Forest Products Industries' Economic Contributions: Massachusetts

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Land Acknowledgement

The Massachusetts Department of Conservation and Recreation acknowledges that indigenous peoples and nations have stewarded through generations the lands and waterways of what is now the Commonwealth of Massachusetts. As an active first step toward decolonization, we encourage you to learn more about the Native Nations whose homelands are impacted by parks, forests, greenways, historic sites, reservoirs, and seashores which now reside on them. We also invite you to deepen your relationship to these living lands and waters on which you live and work.

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Executive Summary

This report assesses broad forest conditions and economic contributions of forest products industries in Massachusetts. 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 program, and economic data come from the 2017 Impact Analysis for Planning (IMPLAN) economic input-output model.

Forest Industries

This report presents seven forest products industries, based on 32 economic sectors in IMPLAN. 29 economic sectors related to forest products are present in Massachusetts:

- 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, Massachusetts's forest products industries provided direct employment to more than 16,000 people, leading to $5.4 billion in output. That same year, labor income was $2.7 billion and value-added was $1.4 billion. In total contributions, these industries supported almost 38,000 jobs, $3.1 billion in labor income, $3.8 billion in value-added, and $9.2 billion in output.

The top sectors[1] which benefited from spending by forest product companies, their suppliers, and individuals were wholesale and retail trade, real estate, restaurants, and hospitals.

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 (6,087), the highest value-added ($721.3 million), and the highest direct output ($2.7 billion).
- Wood furniture had the second highest number of direct jobs (3,195), the second highest value-added ($236.7 million), and the third highest direct output ($556.5 million).

[1] Excluding forest products sectors.

- Secondary solid wood products had the third highest employment (2,790), third-highest value-added ($166.4 million), and fourth highest output ($533.1 million).
- Logging had the sixth highest number of direct jobs (835) and the fifth highest value-added ($108.0 million) and direct output ($126.3 million).

Leading Individual Forest Products Sectors

Among the 29 forest products sectors present in Massachusetts, the top four, by measure of direct contributions, were:

- Employment—Paperboard container manufacturing, paper bag and coated and treated paper manufacturing, paper mills, and wood kitchen cabinet and countertop manufacturing were the top four sectors and had a combined total of 7,636 direct jobs, or 47 percent of direct employment.
- Labor income—Paperboard container manufacturing, paper bag and coated and treated paper manufacturing, paper mills, and all other converted paper product manufacturing had the highest labor income, totaling $882.3 million or 57 percent of direct labor income.
- Value-added—Paperboard container manufacturing, paper bag and coated and treated paper manufacturing, paper mills, and commercial logging had the highest value-added, totaling $782.5 million, or 54 percent of direct value-added.
- Output—Paperboard container manufacturing, paper mills, paper bag and coated and treated paper manufacturing, and paperboard mills were the top four sectors in output totaling $3.5 billion, or 66 percent of total direct output.

Forest Products Compared to Other Massachusetts Industries

Forest products industries collectively represent 6 percent of the 253,000 direct manufacturing jobs in Massachusetts. These industries span across the entire forest product supply chain forming a complex web with regional and global suppliers. Past land use history and economic policy have disconnected downstream forest products industries from in-state forestry, logging, and primary solid wood product manufacturing. Working lands sectors[2,3] ranked third in terms of employment behind agriculture and commercial fishing. While providing fewer jobs, forestry and primary solid wood manufacturing provided higher wages than the agricultural sector. Logging wages are comparable to those in the commercial fishing industry.

[2] Working lands sectors are a grouping of forestry, logging, and primary wood products industries. These industries are responsible for managing the forests of Massachusetts on behalf of landowners.

[3] See Exhibits 8 and 13.

Massachusetts' Forest Products Industries Compared to Those of Vermont, Connecticut, Maine, and New Hampshire

Forest products industries in Massachusetts and the neighboring states of Vermont, Connecticut, Maine, and New Hampshire employed more than 60,000 workers and accounted for almost $16.0 billion in direct output. Maine's forest products economy was the largest in the region in terms of direct employment, followed by that of Massachusetts. This relationship is reversed for direct output.

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 the Massachusetts' economy. They provide jobs, raw materials, and finished goods that generate additional economic activity throughout the state, region, and nation. This report compares the contributions of Massachusetts' 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 economic contributions of forests. A separate regional report covers the collective economic interactions of the 20 states. These documents use identical methods to provide a consistent reporting format across the region. Previous state-level reports were unable to be compared due to differing methodology and data sources.

The Forest Markets & Utilization Committee of the Northeast—Midwest State Foresters Alliance secured federal funds to conduct an economic analysis of 20 states through a 2017 award under a Landscape Scale Restoration grant.[4,5] The project team of this state report comprises of staff from the Michigan Department of Natural Resources, Public Sector Consultants, state forestry experts, and with contributions from Larry Leefers, professor emeritus of forestry economics at Michigan State University.

Much of the data used to develop this report was derived from the U.S. Forest Service Forest Inventory and Analysis database and from IMPLAN. Data and related information are presented in four major sections: Forest Resources of Massachusetts, Forest Products Industries, Economic Contributions of Massachusetts' 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.

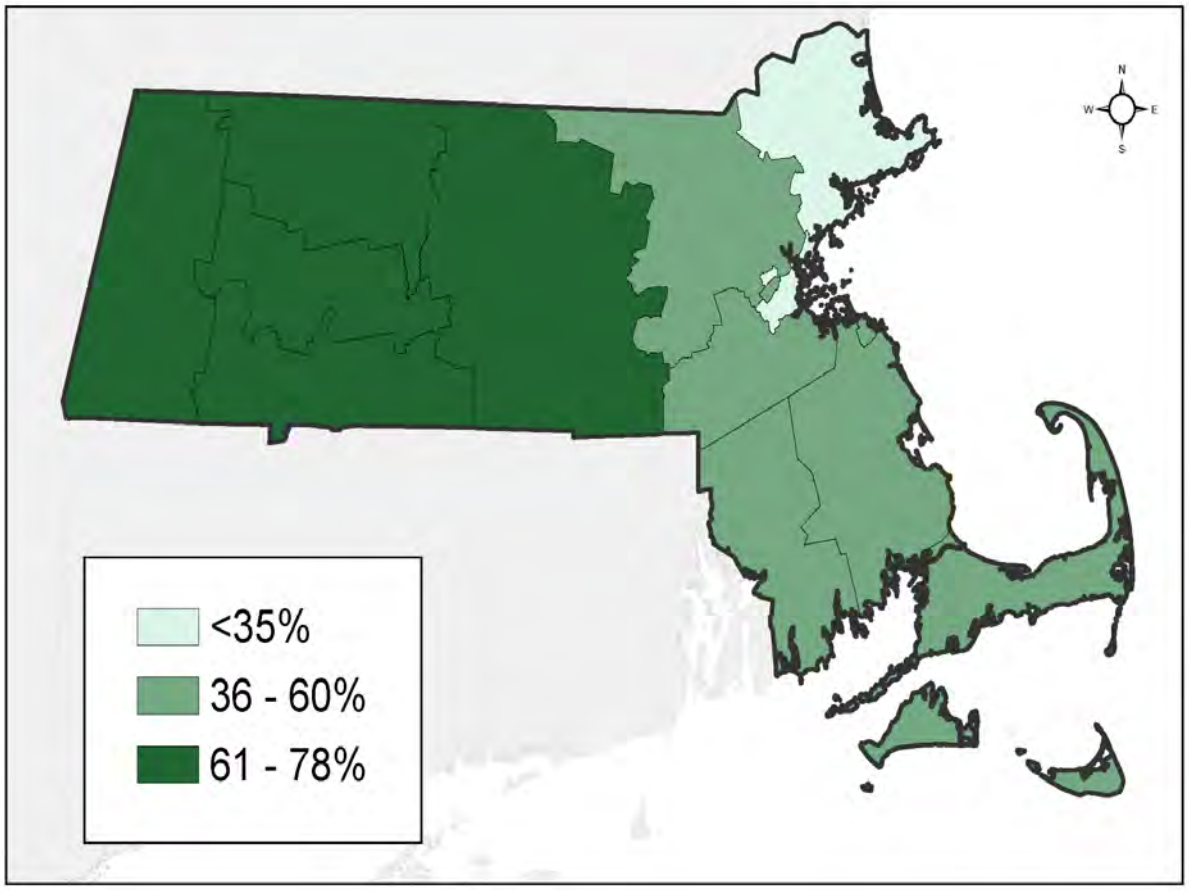
[4] States include: CT,DE,IA,IL,MA,MD,ME,MI,MN,MO,NE,NH,NJ,OH,PA,VT,WI,WV. NY elected not to participate. NY data was included in the regional analysis.

[5] Unites States Department of Agriculture, Forest Service, Cooperative Agreement 17-DG-11420004-266.

Forest Resources of Massachusetts

Massachusetts is fortunate to have abundant forest resources as highlighted in Exhibit 1, which shows the percentage of each county that is forest land. Over 60 percent of the state is forested (Exhibit 2). Timberland is the largest component of forest land, totaling 2.9 million acres. Reserved forest land accounts for the other 129,737 acres and other forest land accounts for the remaining 17,102 acres.

Exhibit 1. Massachusetts' Forest Land by County, 2017



Most of Massachusetts' forest land—63 percent—is privately owned, local municipalities and the Commonwealth of Massachusetts are the major public owners, with the remainder in federal ownership (Exhibit 3). Landowners pursue diverse goals. There are several state and federal programs designed to support active management on private forest lands.

Exhibit 2. Massachusetts Land Area by Land Use Type, 2017 (U.S. Forest Service)

Land Use Type	Acres	Percentage
Forest land	3,016,674	60.6%
Nonforest land	1,957,515	39.4%
Total	**4,974,189**	**100.0%**

Exhibit 3. Forest Land by Ownership Group in Massachusetts (2017)

Ownership Group	Acres	Percentage
Federal government	74,564	2.5%
State and local governments	1,044,503	34.6%
Private	1,897,606	62.9%
Total	**3,016,673**	**100.0%**

Massachusetts major forest types include oak/hickory, maple/beech/birch, white/red/jack pine, oak/pine, and elm/ash/cottonwood (Exhibit 4). Tree species with the greatest standing volume include eastern white pine, red maple, northern red oak, eastern hemlock, black oak, sugar maple, white ash.

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

Forest Type Group	Acres	Percentage
Oak/hickory	1,044,046	34.6%
Maple/beech/birch	724,520	24.0%
White/red/jack pine	416,107	13.8%
Oak/pine	411,796	13.7%
Elm/ash/cottonwood	176,294	5.8%
Other	243,912	8.1%
Total	**3,016,674**	**100.0%**

The estimated volume of standing timber suitable for forest products (i.e., the marketable volume of growing stock) was 7.7 billion cubic feet, or 97.6 million standard cords[6] (Exhibit 5). Average annual net growth exceeded annual harvest removals by a ratio of about 5.8 to 1. For every cubic foot of harvesting that took place, 5.8 cubic feet of timber grew after accounting for mortality. Average annual harvest

[6] A standard cord is a unit of measurement for pulpwood or sawlogs, representing 128 ft^3 of wood and air when tightly stacked in a pattern measuring four feet wide by four feet tall by eight feet long. A stacked cord of wood contains 79 cubic feet of solid wood, excluding air space.

removals in 2017 of growing stock were about 21.4 million cubic feet, or about 270,977 cords—roughly 0.3 percent of standing volume.

Exhibit 5. Characteristics of Growing Stock in Massachusetts, 2017 (million cubic feet)

Measure	Total	Other Federal	State and Local Government	Private
Net volume	7,711.5	108.0	2,608.4	4,995.1
Annual net growth	123.0	1.8	38.4	82.8
Annual harvest removals	21.4	0.2	4.0	17.2
Annual mortality	54.3	0.5	16.8	37.0

Note: Net volume is merchantable volume, in cubic feet, of growing-stock trees for timber species (trees where diameter is measured at breast height) from a 1-foot stump to a minimum 4-inch top diameter, or to where the central stem breaks into limbs all of which are less than 4.0 inches in diameter. Volume loss due to rotten, missing, and form cull has been deducted. Growing stock is defined as live trees of commercial species that meet minimum merchantability standards and only includes trees at least 5 inches in diameter at breast height. Net growth is the average annual change (gross growth minus mortality) in merchantable volume, in cubic feet, of growing-stock trees on forestland. Harvest removals are the average annual merchantable volume, in cubic feet, of growing-stock trees at the time of removal from forest land. Annual mortality is the average annual merchantable volume, in cubic feet, of growing-stock trees at the time of mortality 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). The next step is to define exactly which economic sectors comprise the focus industries. To analyze the contributions of the forest industries, state agency representatives from 20 northeastern and midwestern states selected 32 sectors by consensus for inclusion in the analysis. A description of the methods and data is presented in Appendix A. 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 to characterize financial linkages among and between sectors, households, and institutions. Within these models, various sectors have production functions that show the value of inputs used in production of outputs or commodities. These sectors are based on the North American Industrial Classification System (NAICS).

Economic Contributions of Massachusetts' 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.

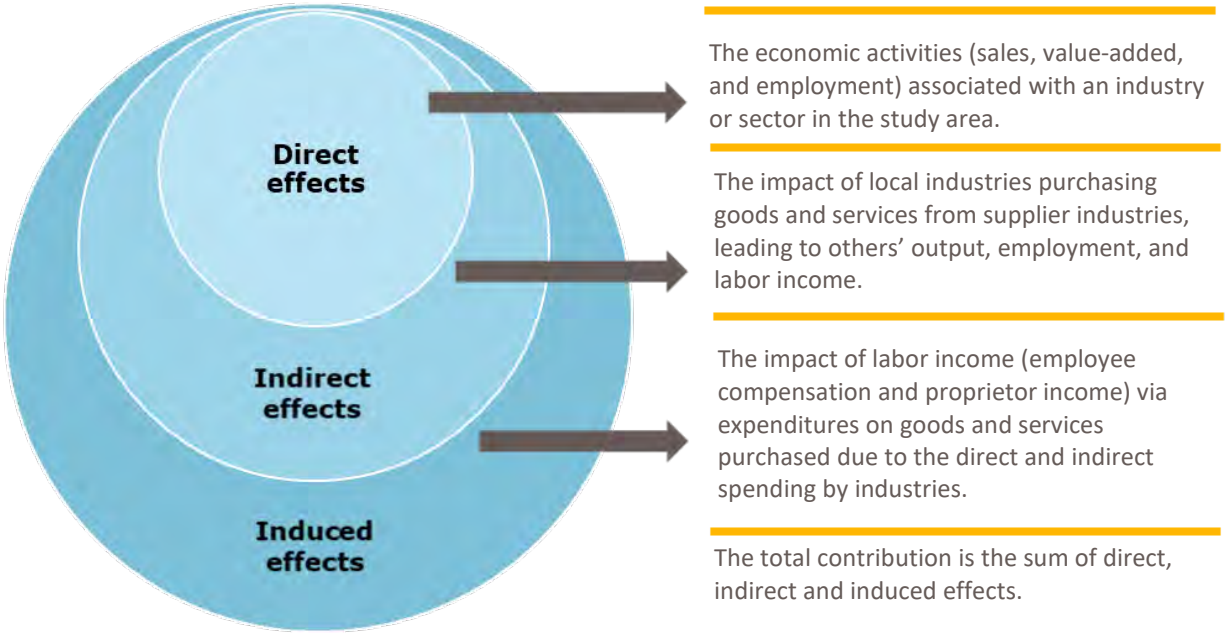
Forests and forest products industries are central for the transition to a climate smart economy. A goods and services economy in balance with the climate relies on the sustainable use of natural resources. Massachusetts' forest products industries provide society with a reliable source of sustainable materials while enhancing ecosystem services. (e.g., wildlife habitat, watershed protection, carbon sequestration, etc.)

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 7). 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 6. 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 Massachusetts (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 Massachusetts and Connecticut, reveals that the direct employment for 2017 was 835 and 569 jobs, respectively. Summing the individual state's total employment contributions (direct, indirect, and induced) yields 2,299 jobs. However, if the states are combined as one region, the total employment contribution increases to 2,338 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. This section also compares forest industries in nearby states, other natural resources industries, and manufacturing industries within the state.

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. Massachusetts forest products industries' total economic contribution in terms of output was $9.2 billion, based on direct output of $5.4 billion (Exhibit 7). Approximately 16,000 direct jobs were associated with this level of economic activity, supporting a total of jobs 37,806 jobs. Direct labor income, which includes employee compensation and proprietor income, was $1.5 billion, or $96,258 per job. Total labor income, which includes income paid directly to industry employees and proprietors, their suppliers, and other industries they support, totaled $3.1 billion.

Exhibit 7. Economic Contribution of the Forest Products Industries in Massachusetts, 2017 Dollars

Effect	Employment	Labor Income (Thousands of Dollars)	Value-added* (Thousands of Dollars)	Output (Thousands of Dollars)
Direct	16,083	$1,548,080	$1,441,125	$5,354,786
Total	37,806	$3,102,352	$3,806,318	$9,225,714

* Value-added in IMPLAN is equivalent to GSP.

Each direct job in the forest products industries supported 1.35 additional jobs, and every $1 million in direct labor income supported an additional $1.0 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, Massachusetts' population was estimated at 6.9 million people, with total employment of 4.8 million. The gross state product was $541.6 billion from 487 economic sectors (of the possible 536 in the US). The GSP's largest component was labor income, which was $351.4 billion.

Direct value-added for forest products industries was $1.4 billion, 0.3 percent of Massachusetts' total GSP. The percentage increases to 0.7 percent when considering total value-added effects.

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 Massachusetts, 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 direct employment and value-added and the third largest group in terms of labor income and output. Primary solid wood products was the smallest in terms of direct employment, labor income, and value-added. Forestry, which includes maple syrup production, timber tract operations, and forestry support activities, was the smallest group in terms of output.

Two groups—secondary paperboard and other paper products and wood furniture—accounted for over half of the employment, labor income, value-added, and output of forest products industries.

Exhibit 8. Direct Economic Contributions in Massachusetts, Industry Groups, 2017

Industry Group	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry	1,030	$47,575	$47,465	$58,990
Logging	835	$98,577	$107,977	$126,321
Primary solid wood products	300	$12,464	$11,206	$104,095
Secondary solid wood products	2,790	$168,452	$166,388	$533,076
Wood furniture	3,195	$215,348	$236,669	$546,528
Pulp, paper, and paperboard mills	1,845	$225,625	$150,104	$1,247,694
Secondary paperboard and other paper products	6,087	$780,039	$721,316	$2,738,083
Total	**16,083**	**$1,548,080**	**$1,441,125**	**$5,354,786**

Exhibit 9. Total Economic Contributions in Massachusetts, Industry Groups, 2017

Industry Group*	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry	1,174	$56,946	$66,184	$91,257
Logging	1,054	$95,540	$117,379	$154,838
Primary solid wood products	745	$49,111	$65,113	$177,121
Secondary solid wood products	5,220	$341,532	$427,955	$956,093
Wood furniture	5,634	$381,744	$488,603	$960,397
Pulp, paper, and paperboard mills	7,307	$646,029	$780,695	$2,239,445
Secondary paperboard and other paper products	16,672	$1,531,450	$1,860,388	$4,646,562
Total	**37,806**	**$3,102,352**	**$3,806,318**	**$9,225,714**

*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 third smallest in terms of direct contributions in 2017. Direct contributions were $59.0 million in output, 1,030 jobs, $47.6 million in labor income, and $47.5 million value-added. Total contributions are based, in part, on backward linkages to suppliers. In most cases, value-added is greater than labor income. 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 Massachusetts in 2017, which leads to the smaller value-added. 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, one-quarter (24 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 $126.3 million in output, 835 jobs, $98.6 million in labor income, and $108.0 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 Massachusetts, 32 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 smallest group in terms of direct employment in Massachusetts. 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 $104.1 million in output, 300 jobs, $12.5 million in labor income, and $11.2 million in value-added. Total contributions for primary solid wood products, including direct, indirect and induced effects, were $177.1 million in output, 745 jobs, $49.1 million in labor income, and $65.1 million in value-added. Many primary solid wood products (e.g., lumber and panels) are inputs in other industries, which 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 Massachusetts. 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 $533.1 million in output, 2,790 jobs, $168.5 million in labor income, and $166.4 million in value-added. Total contributions were $956.1 million in output, 5,220 jobs, $341.5 million in labor income, and $428.0 million in value-added.

Wood Furniture

Wood furniture was the second largest group in terms of direct employment in Massachusetts. Wood furniture includes wood kitchen cabinet and countertop manufacturing; upholstered household furniture manufacturing; non-upholstered 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 $546.5 million in output, 3,195 jobs, $215.3 million in labor income, and $236.7 million in value-added. Total contributions of wood furniture were $960.4 million in output, 5,634 jobs, $381.7 million in labor income, and $488.6 million in value-added.

Pulp, Paper, and Paperboard Mills

The pulp, paper, and paperboard mills industry group was the fourth largest in terms of direct employment in Massachusetts. The group includes pulp mills, paper mills, and paperboard mills that make paper from purchased pulp. The pulp, paper, and paperboard mills group's direct contributions were $1.2 billion in output, 1,845 jobs, $225.6 million in labor income, and $150.1 million in value-added. Total contributions were $2.2 billion in output, 7,307 jobs, $646.0 million in labor income, and $780.7 million 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 Massachusetts. 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 $2.7 billion in output, 6,087 jobs, $780.0 million in labor income, and $721.3 million in value-added. Total contributions were $4.6 billion in output, 16,672 jobs, $1.5 billion in labor income, and $1.9 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 sectors are paperboard container manufacturing (2,716 jobs), paper bag and coated and treated paper manufacturing (2,229 jobs), paper mills (1,478 jobs), and wood kitchen cabinet and countertop manufacturing (1,213 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, and fiber drums, and reels. In a consumer-driven economy with more and more shipping, this industry is well positioned for growth.

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 plastic 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 paper mills sector covers 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. Additionally, the sector also covers 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.

This 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.

In terms of labor income, paperboard container manufacturing, paper bag and coated and treated paper manufacturing, paper mills, and all other converted paper product manufacturing had the highest labor income, totaling $882.3 million. For output (or sales), paperboard container manufacturing, paper mills, paper bag and coated and treated paper manufacturing, and paperboard mills were the top four sectors, totaling $3.5 billion.

Top Non-forest Industries Impacted

Contribution analysis using IMPLAN relies on backward linkages from forest products industry sectors among themselves and to other sectors in Massachusetts. Including the 29 forest products industries present in Massachusetts, 159 sectors were impacted by forest product industry spending in 2017.[7] The top ten sectors[8] included wholesale and retail trade, real estate, restaurants, and hospitals (Exhibit 11). 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 1,805 jobs in wholesale trade includes the wholesale trade of forestry products. Seven of these sectors were among the top ten sectors in the Commonwealth of Massachusetts (hospitals were number one, followed by real estate, wholesale trade, and full-service restaurants—each had over 145,000 jobs).

[7] Sectors were counted if ten or more jobs supported by the 29 forest product industry sectors in Massachusetts.

[8] Excluding forest products sectors.

Exhibit 10. Direct Jobs Impacted by the Forest Products Industries Among Massachusetts' Top Ten Non-Forest Products Industries in 2017

Sector	Description	Jobs
395	Wholesale trade	1,805
461	Management of companies and enterprises	894
501	Full-service restaurants	870
482	Hospitals	824
440	Real estate	792
468	Services to buildings	587
502	Limited-service restaurants	583
485	Individual and family services	449
400	Retail - Food and beverage stores	421
473	Junior colleges, colleges, universities, and professional schools	398
Total	**NA**	**7,623**

Neighboring States

Massachusetts and the neighboring states of Vermont, Connecticut, Maine, and New Hampshire comprise an important region for forest products. Forest products industries employ over 60,000 workers across the region and account for almost $16.0 billion in direct output (Exhibits 11 and 12). Maine had the largest forest products economy in terms of direct employment with 20,119 direct jobs and Massachusetts had the largest forest products economy in terms of direct output with sales in excess of $5.2 billion. Connecticut, New Hampshire, and Vermont follow Maine and Massachusetts in various orders depending on the chosen metric. The three largest industry groups, each with over 9,800 employees, were secondary paperboard and other paper products, logging, and wood furniture.

Exhibit 11. Forest Products Industries Direct Employment in Massachusetts, Vermont, Connecticut, Maine, and New Hampshire, 2017

Industry	Massachusetts	Vermont	Connecticut
Forestry	1,030	3,342	90
Logging	835	1,737	569
Primary solid wood products	300	941	276
Secondary solid wood products	2,790	1,053	1,268
Wood furniture	3,195	1,318	2,535
Pulp, paper, and paperboard mills	1,845	641	828
Secondary paperboard and other paper products	6,087	76	2,164
Sum of Direct Contributions	**16,083**	**9,107**	**7,730**

Industry	Massachusetts	Maine	New Hampshire
Forestry	1,030	3,558	1,250
Logging	835	5,052	1,732
Primary solid wood products	300	2,986	1,107
Secondary solid wood products	2,790	2,484	1,170
Wood furniture	3,195	1,590	1,181
Pulp, paper, and paperboard mills	1,845	3,137	389
Secondary paperboard and other paper products	6,087	1,312	460
Sum of Direct Contributions	**16,083**	**20,119**	**7,289**

Exhibit 12. Forest Products Industries Direct Output in Massachusetts, Vermont, Connecticut, Maine, and New Hampshire, 2017

Industry	Massachusetts (Thousands of Dollars)	Vermont (Thousands of Dollars)	Connecticut (Thousands of Dollars)
Forestry	$58,990	$75,732	$2,506
Logging	$126,321	$90,979	$39,521
Primary solid wood products	$104,095	$305,966	$116,580
Secondary solid wood products	$533,076	$217,960	$230,835
Wood furniture	$546,528	$173,733	$450,940
Pulp, paper, and paperboard mills	$1,247,694	$474,397	$611,003
Secondary paperboard and other paper products	$2,738,083	$32,082	$964,105
Sum of Direct Contributions	**$5,354,786**	**$1,370,850**	**$2,415,490**

Industry	Massachusetts (Thousands of Dollars)	Maine (Thousands of Dollars)	New Hampshire (Thousands of Dollars)
Forestry	$58,990	$84,542	$35,685
Logging	$126,321	$416,480	$265,556
Primary solid wood products	$104,095	$1,066,877	$441,289
Secondary solid wood products	$533,076	$445,458	$229,118
Wood furniture	$546,528	$252,539	$170,622
Pulp, paper, and paperboard mills	$1,247,694	$2,340,964	$287,943
Secondary paperboard and other paper products	$2,738,083	$629,856	$190,198
Sum of direct contributions	**$5,354,786**	**$5,236,715**	**$1,620,412**

Importance of the Forest Products Industries in Context

To help contextualize the relative importance of forest products industries, it is useful to compare the contribution of Massachusetts' forest products industries with other industries. Forest products, fishing, and agricultural industries represent major employers capable of sustainably supplying food, building materials, and energy to the 7 million people who live in Massachusetts (Exhibit 13).[9]

Exhibit 13. Working Lands and Waters Industries in Massachusetts, 2017

Industry	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry, Logging, and Primary Solid Wood Products[10]	2,165	$158,616	$166,648	$289,406
Commercial fishing, hunting, and trapping	6,206	$524,745	$510,248	$516,981
Agricultural production (plant crop and animal)[11]	21,730	$870,256	$873,998	$1,189,115
Total	**30,101**	**$1,553,617**	**$1,550,894**	**$1,995,502**

Forestry, logging, and primary solid wood products has the second highest average income at $73,264; commercial fishing, hunting, and trapping had the highest average income at $84,560 and agricultural production had the lowest average income at $40,049.

[9] Economy defined as gross state product.

[10] Data aggregated from Exhibit 8, p. 16.

[11] Includes part-time employment.

Most forest products industries are classified as manufacturers except for forestry, logging, and biomass power. There were over 253,000 manufacturing jobs in the Massachusetts in 2017. 14,217 were in the forest products industries, 5.6 percent of the total. Of 16 industries, forest products manufacturing was seventh in terms of employment behind computer and electronic product, fabricated metal, food, miscellaneous, machinery, and chemical manufacturing. It was eighth in terms of labor income and output and tenth in terms of value-added (Exhibit 14).

Exhibit 14. Manufacturing Industries in Massachusetts, 2017

Manufacturing Industries	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Computer and electronic product	49,265	$7,546,867	$14,151,099	$32,145,444
Fabricated metal	33,053	2,797,053	$5,163,639	$9,546,051
Food	32,326	$1,855,969	$2,758,472	$11,135,456
Miscellaneous	22,644	$2,561,331	$4,474,095	$8,974,908
Machinery	16,764	$1,803,243	$2,035,013	$5,709,330
Chemical	15,429	$2,145,557	$7,599,103	$17,745,410
Forest products	14,217	$1,401,928	$1,285,683	$5,169,476
Plastics and rubber products	12,762	$1,020,408	$1,574,530	$4,528,128
Printing	12,402	$891,815	$1,212,723	$2,296,059
Transportation equipment	11,723	$1,740,805	$1,845,709	$5,695,580
Textiles and apparel	9,513	$586,342	$744,503	$1,992,770
Electrical equipment	8,748	$950,079	$1,306,452	$3,614,841
Nonmetallic mineral product	6,417	$454,588	$706,424	$1,885,887
Beverage and tobacco product	4,757	$342,728	$709,884	$2,815,560
Primary metal	2,701	$203,587	$315,812	$1,575,395
Petroleum and coal	984	$221,862	$260,667	$785,215
Total	**253,706**	**$26,524,162**	**$46,143,809**	**$115,615,510**

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 29 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 not 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 Massachusetts 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 16,083 direct jobs in the forest products industries, and overall, 37,806 jobs were supported. Direct labor income was $1.5 billion with total labor income at $3.1 billion. Direct value-added was $1.4 billion, and the total contribution for value-added was $3.8 billion. Finally, direct output was $5.4 billion with a total contribution of $9.2 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	290	$35,329	$35,696	$43,298
Support activities for forestry	370	$10,382	$10,054	$11,475
Maple syrup production	370	$1,864	$1,715	$4,217
Subtotal	**1,030**	**$47,575**	**$47,465**	**$58,990**

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	835	$98,577	$107,977	$126,321
Subtotal	**835**	**$98,577**	**$107,977**	**$126,321**

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	194	$7,180	$7,265	$49,965
Wood preservation	100	$5,033	$3,616	$51,302
Veneer and plywood manufacturing	-	-	-	-
Reconstituted wood product manufacturing	6	$250	$326	$2,827
Subtotal	**300**	**$12,464**	**$11,206**	**$104,095**

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	226	$12,311	$13,642	$49,998
Wood windows and doors manufacturing	684	$47,648	$46,890	$154,465
Cut stock, resawing lumber, and planing	18	$681	$673	$3,635
Other millwork, including flooring	515	$32,560	$31,782	$103,726
Wood container and pallet manufacturing	841	$52,979	$51,854	$137,568
Manufactured home (mobile home) manufacturing	28	$1,854	$1,683	$6,401
Prefabricated wood building manufacturing	65	$3,778	$3,736	$11,099
All other miscellaneous wood product manufacturing	413	$16,640	$16,128	$66,184
Subtotal	**2,790**	**$168,452**	**$166,388**	**$533,076**

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	1,213	$78,233	$83,140	$192,736
Upholstered household furniture manufacturing	40	$1,526	$1,636	$7,186
Nonupholstered wood household furniture manufacturing	542	$32,748	$37,633	$78,763
Institutional wood furniture manufacturing	264	$15,164	$16,840	$50,290
Wood office furniture manufacturing	46	$2,608	$3,257	$9,696
Custom architectural woodwork and millwork manufacturing	846	$68,876	$75,707	$156,138
Showcase, partition, shelving, and locker manufacturing	245	$16,193	$18,455	$51,719
Subtotal	**3,195**	**$215,348**	**$236,669**	**$546,528**

Exhibit C6. 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	-	-	-	-
Paper mills	1,478	$180,407	$126,080	$989,990
Paperboard mills	367	$45,217	$24,023	$257,704
Subtotal	**1,845**	**$225,625**	**$150,104**	**$1,247,694**

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	2,716	$333,120	$325,429	$1,308,956
Paper bag and coated and treated paper manufacturing	2,229	$256,521	$222,998	$960,185
Stationery product manufacturing	623	$70,366	$60,589	$229,772
Sanitary paper product manufacturing	36	$7,814	$5,202	$24,205
All other converted paper product manufacturing	483	$112,219	$107,097	$214,964
Subtotal	**6,087**	**$780,039**	**$721,316**	**$2,738,083**

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

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