Forest Products Industries' Economic Contributions: Iowa

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Foreword

Of Iowa's nearly 3 million acres of forest land, 85.5 percent are privately owned. These forested acres provide environmental benefits daily to all Iowans in terms of soil erosion control, air quality, and water quality. Proper woodland and community tree care plays a critical role in creating healthy rural and urban community forests.

The Iowa Department of Natural Resources Forestry Section focuses its efforts on sustaining and enhancing the environmental and economic values of Iowa's forests through technical assistance for private land, educational opportunities for adults and youth, and the demonstration of sustainable forest ecosystem management on public lands. Iowa employs over 17,000 people in forestry-related jobs, with a $1.1 billion payroll, which has nearly $5.0 billion in economic impact on the state's economy. Jobs that are closely related to Iowa forest landowners include consultants, loggers, and sawmills, representing 1,222 people generating over $188 million in economic value. These jobs and economic output would not be possible without the $28 million in sales from timber that was harvested in 2017 from Iowa's forests.

It is impossible to capture all of the benefits from trees with an economic analysis. There are the intrinsic values of trees found in recreational settings that enhance experiences for people of all ages while camping, hunting, studying nature, relaxing, bird watching, mushroom hunting, and fishing. Perhaps the hardest things to capture using economics are the benefits lost from forests that have been converted to other uses. Historically Iowa had more than twice as much area growing trees compared to what exists today. Trees enhance how the soil absorbs moisture, what flora will grow on the site, and what kind of fauna will live in the area. Hence, trees within a forest are an important part of a complex ecosystem that cannot be re-engineered once they are gone. Maintaining as much of Iowa's forests in a healthy, sustainable condition is important for the woodland owner, the businesses that convert trees into products, and most importantly to the future generations who will inhabit the environment we leave to them.

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Executive Summary

This report assesses broad forest conditions and economic contributions of forest products industries in Iowa. 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.

Iowa boasts 2.9 million acres of forest land that cover 8 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. Urban areas with woodlands are not included as forest, even if they meet the criteria of a forest, due to their proximity to city limits.

Forest Industries

This report presents seven forest products industries, which are based on 32 economic sectors in IMPLAN, 27 of which are present in Iowa:

- 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, Iowa's forest products industries provided direct employment to 17,834 people, leading to nearly $5.0 billion in output. That same year, labor income was $1.1 billion and value-added was $1.8 billion. In total contributions, these industries supported 33,656 jobs, $1.9 billion in labor income, $3.1 billion in value-added, and $7.3 billion in output.

Among the top sectors (excluding forest products sectors) impacted by forest products industries were wholesale trade, restaurants, trucking, real estate, and management of companies and enterprises. 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 solid wood products had the highest number of direct jobs (9,038), the second highest value-added ($723.6 million), and the highest direct output ($2.1 billion).
- Wood furniture had the second highest number of direct jobs (3,751), the third highest value-added ($218.1 million), and the third highest direct output ($582.0 million).
- Secondary paperboard and other paper products had the third highest employment (3,688), the highest value-added ($ 793.2 million), and second highest output ($2.0 billion).

Leading Individual Forest Products Sectors

Among the 27 forest products sectors present in Iowa, the top four, by measure in order from highest to fourth highest of direct contributions, were:

- Employment—Wood windows and door manufacturing, wood kitchen cabinet and countertop manufacturing, paperboard container manufacturing, and paper bag and coated and treated paper manufacturing were the top four sectors and had a combined total of 12,206 direct jobs, or 68.4 percent of direct employment.
- Labor income—Wood windows and door manufacturing, paperboard container manufacturing, wood kitchen cabinet and countertop manufacturing, and paper bag and coated and treated paper manufacturing had the highest labor income, totaling $823.9 million, or 73.6 percent of direct labor income.
- Value-added—Wood windows and door manufacturing, paperboard container manufacturing, paper bag and coated and treated paper manufacturing, and wood kitchen cabinet and countertop manufacturing had the highest value-added, totaling $1.4 billion, or 75.4 percent of direct value-added.
- Output—Wood windows and door manufacturing, paperboard container manufacturing, paper bag and coated and treated paper manufacturing, and wood kitchen cabinet and countertop manufacturing were the top four sectors in output, totaling $3.7 billion, or 74.8 percent of total direct output.

Iowa's Forest Products Industries Compared to Other Iowa Industries

The forest products industries provide more direct labor income, value-added, and output than commercial fishing, hunting, and trapping and mining and oil and gas production. Overall, forest products industries accounted for 10.6 percent of the nonfood manufacturing jobs in Iowa. Nearly 8 percent of Iowa's 223,000 direct manufacturing jobs in 2017 were in the forest products industries, one out of every 13 manufacturing jobs.

Iowa's Forest Products Industries Compared to Those of Illinois, Indiana, Missouri, Nebraska, and Ohio

Forest products industries in six midwestern states (Iowa, Illinois, Indiana, Missouri, Nebraska, and Ohio) employed over 192,000 workers and accounted for over $55 billion in direct output. Ohio's forest products economy was the largest in the region, followed by Indiana. Iowa's forest products economy was the fifth largest among these states.

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 Iowa's 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 Iowa'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.

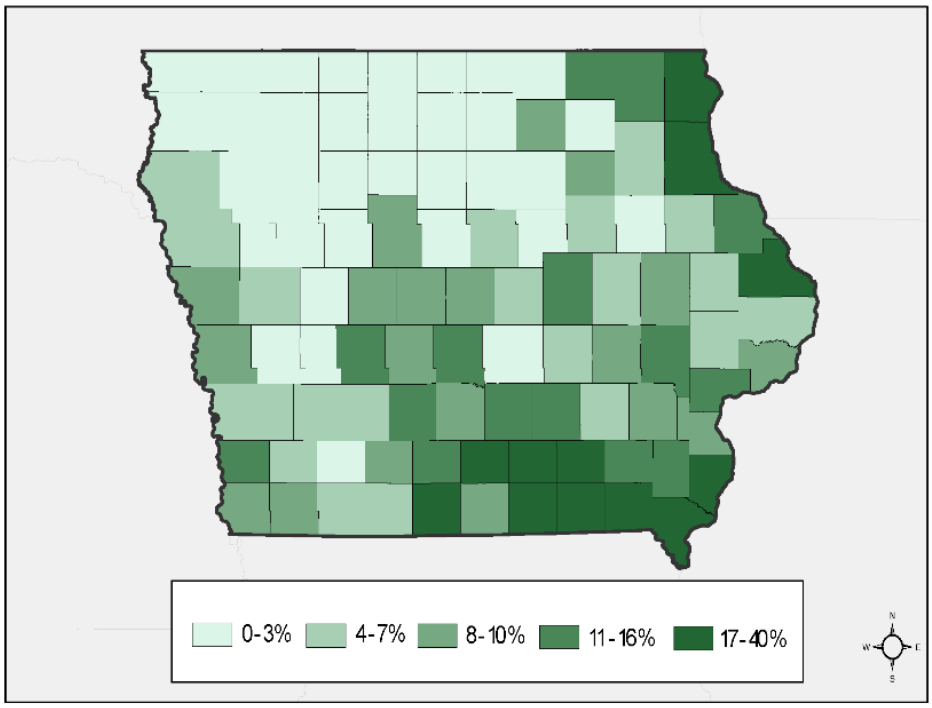
Much of the data used in this report were derived from the U.S. Forest Service Forest Inventory and Analysis database and from IMPLAN, a widely used economic modeling system. These data and related information are presented in four major sections: Forest Resources of Iowa, Forest Products Industries, Economic Contributions of Iowa'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 Iowa

Sustainable forest management promotes production of wood and nontimber forest products in a way that maintains the ecosystem's capacity for renewal. A forest's ability to provide these benefits is dependent upon soil type, moisture levels, and the general health of sites that are suitable for production. Forest-use decisions affect the acreage available for production and management choices affect short- and long-term yield potential.

Exhibit 1 shows the percent of forest land by county in Iowa. Trees are concentrated along river corridors for much of the state, becoming more prevalent going from west to east across the state. The largest quadrant of the state where trees are growing is in the southeastern part of Iowa, which comprises of almost half of Iowa's forests (48 percent).

Exhibit 1. Iowa's Forest Land by County, 2017



According to 2017 U.S. Forest Service FIA data, there are over one billion trees growing in Iowa, with nearly 2.9 million acres of forest land (Exhibit 2). Land that formerly had such tree cover and will be naturally or artificially regenerated falls within this classification as well. Forest land also includes transition zones, such as areas between heavily forested and nonforested lands comprised of at least 10 percent forest tree stock and areas adjacent to urban and built-up lands; afforested areas, where no trees were growing before trees were planted, also count as forest land. The minimum area for classification of forest land is one acre; roadside, streamside, and shelterbelt strips of trees must have a crown width of at least 120 feet, whereas unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide. About 95 percent of Iowa's forest land is timberland.

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

Land Use Type	Acres	Percentage
Forest land	2,875,588	8.1%
Nonforest land	32,719,834	91.9%
Total	**35,595,422**	**100.0%**

Knowing how much actual land is unavailable for harvesting, or reserved, is difficult to determine because private landowners own over 85 percent of Iowa's forests; landowner attitudes about cutting trees on their land can change from day to day. Data from the U. S. Forest Service's 2006 *National Woodland Owner Survey* revealed that landowners who had trees harvested or removed from their property were outnumbered two to one by those who had not allowed any harvesting or cutting. The survey also found that Iowa landowners who do not intend to harvest timber from their land in the next five years outnumber those who do by a ratio of five to one. According to the survey, landowners who do harvest typically do so in order to improve the quality of remaining trees, remove trees damaged by natural catastrophes, or use the wood of mature trees for personal consumption (Butler, Miles, and Hansen 2016).

Most of Iowa's forest land is privately owned (85.5 percent), while state and local governments own 10.7 percent, with the remainder being in federal ownership (Exhibit 3). Most owners of forest land own fewer than ten acres, with the average landowner owning 17 acres.

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

Ownership Group	Acres	Percentage
Federal land	110,455	3.8%
State and local governments	307,815	10.7%
Private	2,457,319	85.5%
Total	**2,875,589**	**100.0%**

In Iowa, over 95 percent of forests are mixed hardwoods. Iowa's major forest types include northern hardwoods classified into groups of trees, defined by the U.S. Forest Service FIA as oak/hickory (post oak, blackjack oak, white oak, red oak, hickory, bur oak, black walnut, black locust, black oak, black cherry, elm), elm/ash/cottonwood (American elm, river birch, sycamore, cottonwood, willow, pecan, hackberry, green ash, silver maple), maple/beech/ birch (sugar maple, black cherry, basswood), and oak/pine (eastern white pine, northern red oak, white ash) (Exhibit 4). Tree species with the greatest standing volume are black walnut, other eastern softwoods (eastern redcedar), hickory, white oak, red oak, basswood and soft maple. Iowa is internationally known for its high-quality black walnut timber. These valuable trees are prized for their use as a veneer, which allows that veneer to be glued to different types of wood, giving the appearance of a solid piece of walnut. Walnut heartwood has a color that is unique, allowing it to command much better prices compared to any other tree in the United States. Iowa's diverse timber species support a wide variety of forest products industries, from cabinet manufacturers to whiskey barrel production and from hardwood-grade lumber to wood pallets.

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

Forest Type Group	Acres	Percentage
Oak/hickory	1,957,678	68.1%
Elm/ash/cottonwood	630,611	21.9%
Maple/beech/birch	93,367	3.2%
Oak/pine	81,520	2.8%
Other eastern softwoods	26,550	0.9%
Aspen/birch	10,020	0.3%
Other	28,142	1.0%
Nonstocked	47,699	1.7%
Total	**2,875,587**	**100.0%**

The estimated volume of standing timber suitable for forest products was about 3.3 billion cubic feet, or about 41 million standard cords[1] (Exhibit 5). Average annual net growth exceeded annual harvest removals by more than two-and-a-half times. That is, for every cubic foot of harvesting that took place, more than two-and-a-half as much wood was grown. Average annual harvest removals in 2017 of growing stock were less than 1 percent of standing volume. In fact, the tree mortality rate was double the amount of the 2017 harvest from Iowa's forests.

[1] A standard cord is a unit of measurement for pulpwood or sawlogs, generally equivalent to a stack of wood measuring four feet wide by four feet tall by eight feet long. A stacked cord of wood typically contains about 79 cubic feet of solid wood, excluding air space.

Exhibit 5. Characteristics of Growing Stock in Iowa, 2017 (in millions of cubic feet)

Measure	Total	National Forest	Other Federal	State and Local Government	Private
Net volume	3,254.7	NA	198.6	414.2	2,641.9
Average annual net growth	62.7	NA	2.0	7.5	53.2
Average annual harvest removals	22.8	NA	0.0	0.3	22.5
Average annual mortality	53.9	NA	4.6	6.3	43.0

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). 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. Within these models, various sectors have production functions that show the value of inputs used in production of outputs or commodities. Iowa's economy was represented by 462 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).

IMPLAN models can be constructed for different geographic areas. State data were used in this report, but given IMPLAN's structure, substate and multistate analyses can be developed.

Economic Contributions of Iowa's Forest Products Industries

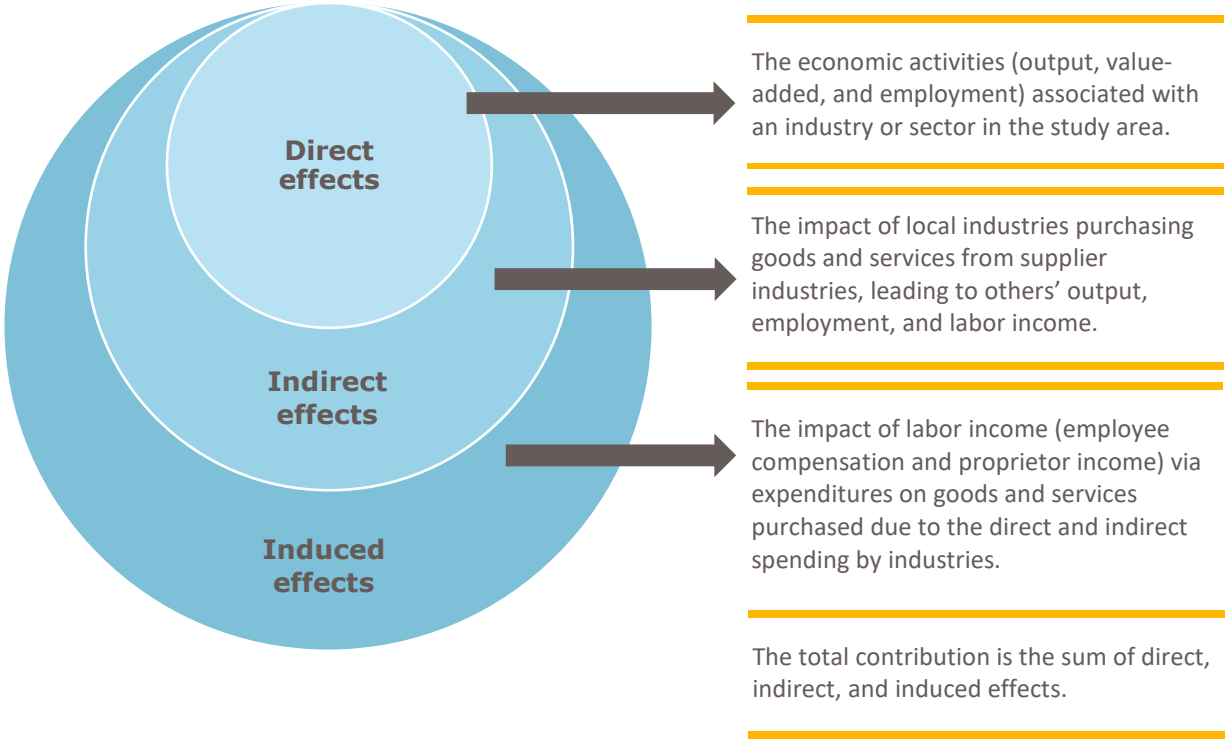
This section of the report includes four major subsections: Economic Contributions Defined, Economic Contribution Results, Importance of the Forest Products Industries in Context, and Supplemental Economic Contribution Information.

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 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 Iowa (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 Iowa and Illinois reveals that the direct employment for 2017 was 610 and 705 jobs, respectively. Summing the individual state's total employment contributions (direct, indirect, and induced) yields 1,578 jobs. However, if the states are combined as one region, the total employment contribution increases to 1,601 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 Iowa'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. Iowa forest products industries' total economic contribution in terms of output was $7.3 billion, based on direct output of $5.0 billion (Exhibit 7). Over 17,800 direct jobs were associated with this level of economic activity, supporting a total of 33,656 jobs. Direct labor income, which includes employee compensation and proprietor income, was $1.1 billion, or $62,730 per job. Total labor income, which includes income paid directly to industry employees and proprietors, their suppliers, and other industries they support, totaled $1.9 billion.

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

Effect	Employment	Labor Income (Thousands of Dollars)	Value-added* (Thousands of Dollars)	Output (Thousands of Dollars)
Direct	17,834	$1,118,759	$1,828,168	$4,978,201
Total	**33,656**	**$1,880,743**	**$3,116,328**	**$7,285,278**

* Value-added in IMPLAN is equivalent to GSP.

Each direct job in the forest products industries supported 0.9 additional jobs, and every $1 million in direct labor income supported an additional $0.7 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, Iowa's population was estimated at 3.1 million people, with total employment of 2.1 million. The gross state product was $190.7 billion from 462 economic sectors (of the possible 536 in the US). The GSP's largest component was labor income, which was $108.6 billion.

Direct value-added for forest products industries was $1.8 billion, 1.0 percent of Iowa's total GSP, increasing to 1.6 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 Iowa, secondary solid wood products was the largest of these groups in terms of direct employment, labor income, and output and the second largest in terms of value-added. Wood furniture was the second largest group in terms of direct employment, and the third largest group in terms of labor income, value-added, and output. Secondary paperboard and other paper products was the third largest group in terms of direct employment, the second largest in terms of labor income and output, and the largest in terms of value-added. Forestry, which includes maple syrup production, timber tract operations, and forestry support activities, was the smallest group for all metrics except employment. Pulp, paper, and paperboard mills was the smallest group in terms of direct jobs.

Two groups—secondary solid wood products and secondary paperboard and other paper products—accounted for most (82.5 percent) of the output of forest products industries. Over half of forest products industries employment was in the secondary solid wood products group.

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

Industry Group	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry	94	$3,751	$4,018	$5,317
Logging	610	$23,098	$25,669	$39,080
Primary solid wood products	590	$30,924	$36,226	$177,580
Secondary solid wood products	9,038	$605,481	$723,554	$2,064,553
Wood furniture	3,751	$172,265	$218,103	$581,969
Pulp, paper, and paperboard mills	63	$5,560	$27,441	$67,209
Secondary paperboard and other paper products	3,688	$277,679	$793,156	$2,042,494
Total	**17,834**	**$1,118,759**	**$1,828,168**	**$4,978,201**

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

Industry Group*	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forestry	96	$3,957	$4,768	$6,749
Logging	320	$12,439	$15,754	$25,199
Primary solid wood products	1,263	$61,609	$87,168	$239,683
Secondary solid wood products	17,389	$1,002,553	$1,391,094	$3,279,445
Wood furniture	6,040	$277,721	$395,597	$907,849
Pulp, paper, and paperboard mills	257	$15,669	$44,040	$98,395
Secondary paperboard and other paper products	8,291	$506,796	$1,177,907	$2,727,958
Total	**33,656**	**$1,880,743**	**$3,116,328**	**$7,285,278**

*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 second smallest in terms of direct employment in 2017. Direct contributions were $5.3 million in output, 94 jobs, $3.8 million in labor income, and $4.0 million 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, 22.2 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 fourth smallest in terms of direct employment. The direct contributions of logging were $39.1 million in output, 610 jobs, $23.1 million in labor income, and $25.7 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 Iowa, almost 60 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 third smallest group in terms of direct employment in Iowa. 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 $177.6 million in output, 590 jobs, $30.9 million in labor income, and $36.2 million in value-added. Total contributions for primary solid wood products, including direct, indirect and induced effects, were $239.7 million in output, 1,263 jobs, $61.6 million in labor income, and $87.2 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. For example, sawmills represent 518 of the jobs, $26.8 million in labor income, and $30.2 million in value-added.

Secondary Solid Wood Products

Secondary solid wood products was the largest group in terms of direct employment in Iowa. 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 $2.1 billion in output, 9,038 jobs, $605.5 million in labor income, and $723.6 million in value-added. Total contributions were $3.3 billion in output, 17,389 jobs, $1.0 billion in labor income, and $1.4 billion in value-added.

Wood Furniture

Wood furniture was the second largest group in terms of direct employment in Iowa. 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 $582.0 million in output, 3,751 jobs, $172.3 million in labor income, and $218.1 million in value-added. Total contributions of wood furniture were $907.8 million in output, 6,040 jobs, $277.7 million in labor income, and $395.6 million in value-added.

Pulp, Paper, and Paperboard Mills

The pulp, paper, and paperboard mills industry group was the smallest in terms of direct employment in Iowa. 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 $67.2 million in output, 63 jobs, $5.6 million in labor income, and $27.4 million in value-added. Total contributions were $98.4 million in output, 257 jobs, $15.7 million in labor income, and $44.0 million in value-added.

Secondary Paperboard and Other Paper Products

The secondary paperboard and other paper products group was the third largest in terms of direct employment in Iowa. 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 $2.0 billion in output, 3,688 jobs, $277.7 million in labor income, and $793.2 million in value-added. Total contributions were $2.7 billion in output, 8,291 jobs, $506.8 million in labor income, and $1.2 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 wood windows and door manufacturing (6,407 jobs), wood kitchen cabinet and countertop manufacturing (2,665 jobs), paperboard container manufacturing (1,922 jobs), and paper bag and coated and treated paper manufacturing (1,212 jobs). These sectors reflect the diversity of manufacturing in the state.

The wood windows and door manufacturing sector is comprised of establishments primarily engaged in manufacturing window and door units, sash, window and door frames, and doors from wood or wood clad with metal or plastics.

The wood kitchen cabinet and countertop manufacturing sector has establishments primarily engaged 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 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.

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.

These same four sectors had the highest labor income, value-added, and output as well, but the position of the sectors from highest to fourth-highest varied by metric. In terms of labor income, wood windows and door manufacturing was the highest, followed by paperboard container manufacturing, wood kitchen cabinet and countertop manufacturing, and paper bag and coated and treated paper manufacturing, for a total of $823.9 million. Wood windows and door manufacturing, paperboard container manufacturing, paper bag and coated and treated paper manufacturing, and wood kitchen cabinet and countertop manufacturing had the highest value-added, totaling $1.4 billion. In terms of output, the order of the top four sectors was the same as for value-added and totaled $3.7 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 Iowa. Including the 27 forest products industries present in Iowa, 144 sectors were impacted in 2017 (counting sectors with ten or more jobs supported). The top ten sectors (excluding forest products sectors) included wholesale trade, restaurants, trucking, real estate, management of companies and enterprises, and hospitals (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 611 jobs in truck transportation included log trucks, delivery trucks, and office jobs for some trucking companies, among others. Six of these sectors were among the top ten sectors in the state of Iowa (wholesale trade was number two, followed by real estate at number three and limited-service restaurants at number five—each had over 50,000 jobs).

Exhibit 10. Top Ten Industries Impacted by Iowa's Forest Products Industries—Number of Jobs, 2017

Sector	Description	Jobs
395	Wholesale trade	1,192
502	Limited-service restaurants	722

Sector	Description	Jobs
501	Full-service restaurants	675
411	Truck transportation	611
440	Real estate	562
461	Management of companies and enterprises	561
482	Hospitals	410
468	Services to buildings	380
400	Retail—food and beverage stores	341
405	Retail—general merchandise stores	328
Total	**NA**	**5,783**

Neighboring States

The midwestern states of Iowa, Illinois, Indiana, Missouri, Nebraska, and Ohio are important for forest products. Forest products industries employ over 192,400 workers across these states and account for over $55 billion in direct output (Exhibits 11 and 12). Ohio had the largest forest products economy with 54,445 direct jobs and output in excess of $16 billion, followed by Indiana's with 50,093 direct jobs and output of $12.9 billion. Iowa's forest products economy was the second smallest among these six states, followed by Nebraska. The three largest industry groups, each with over 48,000 employees, were wood furniture, secondary paperboard and other paper products, and secondary solid wood products.

Exhibit 11. Forest Products Industries Direct Employment in Iowa, Illinois, Indiana, Missouri, Nebraska, and Ohio, 2017

Industry	Iowa	Illinois	Indiana
Forestry	94	499	356
Logging	610	705	1,422
Primary solid wood products	590	1,201	3,485
Secondary solid wood products	9,038	6,304	12,572
Wood furniture	3,751	10,808	22,062
Pulp, paper, and paperboard mills	63	1,081	1,202
Secondary paperboard and other paper products	3,688	17,956	8,995
Sum of Direct Contributions	**17,834**	**38,554**	**50,093**

Industry	Missouri	Nebraska	Ohio
Forestry	536	36	596
Logging	2,270	197	3,069

Industry	Missouri	Nebraska	Ohio
Primary solid wood products	3,053	246	3,178
Secondary solid wood products	5,989	2,121	12,516
Wood furniture	7,063	1,649	14,904
Pulp, paper, and paperboard mills	460	17	2,211
Secondary paperboard and other paper products	6,329	1,534	17,971
Sum of Direct Contributions	**25,699**	**5,800**	**54,445**

Exhibit 12. Forest Products Industries Direct Output in Iowa, Illinois, Indiana, Missouri, Nebraska, and Ohio, 2017

Industry	Iowa (Thousands of Dollars)	Illinois (Thousands of Dollars)	Indiana (Thousands of Dollars)
Forestry	$5,317	$22,227	$30,689
Logging	$39,080	$23,565	$241,876
Primary solid wood products	$177,580	$487,465	$997,860
Secondary solid wood products	$2,064,553	$1,149,448	$2,596,710
Wood furniture	$581,969	$2,101,745	$3,984,937
Pulp, paper, and paperboard mills	$67,209	$852,881	$969,400
Secondary paperboard and other paper products	$2,042,494	$8,226,039	$4,062,026
Sum of Direct Contributions	**$4,978,201**	**$12,863,371**	**$12,883,498**

Industry	Missouri (Thousands of Dollars)	Nebraska (Thousands of Dollars)	Ohio (Thousands of Dollars)
Forestry	$35,816	$1,549	$37,948
Logging	$199,936	$9,768	$484,704
Primary solid wood products	$894,618	$91,874	$987,376
Secondary solid wood products	$1,106,338	$415,319	$2,379,878
Wood furniture	$1,187,050	$296,447	$2,436,627
Pulp, paper, and paperboard mills	$399,724	$12,454	$1,717,609
Secondary paperboard and other paper products	$3,162,490	$707,147	$8,067,397
Sum of Direct Contributions	**$6,985,972**	**$1,534,558**	**$16,111,539**

A productivity metric could also be used for comparing the contributions of forest products industries among states. While there are many variables that influence the business environment within each state, a simple comparison of how much economic activity is generated within each state as it relates to the number of forest land acres available can be another way the impact of a state's forest products industry compared to others.

In Exhibit 13, acres of forest land, and direct output and direct output per acre are listed for each of the 20 states. While Iowa ranks 15th in forest size for the 20 states compared in this study, it ranks 13th in direct output, and 8th in output per forest land acre, table below. Several states (Ohio, Illinois, Indiana) with a much larger forest resource are just ahead of Iowa in terms of total direct output per acre.

Iowa has a similar amount of forest as Massachusetts and New Jersey, yet those states are returning greater output per acre of forest; leaving the question to answer- what are these states doing that Iowa could improve upon to increase Iowa's economic value per forested acre. This would not only help the state economy but the 1,222 people employed in forestry, logging and sawmills throughout Iowa. Additionally, understanding the wood supply needs for the secondary processors in Iowa is another opportunity to grow Iowa's wood based economy.

Exhibit 13. Forest land acres, direct output, direct output per acre, and rank among the 20 northeast and midwest states, 2017.

State	Forest Land Acres	Direct Output (Thousands of Dollars)	Output / Acre	Rank – Forest Land acres	Rank - Direct Output	Rank - Output / Acre
New Jersey	1,994,191	$6,720,879	$3,370	17	10	1
Indiana	4,913,336	$12,883,498	$2,622	11	5	2
Illinois	5,011,150	$12,863,371	$2,567	10	6	3
Rhode Island	368,373	$929,557	$2,523	19	19	4
Delaware	358,857	$811,193	$2,260	20	20	5
Ohio	7,986,718	$16,111,539	$2,017	9	3	6
Massachusetts	3,016,674	$5,354,786	$1,775	14	11	7
Iowa	2,875,588	$4,978,201	$1,731	15	13	8
Wisconsin	17,024,984	$25,282,710	$1,485	5	1	9
Connecticut	1,790,100	$2,415,490	$1,349	18	15	10
Pennsylvania	16,789,992	$22,419,639	$1,335	6	2	11
Maryland	2,459,561	$2,633,880	$1,071	16	14	12
New York	18,730,813	$13,484,023	$720	2	4	13
Michigan	20,340,255	$12,182,249	$599	1	7	14
Minnesota	17,600,923	$10,503,265	$597	3	8	15
Missouri	15,346,259	$6,985,972	$455	7	9	16
New Hampshire	4,741,185	$1,620,412	$342	12	17	17
Vermont	4,494,125	$1,370,850	$305	13	18	18
Maine	17,589,532	$5,236,715	$298	4	12	19
West Virginia	12,072,879	$2,214,972	$183	8	16	20

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 Iowa's forest products industries with others. Natural resources and agricultural industries significantly contribute to the diversity of economic activities reflected in Iowa's $190.7 billion GSP. The forest products industries provide more direct labor income, value-added, and output than the commercial fishing, hunting, and trapping and mining and oil and gas production industries combined (Exhibit 14). Iowa's forest products industries comprised nearly 1 percent of the GSP in 2017. Agricultural production provided the largest amount of employment (full- and part-time), by far, of these industries.

Exhibit 14. Natural Resources and Agricultural Production Industries in Iowa, 2017

Industry	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Forest products	17,834	$1,118,759	$1,828,168	$4,978,201
Commercial fishing, hunting, and trapping	395	$861	$20,002	$20,211
Mining and oil and gas production	4,740	$172,926	$341,576	$742,940
Agricultural production (plant crop and animal)	106,786	$4,707,006	$8,067,359	$28,465,315
Total	**129,755**	**$5,999,552**	**$10,257,104**	**$34,206,667**

Labor income per job is highest in forest products ($62,730) and lowest in commercial fishing, hunting, and trapping ($2,180). Agricultural production has the second highest average income at $44,080; mining and oil and gas production has the third highest at $36,480.

Most of the forest products industries are manufacturers, however, the forestry, logging, and biomass power groups are not. There were over 223,200 manufacturing jobs in Iowa in 2017 with 17,130 in the forest products industries, 7.7 percent of the total. Of 16 industries, forest products manufacturing was fourth in terms of employment, behind food, machinery, and fabricated metal manufacturing. It was sixth in terms of labor income and value-added, and seventh in terms of output (Exhibit 15).

Exhibit 145. Manufacturing Industries in Iowa, 2017

Manufacturing Industries	Employment	Labor Income (Thousands of Dollars)	Value-added (Thousands of Dollars)	Output (Thousands of Dollars)
Food	58,604	$3,801,769	$7,435,136	$43,858,802
Machinery	37,708	$3,263,204	$7,191,283	$18,754,541
Fabricated metal	20,857	$1,347,991	$1,824,263	$5,085,851
Forest products	17,130	$1,091,909	$1,798,481	$4,933,804
Transportation equipment	14,029	$952,670	$1,258,156	$5,990,197
Plastics and rubber products	11,824	$793,068	$1,252,298	$4,055,300
Computer and electronic product	11,480	$1,412,996	$2,154,647	$4,949,978
Chemical	11,221	$2,051,658	$5,453,747	$13,726,007
Miscellaneous	8,391	$797,180	$990,021	$2,473,526
Primary metal	7,154	$606,690	$908,858	$4,326,702
Printing	7,063	$338,447	$514,046	$1,142,002
Electrical equipment	6,803	$509,486	$642,289	$2,920,462
Nonmetallic mineral product	6,052	$415,103	$1,113,070	$2,632,525
Beverage and tobacco product	2,409	$114,552	$283,919	$1,340,220
Textiles and apparel	2,145	$84,514	$105,162	$347,692
Petroleum and coal	381	$489,701	$322,212	$813,251
Total	**223,254**	**$18,070,936**	**$33,247,588**	**$117,350,859**

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 27 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 Iowa 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 17,834 direct jobs in the forest products industries, and overall, 33,656 jobs were supported. Direct labor income was $1.1 billion with total labor income at $1.9 billion. Direct value-added was $1.8 billion, and

the total contribution for value-added was $3.1 billion. Finally, direct output was $5.0 billion with a total contribution of $7.3 billion in output. Similar report findings are available from other states in the region and are summarized in a regional report.

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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 overreporting 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 detailed 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 and Wood 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	42	$1,585	$1,803	$2,904
Support activities for forestry	52	$2,166	$2,215	$2,413
Maple syrup production	-	-	-	-
Subtotal	**94**	**$3,751**	**$4,018**	**$5,317**

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	610	$23,098	$25,669	$39,080
Subtotal	**610**	**$23,098**	**$25,669**	**$39,080**

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	518	$26,832	$30,167	$144,370
Wood preservation	45	$2,578	$4,301	$25,827
Veneer and plywood manufacturing	27	$1,514	$1,759	$7,383
Reconstituted wood product manufacturing	-	-	-	-
Subtotal	**590**	**$30,924**	**$36,226**	**$177,580**

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	756	$48,955	$53,481	$175,056
Wood windows and doors manufacturing	6,407	$459,162	$557,704	$1,566,056
Cut stock, resawing lumber, and planing	60	$2,507	$3,152	$12,883
Other millwork, including flooring	251	$15,508	$19,764	$54,842
Wood container and pallet manufacturing	1,122	$54,723	$62,057	$176,425
Manufactured home (mobile home) manufacturing	14	$722	$927	$3,180
Prefabricated wood building manufacturing	283	$17,803	$19,534	$51,675
All other miscellaneous wood product manufacturing	144	$6,100	$6,935	$24,436
Subtotal	**9,038**	**$605,481**	**$723,554**	**$2,064,553**

Exhibit 15. 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	2,665	$118,969	$140,831	$381,683
Upholstered household furniture manufacturing	84	$7,304	$9,184	$20,970
Nonupholstered wood household furniture manufacturing	341	$11,914	$16,973	$42,886
Institutional wood furniture manufacturing	96	$4,190	$5,345	$17,503
Wood office furniture manufacturing	210	$11,983	$21,816	$51,044
Custom architectural woodwork and millwork manufacturing	104	$4,565	$5,707	$15,574
Showcase, partition, shelving, and locker manufacturing	250	$13,340	$18,249	$52,309
Subtotal	**3,751**	**$172,265**	**$218,103**	**$581,969**

Exhibit 16. 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	-	-	-	-
Paperboard mills	63	$5,560	$27,441	$67,209
Subtotal	**63**	**$5,560**	**$27,441**	**$67,209**

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	1,922	$149,530	$346,808	$1,042,564
Paper bag and coated and treated paper manufacturing	1,212	$96,265	$333,003	$733,855
Stationery product manufacturing	396	$22,579	$73,933	$181,422
Sanitary paper product manufacturing	32	$2,370	$22,993	$39,879
All other converted paper product manufacturing	127	$6,934	$16,419	$44,774
Subtotal	**3,688**	**$277,679**	**$793,156**	**$2,042,494**

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

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