after discounting to 2012 dollars. If recent trends persist, the $20 billion target is achievable. Underlying this increase were shifts between different industries. For example, primary paper and paperboard employment declined from 2013 to 2014, whereas primary solid wood products employment increased. Market opportunities and industrial policies will determine the mix of industry sectors that may ultimately achieve the $20 billion goal.

Table 12 - Progress Toward Five-Year Goals (2018) Set at the 2013 Governor's Forest Products Summit

Goal	Unit	2012	2013	2014	2015	2018 Target
Increasing economic impacts to $20 billion	Billions of 2012 $	17.487	17.475	19.602		**20.000**
Increasing international value-added exports by 50%	Billions of 2012 $	0.484	0.518	0.510	0.526	**0.726**
Increasing forest products-related employment by 10%	Number of Jobs	34,204	34,951	38,291		**37,624**

5.2 GOAL 2: INCREASING INTERNATIONAL EXPORT OF VALUE ADDED FOREST PRODUCTS BY 50%

As with Goal 1, there are a number of options for monitoring progress towards the export goal. Exports from wood products (NAICS 321) and paper (NAICS 322) industries were used to calculate the 2012 baseline (Table 6). Across these two industries, there was an 8.7% increase in exports over the 2012-15 period. This is significantly below the track needed to achieve a 50% increase by 2018. A strong U.S. dollar, among other factors, reduces opportunities for exports in the short run. Aggregate industry figures are used because export data does not differentiate between primary and secondary products. The Furniture and Fixtures industry was not included due to the lack of export details on wood-based furniture at this time.

For solid wood products, the 2012-15 export values combined output from Sawmills; Wood Preservation; Veneer and Plywood Manufacturing; Engineered Wood Member and Truss Manufacturing; Reconstituted Wood Product Manufacturing; Wood Window and Door Manufacturing; Cut Stock, Resawing Lumber, and Planning; Other Millwork, including Flooring; Wood Container and Pallet Manufacturing; Manufactured Home (Mobile Home) Manufacturing; Prefabricated Wood Building Manufacturing; and All Other Miscellaneous Wood

Product Manufacturing. For paper products, export values combined output from Pulp Mills; Paper Mills; Paperboard Mills; Paperboard Container Manufacturing; Coated and Laminated Paper, Packaging Paper and Plastics Film Manufacturing; Stationery Product Manufacturing; Sanitary Paper Product Manufacturing; and All Other Converted Paper Product Manufacturing.

5.3 Goal 3: Increasing Forest Products – Related Careers by 10%

The third goal, increasing forest products-related employment, was derived by adding 3,420 jobs (10%) to the 2012 baseline level of 34,204 yielding a goal of 37,624 jobs. Employment estimates (Table 12) were derived from IMPLAN data in 2012-14; employment increased 11.9% from 2012 to 2014. The 2018 goal was exceeded in 2014 by 667 jobs.

5.4 Summary

The goals for expanding the forest products industries are interrelated. Changes in final demand or output drive economic activity yielding increased employment, labor income and total impacts on Michigan's economy. Goal 1 required additional total impacts of $2,525 million above the 2013 level. This translated into a needed increase of direct output (final demand) of approximately $1,451 million. In fact, direct output increased by $1,387 million from 2013 to 2014 (after accounting for inflation), and the goal was almost achieved in real terms. In nominal terms ($20,334 million), the goal was met in 2014. Goal 2 exports are $200 million below the 2018 target. It is likely that domestic exports increased considerably from 2013 to 2014. However, international exports were hindered by a strong U.S. dollar. Although they are not perfectly correlated, increasing outputs for domestic and international markets have led to increases in employment, the focus of Goal 3.

The purpose of quantifying goals provides a basis for future comparisons regarding accomplishments associated with goals of the Governor's Forest Products Summit. Scenarios can be developed to describe more details about direct and total impacts of meeting these goals across various forest products industries in terms of output, employment and labor.

As summarized by Woodall and others (2012), "the high value forest resources of the northern region continue to mature and could provide more wood for an expanded wood products manufacturing industry. An opportunity exists to both improve the health and resiliency of these maturing forests while developing the local economies with improved competitiveness, capacity, and production of wood industries." They noted the positive opportunities for more paperboard production and increased international trade, biofuels and wood energy. These opportunities exist in Michigan; supportive policies and investments can make them a reality.

6.0 References Cited

Brandeis, C. and D.G. Hodges. 2015. Forest sector and primary forest products industry contributions to the economies of southern states: 2011 update. Journal of Forestry 113(2): 205-209.

Chappelle, D.E., S.E.Heinen, L.M. James, K.M. Kittleson, and D.D. Olson. 1986. Economic impacts of Michigan forest industries: a partially survey-based input-output study. Research Report 472. East Lansing, MI: Michigan State University, Agricultural Experiment Station. 13 p.

Deckard, D.L. and J.A. Skurla. 2011. Economic contribution of Minnesota's forest products industry—2011 edition. Duluth, MN: Bureau of Business and Economic Research, University of Minnesota. 18 p.

Henderson, J.E. and I.A. Munn. 2012. Forestry in Illinois – The Impact of the Forest Products Industry on the Illinois Economy: An Input-Output Analysis. Illinois Forestry Development Council. 22 p.

Impact Analysis for Planning (IMPLAN) Group, LLC. 2013. IMPLAN System, Version 3.1 (data and software). Huntsville, NC: IMPLAN.

Joshi, O., C. Edgar, R. Zehnder, and A.B. Carraway. 2014. Economic Impact of the Texas Forest Sector, 2012. College Station, TX: Sustainable Forestry Department, Texas A&M Forest Service. 12 p.

Leefers, L.A. 2007. The U.P. Economy and the Role of the Forest Products Industries. Michigan State University, Land Policy Institute Report 2007-07. 49 p.

Leefers, L., L. Pedersen, K. Potter-Witter, M. Vasievich, and R. Yin. 2015. Michigan's Forest Products Industries: Centerpiece of the Green Economy—2013 Edition (Draft). Department of Forestry, Michigan State University. 60 p.

Michigan Department of Natural Resources. 2015. Forest Products Industries' Economic Contributions to Michigan's Economy in 2013. L. Leefers, author. Michigan Department of Natuiral Resources, Forest Resources Division, Lansing.

Pedersen, L. and D. Chappelle. 1990. Economic Contributions of the Lake States' Forest Resources, 1982-1995. Northern Journal of Applied Forestry 7(1): 10-13.

Potter-Witter, K., H.J. Haas, M.R. Koelling, and P. Kakela. 2000. Michigan's Forestry Industry. Michigan State University Agricultural Experiment Station SAPMNR Report 4. p.

Rephann, T.J. 2013. The economic impact of agriculture and forest industries in Virginia. Charlottesville, VA: Weldon Cooper Center for Public Service, University of Virginia. 71 p.

Watson, P., J. Wilson, D. Thilmany, and S. Winter. 2007. Determining economic contributions and impacts: what is the difference and why do we care? The Journal of Regional Analysis & Policy 37(2): 1-15.

Woodall, C.W.; W.G.Luppold, P.J. Ince, R.J. Piva, and K.E. Skog. 2012. An assessment of the downturn in the forest products sector in the northern region of the United States. Forest Products Journal 61: 604-613.

APPENDIX 1

Table 13 - Description of Economic Sectors for Forest Industries, Including IMPLAN Industry Sectors and 2007 North American Industry Classification System (NAICS) Codes

IMPLAN Sector	Description (NAICS Code): Detailed Description
15	Timber Tract Operations (113110): This industry comprises establishments primarily engaged in the operation of timber tracts for the purpose of selling standing timber. Forest Nurseries and Gathering of Forest Products (113210): This industry comprises establishments primarily engaged in (1) growing trees for reforestation and/or (2) gathering forest products, such as gums, barks, balsam needles, rhizomes, fibers, Spanish moss, ginseng, and truffles.
16	Logging (113310): This industry comprises establishments primarily engaged in one or more of the following: (1) cutting timber; (2) cutting and transporting timber; and (3) producing wood chips in the field.
19*	Support Activities for Forestry (115310): This industry comprises establishments primarily engaged in performing particular support activities related to timber production, wood technology, forestry economics and marketing, and forest protection. These establishments may provide support activities for forestry, such as estimating timber, forest firefighting, forest pest control, and consulting on wood attributes and reforestation. IMPLAN Sector 19 (NAICS 115) initial values were reduced to 4.5% of initial values based on the employment and annual wages ratios between (1) Forestry Support Activities and (2) Agriculture and Forestry Support Activities for the MI from 2012-14 (Bureau of Labor Statistics).
47 (NA)	Biomass Electric Power Generation (221117): This U.S. industry comprises establishments primarily engaged in operating biomass electric power generation facilities. These facilities use biomass (e.g., wood, waste, alcohol fuels) to produce electric energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems. This was a new sector in 2013 IMPLAN datasets.
134 (95)	Sawmills (321113): This U.S. industry comprises establishments primarily engaged in sawing dimension lumber, boards, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips from logs or bolts. Sawmills may plane the rough lumber that they make with a planing machine to achieve smoothness and uniformity of size.
135 (95)	Wood preservation (321114): This U.S. industry comprises establishments primarily engaged in (1) treating wood sawed, planed, or shaped in other establishments with creosote or other preservatives, such as alkaline copper quat, copper azole, and sodium borates, to prevent decay and to protect against fire and insects and/or (2) sawing round wood poles, pilings, and posts and treating them with preservatives.
136 (96)	Hardwood Veneer and Plywood Manufacturing (321211): This U.S. industry comprises establishments primarily engaged in manufacturing hardwood veneer and/or hardwood plywood. Softwood Veneer and Plywood Manufacturing (321212): This U.S. industry comprises establishments primarily engaged in manufacturing softwood veneer and/or softwood plywood.
137 (97)	Engineered Wood Member (except Truss) Manufacturing (321213): This U.S. industry comprises establishments primarily engaged in manufacturing fabricated or laminated wood arches and/or other fabricated or laminated wood structural members. Truss Manufacturing (321214): This U.S. industry comprises establishments primarily engaged in manufacturing laminated or fabricated wood roof and floor trusses.

IMPLAN Sector	Description (NAICS Code): Detailed Description
138 (98)	Reconstituted Wood Product Manufacturing (321219): This U.S. industry comprises establishments primarily engaged in manufacturing reconstituted wood sheets and boards.
139 (99)	Wood Window and Door Manufacturing (321911): This U.S. industry comprises establishments primarily engaged in manufacturing window and door units, sash, window and door frames, and doors from wood or wood clad with metal or plastics
140 (99)	Cut Stock, Resawing Lumber, and Planing (321912): This U.S. industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing dimension lumber from purchased lumber; (2) manufacturing dimension stock (i.e., shapes) or cut stock; (3) resawing the output of sawmills; and (4) planing purchased lumber. These establishments generally use woodworking machinery, such as jointers, planers, lathes, and routers to shape wood.
141 (99)	Other Millwork, including Flooring (321918): This U.S. industry comprises establishments primarily engaged in manufacturing millwork (except wood windows, wood doors, and cut stock).
142 (100)	Wood Container and Pallet Manufacturing (321920): This industry comprises establishments primarily engaged in manufacturing wood pallets, wood box shook, wood boxes, other wood containers, and wood parts for pallets and containers.
143 (101)	Manufactured home (mobile home) manufacturing (321991): This U.S. industry comprises establishments primarily engaged in making manufactured homes (i.e., mobile homes) and nonresidential mobile buildings. Manufactured homes are designed to accept permanent water, sewer, and utility connections and although equipped with wheels, they are not intended for regular highway movement.
144 (102)	Prefabricated Wood Building Manufacturing (321992): This U.S. industry comprises establishments primarily engaged in manufacturing prefabricated wood buildings and wood sections and panels for prefabricated wood buildings.
145 (103)	All Other Miscellaneous Wood Product Manufacturing (321999): This U.S. industry comprises establishments primarily engaged in manufacturing wood products (except establishments operating sawmills and preservation facilities; establishments manufacturing veneer, engineered wood products, millwork, wood containers, pallets, and wood container parts; and establishments making manufactured homes (i.e., mobile homes) and prefabricated buildings and components).
146 (104)	Pulp Mills (322110): This industry comprises establishments primarily engaged in manufacturing pulp without manufacturing paper or paperboard. The pulp is made by separating the cellulose fibers from the other impurities in wood or other materials, such as used or recycled rags, linters, scrap paper, and straw.
147 (105)	Paper (except Newsprint) Mills (322121): This U.S. industry comprises establishments primarily engaged in manufacturing paper (except newsprint and uncoated groundwood paper) from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paper they make. Newsprint Mills (322122): This U.S. industry comprises establishments primarily engaged in manufacturing newsprint and uncoated groundwood paper from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paper they make.

IMPLAN Sector	Description (NAICS Code): Detailed Description
148 (106)	Paperboard Mills (322130): This industry comprises establishments primarily engaged in manufacturing paperboard from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paperboard they make.
149 (107)	Paperboard Container Manufacturing (32221): This industry comprises establishments primarily engaged in converting paperboard into containers without manufacturing paperboard. These establishments use corrugating, cutting, and shaping machinery to form paperboard into containers. Products made by these establishments include boxes, corrugated sheets, pads, pallets, paper dishes, and fiber drums, and reels. Six-digit NAICS industries are: Corrugated and Solid Fiber Box Manufacturing (322211), Folding Paperboard Box Manufacturing (322212), and Other Paperboard Container Manufacturing (322219).
150 (108, 109)	Paper Bag and Coated and Treated Paper Manufacturing (322220): This industry comprises establishments primarily engaged in one or more of the following: (1) cutting and coating paper and paperboard; (2) cutting and laminating paper, paperboard, and other flexible materials (except plastics film to plastics film); (3) manufacturing bags, multiwall bags, sacks of paper, metal foil, coated paper, laminates, or coated combinations of paper and foil with plastics film; (4) manufacturing laminated aluminum and other converted metal foils from purchased foils; and (5) surface coating paper or paperboard.
151 (110)	Stationery Product Manufacturing (322230): This industry comprises establishments primarily engaged in converting paper or paperboard into products used for writing, filing, art work, and similar applications.
152 (111)	Sanitary Paper Product Manufacturing (322291): This U.S. industry comprises establishments primarily engaged in converting purchased sanitary paper stock or wadding into sanitary paper products, such as facial tissues, handkerchiefs, table napkins, toilet paper, towels, disposable diapers, sanitary napkins, and tampons.
153 (112)	All Other Converted Paper Product Manufacturing (322299): This U.S. industry comprises establishments primarily engaged in converting paper or paperboard into products (except containers, bags, coated and treated paper, stationery products, and sanitary paper products) or converting pulp into pulp products, such as egg cartons, food trays, and other food containers from molded pulp.
368 (295)	Wood Kitchen Cabinet and Countertop Manufacturing (337110): This industry comprises establishments primarily engaged in manufacturing wood or plastics laminated on wood kitchen cabinets, bathroom vanities, and countertops (except freestanding). The cabinets and counters may be made on a stock or custom basis.
369 (296)	Upholstered Household Furniture Manufacturing (337121): This U.S. industry comprises establishments primarily engaged in manufacturing upholstered household-type furniture. The furniture may be made on a stock or custom basis.
370 (297)	Nonupholstered Wood Household Furniture Manufacturing (337122): This U.S. industry comprises establishments primarily engaged in manufacturing nonupholstered wood household type furniture and freestanding cabinets (except television, radio, and sewing machine cabinets). The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown).

IMPLAN Sector	Description (NAICS Code): Detailed Description
372* (299)	Institutional Furniture Manufacturing (337127): This U.S. industry comprises establishments primarily engaged in manufacturing institutional-type furniture (e.g., library, school, theater, and church furniture). Included in this industry are establishments primarily engaged in manufacturing general purpose hospital, laboratory, and dental furniture (e.g., tables, stools, and benches). The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). Bureau of Labor Statistics does not break this industry into wood and non-wood components. To estimate the amount of this industry is wood-based, the ratio of wood-based subsectors (337121 and 337122) and total household furniture subsectors (337121, 337122, 337124 and 337125) for the MI in 2014 (Bureau of Labor Statistics) was calculated for employment (69.9%) and applied to adjust IMPLAN Sector 372 values.
373 (300)	Wood Office Furniture Manufacturing (337211): This U.S. industry comprises establishments primarily engaged in manufacturing wood office-type furniture. The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). This was a new sector in 2013 IMPLAN datasets. Previously, IMPLAN Sector 300 included Non-Wood Office Furniture Manufacturing (337214).
374 (301)	Custom Architectural Woodwork and Millwork Manufacturing (337212): This U.S. industry comprises establishments primarily engaged in manufacturing custom designed interiors consisting of architectural woodwork and fixtures utilizing wood, wood products, and plastics laminates. All of the industry output is made to individual order on a job shop basis and requires skilled craftsmen as a labor input. A job might include custom manufacturing of display fixtures, gondolas, wall shelving units, entrance and window architectural detail, sales and reception counters, wall paneling, and matching furniture.
376* (302)	Showcase, Partition, Shelving, and Locker Manufacturing (337215): This U.S. industry comprises establishments primarily engaged in manufacturing wood and nonwood office and store fixtures, shelving, lockers, frames, partitions, and related fabricated products of wood and nonwood materials, including plastics laminated fixture tops. The products are made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). Establishments exclusively making furniture parts (e.g., frames) are included in this industry. Like Institutional Furniture Manufacturing, this sector includes both wood and nonwood components. To estimate the amount of this industry is wood-based, the ratio of wood-based custom and office furniture subsectors (337211 and 337212) and total office furniture subsectors (337211, 337212, and 337214) for the MI in 2014 (Bureau of Labor Statistics) was calculated for employment (36.8%) and applied to adjust IMPLAN Sector 376 values.

Note: Sector numbers from 2012 IMPLAN sectorization scheme noted in parentheses, and sectors modified for this analysis denoted with "".*

Appendix 2

Table 14 - Detailed Forest Industry Sector Direct Contributions, 2014

IMPLAN Sector	Forest Industry Sector	Direct Contributions, 2014		
		Employment (Jobs)	Output (2014 Dollars)	Labor Income (2014 Dollars)
15	Forestry, forest products, and timber tract production	317	$ 28,509,089	$10,361,712
16	Commercial logging	4,402	402,391,357	160,876,137
19	Support activities for forestry*	360	16,690,125	10,061,762
47	Electric power generation - Biomass	132	148,369,659	20,811,769
134	Sawmills	2,893	776,106,567	139,386,793
135	Wood preservation	179	77,316,185	6,855,202
136	Veneer and plywood manufacturing	974	258,683,441	48,736,321
137	Engineered wood member and truss manufacturing	822	155,851,212	44,196,625
138	Reconstituted wood product manufacturing	843	433,139,496	64,913,179
139	Wood windows and door manufacturing	675	131,110,229	34,366,604
140	Cut stock, resawing lumber, and planing	513	115,317,642	23,792,898
141	Other millwork, including flooring	1,278	222,792,572	58,842,683
142	Wood container and pallet manufacturing	2,145	285,133,606	92,660,641
143	Manufactured home (mobile home) manufacturing	157	30,256,767	9,556,653
144	Prefabricated wood building manufacturing	414	72,034,027	19,776,882
145	All other miscellaneous wood product manufacturing	870	145,179,474	37,292,567
146	Pulp mills	64	41,634,163	5,954,627
147	Paper mills	2,400	1,889,262,695	249,282,156
148	Paperboard mills	824	672,454,407	76,783,811
149	Paperboard container manufacturing	6,133	2,666,858,887	412,515,628
150	Paper bag and coated and treated paper manufacturing	1,077	499,706,604	85,732,778
151	Stationery product manufacturing	179	61,983,765	9,804,903
152	Sanitary paper product manufacturing	486	386,102,722	34,932,341
153	All other converted paper product manufacturing	208	67,307,175	11,920,949

IMPLAN Sector	Forest Industry Sector	Direct Contributions, 2014		
		Employment (Jobs)	Output (2014 Dollars)	Labor Income (2014 Dollars)
368	Wood kitchen cabinet and countertop manufacturing	1,611	237,042,557	87,844,618
369	Upholstered household furniture manufacturing	246	46,251,324	9,873,489
370	Nonupholstered wood household furniture manufacturing	688	92,925,293	26,487,486
372	Institutional wood furniture manufacturing*	1,675	319,607,458	98,783,713
373	Wood office furniture manufacturing	3,897	957,081,360	296,420,885
374	Custom architectural woodwork and millwork	649	111,009,140	41,250,710
376	Showcase, partition, shelving, and locker manufacturing*	1,176	253,152,448	67,495,806
		38,291	**$11,601,261,445**	**$2,297,572,325**

Note: sectors modified for this analysis denoted with "".*

APPENDIX 3

Table 15 - Detailed Forest Industry Sector Total Contributions, 2014

IMPLAN Sector	Forest Industry Sector	Total Contributions, 2014		
		Employment (Jobs)	Output (2014 Dollars)	Labor Income (2014 Dollars)
15	Forestry, forest products, and timber tract production	573	$51,548,835	$9,389,595
16	Commercial logging	7,076	689,514,410	260,510,509
19	Support activities for forestry*	446	28,267,811	13,786,913
47	Electric power generation - Biomass	1,230	281,355,351	68,182,606
134	Sawmills	9,930	1,708,623,855	459,238,985
135	Wood preservation	644	151,094,949	30,516,674
136	Veneer and plywood manufacturing	2,796	521,322,391	135,863,788
137	Engineered wood member and truss manufacturing	1,838	312,821,425	94,855,842
138	Reconstituted wood product manufacturing	2,596	737,259,914	153,646,552
139	Wood windows and door manufacturing	1,434	243,948,123	71,913,757
140	Cut stock, resawing lumber, and planing	1,259	221,589,910	58,789,184
141	Other millwork, including flooring	2,774	439,732,352	130,416,229
142	Wood container and pallet manufacturing	3,767	531,963,315	172,428,042
143	Manufactured home (mobile home) manufacturing	300	51,234,074	16,227,595
144	Prefabricated wood building manufacturing	841	135,248,251	40,661,900
145	All other miscellaneous wood product manufacturing	1,836	288,442,659	84,241,682
146	Pulp mills	294	76,847,709	17,304,551
147	Paper mills	10,622	3,234,699,514	680,960,389
148	Paperboard mills	4,401	1,255,169,705	261,141,245
149	Paperboard container manufacturing	16,631	4,310,619,971	950,231,880
150	Paper bag and coated and treated paper manufacturing	2,746	775,002,453	172,518,021
151	Stationery product manufacturing	411	99,966,575	22,101,899
152	Sanitary paper product manufacturing	1,612	577,316,304	95,340,875
153	All other converted paper product manufacturing	488	111,659,259	26,555,573

IMPLAN Sector	Forest Industry Sector	Total Contributions, 2014		
		Employment (Jobs)	Output (2014 Dollars)	Labor Income (2014 Dollars)
368	Wood kitchen cabinet and countertop manufacturing	3,008	433,774,468	152,430,855
369	Upholstered household furniture manufacturing	443	78,034,479	19,948,068
370	Nonupholstered wood household furniture manufacturing	1,153	162,879,013	49,034,314
372	Institutional wood furniture manufacturing*	3,288	557,133,069	176,647,570
373	Wood office furniture manufacturing	8,671	1,651,555,862	525,388,453
374	Custom architectural woodwork and millwork	1,226	193,512,407	68,112,964
376	Showcase, partition, shelving, and locker manufacturing*	2,287	421,971,511	121,666,080
		96,623	**$20,334,109,921**	**$5,150,052,591**

Note: sectors modified for this analysis denoted with "".*

Appendix 4

Table 16 - Direct Contributions, Total Contributions and SAM Multipliers for Seven Aggregated Forest Products Industries, 2012

FOREST PRODUCTS INDUSTRIES	Employment (Jobs)	Output	Labor Income
		(Millions of 2012 Dollars)	
Direct Contributions			
Forestry	873	$107.5	$35.9
Logging	3,170	261.8	131.4
Primary Solid Wood Products and Wood-based Power	4,350	1,027.7	204.4
Secondary Solid Wood Products	5,807	909.2	241.1
Wood Furniture	8,591	2,053.2	549.7
Primary Paper and Paperboard Products	3,470	2,806.1	340.5
Secondary Paper and Paperboard Products	7,943	3,227.1	531.0
Grand Total	**34,204**	**$10,392.5**	**$2,034.0**
Total Contributions			
Forestry	1,974	$203.8	$75.0
Logging	5,593	546.2	232.5
Primary Solid Wood Products and Wood-based Power	11,943	1,981.1	540.4
Secondary Solid Wood Products	11,509	1,714.1	507.7
Wood Furniture	18,425	3,380.2	989.6
Primary Paper and Paperboard Products	14,651	4,517.6	905.3
Secondary Paper and Paperboard Products	20,113	5,144.2	1,147.7
Grand Total	**84,208**	**$17,487.2**	**$4,398.1**
SAM Multiplier			
Forestry	2.26	1.90	2.09
Logging	1.76	2.09	1.77
Primary Solid Wood Products and Wood-based Power	2.75	1.93	2.64
Secondary Solid Wood Products	1.98	1.89	2.28
Wood Furniture	2.14	1.65	1.82
Primary Paper and Paperboard Products	4.22	1.61	2.66
Secondary Paper and Paperboard Products	2.53	1.59	2.16
Grand Total	**2.46**	**1.68**	**2.16**