FORESTRY AND FOREST PRODUCTS IN OHIO: 2011 ECONOMIC IMPACTS WITH COMPARISONS TO 2001 VALUES

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Abstract. Market forces have driven the downsizing and restructuring of the US forest economy, which prompted our assessment of the current conditions of forestry and forest products manufacturing in Ohio. We constructed a series of input–output models with 2011 data using the IMpact Analysis for PLANning system to determine the economic impacts of Ohio's forest-based industries. We then compared the 2011 findings with those from 2001, the year for which the industry impacts had last been assessed. Direct impacts of all forestry and forest products sectors in 2011 summed to 47,200 employees, $4.00 billion in value added, and $13.7 billion in outputs. Total economic impacts were 106,000 employees, $8.53 billion in value added, and $21.9 billion in outputs. Nearly all 2011 industry values in real terms were lower than those from 2001, which were inflation-adjusted to 2011 constant dollars. Industry shifts have occurred in the state. All economic multipliers increased, which suggested a greater integration of forestry and forest products manufacturing with the state's economy from 2001 to 2011.

Keywords: Forestry and logging, IMPLAN, input–output model, paper manufacturing, wood products manufacturing, wood furniture manufacturing.

INTRODUCTION

Management and conversion of standing timber into primary and secondary wood and fiber products provides sizable support to the US economy (McKeever and Howard 1996). The economic role of forestry and forest products is often measured using an input–output model. This model quantifies interindustry linkages to the output and employee spending of forest-based production and its supply chain. This provides a gauge for not only the size of the forest products industry but also how integrated it is in the economy.

State agencies and university Extension services are increasingly providing clientele with forestry and forest products economic impact literature. These publications not only highlight industry contributions to their state's economy,

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but provide a focus on particular sectors or geographic areas in which forest-based production in that state may possess a comparative advantage, such as in the following examples. Kentucky has a $12.8 billion dollar forest products industry (Stringer et al 2014) providing staves for barrels used by the state's bourbon producers. Wood furniture manufacturing is the greatest contributor to Mississippi's $10.4 billion forest products industry (Dahal et al 2013a), and upholstered furniture production is concentrated in the northern portion of the state. Tennessee's forest economy generated $21.7 billion in total economic activity in 2000 (Young et al 2007). Hardwood flooring production ranked number one and hardwood lumber production ranked number two there nationally. In all, 82% of forest sector activities related to growing, harvesting, and primary processing of timber in Texas are concentrated in the eastern Pineywoods region of the state (Li et al 2011).

Regionally, an input–output model of the Lake states' forest industries constructed by Pederson and Chappelle (1990) highlighted the forest products industry as well as sales related to wood energy and outdoor recreation. Because of the shift in timber production and wood utilization to the South during the past few decades (Cox and Munn 2001), a regional forest products economic impact study on the South was conducted by Aruna et al (1997). Subsequent updates and comparisons have been provided by Tilley and Munn (2007a, b) and Dahal et al (2013b).

An analysis of Ohio's forest products industry was conducted by Hushak (2005) using 2001 economic data. Direct impacts included 71,000 employees, $3.99 billion in value added, and outputs of $11.7 billion (in 2001 dollars). Paper manufacturing employed most of the people (42.0% of all employees) followed by wood products manufacturing, wood furniture manufacturing, and forestry and logging, respectively. Output ranged from $294 million in forestry and logging to $7.50 billion in paper manufacturing. Total economic contributions of forest products when accounting for the industry's multiplier effects were 131,000 employees, $7.29 billion in value added, and $18.0 billion in outputs.

However, much has happened in the forest products industry in the relatively short time since 2001. Hardwood timber prices in Ohio, for example, continued to climb until reaching all-time highs in 2004 (Luppold et al 2014). A rapid decline in Appalachian hardwood lumber prices caused by falling demand in the home construction and remodeling sectors quickly eroded what had been a 15-yr general rise in local timber prices (Duval et al 2014; Luppold et al 2014). Housing starts were more than 2.0 million in 2005 but had dropped to 554,000 in 2009 (Keegan et al 2011). Inflation-adjusted stumpage prices in Ohio were 33.0% lower in 2011 compared with 2001, as sawlog prices had also declined 39.0% (McConnell 2014). Appalachian #1 Common hardwood lumber prices dropped 42.0% during the same period (Hardwood Review 2001, 2011).

Likewise, falling demand caused steep price declines in softwood markets, which led to production curtailments in forest economies dependent on the processing of southern pine (*Pinus* spp.) and Douglas-fir (*Pseudotsuga menziessi*). The Mississippi forest products economic impact report, for example, found employment, value added, and output each decreased between 27% and 30% from 2006 to 2010 (Dahal et al 2013c). Primary milling capacity in Oregon decreased by 12% from 2006 to 2010, and capacity utilization declined below 57% (Gale et al 2012).

The reshaping of the timber processing and wood and fiber manufacturing sectors following the great recession (Woodall et al 2011a) necessitated updating of the economic impacts of forestry and forest products in Ohio. These data can provide interested parties, such as industry participants (landowners, loggers, and mills), advocates (associations and organizations), as well as lawmakers, needed information when involved in policy- and decision-making discussions, particularly in regions or communities in which the industry's role(s) may not be fully understood.

The purpose of this study was to determine the economic impacts of forest-based outputs in Ohio for the year 2011. IMpact Analysis for PLANing (IMPLAN), an economic impact software system, was used to develop a series of input–output models. Models were constructed for the state's timber processing and wood and fiber manufacturing sectors, with their economic multipliers subsequently determined. The total economic impacts of forest products were computed based on these results. Results for 2011 were compared with Hushak's (2005) report of 2001 Ohio forest products industry values.

METHODS

IMPLAN and the Input–Output Model

The IMPLAN system was created to detail the economic impacts of forest management activities occurring on federal forest lands to surrounding communities. In 1976, Minnesota IMPLAN Group Inc. (Stillwater, MN) designed an economic impact modeling system under the direction of the US Forest Service. Today, IMPLAN is used to quantify the economic impacts of various industries and community development projects, such as agriculture, tourism, and new construction projects, among others. The IMPLAN system is now administered by IMPLAN Group LLC of Huntersville, NC.

The IMPLAN software analyzes economic impacts generated within a predefined region in terms of dollars added into the economy and jobs produced (IMPLAN Group 2004). Data are obtained from various government sources. One source is household data that are compiled by estimating personal consumption expenditures. These values are estimated by collecting data from the Bureau of Economic Analysis and National Institute of Pension Administrators. Other data sources include the annual survey of manufacturers, census data, import and export data, and capital expenditures. Earlier versions of IMPLAN's input–output model were based on an economy of more than 500 industrial sectors. This has since been decreased to a 440-sector model through sectorial aggregations. Ohio's forest products industry is represented by 26 of these sectors (Table 1).

The IMPLAN system's input–output model defines sectors in an economy and uses its database to model interindustry linkages, such as purchases and sales among sectors. Inputs are defined by the total outlay of industry purchases. Purchased inputs include those from other production sectors, those from value added, along with any intermediate and value-added inputs imported from outside the study region. Sales to intermediate production sectors and final demand comprise industrial output.

Table 1. Individual forestry and forest products sectors, aggregated by industry groups, assessed in this study. The associated 3-digit North American Industry Classification System (NAICS) code is provided for each industry group.

Industry (3-digit NAICS code)	IMPLAN sectors
Forestry and logging (113)	Forestry, forest products, and timber tract production; commercial logging
Wood products manufacturing (321)	Sawmills and wood preservation; veneer and plywood manufacturing; engineered wood member and truss manufacturing; reconstituted wood product manufacturing; wood windows, doors, and millwork manufacturing; wood container and pallet manufacturing; manufactured home (mobile home) manufacturing; prefabricated wood building manufacturing; all other miscellaneous wood product manufacturing
Paper manufacturing (322)	Pulp mills; paper mills; paperboard mills; coated and laminated packaging paper and plastics film manufacturing; all other paper bag and coated and treated paper manufacturing; stationery product manufacturing; sanitary paper product manufacturing; all other converted paper product manufacturing
Wood furniture manufacturing (337)	Wood kitchen cabinet and countertop manufacturing; upholstered household furniture manufacturing; nonupholstered wood household furniture manufacturing; institutional furniture manufacturing; wood television, radio, and sewing machine cabinet manufacturing; office furniture, custom architectural woodwork, and millwork manufacturing

Outputs are determined from the transactions table describing makes and uses. The transactions table separates processing sectors and purchasing sectors. Each sector in the economy is considered to be both a processing and a purchasing sector. Processing sectors are allocated to rows, and purchasing sectors are assigned to columns. The table shows how many dollars of a good a sector has purchased from a processing sector along with how many dollars of a good processing sector has sold to an individual purchasing sector. This illustrates the economic relationships among sectors based on the value of the commodities bought and sold. Summing each row quantifies an industry's output.

The fixed coefficient production function is then calculated using data from the sectorial interactions contained within the transaction table. The fixed coefficient production function is a representation of the degree to which an industry relies on other industries to produce one dollar of output to satisfy final demand. This relationship between output and final demand was first described by Leontief (1936) and is illustrated in Eq 1:

$$x = (I - A)^{-1} y \quad (1)$$

where x is the column vector of output, I is an identity matrix, A is the matrix of fixed coefficient production functions (which is a 440 $\times$ 440 matrix relating input to output), and y represents the final demand column vector. This function assumes input and output relationships are constant and occur in fixed proportions, ie one dollar of additional output requires one dollar of additional input, with no substitutions.

The term $(I - A)^{-1}$ is the total requirements matrix. Each element of the matrix describes the amount needed from sector i (row) as input to produce one dollar of output in sector j (column) to satisfy final demand. Summing the column elements, or the total requirement from each individual sector i, for sector j provides sector j's output multiplier. Employment, labor income, and value-added multipliers are also derived from summing a sector's column elements with each element being an average value per unit of output for sector j's total requirement for each sector i input (Horowitz and Planting 2009).

The IMPLAN input–output model defines employment as the number of both full- and part-time jobs an industry creates to meet final demand. Value added is composed of labor income, which includes employee compensation and proprietor (self-employed) income, other property type income, and indirect business taxes. Output represents the total value of an industry's production, which is the sum of value added plus the cost of buying goods and services to produce the product.

Using the economic multipliers in conjunction with an industry's direct impacts, which are the effects generated by a particular industry to meet final demand for its products, allows for calculating that industry's spillover effects, the indirect and induced impacts. Indirect effects result from interindustry purchasing to meet final demand as described in matrix A. Dividing the direct effect into the sum of the direct and indirect effects provides the Type I economic multiplier (USDC BEA 2013).

Induced effects result from changes in employee spending within the interlinked industries. Induced effects in an input–output analysis are those assumed to be endogenous to a study region, in which the changes in value-added inputs (which includes labor income) and consumption are fed back into the economy of interest. Type II multipliers incorporate these effects and are defined as the sum of the direct, indirect, and induced effects divided by the direct effect. Type II multipliers differ by how they define value added and account for any of its potential endogenous components. A particular Type II multiplier, the type social accounting matrix (SAM) multiplier, considers portions of value added to be both endogenous and exogenous to a study region. Type SAM multipliers are generally the preferred Type II multipliers used in input–output analyses (Tilley and Munn 2007a) and were used in this study to estimate changes in total economic impacts.

Analyses

Economic data for Ohio from 2001 were available from Hushak (2005) and 2011 data (the most recent available at the onset of this study) were obtained from IMPLAN LLC. The 2011 economic database was modified to assure that year's input–output models matched 2001 in terms of industry classifications and economic contributions. For example, the name and representation for certain sectors in IMPLAN have changed since Hushak's (2005) report, as newer versions of the software have been released. Thus, two sectors from 2011, paper mills and paperboard mills, were combined into paper and paperboard mills, which provided a match to the 2001 data. This left us with 25 individual forest products industrial sectors. The economic database defined each sector's direct impacts. Multiplier reports generated by IMPLAN provided Type SAM economic multiplier data for employment, value added, and output for each sector. Models were constructed for five industry groups: forestry and logging, wood products manufacturing, paper manufacturing, wood furniture manufacturing, and the industry as a whole (hereafter termed forest products industry; Table 1).

To estimate the total effects of forest products industry outputs in Ohio, we adjusted our Type SAM multipliers to discount forest products sectors' purchases from themselves to meet final demand. Doing this reflected the measured impact of a per unit change in output vs a per unit change to final demand, which paralleled Hushak's (2005) methodology. Calculating this adjustment required dividing each forest-based industry's Type SAM multiplier, the sum of industry j's column elements in the total requirements matrix, by its associated diagonal element a_{ij}:

$$\text{Adjusted Type SAM multiplier}_j = \frac{\text{Type SAM multiplier}_j}{a_{ij}} \quad (2)$$

The term a_{ij} represents the total input requirements sector j has from itself to produce a unit of its own output to meet final demand. The diagonal element's value is at least 1.00 because of sector j's requirement of itself to produce one unit of output at minimum. The value of a_{ij} exceeds 1.00 when sector j's output is required to produce its product. Accounting for this effect resulted in an adjusted Type SAM multiplier$_j$ that was less than or equal to the original Type SAM multiplier$_j$. The magnitude of any decrease was dependent on sectorial need for its own production in the manufacturing of output.

All 2001 dollar values were adjusted for inflation to 2011 constant dollars using the producer price index (PPI) for all commodities (US Department of Labor Bureau of Labor Statistics 2014). Forest products 2001 and 2011 sectorial economic data were compared descriptively by illustrating the absolute dollar differences and relative changes between years. We first compared the direct impacts (employment, value added, and output) of the sectors within the four industry groups and the forest products industry. We then presented the industries' adjusted Type SAM multipliers for the 2 years. Lastly, we compared the total economic impacts for 2001 and 2011, which were the products of the direct contributions of the sectors and their associated adjusted Type SAM multipliers.

RESULTS

Ohio's forest products industry in 2011 showed both absolute and relative decreases in its direct contributions to the state's economy compared with 2001. Forest products industry employment and value added, each contributed less than 1% to their respective state totals in 2011 (Table 2). In 2001, the relative contributions of these values were at least 1.04%. Only forest products industry output continued to contribute greater than 1% to state output at 1.40%, respectively. However, direct output decreased 21.9% in real terms between the 2 years. Forest products industry employment from 2001 to 2011 dropped by 33.5% (Fig 1). Also, dollars contributed through value added and output each declined more than 20.0% compared with 2001. Direct impacts of all

Table 2. Contribution of Ohio's forest-based employment, value added, and output in 2001 and 2011. For the four aggregated sectors, percentage contribution is based on the forest products industry total. For the forest products industry, percentage contribution is based on Ohio's total economy.

Industry	Employment	Value added[a]	Output[a]
Forestry and logging 2001	2178	$222	$441
Percentage of forest products industry	3.07%	3.71%	2.52%
Forestry and Logging 2011	2273	$34.1	$182
Percentage of forest products industry	4.82%	0.85%	1.33%
Wood products manufacturing 2001	20,392	$1147	$3241
Percentage of forest products industry	28.7%	19.2%	18.5%
Wood products manufacturing 2011	13,689	$620	$2245
Percentage of forest products industry	29.0%	15.5%	16.4%
Paper manufacturing 2001	29,808	$3434	$11,280
Percentage of Forest products industry	42.0%	57.4%	64.5%
Paper manufacturing 2011	20,009	$2317	$9143
Percentage of forest products industry	42.4%	57.9%	66.9%
Wood furniture manufacturing 2001	18,613	$1179	$2530
Percentage of forest products industry	26.2%	19.7%	14.5%
Wood furniture manufacturing 2011	11,232	$1033	$2086
Percentage of forest products industry	23.8%	25.8%	15.3%
Forest products industry 2001	70,991	$5981	$17,493
Percentage of Ohio's economy	1.04%	1.10%	1.69%
Forest products industry 2011	47,205	$4005	$13,656
Percentage of Ohio's economy	0.73%	0.80%	1.40%

[a] Values are 2011 constant dollars in millions (2011 $MM).

forestry and forest products sectors in 2011 summed to 47,200 employees, $4.00 billion in value added, and $13.7 billion in outputs.

Changes were also observed for direct effects for the four industry groups in 2011 compared with 2001 (Table 2). Nearly all 2011 absolute values were lower than 2001 values. However, the relative contributions provided by these industry groups to the forest products industry varied between the 2 years, which indicated that industry shifts had occurred in the state. For example, wood furniture manufacturing declined more than $100 million dollars in value added but provided a larger percentage of value added to the forest products industry than in 2001. Paper

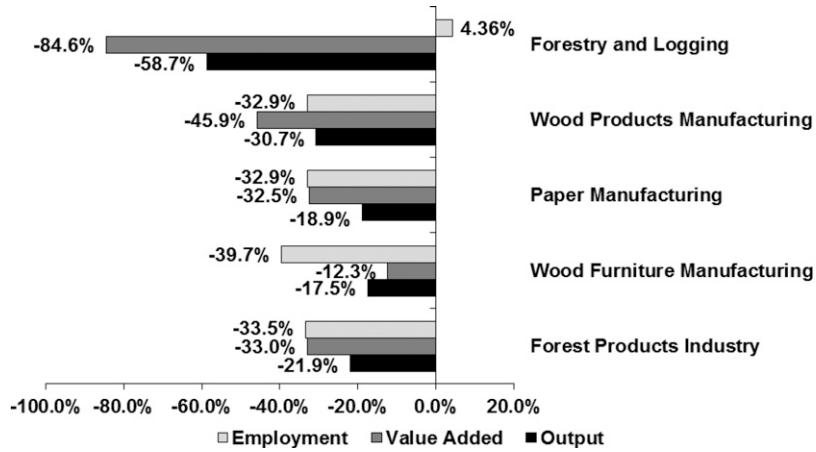

Figure 1. Percentage change of direct impacts in Ohio forest-based industries 2001 and 2011. Changes in value added and output were calculated using 2011 constant dollars.

Table 3. Adjusted type social accounting matrix multipliers for 2001 and 2011 economic data for the aggregated forest-based industries.

Industry	Employment		Value added		Output	
	2001	2011	2001	2011	2001	2011
Forestry and logging	1.49	1.57	1.32	2.80	1.30	1.62
Wood products manufacturing	1.65	1.83	1.91	2.27	1.63	1.65
Paper manufacturing	2.18	2.90	1.87	2.28	1.50	1.60
Wood furniture manufacturing	1.57	2.11	1.71	1.87	1.63	1.78
Forest products industry	1.85	2.25	1.83	2.13	1.54	1.60

manufacturing showed slight increases in all relative contributions to the forest products industry despite absolute declines. The percentage contributions of forestry and logging and wood products manufacturing to forest products industry employment increased, and value added and output percentage contributions decreased.

Employment in forestry and logging was the only value that increased between 2001 and 2011 (Table 2). Forestry and logging showed a +4.36% increase in the amount of full- and part-time jobs produced in 2011 compared with 2001 (Fig 1). Job declines were more than 30.0% in wood products manufacturing, paper manufacturing, and wood furniture manufacturing between the 2 years. The greatest relative decrease between the 2 years was observed in total value added of forestry and logging, which experienced a decrease of 84.6% (Fig 1). Output was also down the greatest percentage in forestry and logging, −58.7%, between the 2 years. Wood furniture manufacturing had a relative employment loss greater than the forest products industry. Wood products manufacturing was the only one of the manufacturing groups in which output and value added experienced greater percentage declines than the forest products industry.

Adjusted Type SAM multipliers for the industry groups are presented in Table 3. The economic multipliers are interpreted as follows using the forest products industry as an example. The forest products industry's 2011 employment multiplier was 2.25, which means it employed 1.25 people in additional sectors for every one of its employees. Its value added and output multipliers were 2.13 and 1.60. This means that for every one dollar of value added and output generated by the forest products industry, $1.13 and $0.60 of value added and output were generated in other sectors. All adjusted Type SAM multipliers were higher in 2011 than 2001. The average multiplier increased 23.0% during the period, and trimming the high and low values yielded an average increase of 17.7% (Fig 2).

Total economic activity associated with forestry and forest products manufacturing was 106,000 employees, $8.53 billion in value added, and $21.9 billion in outputs (Table 4). Increases in the 2011 economic multipliers did not compensate for the large declines in many of that year's direct economic contributions. For example, the total impact of wood products manufacturing employment accounted for 8000 fewer full- and part-time jobs in 2011 than in 2001. Similarly, paper manufacturing provided 6900 less and wood furniture manufacturing accounted for 5500 less full- and part-time jobs in 2011 than in 2001. The total impact of forest products industry employment was 24,700 jobs below the impact of 2001.

Overall, total economic impact declined monetarily across industry groups, with relative changes in wood furniture manufacturing being less than other industry groups (Table 4; Fig 3). Forestry and logging contributed −67.2% less in value added in 2011 compared with 2001. Between 2001 and 2011; wood products manufacturing value added decreased by 35.7% and paper manufacturing saw a decline of 17.8%, respectively. Value added in wood furniture manufacturing, however, declined 4.02%. Forestry and

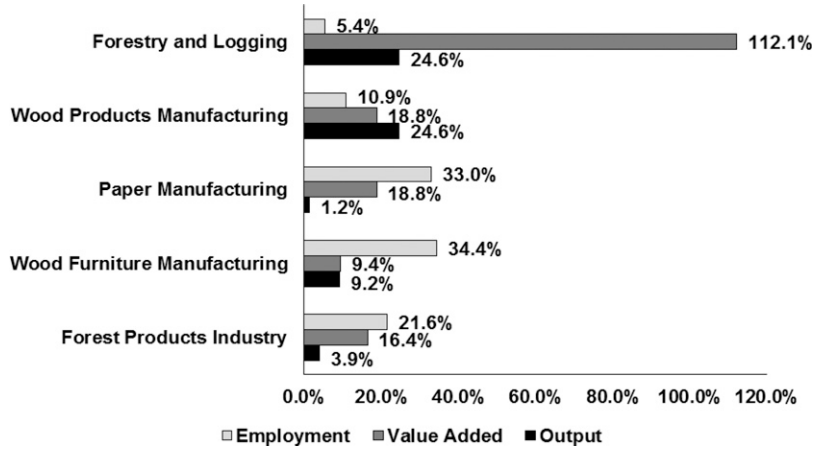

Figure 2. Percentage change of adjusted Type social accounting matrix economic multipliers in Ohio forest-based industries 2001 and 2011.

Table 4. Total economic impacts for the aggregated forest-based industries in 2001 and 2011.

	Employment		Value added[a]		Output[a]	
Industry	2001	2011	2001	2011	2001	2011
Forestry and logging	3248	3569	$294	$96.5	$574	$295
Wood products manufacturing	33,559	25,052	$2191	$1408	$5291	$3705
Paper manufacturing	65,002	58,027	$6425	$5282	$16,948	$14,628
Wood furniture manufacturing	29,188	23,701	$2013	$1932	$4116	$3714
Forest products industry	130,997	106,211	$10,923	$8530	$26,930	$21,850

[a] Values are 2011 constant dollars in millions (2011 $MM).

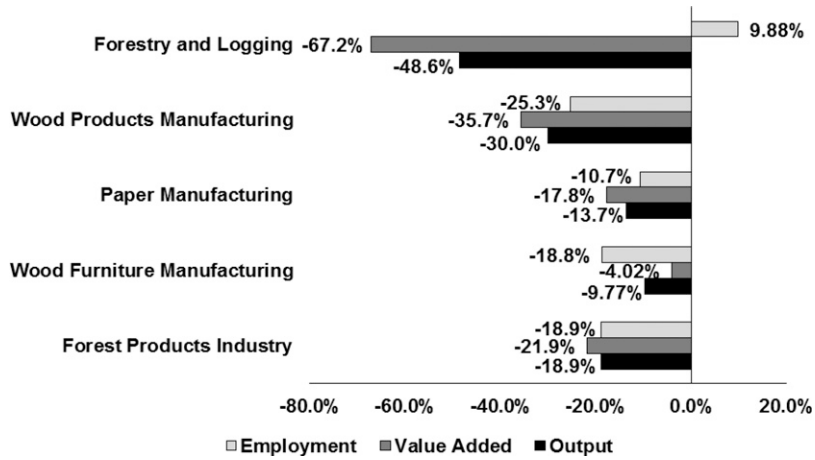

Figure 3. Percentage change of total impacts in Ohio forest-based industries 2001 and 2011.

logging was also lower in total output in 2011 by −48.6%. Wood products manufacturing output was −30.0% lower and paper manufacturing output was −13.7% lower. Wood furniture manufacturing output also decreased but by a more modest 9.77%. The forest products industry experienced decreases in value added and output of 21.9% and 18.9%, respectively.

DISCUSSION

Forest-based industries in Ohio have changed between 2001 and 2011. For the most part, these changes have been negative. Since 2001, however, forestry and forest products manufacturing declines have not been limited to Ohio. For example, North Carolina and Virginia, historic leaders in wood furniture manufacturing in the Appalachian hardwood region, employed −62.0% and −73.0% less people, respectively, in 2011 compared with 2001 (Tilley and Munn 2007a; USDC Census Bureau 2014). Ohio's wood furniture manufacturing sector by comparison lost 39.7% of its employment. Losses from 2002 to 2011 (USDC 2002, 2011) in North Carolina (57.3% in value added and 52.9% in output) and Virginia (61.4% in value added and 55.3% in output) were also much larger than Ohio's 2001 to 2011 declines (12.4% in value added and 17.5% in output). These lower percentages of decline may be partly attributed to Ohio's unique Amish furniture cluster. This subset of wood furniture manufacturing is an important part of the state's forest products industry (Buehlmann and Schuler 2009), because it consumes an equivalent of about 11% of the hardwood lumber produced in Ohio (Bumgardner et al 2007).

The employment decline of 32.9% from 2001 to 2011 in Ohio wood products manufacturing (Fig 1) was greater than that experienced in the neighboring state of Kentucky (−20.9%) but was comparable with the 10-yr decrease of 33.9% in Pennsylvania (USDC Census Bureau 2014). These changes in the central hardwood region were similar to those in the South for southern pine lumber and wood products, which saw employment decline 37.3% from 2001 to 2009 (Dahal et al 2013b). From 2002 to 2011, value added in Kentucky and Pennsylvania declined 35.0% and 48.0%, respectively, and in Ohio, the decline was 45.9% from 2001 to 2011. However, output decreased slightly less in Ohio (30.7%) than in Kentucky (31.5%) and Pennsylvania (46.8%) (USDC 2002, 2011).

Paper manufacturing decreased regionally as well as locally. Employment losses ranged from 14.9% to 32.9% across the Kentucky–Ohio–Pennsylvania region (USDC Census Bureau 2014), and value-added declines ranged from 17.8% to 35.2%. Output declined between 16.8% and 23.5% (Fig 1) (USDC 2002, 2011). Paper manufacturing in the South also declined in employment by 26.0% from 2001 to 2009. However, value added and output grew by 26.9% and 42.6%, respectively, during this time (Dahal et al 2013b).

Employment changes in Ohio's forest products industry were similar to changes occurring in the northern region of the United States (Woodall et al 2011b) where employment decreased 28.0% in the forest products industry between 2005 and 2010. This was approximately 5.00% less than the 33.5% loss observed in Ohio's forest products industry from 2001 to 2011. Also, softwood-dependent regions saw total forest-based employment decrease 33.9% and 28.0% in the South and Oregon, respectively, from 2001 to 2009 (Dahal et al 2013b; Gale et al 2012).

Direct output and value added declined by degrees greater than one-half in forestry and logging, but employment showed a slight increase. Logging costs have generally outpaced inflation for the past 30 yr, as measured by the PPI-logging vs the PPI-all commodities. This included a consecutive 20-year period from 1987 to 2007 (US Department of Labor Bureau of Labor Statistics 2014). In addition, 30-yr lows in state timber prices and 45-yr lows in eastern hardwood lumber prices occurred at the height of the 2007 to 2009 recession (Luppold et al 2014; McConnell 2014). One implication of these events was the loss of logging firms and their proprietors' incomes. The USDC Census Bureau (2014) estimated that the number of Ohio logging firms in 2011 was −58.0% lower than that in 2001. Proprietor income declined two-thirds from 2001 to 2011, and employee compensation declined 21.8%. Those companies remaining operational may have hired a portion of the unemployed workers.

The small increase in forestry and logging employment may have been caused by census

methodology. Capturing the true size of this rural industry, often family owned, employing few or no people, and in some instances, seasonal or transient, has historically been problematic. Companies within forestry and logging have, at times incorrectly, been classified by the federal government into various other sectors, including truck transport or support services for forestry (Greene et al 1998). Support services for forestry is a sector not involved directly in the production and manufacturing of wood and fiber-based products. Therefore, it was excluded from this analysis and others (Hushak 2005; Dahal et al 2013a). Perhaps census surveying and/or classification procedures have changed to improve precision. But, some businesses' primary outputs may have also changed, for instance from a service to a product. They would have probably been reclassified by the federal government into forestry and logging. As an example, a business that historically provided a service, such as timber marketing, may have begun purchasing and managing land for timber production. Or, a contract trucker may have purchased timber harvesting equipment for conducting logging operations.

Although forest products' direct impacts declined in Ohio, all of the state's adjusted Type SAM economic multipliers increased (Table 3). Multipliers are calculated through the transactions table that defines industry sectors as buyers and sellers of goods. Higher multipliers in 2011 suggest buying and selling among forest-based industries and external sectors within Ohio had increased in 2011 compared with 2001. As a result, Ohio's forest products industry has become more integrated with, and dependent on, the state's economy as a whole. This does not necessarily mean, however, that forestry and forest products were more important to the state's economy in 2011 than they were in 2001 (Cox and Munn 2001).

Woodall et al (2011a) provided a synopsis of how the national forest products industry has restructured in the wake of globalization, the rise of electronic media, and the very large decline in housing construction since 2006. The slowdown in US forest products industrial growth that was accelerated by the 2007 to 2009 recession was described as actually being much longer-term, dating to the early 1990s for some sectors. Forestry and forest products manufacturing was declining in most of the economic measures displayed here, although it still contributed nearly $22.0 billion in total economic activity to the state. Although Ohio has unique components within its forest economy, its forest products industry was largely not resistant to the greater trends occurring regionally and nationally.

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