Forest Products Industries' Economic Contributions: Ohio

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Foreword

Ohio is fortunate to have nearly 8 million acres of forestland throughout the state. Whether it is hiking, hunting, or simply appreciating the autumn beauty, Ohioans enjoy a wide variety of benefits from the state's forests.

This list of benefits would not be complete without recognizing the value of forest management throughout the state. Ohio's forests have long provided valuable timber products to move the country forward—from manufacturing railroad ties during westward expansion to fueling iron furnaces. Although times have changed, Ohio is still proud to be producing quality forest products and providing economic opportunities for its citizens.

As you will see in the following pages, Ohio's forest products industries are as diverse as the forests growing here. From loggers to maple syrup producers, more than 124,000 individuals contribute to a $27 billion forest products economy in the state. These industries create furniture, flooring, paper, and other wood products used locally and around the globe.

Ohio's forests are a valuable renewable resource; through sustainable management they will continue providing environmental and economic benefits well into the future. Thank you for your interest in this report and Ohio's forest products industries.

Sincerely,

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Table of Contents

Foreword **2**
Acknowledgements **3**
Table of Contents **4**
Executive Summary **5**
Glossary **8**
Introduction **10**
Forest Resources of Ohio **10**
Forest Products Industries **13**
Economic Contributions of Ohio's Forest Products Industries **14**
Economic Contributions Defined 14
Economic Contribution Results 16
Direct and Total Contributions by Forest Products Industries 16
Direct and Total Contributions by Forest Product Industry Groups 17
Top Forest Product Sectors 20
Top Nonforest Industries Impacted 21
Neighboring States 22
Importance of the Forest Products Industries in Context 23
Supplemental Economic Contribution Information 25
Summary **25**
References **27**
Appendix A: Methods and Data **28**
Appendix B: Forest Products Industries Groupings and IMPLAN Sectors **31**
Appendix C: Detailed Economic Contribution Results **33**

Executive Summary

This report assesses broad forest conditions and economic contributions of forest products industries in Ohio. It is one of 20 coordinated and comparable state reports in the northeastern and midwestern United States that provides an improved assessment of forests and the economies they support. Forest data come from the U.S. Forest Service's Forest Inventory and Analysis website, and economic data come from the 2017 Impact Analysis for Planning (IMPLAN), a commercially available economic input-output (IO) model.

Ohio boasts 8.0 million acres of forest land covering 31 percent of its land base, with most of this forest land able to produce commercial timber. The majority, 85 percent, is privately owned, while state and local governments own about 11 percent and the federal government owns about 4 percent.

Forest Industries

This report presents seven forest products industries, which are based on 32 economic sectors in IMPLAN, 31 of which are present in Ohio:

- Forestry
- Logging
- Primary solid wood products
- Secondary solid wood products
- Wood furniture
- Pulp, paper, and paperboard mills
- Secondary paperboard and other paper products

In 2017, Ohio's forest products industries provided direct employment to 54,445 people, leading to $16.1 billion in output. That same year, labor income was $3.7 billion and value-added was $4.6 billion. In total contributions, these industries supported 124,692 jobs, $7.5 billion in labor income, $11.1 billion in value-added, and $27.4 billion in output.

Among the top sectors (excluding forest products sectors) impacted by forest products industries were wholesale trade, management of companies and enterprises, restaurants, real estate, hospitals, and trucking. This group of sectors reflects spending by forest products companies, their suppliers, and individuals.

Leading Forest Products Industry Groups

Among the seven industry groups, the leading industries' rank in terms of direct jobs, value-added, and direct output varied by chosen measure:

- Secondary paperboard and other paper products had the highest number of direct jobs (17,971), value-added ($1.9 billion), and output ($8.1 billion).
- Wood furniture had the second highest number of direct jobs (14,904), value-added ($968.3 million), and output ($2.4 billion).
- Secondary solid wood products had the third highest number of direct jobs (12,516), value-added ($776.8 million), and direct output ($2.4 billion).

Leading Individual Forest Products Sectors

Among the 31 forest products sectors present in Ohio, the top four, by measure in order from highest to fourth highest of direct contributions, were:

- Employment—Paperboard container manufacturing, wood kitchen cabinet and countertop manufacturing, paper bag and coated and treated paper manufacturing, and nonupholstered wood household furniture manufacturing were the top four sectors and had a combined total of 24,195 direct jobs, or 44.4 percent of direct employment.
- Labor income—Paperboard container manufacturing, paper bag and coated and treated paper manufacturing, commercial logging, and wood kitchen cabinet and countertop manufacturing had the highest labor income, totaling $1.8 billion, of 47.9 percent of direct labor income.
- Value-added—Paperboard container manufacturing, paper bag and coated and treated paper manufacturing, commercial logging, and wood kitchen cabinet and countertop manufacturing had the highest value-added, totaling $2.3 billion, or 48.5 percent of direct value-added.
- Output—Paperboard container manufacturing, paper bag and coated and treated paper manufacturing, paper mills, and wood container and pallet manufacturing were the top four sectors in output, totaling $8.5 billion, or 53.0 percent of total direct output.

Ohio's Forest Products Industries Compared to Other Ohio Industries

The forest products industries provide more direct labor income and output than commercial fishing, hunting, and trapping; mining and oil and gas production; and agricultural production industries (plant crop and animal). Overall, forest products industries accounted for 8 percent of the nonfood manufacturing jobs in Ohio. Over 7 percent of Ohio's 712,426 direct manufacturing jobs in 2017 were in the forest products industries (i.e., 1 in 14 manufacturing jobs).

Ohio's Forest Products Industries Compared to Those of Indiana, Pennsylvania, and West Virginia

Ohio's forest products industries are similar in nature to those of Indiana, Pennsylvania, and West Virginia—making for good comparisons. Combined, the four states employed 183,188 workers and

accounted for almost $54 billion in direct output. Pennsylvania's forest products economy was the largest among these states, followed by that of Ohio.

Glossary

The following technical terms are used throughout this report when discussing forestry and economic contributions.

Forestry Terms

Average annual harvest removals: The average annual merchantable volume of growing-stock trees that were live at the time of the previous inventory and were either cut and removed by direct human activity related to harvesting or died as a result of silvicultural or land-clearing activity by the time of the current inventory.

Average annual mortality: The average annual merchantable volume of growing-stock trees that were live at the time of the previous inventory and are dead in the current inventory.

Average annual net growth: The average annual change in merchantable volume of growing-stock trees, after deducting mortality volume, between inventories.

Forest land: Land that is at least 10 percent stocked by trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and nonforested lands that have at least 10 percent canopy cover with live tally trees, or recently had at least 10 percent canopy cover by live tally trees based on the presence of stumps, snags or other evidence, and forest areas adjacent to urban and built-up lands, including pinyon-juniper and chaparral areas in the western U.S. and afforested areas. The minimum area for classification of forest land is one acre and 120 feet wide measured stem-to-stem from the outermost edge. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest land if less than 120 feet wide.

Growing stock: Live trees of commercial species that meet minimum merchantability standards and only includes trees at least 5 inches in diameter at breast height. In general, these trees have at least one solid eight-foot section, are reasonably free of form defect on the merchantable bole, and at least 34 percent or more of the volume is merchantable. Excludes rough or rotten cull trees.

Timberland: A subset of forest land that produces or can produce crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland can produce at least 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.)

Economic Contribution Terms

Direct effects/contributions: 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.

Employment: The number of full- and part-time jobs associated with an industry.

Indirect effects/contributions: The impact of local industries purchasing goods and services from other industries, leading to others' outputs, employment, and labor income. This report uses "indirect effects" to refer to the combination of indirect and induced effects.

Induced effects/contributions: The impact of labor income (employee compensation and proprietor income) via goods and services purchased due to the direct and indirect spending by industries. For this report, induced effects are included with indirect effects and referred to as indirect effects.

Labor income: The dollar total of employee compensation and proprietor income; the latter is associated with self-employed individuals.

Output: The dollar measure of production within an area; it is also viewed as sales.

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, and more. 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").

Total effects/contributions: The sum of direct, indirect, and induced effects.

Value-added (also known as gross state product, or GSP): The sum of 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 region equals the total GSP.

Introduction

Forest products industries are an integral component of Ohio's economy. They provide jobs, raw materials, and finished goods that generate additional economic activity throughout the state, region, and nation. Previous studies of the industries' economic contributions have focused solely on Ohio—most recently in 2010 following the 2008–2009 recession. This report compares the contributions of Ohio's forest products industries with those of adjacent states. It is one of 20 reports in the Northeast and Midwestern area of the United States that broadly assesses forests and their economic contributions. The interactions of these 20 states are covered in a regional report. In total, these documents provide a consistent reporting format, compiled using identical methods, across the northeastern and midwestern United States. Previous state-level reports in this area were not comparable because they used different methods and data.

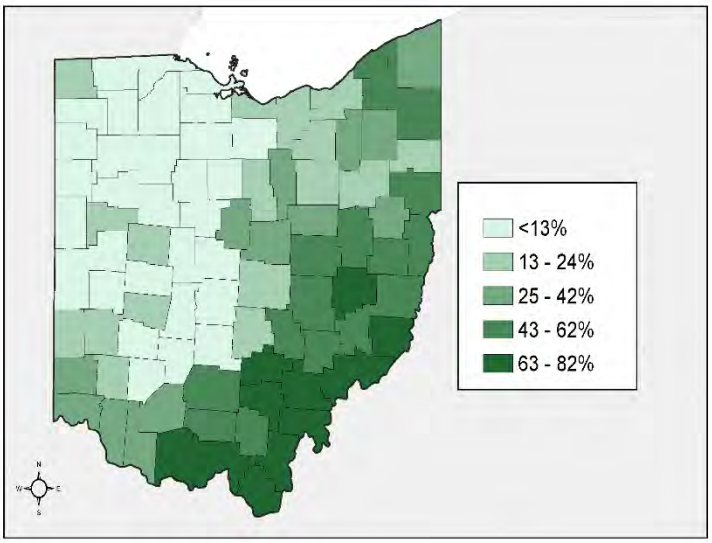
To help quantify these relationships and consistently document the industries' contributions, the Forest Markets & Utilization Committee of the Northeast—Midwest State Foresters Alliance secured federal grant funds to conduct an analysis of 20 midwestern- and northeastern–area states as well as Nebraska. As part of this work, the same project team that completed the individual state reports—comprising members of the Michigan Department of Natural Resources, Public Sector Consultants, Michigan State University forestry economics professor emeritus Larry Leefers, and state forestry experts—published a 20-state report summarizing the economic contributions of forest products industries at a regional level. The U.S. Forest Service funded this work through a 2017 Landscape Scale Restoration grant.

Much of the data used in this report were derived from the U.S. Forest Service Forest Inventory and Analysis database and from IMPLAN, a widely used economic modeling system. These data and related information are presented in four major sections: Forest Resources of Ohio, Forest Products Industries, Economic Contributions of Ohio's Forest Products Industries, and Summary. Due to rounding, some figures in the following tables may not sum to the exact total indicated. The appendices present the economic methods and detailed economic sector data used for this report.

Forest Resources of Ohio

Ohio's forest resources can be found throughout the state; however, most forest land is found in southern and eastern Ohio. As shown in Exhibit 1, many of these counties are over 50 percent forested, whereas most forests in the western half of the state are found interspersed among agricultural fields.

Exhibit 1. Percent of Forest Land by County, 2017



Source: U.S. Forest Service Forest Inventory and Analysis Program

Overall, 30.6 percent of the state is forested (Exhibit 2). Timberland is the largest component of forest land, totaling 7.6 million acres. Reserved and other forest land accounts for the other 0.3 million acres.

Exhibit 2. Ohio Land Area by Land Use Type, 2017

Land Use Type	Acres	Percentage
Forest land	7,986,719	30.6%
Nonforest land	18,090,409	69.4%
Total	**26,077,128**	**100.0%**

Most land (84.9 percent) is privately owned, and the State of Ohio and U.S. Forest Service are the major public owners (Exhibit 3). Landowners may pursue diverse goals in their forests depending on the specific objectives they wish to achieve. Private landowners have wide latitude in how they treat their lands—some have a hands-off approach, while others pursue active management. There are several state and federal programs, such as the Ohio Forest Tax Law and the Environmental Quality Program (EQIP), designed to encourage the active management of private forest lands. State-owned forests and the Wayne National Forest are actively managed in many areas. In other areas, publicly owned forests have been set aside for preservation, recreation, and resource protection.

Exhibit 3. Forest Land by Ownership Group (2017)

Ownership Group	Acres	Percentage
National forest	289,350	3.6%
Other federal	65,379	0.8%
State and local governments	851,764	10.7%
Private	6,780,225	84.9%
Total	**7,986,718**	**100.0%**

Ohio's forests are primarily composed of the oak/hickory type, with maple/beech/birch being common in the northern part of the state (Exhibit 4). Tree species with the greatest standing volume include red and sugar maples, yellow poplar, white oak species, red oak species, hickories, black cherry, and ash. Ohio is widely known for its high-quality hardwoods, particularly white oak, which is prized for veneers and barrel staves. Other common products coming from Ohio hardwoods include flooring, cabinets, and furniture.

Exhibit 4. Forest Land Area by Forest Type Group (2017)

Forest Type Group	Acres	Percentage
Oak/hickory	5,068,145	63.5%
Maple/beech/birch	1,657,714	20.8%
Elm/ash/cottonwood	718,010	9.0%
Oak/pine	135,814	1.7%
Other	407,035	5.1%
Total	**7,986,718**	**100.0%**

The estimated volume of standing timber suitable for forest products was about 54.7 billion board feet (International ¼ inch scale) (Exhibit 5). Average annual net growth exceeded annual harvest removals by a ratio of about 1.9 to 1. That is, for every board foot of harvesting that took place, 1.9 board feet of timber grew (after accounting for mortality). Average annual harvest removals in 2017 of growing stock were about 770.4 million board feet, or 1.4 percent of standing volume.

Exhibit 5. Characteristics of Sawtimber Trees on Forestland in Ohio, 2017 (in million board feet, International ¼-inch rule)

Measure	Total	National Forest	Other Federal	State and Local Government	Private
Net volume	54,688.8	2,336.2	457.5	7,775.6	44,119.4
Average annual net growth	1,455.7	43.6	11.0	160.1	1,241.0
Average annual harvest removals	770.4	-	-	58.7	711.7
Average annual mortality	573.1	20.2	3.3	80.5	469.1

Note: Sawtimber is a tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches in diameter at breast height (d.b.h.). Hardwoods must be at least 11.0 inches d.b.h. Net volume is net volume in board feet of the sawlog portion of sawlog-sized trees for timber species. Net growth is the average annual change (gross growth minus mortality) in the sawlog volume of sawtimber trees, in board feet (International ¼-inch rule), on forest land. Harvest removals are the average annual harvest removals, the sawlog volume of sawtimber trees, in board feet (International ¼-inch rule, on forest land. Annual mortality is the average annual cubic foot mortality of the sawlog volume of sawtimber trees, in board feet (International ¼-inch rule, on forest land.

Forest Products Industries

Contribution analysis focuses on industries' role in an economy. The first step is often defining the region (e.g., a state). One of the next steps is to define exactly which economic sectors comprise the focus industries. To analyze the contributions of the forest industries, representatives from the U.S. Forest Service's northeastern and midwestern states and Nebraska selected 32 sectors by consensus for inclusion in the analysis. A description of the methods and data is presented in Appendix A. To concisely describe and communicate the economic contribution of the forest products industries, these 32 sectors were aggregated into seven broad groups (Appendix B):

- Forestry
- Logging
- Primary solid wood products
- Secondary solid wood products
- Wood furniture
- Pulp, paper, and paperboard mills
- Secondary paperboard and other paper products

In total, these sectors cover forest-specific manufacturing activities, including the conversion of trees into primary products and the manufacture of products used by other sectors and households. Primary industries (e.g., sawmills, reconstituted wood products [such as oriented strand board], 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 paperboard) in their manufacturing processes. Value is added as the timber is processed through primary and secondary manufacturers. Several sectors included wood and nonwood products (e.g., institutional furniture manufacturing). Therefore, output and other measures were reduced to better reflect the wood-only component by using published government data or surveys (Gibson, Leefers, and Poudel 2020).

This report used IMPLAN to estimate economic contributions of the forest products industries. IMPLAN is a widely used input-output model that comprises economic data and software. IO models characterize financial linkages among and between sectors, households, and institutions, and can be constructed for different geographic areas. Within these models, various sectors have production functions that show the value of inputs used in production of outputs or commodities. Ohio's economy was represented by 514 sectors in 2017, the most recent year available for IMPLAN data at the time of the analysis. These sectors are based on the North American Industrial Classification System (NAICS).

Economic Contributions of Ohio's Forest Products Industries

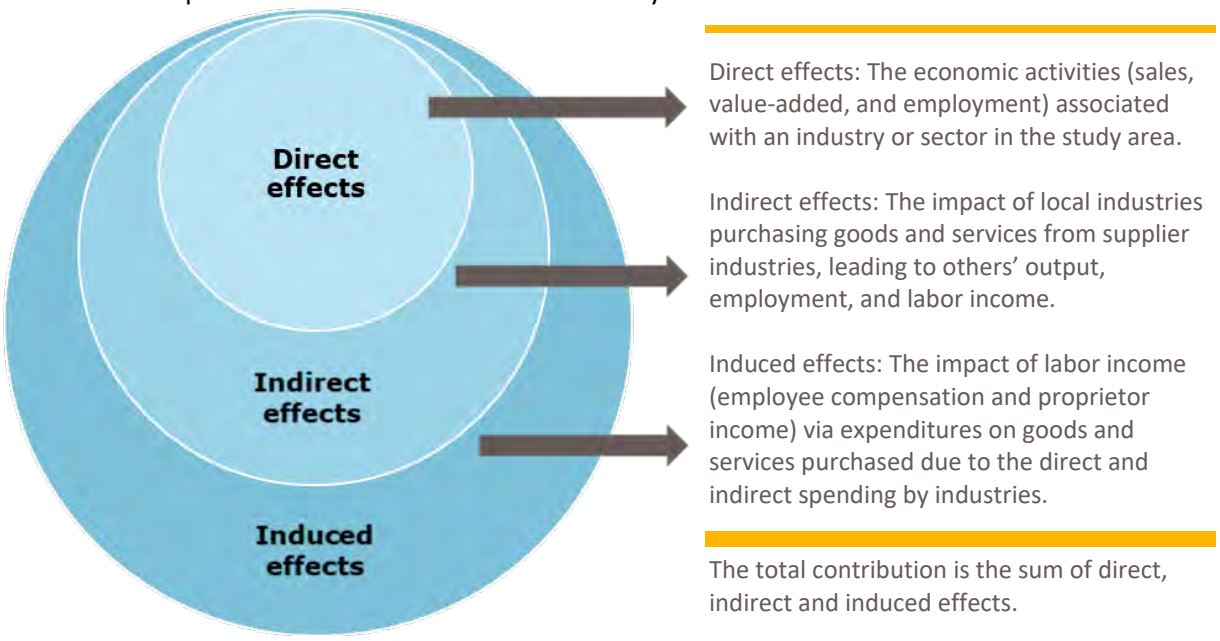
This section of the report includes four major subsections: Economic Contributions Defined, Economic Contribution Results, Importance of the Forest Products Industries in Context, and Supplemental Economic Contribution Information.

Economic Contributions Defined

Input-Output Analysis and IMPLAN

Forest products industries influence the economy in three ways: direct effects (when industries sell commodities in response to demand), indirect effects (as suppliers to directly impacted sectors), and induced effects (household spending by employees in directly and indirectly impacted sectors) (Exhibit 6). The total economic contribution is the value of production required to meet all the needs stemming from the initial activity—in this case, forest product–related purchases.

Exhibit 1. Concept of Total Economic Contribution Analysis



IO modeling using IMPLAN software and data is a conventional approach for documenting forest products industries' economic contributions. This analysis used the matrix inversion approach with external IMPLAN model adjustment as a primary method for estimating economic contributions of forest products industries in Ohio (Gibson, Leefers, and Poudel 2020). Major economic indicators generated by IMPLAN include employment (full- and part-time jobs), labor income, total output, and value-added.

Interaction Between State and Regional Analyses

IMPLAN models are based on interactions across the economy. One important aspect of these interactions is whether commodities are sourced locally or imported. In smaller areas (e.g., counties), fewer commodities are sourced locally. As a result, leakages occur when purchases are made—that is, fewer dollars stay in the local economy.

Larger economies have fewer leakages and more commodities are sourced locally. For example, an examination of the logging industries (IMPLAN sector 16) in Ohio, Pennsylvania, and West Virginia reveals that the direct employment for 2017 was 3,069, 4,740, and 1,919 jobs, respectively. Summing the individual state's total employment contributions (direct, indirect, and induced) yields 17,637 jobs. However, if the states are combined as one region, the total employment contribution increases to 17,719 jobs. This increase reflects less leakage and more local purchases.

The larger role is due to trade, but IMPLAN does not explicitly show trade with specific states, only overall imports and exports. The regional analysis highlights the larger role of forest products industries in the region's economy. Consequently, the state-level analyses underestimate the actual contributions from a regional perspective.

Economic Contribution Results

This section presents direct and total contributions for all forest products industries, direct and total contributions by forest product industry groups (e.g., logging, furniture, etc.), the top forest products sectors, and the top nonforest products sectors affected by the forest products industries. Finally, this section compares forest industries in nearby states, other natural resources industries, and manufacturing industries within the state.

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

Direct and Total Contributions by Forest Products Industries

Contribution analysis provides a means to assess the role various industries play in a state's economy. Ohio forest products industries' total economic contribution in terms of output was $27.4 billion, based on direct output of $16.1 billion (Exhibit 7). There were 54,445 direct jobs associated with this level of economic activity, supporting a total of 124,692 jobs. Direct labor income, which includes employee compensation and proprietor income, was $3.7 billion, or $67,778 per job. Total labor income, which includes income paid directly to industry employees and proprietors, their suppliers, and other industries they support, totaled $7.5 billion.

Exhibit 2. Economic Contribution of Forest Products Industries in Ohio, 2017 Dollars

Effect	Employment	Labor Income (Thousands of Dollars)	Value-added* (Thousands of Dollars)	Output (Thousands of Dollars)
Direct	54,445	$3,690,189	$4,649,464	$16,111,539
Total	124,692	$7,516,031	$11,069,310	$27,365,814

* Value-added in IMPLAN is equivalent to GSP.

Each direct job in the forest products industries supported 1.3 additional jobs, and every $1 million in direct labor income supported an additional $1.04 million in indirect and induced labor income.

Most state economies are large relative to any particular industry or group of industries. The forest products industries are no exception. In 2017, Ohio's population was estimated at 11.7 million people, with total employment of 7.0 million. The gross state product was $651.5 billion from 514 economic sectors (of the possible 536 in the US). The GSP's largest component was labor income, which was $389.6 billion.

Direct value-added for forest products industries was $4.6 billion, 0.7 percent of Ohio's total GSP, increasing to 1.7 percent when considering total value-added effects. These percentages hold for other economic measures (e.g., jobs) as well.

Direct and Total Contributions by Forest Product Industry Groups

As previously noted, the 32 IMPLAN forest products sectors were combined into seven industry groups (Appendix B). In Ohio, secondary paperboard and other paper products was the largest of these groups in terms of direct employment, labor income, value-added, and output (Exhibit 8). Wood furniture was the second largest group in terms of all four metrics. Forestry, which includes maple syrup production, timber tract operations, and forestry support activities, was the smallest group for all metrics.

Secondary paperboard and other paper products accounted for half the output of forest products industries. Secondary paperboard and other paper products and wood furniture accounted for six out of every ten direct jobs in the forest product industries.

Exhibit 3. Direct Economic Contributions in Ohio, Industry Groups, 2017

Industry Group	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry	596	$31,638	$31,389	$37,948
Logging	3,069	$361,555	$417,276	$484,704
Primary solid wood products	3,178	$175,499	$196,317	$987,376
Secondary solid wood products	12,516	$706,681	$776,757	$2,379,878
Wood furniture	14,904	$867,817	$968,291	$2,436,627
Pulp, paper, and paperboard mills	2,211	$221,564	$389,328	$1,717,609
Secondary paperboard and other paper products	17,971	$1,325,435	$1,870,107	$8,067,397
Total	**54,445**	**$3,690,189**	**$4,649,464**	**$16,111,539**

Exhibit 4. Total Economic Contributions in Ohio, Industry Groups, 2017

Industry Group*	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry	559	$33,684	$39,720	$55,180
Logging	3,343	$276,477	$361,495	$486,962
Primary solid wood products	7,643	$461,772	$659,494	$1,610,748
Secondary solid wood products	25,872	$1,442,016	$1,978,765	$4,507,672
Wood furniture	28,165	$1,556,612	$2,122,363	$4,522,088
Pulp, paper, and paperboard mills	9,633	$663,747	$1,116,602	$2,913,528
Secondary paperboard and other paper products	49,477	$3,081,722	$4,790,870	$13,269,635
Total	**124,692**	**$7,516,031**	**$11,069,310**	**$27,365,814**

*Forestry and logging are reported in this table, but most of their contributions are as indirect inputs or intermediate inputs used for production in the other five industry groups.

For the following sector-specific discussions, refer to Exhibit 8 for direct contribution details and Exhibit 9 for total contribution details. See Appendix C for detailed economic measures for industry groups and their component sectors.

Forestry

The forestry group includes timber tract operations, establishments primarily engaged in the operation of timber tracts for the purpose of selling standing timber, and support activities for forestry such as estimating timber; forest firefighting; forest pest control; treating burned forests from the air for reforestation or on an emergency basis; and consulting on wood attributes and reforestation related to timber production, wood technology, forestry economics and marketing, and forest protection.

Out of seven industry groups, forestry was the smallest in terms of direct employment in 2017. Direct contributions were $37.9 million in output, 596 jobs, $31.6 million in labor income, and $31.4 million value-added. In most cases, value-added is greater than labor income, one of the value-added components. Often, this situation does not hold for agricultural sectors due to farm subsidies, which show up as “negative taxes.” Sector 19, support activities for agriculture and forestry, reflects this for Ohio in 2017, leading to the smaller value-added. Total contributions are based, in part, on backward linkages to suppliers. Total contributions for forestry can be lower than direct contributions (i.e., initial IMPLAN levels) because many of the contributions are inputs into other industries. For example, 43 percent of forestry jobs are counted as contributions in other industries, mostly logging and primary solid wood products (e.g., sawmills). Hence, the total contributions displayed in Exhibit 9

underrepresent the industry's broader contributions—reporting total contributions for forestry is somewhat misleading because much of the forestry total contribution effects are hidden in the total contributions of other industries. The same holds true for logging below.

Logging

The logging industry group contains establishments primarily engaged in one or more of the following: cutting timber, cutting and transporting timber, and producing wood chips in the field. Logging was the third smallest in terms of direct employment. The direct contributions of logging were $484.7 million in output, 3,069 jobs, $361.6 million in labor income, and $417.3 million in value-added. Most logging activity is an input into production in other industries, especially for manufacturing primary solid wood products (e.g., lumber), paper, and paperboard. In Ohio, 43 percent of logging jobs are included in the total contributions of other industries. As with forestry, logging's total contributions are underrepresented due to their inclusion in other industries.

Primary Solid Wood Products

The primary solid wood products industry group was the fourth largest group in terms of direct employment in Ohio. Primary solid wood products sectors include wood-based electric power generation, sawmills, wood preservation, veneer and plywood manufacturing, and reconstituted and wood product manufacturing industries. The direct contributions of the group were $987.4 million in output, 3,178 jobs, $175.5 million in labor income, and $196.3 million in value-added. Total contributions for primary solid wood products, including direct, indirect and induced effects, were $1.6 billion in output, 7,643 jobs, $461.8 million in labor income, and $659.5 million in value-added. Many primary solid wood products (e.g., lumber and panels) are inputs in other industries; those inputs are counted in other industries' total contributions.

Secondary Solid Wood Products

Secondary solid wood products was the third largest group in terms of direct employment in Ohio. This group contains engineered wood member and truss manufacturing; wood windows and doors manufacturing; cut stock, resawing lumber, and planing; 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. Direct contributions of secondary solid wood products were $2.4 billion in output, 12,516 jobs, $706.7 million in labor income, and $776.8 million in value-added. Total contributions were $4.5 billion in output, 25,872 jobs, $1.4 billion in labor income, and $2.0 billion in value-added.

Wood Furniture

Wood furniture was the second largest group in terms of direct employment in Ohio. Wood furniture includes wood kitchen cabinet and countertop manufacturing; upholstered household furniture manufacturing; nonupholstered wood household furniture manufacturing; institutional wood furniture

manufacturing; wood office furniture manufacturing; custom architectural woodwork and millwork manufacturing; and showcase, partition, shelving, and locker manufacturing. Direct contributions of wood furniture were $2.4 billion in output, 14,904 jobs, $867.8 million in labor income, and $968.3 million in value-added. Total contributions of wood furniture were $4.5 billion in output, 28,165 jobs, $1.6 billion in labor income, and $2.1 billion in value-added.

Pulp, Paper, and Paperboard Mills

The pulp, paper, and paperboard mills industry group was the second smallest in terms of direct employment in Ohio. The group includes pulp mills, paper mills, and paperboard mills that make paper or pulp from raw wood and from purchased pulp. The pulp, paper, and paperboard mills group's direct contributions were $1.7 billion in output, 2,211 jobs, $221.6 million in labor income, and $389.3 million in value-added. Total contributions were $2.9 billion in output, 9,633 jobs, $663.7 million in labor income, and $1.1 billion in value-added.

Secondary Paperboard and Other Paper Products

The secondary paperboard and other paper products group was the largest in terms of direct employment in Ohio. The group comprises paper and paperboard manufacturing, paper bag and coated and treated paper manufacturing, stationery product manufacturing, sanitary paper product manufacturing, and all other converted paper product manufacturing. Facilities in this group manufacture products from purchased pulp, paper, paperboard, or recycled materials. The direct contributions in 2017 were $8.1 billion in output, 17,971 jobs, $1.3 billion in labor income, and $1.9 billion in value-added. Total contributions were $13.3 billion in output, 49,477 jobs, $3.1 billion in labor income, and $4.8 billion value-added.

Top Forest Product Sectors

Among the 32 industry sectors that comprise the seven industry groups listed above, the leading sectors varied by the contribution measure examined. In terms of direct jobs, the four largest forest products sectors are paperboard container manufacturing (10,031 jobs), wood kitchen cabinet and countertop manufacturing (4,868 jobs), paper bag and coated and treated paper manufacturing (4,683 jobs), and nonupholstered wood household furniture manufacturing (4,613 jobs). These sectors reflect the diversity of manufacturing in the state.

The paperboard container manufacturing sector 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, fiber drums, and reels.

The wood kitchen cabinet and countertop manufacturing sector 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.

The paper bag and coated and treated paper manufacturing sector comprises establishments primarily engaged in one or more of the following: cutting and coating paper and paperboard; cutting and laminating paper, paperboard, and other flexible materials (except plastics film to plastics film); manufacturing bags, multiwall bags, sacks of paper, metal foil, coated paper, laminates, or coated combinations of paper and foil with plastics film; manufacturing laminated aluminum and other converted metal foils from purchased foils; and surface coating paper or paperboard.

The nonupholstered wood household furniture manufacturing sector 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).

In terms of labor income, paperboard container manufacturing, paper bag and coated and treated paper manufacturing, commercial logging, and wood kitchen cabinet and countertop manufacturing had the highest labor income, totaling $1.8 billion. They also had the highest value-added, totaling $2.3 billion. For output, paperboard container manufacturing, paper bag and coated and treated paper manufacturing, paper mills, and wood container and pallet manufacturing were the top four sectors, totaling $8.5 billion.

Top Nonforest Industries Impacted

Contribution analysis using IMPLAN relies on backward linkages from forest products industries sectors among themselves and to other sectors in Ohio. Including the 31 forest products industries, 213 sectors were impacted in 2017 (counting sectors with ten or more jobs supported). The top ten sectors (excluding forest products sectors) included wholesale trade, management of companies and enterprises, restaurants, real estate, hospitals, and trucking (Exhibit 10). This set of sectors reflects indirect and induced spending by forest products companies, their suppliers, and individuals.

These data were at an aggregate level, so 2,317 jobs in truck transportation included log trucks, delivery trucks, and office jobs for some trucking companies, among others. Seven of these sectors were among the top ten sectors in the state of Ohio (wholesale trade was number two, followed by hospitals, real estate, and limited- and full-service restaurants—each had over 200,000 jobs).

Exhibit 5. Direct Jobs Impacted by the Forest Products Industries Among Ohio's Top Ten Non-Forest Products Industries in 2017

Sector	Description	Jobs
395	Wholesale trade	5,642
461	Management of companies and enterprises	3,023
501	Full-service restaurants	2,913
502	Limited-service restaurants	2,912
440	Real estate	2,587
482	Hospitals	2,473
411	Truck transportation	2,317
464	Employment services	1,748
468	Services to buildings	1,726
405	Retail—General merchandise stores	1,208
Total	**NA**	**26,548**

Neighboring States

The states of Ohio, Indiana, Pennsylvania, and West Virginia are important for forest products. Forest products industries employ 183,188 workers across these states and account for $53.6 billion in direct output (Exhibits 11 and 12). Pennsylvania had the largest forest products economy with 68,541 direct jobs and output in excess of $22 billion. Ohio had the second-largest industry with 54,445 direct jobs and output of 16.1 billion. West Virginia had the smallest industry among these states. The three largest industry groups, each with over 46,000 employees, were wood furniture, secondary paperboard and other paper products, and secondary solid wood products.

Exhibit 6. Forest Products Industries Direct Employment in Ohio, Indiana, Pennsylvania, and West Virginia, 2017

Industry	Ohio	Indiana	Pennsylvania	West Virginia
Forestry	596	356	1,865	701
Logging	3,069	1,422	4,740	1,919
Primary solid wood products	3,178	3,485	6,812	2,836
Secondary solid wood products	12,516	12,572	18,638	2,613
Wood furniture	14,904	22,062	13,720	1,527
Pulp, paper, and paperboard mills	2,211	1,202	3,186	232
Secondary paperboard and other paper products	17,971	8,995	19,581	281
Sum of Direct Contributions	**54,445**	**50,093**	**68,541**	**10,108**

Exhibit 12. Forest Products Industries Direct Output in Ohio, Indiana, Pennsylvania, and West Virginia, 2017

Industry	Ohio (Thousands of Dollars)	Indiana (Thousands of Dollars)	Pennsylvania (Thousands of Dollars)	West Virginia (Thousands of Dollars)
Forestry	$37,948	$30,689	$126,178	$22,653
Logging	$484,704	$241,876	$697,606	$354,327
Primary solid wood products	$987,376	$997,860	$2,151,337	$878,920
Secondary solid wood products	$2,379,878	$2,596,710	$3,613,125	$512,662
Wood furniture	$2,436,627	$3,984,937	$2,282,116	$186,335
Pulp, paper, and paperboard mills	$1,717,609	$969,400	$2,722,271	$150,748
Secondary paperboard and other paper products	$8,067,397	$4,062,026	$10,827,005	$109,328
Sum of Direct Contributions	**$16,111,539**	**$12,883,498**	**$22,419,639**	**$2,214,972**

Importance of the Forest Products Industries in Context

To help contextualize the relative importance of the forest products industries, it is useful to compare the contribution of Ohio's forest products industries with others. Natural resources and agricultural industries significantly contribute to the diversity of economic activities reflected in Ohio's $651.5 billion GSP. The forest products industries provided more direct labor income and output than the commercial fishing, hunting, and trapping; mining and oil and gas production; and agricultural production industries (Exhibit 13). Ohio's forest products industries comprised 0.7 percent of the GSP in 2017. Agricultural production provided the largest amount of employment (full- and part-time) of these industries.

Exhibit 7. Natural Resources and Agricultural Production Industries in Ohio, 2017

Industry	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forest products	54,445	$3,690,189	$4,649,464	$16,111,539
Commercial fishing, hunting, and trapping	849	$7,254	$27,631	$36,859
Mining and oil and gas production	33,723	$2,062,309	$9,741,770	$12,374,399
Agricultural production (plant crop and animal)	99,495	$1,388,579	$3,350,614	$9,748,721
Total	**188,514**	**$7,148,332**	**$17,769,478**	**$38,271,518**

Labor income per job was highest in forest products ($67,778) and lowest in commercial fishing, hunting, and trapping ($8,544). For agricultural production, the average labor income per job was $13,956; mining and oil and gas had the second highest average income at $61,154.

Most of the forest products industries are manufacturers, however, the forestry, logging, and biomass power groups are not. There were 712,427 manufacturing jobs in Ohio in 2017, of which 50,780 were in the forest products industries, 7.1 percent of the total. Of 16 industries, forest products manufacturing was sixth in terms of employment, behind transportation equipment, fabricated metal, machinery, food, and plastics and rubber products manufacturing. It was seventh in terms of labor income and ninth in terms of value-added and output (Exhibit 14).

Exhibit 8. Manufacturing Industries in Ohio, 2017

Manufacturing Industries	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Transportation equipment	123,175	$10,655,608	$18,710,552	$84,824,400
Fabricated metal	102,793	$7,296,828	$11,268,706	$27,084,070
Machinery	78,212	$6,481,763	$8,788,268	$25,146,815
Food	70,397	$4,143,751	$10,174,807	$41,856,209
Plastics and rubber products	58,094	$3,632,733	$6,044,400	$19,519,389
Forest products	50,780	$3,296,996	$4,200,799	$15,588,887
Chemical	43,936	$5,166,005	$17,435,644	$48,634,321
Primary metal	36,891	$3,217,422	$5,792,861	$21,239,450
Nonmetallic mineral product	27,710	$1,984,474	$3,262,237	$8,710,351
Electrical equipment	27,208	$2,278,676	$3,564,046	$11,932,971
Miscellaneous	27,003	$1,996,188	$2,273,791	$6,698,990
Printing	24,693	$1,315,090	$1,969,722	$4,164,044
Computer and electronic product	19,046	$1,576,397	$2,122,560	$6,568,452
Beverage and tobacco product	9,597	$608,105	$2,171,302	$6,382,633
Textiles and apparel	8,132	$391,456	$470,819	$1,489,393
Petroleum and coal	4,759	$1,367,898	$6,228,822	$18,638,096
Total	**712,427**	**$55,409,391**	**$104,479,334**	**$348,478,471**

Supplemental Economic Contribution Information

The report by Gibson, Leefers, and Poudel provides a detailed discussion of which sectors were included and excluded from this analysis (2020). Most economic data used in this report were derived from IMPLAN, with one notable exception.

For most of the partial sectors (Appendix B), ratios of published government data were used to identify a portion of the industry that would be treated as forest products. In cases where only part of an IMPLAN sector was associated with forest products, analysts faced three options. The most conservative option was to include only sectors viewed as 100 percent in forest products, excluding sectors where only part produced forest products. At the other end of the spectrum, analysts could have focused on sectors producing any forest products at all, even if the forest products represented a small part of total output. Between these extremes, analysts could choose a third option—selecting the portion of a sector that produced forest products and include only that portion, mindful to include a means for assessing the magnitude of that portion. That is the approach used in this report.

Wood is used in many other products not covered by the 31 sectors highlighted in this report. For example, boats, blinds, musical instruments, burial caskets, organic chemicals, and pharmaceuticals may use wood directly or as an extract. However, the wood-only component of these product groups is difficult to quantify and was unable to be included in this report. Surveys could be designed and conducted to determine the forest products component of these sectors. In practice, the production functions, employment, output, and other metrics would need to be compiled and inserted into IMPLAN.

Summary

Over the last 20 years, individual states located in the midwestern and northeastern area of the United States have conducted statewide economic contributions studies of the forest products industries. However, these studies differed in approach, data used, and measures reported. Developing a consistent approach required funding that spanned multiple states. The Forest Markets & Utilization Committee of the Northeast—Midwest State Foresters Alliance secured grant funds through the Landscape Scale Restoration Program within the U.S. Forest Service, Eastern Region, State and Private Forestry to support investigation of the economic contributions of the forest products industry in the 20 northeastern and midwestern states and Nebraska. To that end, the Michigan Department of Natural Resources Forest Resources Division (serving as the lead on the grant project) contracted with Public Sector Consultants to facilitate discussions among the project partner states and to reach consensus on an appropriate analysis methodology and report template for both the regional and state reports, in addition to conducting the analysis.

This report serves as a snapshot of economic contributions of the forest products industries in Ohio for 2017, as well as a baseline report for future analyses. State data were used in this report, but given

IMPLAN's structure, substate and multistate analyses can be developed. However, future analyses may again require funding from the U.S. Forest Service or other institutions for assessments across multiple states. Methods used in developing this report are consistent across the region. There were 54,445 direct jobs in the forest products industries, and overall, 124,692 jobs were supported. Direct labor income was $3.7 billion with total labor income at $7.5 billion. Direct value-added was $4.6 billion, and the total contribution for value-added was $11.1 billion. Finally, direct output was $16.1 billion with a total contribution of $27.4 billion in output. Similar report findings are available from other states in the region and are summarized in a regional report.

References

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Appendix A: Methods and Data

Input-Output Analysis: IMPLAN

Several key decisions related to methods were developed through a consensus process (Gibson, Leefers, and Poudel 2020). The project team, in consultation with the states, made consensus decisions regarding the modeling method for estimating economic contributions, the forest products sectors to include in analysis (either in total or in part), the IMPLAN year for reporting results, and the use of an analysis spreadsheet for consistent reporting.

The economic contributions of the region and each state's forest products industries relied on 2017 IMPLAN software and data. IMPLAN is a widely used economic IO model that focuses on interdependence among various producing and consuming sectors in the economy. IMPLAN has 536 industry sectors for the 2017 data set and is based on the NAICS. 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, and others. More detailed information on data sources is available at the IMPLAN website.

Wassily Leontief developed IO modeling in the mid-20th century. Impact analysis examines the effects of changes in demand in a regional economy, while contribution analysis can evaluate the role of several related sectors in a region. IMPLAN provides the software and data to conduct such analyses. Each sector has a production function tracing the backward linkages (i.e., suppliers) to other sectors. Various sectors produce commodities (e.g., the logging sector produces logs). Leakages (e.g., foreign and domestic imports/exports) to and from other regions are also modeled. Social accounting flows among industries, households, government, and capital are included in IMPLAN.

The analysis process begins with creating an IMPLAN model. One or more geographic areas (e.g., counties or states) are selected as the region. Then, models are run through the creation of multipliers. This report uses Social Accounting Matrix (SAM) multipliers. Next, activities are selected to estimate either economic impacts or contributions. For example, analysts can estimate the impacts of expanding or contracting industries. In the case of contribution analysis, it is important to ensure that the level of production does not exceed the actual level of production in the region. Contribution analysis essentially counters the effects of the multipliers.

Contributions can be in terms of value-added, output, employment, and/or labor income. Value-added is commonly used to describe an industry's economic contributions and is a conservative measure of these contributions. Value-added is the difference between an industry's output, 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) 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 GSP.

Another measure of economic contribution is industry output. For example, if a log is sold to a sawmill that sells boards, both sales are counted as part of the overall region's output, as they are important economic activities. Another measure, employment, includes both full- 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.

Methods

IMPLAN estimates economic impacts (i.e., effects of economic changes) and contributions (i.e., effects of existing industries). Two methods for multisector economic contribution analysis are available (Parajuli et al., 2018), both requiring significant data manipulation.

The first method customizes the IMPLAN model by changing selected endogenous tables, whereas the second method adjusts input values based on matrix inversion prior to analysis. In method one, the changes are internal to IMPLAN and difficult to monitor from a quality control perspective.

Method two relies mostly on spreadsheet-based manipulation and is easier to monitor. When the contribution analysis is completed, direct effects from the IMPLAN sectors of interest equal the amounts shown in IMPLAN's "Industry Detail" table, and the total contributions (direct plus indirect plus induced) are estimated. Both methods prevent over reporting of total effects, which can occur if standard economic impact analysis is used when contribution analysis results are desired.

IMPLAN was designed for economic impact analysis. Multipliers ensure that the ripple effect manifests across the economy. A portion of those effects often involve self-purchases within the sector of interest. That is, if the output from the logging sector is $1 million in a local economy, the economic impact of $1 million in sales would be greater than that amount due to self-purchases. The contribution methods are designed to yield the $1 million direct contribution and its associated effects. Put simply, the amount of sales (direct contribution) estimated cannot exceed the amount that actually exists. Methods one and two accomplish this.

The matrix inversion approach relies on developing a detailed social accounting matrix (SAM) output multipliers for each sector in the forest products industries. Hence, a 32x32 matrix is developed with the diagonal yielding a value close to 1.0 for the detailed multipliers relating each row-column sector to itself (e.g., logging to logging, sawmills to sawmills, etc.). The actual matrix can be developed in several ways. For example, the SAM matrix can be exported from IMPLAN and narrowed down to the appropriate row and columns for the forest products industries. Then, it can be used to develop detailed multipliers via matrix inversion. Alternatively, detailed multipliers can be exported and rearranged into a 32x32 matrix. The approach used in this report was to rely on a matrix developed by IMPLAN staff for

the state. Then, the matrix was inverted and multiplied the initial IMPLAN output values for forest industries sectors to yield inputs for IMPLAN analysis.

Appendix B: Forest Products Industries Groupings and IMPLAN Sectors

Exhibit B1. Forestry Industry Grouping and IMPLAN Sectors

IMPLAN Sector	Sector Name
10	Maple syrup production*
15	Forestry, forest products, and timber tract production
19	Support activities for forestry*

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

Exhibit B2. Logging Industry Grouping and IMPLAN Sector

IMPLAN Sector	Sector Name
16	Commercial logging

Exhibit B3. Primary Solid Wood Products Industry Grouping and IMPLAN Sectors

IMPLAN Sector	Sector Name
47	Electric power generation—biomass*
134	Sawmills
135	Wood preservation
136	Veneer and plywood manufacturing
138	Reconstituted wood product manufacturing

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

Exhibit B4. Secondary Solid Wood Products Industry Grouping and IMPLAN Sectors

IMPLAN Sector	Sector Name
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

Exhibit B5. Wood Furniture Industry Grouping and IMPLAN Sectors

IMPLAN Sector	Sector Name
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*

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

Exhibit B6. Pulp, Paper, and Paperboard Mills Industry Grouping and IMPLAN Sectors

IMPLAN Sector	Sector Name
146	Pulp mills
147	Paper mills
148	Paperboard mills

Exhibit B7. Secondary Paperboard and Other Paper Products Industry Grouping and IMPLAN Sectors

IMPLAN Sector	Sector Name
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

Appendix C: Detailed Economic Contribution Results

Direct Economic Contribution by IMPLAN Sector

Exhibit C1. Direct Economic Contributions, Forestry Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry, forest products, and timber tract production	161	$20,096	$20,311	$24,523
Support activities for forestry	286	$10,318	$9,246	$10,345
Maple syrup production	149	$1,223	$1,832	$3,080
Subtotal	**596**	**$31,638**	**$31,389**	**$37,948**

Exhibit C2. Direct Economic Contributions, Logging Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Commercial logging	3,069	$361,555	$417,276	$484,704
Subtotal	**3,069**	**$361,555**	**$417,276**	**$484,704**

Exhibit C3. Direct Economic Contributions, Primary Solid Wood Products Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Electric power generation—biomass	-	-	-	-
Sawmills	2,123	$112,272	$119,564	$587,231
Wood preservation	196	$13,445	$16,360	$109,613
Veneer and plywood manufacturing	620	$32,345	$36,872	$166,251
Reconstituted wood product manufacturing	240	$17,436	$23,522	$124,281
Subtotal	**3,178**	**$175,499**	**$196,317**	**$987,376**

Exhibit C4. Direct Economic Contributions, Secondary Solid Wood Products Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Engineered wood member and truss manufacturing	1,208	$65,550	$71,149	$265,342
Wood windows and doors manufacturing	1,448	$85,963	$95,960	$323,768
Cut stock, resawing lumber, and planing	549	$33,182	$39,198	$127,933
Other millwork, including flooring	2,392	$133,249	$152,429	$486,952
Wood container and pallet manufacturing	4,606	$251,159	$267,656	$737,086
Manufactured home (mobile home) manufacturing	255	$16,437	$19,934	$62,211
Prefabricated wood building manufacturing	444	$30,092	$31,474	$81,985
All other miscellaneous wood product manufacturing	1,613	$91,049	$98,958	$294,600
Subtotal	**12,516**	**$706,681**	**$776,757**	**$2,379,878**

Exhibit C5. Direct Economic Contributions, Wood Furniture Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Wood kitchen cabinet and countertop manufacturing	4,868	$274,798	$293,852	$733,783
Upholstered household furniture manufacturing	470	$20,874	$22,759	$88,447
Nonupholstered wood household furniture manufacturing	4,613	$235,071	$270,802	$621,103
Institutional wood furniture manufacturing	1,547	$123,603	$137,397	$333,438
Wood office furniture manufacturing	369	$22,834	$29,221	$80,583
Custom architectural woodwork and millwork manufacturing	1,168	$77,319	$85,150	$196,174
Showcase, partition, shelving, and locker manufacturing	1,868	$113,317	$129,110	$383,100
Subtotal	**14,904**	**$867,817**	**$968,291**	**$2,436,627**

Exhibit 9. Direct Economic Contributions, Pulp, Paper, and Paperboard Mills Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Pulp mills	52	$5,491	$7,144	$33,712
Paper mills	1,389	$146,474	$261,375	$1,073,378
Paperboard mills	770	$69,598	$120,808	$610,518
Subtotal	**2,211**	**$221,564**	**$389,328**	**$1,717,609**

Exhibit C7. Direct Economic Contributions, Secondary Paperboard and Other Paper Products Detail, 2017

Sector	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Paperboard container manufacturing	10,031	$712,333	$933,225	$4,565,237
Paper bag and coated and treated paper manufacturing	4,683	$417,606	$610,877	$2,159,784
Stationery product manufacturing	1,304	$71,826	$103,088	$457,329
Sanitary paper product manufacturing	757	$51,799	$133,664	$528,835
All other converted paper product manufacturing	1,196	$71,871	$89,253	$356,212
Subtotal	**17,971**	**$1,325,435**	**$1,870,107**	**$8,067,397**

Note: Value-added in IMPLAN is equivalent to gross state product.

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