

Economic Impact of the COVID-19 Pandemic on Tennessee Forest Product Exports

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Introduction

In 2020, the COVID-19 pandemic spread across the globe and had severe impacts on the global economy. As the pandemic began to spread across the U.S., businesses closed and individuals were asked to comply with shelter-in-place and stay-at-home orders (Baker et al., 2020). Countries around the globe imposed similar measures, which negatively affected the global economy beyond anything experienced in nearly a century (Jackson et al., 2020; Sarkodie and Owusu, 2021). Consequently, the pandemic had a negative impact on U.S. forestry exports at the national and state level. Lower global economic activity and disruptions to transportation networks decreased international timber trade. Early in the pandemic, foreign ports were closed, which curtailed timber shipments, and worldwide shutdowns in construction and manufacturing weakened international demand for logs, lumber and other forest products (Riddle, 2020).

In this report, we assess the impact of the COVID-19 pandemic on Tennessee forest product exports. We examine export losses in 2020 by destination countries and forest product category and further assess the full economic impact of decreased export sales on income and jobs at the state and county level. According to Muhammad and Taylor (2020), the COVID-19 pandemic had a significant impact on Tennessee's forest product exports in 2020 due to supply and demand disruptions in the global market for finished wood products markets (e.g., furniture) and the interrelated market for raw materials and inputs (e.g., logs and lumber). In 2020, U.S. forest-product exports were down by more than \$670 million when compared to the previous year. Geographically, the decline in export sales was mostly in southern states (\$240 million), followed by western states (\$217 million). Losses in 2020 were in addition to losses in 2019, due to the trade war between the U.S. and China. In 2020, the decrease in export sales for Tennessee was \$38 million. Given the state's dependence on foreign export sales of hardwoods, losses for Tennessee in percentage terms (22 percent in 2020 and 46 percent since 2018) exceeded national and regional averages (see Table 1) (USDA-FAS, 2021). The impacts of the trade war on U.S. and Tennessee forest product exports have been discussed in previous UT Extension reports (Muhammad and Taylor, 2020; Muhammad and Smith, 2020). The analysis in this report is based on the decrease in export sales in 2020, which has been mostly attributed to the pandemic (Riddle, 2020).

Table 1. U.S. Forest Product Exports: 2018-2020.

Country/ Region/State	2018	2019	2020	\$ Change 2020-2019	\$ Change 2020-2018	% Change 2020-2019	% Change 2020-2018
	<i>\$ million</i>						
United States	\$9,865	\$8,324	\$7,655	-\$669	-\$2,210	-8.0%	-22.4%
South	3,875	3,297	3,057	-240	-818	-7.3%	-21.1%
West	2,654	2,139	1,922	-217	-732	-10.1%	-27.6%
Midwest	1,507	1,276	1,241	-35	-266	-2.7%	-17.7%
Northeast	1,511	1,295	1,150	-145	-361	-11.2%	-23.9%
Tennessee	257	177	139	-38	-118	-21.5%	-45.9%

Source: U.S. Department of Agriculture, Foreign Agricultural Service (2021)

Background

Tennessee Forestry Sector

The Southeast U.S. is the world's most important center for timber production (FAO, 2019). Much of this production is pine, and forestry is a substantial part of the economy in pine states such as Mississippi, Alabama and Georgia. Tennessee is mostly a hardwood state; however, hardwoods are high-value and an important part of Tennessee's economy (Pelkki and Sherman, 2020). Tennessee's forestry activity is generally located in rural areas and, especially in the hardwood region, often smaller scale than other industries. Thus, the total economic activity of the wood products industry is often underappreciated. When examining the wood products, wood pulp and paper industries, and associated upstream and downstream activities, Menard, English and Jensen (2017) estimate that forestry in Tennessee provides over 98,000 jobs and has annual economic impact of over \$24 billion, almost 3 percent of the state's economy. Consequently, Tennessee is among the top ten states in terms of the relative importance of forestry, alongside Maine, Wisconsin and Oregon (Pelkki and Sherman, 2020).

Tennessee is a top ten state in terms of the absolute numbers of forestry jobs, wages and economic activity. This puts Tennessee in the company of Georgia and Alabama, the biggest pine-producing states. Although the volume of Tennessee hardwood production is not comparable to the amount of pine produced in states like Georgia and Alabama, the value of the forest industry in Tennessee is comparable since hardwoods have a higher value than softwoods (Pelkki and Sherman, 2020).

The Tennessee forest products industry is increasingly globally connected. About half of the higher-grade hardwood lumber produced by Tennessee's sawmills is exported (Luppold et al., 2018). This globalization trend began with the decline of domestic furniture production; at that time, much of the lumber exported was returned to the U.S. in the form of finished goods. Now, however, most of the lumber and logs exported remains as finished good in the destination countries. Tennessee is a key part of the world's wood basket and helps to supply the increasing global demand for forest products (FAO, 2019).

Despite the current importance of the forest products industry in Tennessee, there has been a long-term trend towards fewer sawmills and reduced hardwood lumber production. Production levels are very dynamic; however, a record low level was set in 2020 and, while production has rebounded to a large extent, it is still well below past high levels set in the early 2000s.

The sudden surge of prices for softwood lumber to record highs has not been matched in the hardwood lumber market. While there have been price increases in hardwoods recently due to increasing demand at a time of low production volumes, these price increases have been modest in comparison to softwood lumber. In fact, after accounting for inflation, prices for most hardwood lumber items are below their long-term (25 year) averages (HMR, 2021).

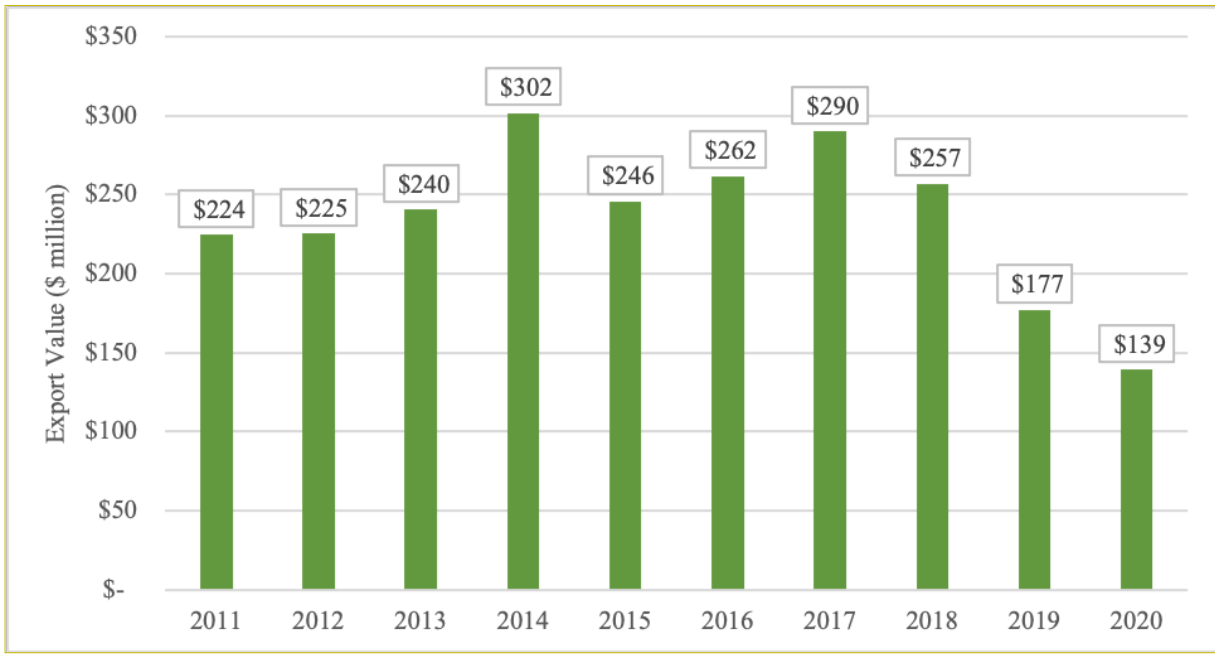
Forest Product Exports

Tennessee generated \$139 million in forest product export sales in 2020 (see Figure 1). This was a decrease from 2019 (down \$38 million) and was the lowest export value in the last 10 years. In 2018, Tennessee forest product exports were valued at \$257 million but decreased to \$177 million in 2019. The decrease since 2018 is due to two important factors: the U.S.-China trade war, which started in 2018, and the COVID-19 pandemic in 2020.

Tennessee's forest product exports by destination country and product category (2018-2020) are reported in Figure 2. As the figure shows, the importance of China to Tennessee's export disappearance cannot be overstated. In 2018, over \$100 million of Tennessee forest product exports went to China (Figure 2). That year, China imported more than the remaining top ten countries combined. In 2019, however, the retaliatory tariffs that China imposed on U.S. forest products caused Tennessee's exports to China to decline significantly to less than \$40 million. In 2020, exports to China declined even further to about \$30 million. Note that exports across almost all countries declined in 2020 relative to the previous year.

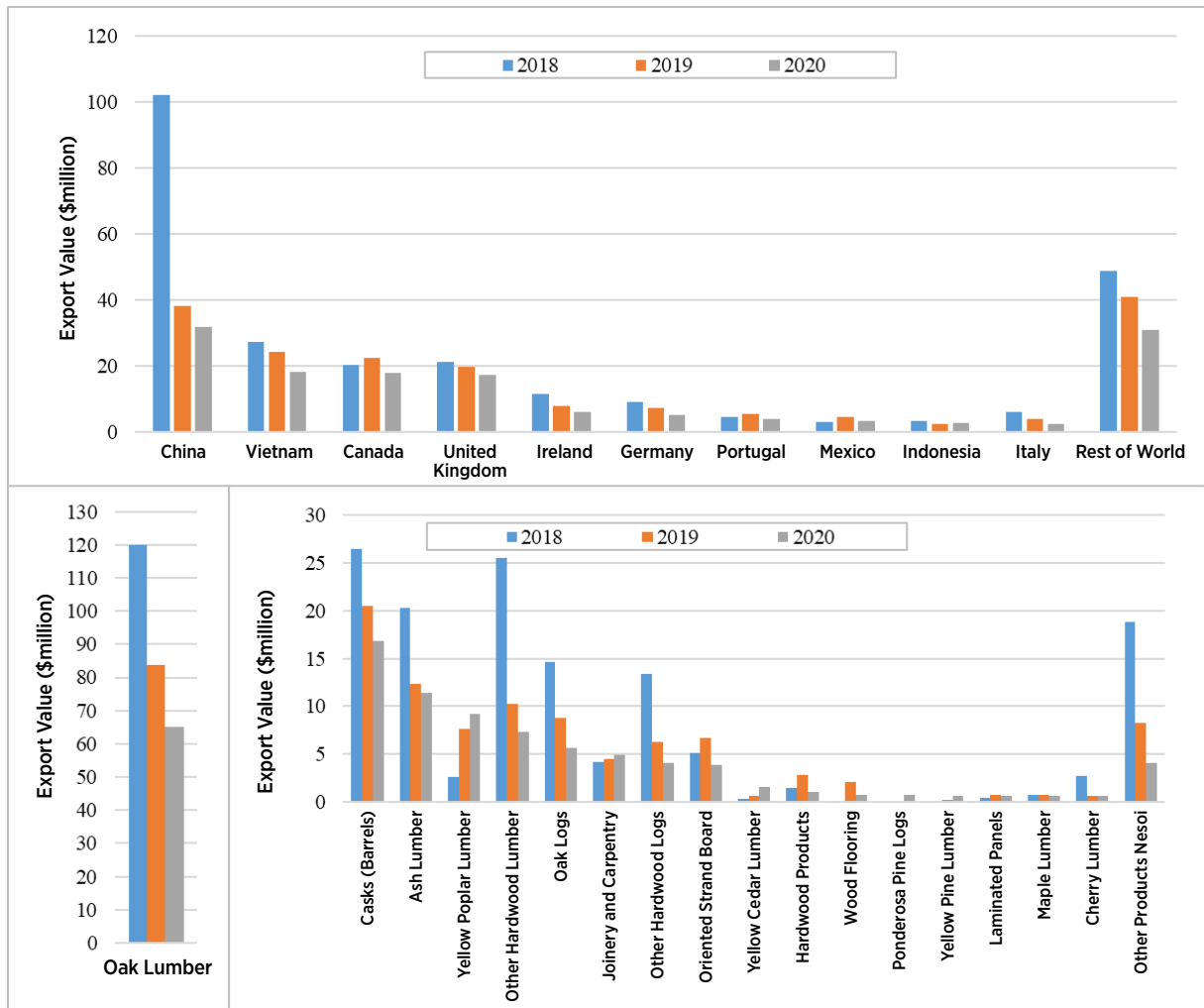
Oak lumber is Tennessee's largest forest product export (See Figure 2). In 2018, oak lumber generated approximately \$120 million in exports; this value decreased to approximately \$85 million in 2019. Oak lumber exports further decreased in 2020 to approximately \$65 million, likely due to the pandemic. Note that oak lumber exports and other major forest products followed a similar pattern over the last three years. While most products decreased in value of exports, yellow poplar lumber is one of the few categories that actually increased every year since 2018.

Figure 1. Tennessee Forest Product Exports: 2011-2020.



Source: USDA, Foreign Agricultural Service's Global Agricultural Trade System (GATS)

Figure 2. Tennessee Forest Product Exports by Country and Product Category: 2018-2020.



Source: USDA, Foreign Agricultural Service's Global Agricultural Trade System (GATS)

A breakdown by both major destination and product category is in Table 2. Table 2 also includes percentage changes in destination- and product-specific exports in 2020 relative to the previous year. Oak lumber is the leading export to most destinations. Exceptions include the United Kingdom and Ireland — both countries import casks (primarily oak barrels) for whiskey production — as well as Portugal (oak logs) and Canada (oriented strand board and joinery carpentry). Note that oak lumber exports mostly declined in 2020 (Mexico and Indonesia are the exceptions). Other exports to specific destinations were zero in 2020 (e.g., oak log exports to the United Kingdom, Ireland, Indonesia and Italy). However, this could be due to unreported trade.

Table 2. Tennessee Exports and Percentage Change in 2020 by Major Destination Country and Product Category.

Country	Oak Lumber	Casks (Barrels)	Other Hardwood Lumber	Ash Lumber	Yellow Poplar Lumber	Oak Logs	Other Hardwood Logs	Oriented Strand Board	Joinery Carpentry	Cherry Lumber
<i>\$ million</i>										
China	\$17.84	\$0.80	\$2.73	\$3.93	\$0.53	\$1.14	\$2.09			\$0.55
Vietnam	9.01		2.40	1.22	4.37	0.48	0.14			0.06
Canada	2.37	0.39	0.58	0.18	1.26		0.08	3.90	4.88	
United Kingdom	6.28	8.32	0.11	1.06	1.26					
Ireland	0.38	5.17	0.01	0.29	0.12					
Germany	4.21		0.04	0.11	0.27	0.14	0.29			
Portugal	0.95		0.11	0.29	0.04	2.29				
Mexico	1.46	0.09	0.31	0.14	0.24	0.05				
Indonesia	2.39		0.10	0.04	0.01					
Italy	0.47		0.06	0.93	0.62		0.15			

Country	Oak Lumber	Casks (Barrels)	Other Hardwood Lumber	Ash Lumber	Yellow Poplar Lumber	Oak Logs	Other Hardwood Logs	Oriented Strand Board	Joinery Carpentry	Cherry Lumber
<i>Percentage change from 2019 to 2020</i>										
China	-12%	∞%	-30%	-21%	190%	-68%	-32%			71%
Vietnam	-36%		-27%	26%	36%	-29%	-12%			-22%
Canada	-12%	-8%	97%	71%	49%	0%	344%	-43%	9%	-100%
United Kingdom	-24%	6%	-49%	-13%	-23%	-100%	-100%			
Ireland	-19%	-29%	∞%	120%	172%	-100%				
Germany	-14%	168%	-70%	183%	4%	-65%	-79%			
Portugal	-50%		14%	376%	-50%	-32%	-100%			
Mexico	36%	-83%	-22%	20%	88%	∞%		0%	136%	0%
Indonesia	31%		-58%	-63%	-48%	-100%	-100%			
Italy	-69%		-41%	28%	-31%	-100%	-63%			

^a **Note:** ∞% denotes a percentage increase from zero.

100 percent declines could be due to unreported trade.

Source: USDA, Foreign Agricultural Service's Global Agricultural Trade System (GATS)

Impacts of the Pandemic on Tennessee Forest Product Exports

Model Overview and Data

IMPLAN® (Version 3.0 using basic data for 2019) is used in estimating the economic impact of loss export sales at the state and county level. Using state export data from the Foreign Agricultural Service's Global Agricultural Trade System (GATS), the decrease in forestry export sales in 2020 by product category, based on the Harmonized System (HS) of classifying traded products, is mapped to the corresponding North American Industry Classification System (NAICS) sectors. The Commodity Translation Wizard was used to translate the HS classifications to NAICS sectors (DataWeb, 2021). In a few instances where more than one NAICS code matched the same HS code, the NAICS sector that most closely aligned with the HS description was used. The NAICS codes were then matched to corresponding IMPLAN codes using the IMPLAN conversion spreadsheet (IMPLAN, 2021). Sales by IMPLAN codes based on state exports are reported in Table 3.

Table 3. Direct Income Changes by IMPLAN Sector Based on Changes in Export Sales.

IMPLAN Code	IMPLAN Sector	2019	2020	Change	%
				Direct Income Effect	
		Value (\$)			Change
132	Sawmills	\$116,296,393	\$96,575,252	-\$19,721,141	-17.0%
16	Commercial logging	17,228,742	10,894,246	-6,334,496	-36.8%
140	Wood container and pallet manufacturing	22,159,920	17,750,518	-4,409,402	-19.9%
136	Reconstituted wood product manufacturing	7,355,515	4,380,074	-2,975,441	-40.5%
139	Other millwork, including flooring	2,917,684	1,080,989	-1,836,695	-63.0%
134	Veneer and plywood manufacturing	2,881,622	1,446,731	-1,434,891	-49.8%
137	Wood windows and door manufacturing	1,039,590	221,561	-818,029	-78.7%
143	All other miscellaneous wood product manufacturing	1,837,128	1,060,268	-776,860	-42.3%
391	All other miscellaneous manufacturing	40,022	4,453	-35,569	-88.9%
133	Wood preservation	161,968	194,000	32,032	19.8%
135	Engineered wood member and truss manufacturing	4,691,965	4,946,354	254,389	5.4%
163	Other basic organic chemical manufacturing	189,959	594,065	404,106	212.7%
Total Income		176,800,508	139,148,511	-37,651,997	-21.3%

Note: These sectors and their county level direct income change are used to shock the IMPLAN model to derive state and county income and employment changes.

Source: Authors' calculations using trade data from the USDA, Foreign Agricultural Service's Global Agricultural Trade System (GATS) and the Commodity Translation Wizard (DataWeb, 2021) to map the trade data to NAICS sectors and IMPLAN codes.

This IMPLAN model includes over 540 industries that are classified based on the economy and measures the economic transaction (buying/selling) relationships among industries in the economy. For each type of business category, expenditure and employment data are used to estimate county level multipliers for all sectors. Like all input-output models, IMPLAN describes the buying and selling of products and resulting transfer of money between different industries. Output from the model provides descriptive measures of the economy including total industry output (the value of all sales), employment, labor income, value-added and taxes at the state and county levels.

The state IMPLAN model provides estimates of multiplier-based impacts. The multipliers, in this instance, measure the response of the entire state economy to changes in forestry sector sales. There are three different multiplier effects in the model. First is the initial impact or direct impact due to direct sales. Second is the indirect multiplier effects, which indicates to what extent output in the primary industry will impact other industries in the region due to the input needs (goods as well as services). The last impact (induced multiplier effect) indicates to what extent the output of the regional economy increases (decreases) as a result of changing consumer income and the rippling impact of local purchases.

Economic Impacts

State level results are reported in Table 4. The \$37.6 million decline in forestry exports in 2020 led to an estimated total loss of \$53.7 million (\$10.1 million indirect and \$6.0 million induced loss). Estimates indicate that this decline led to the loss of 304 jobs statewide (178 direct, 81 indirect and 46 induced losses). Given the composition of Tennessee’s export sales, which are mostly lumber and logs, the milling sector (sawmills) (\$28.6 million and 129 jobs) and commercial logging sector (\$9.6 million and 104 jobs) experience the largest total declines.

The direct changes in exports were further disaggregated using IMPLAN county data to derive county shares of state totals. The ten most impacted counties in terms of lost income and employment are listed in Table 5. The ranking order varies somewhat from income to employment, but the most affected counties are those with relatively large hardwood sawmills. In most cases, the larger hardwood sawmills participate directly in global markets. Figure 3 shows losses for all Tennessee counties.

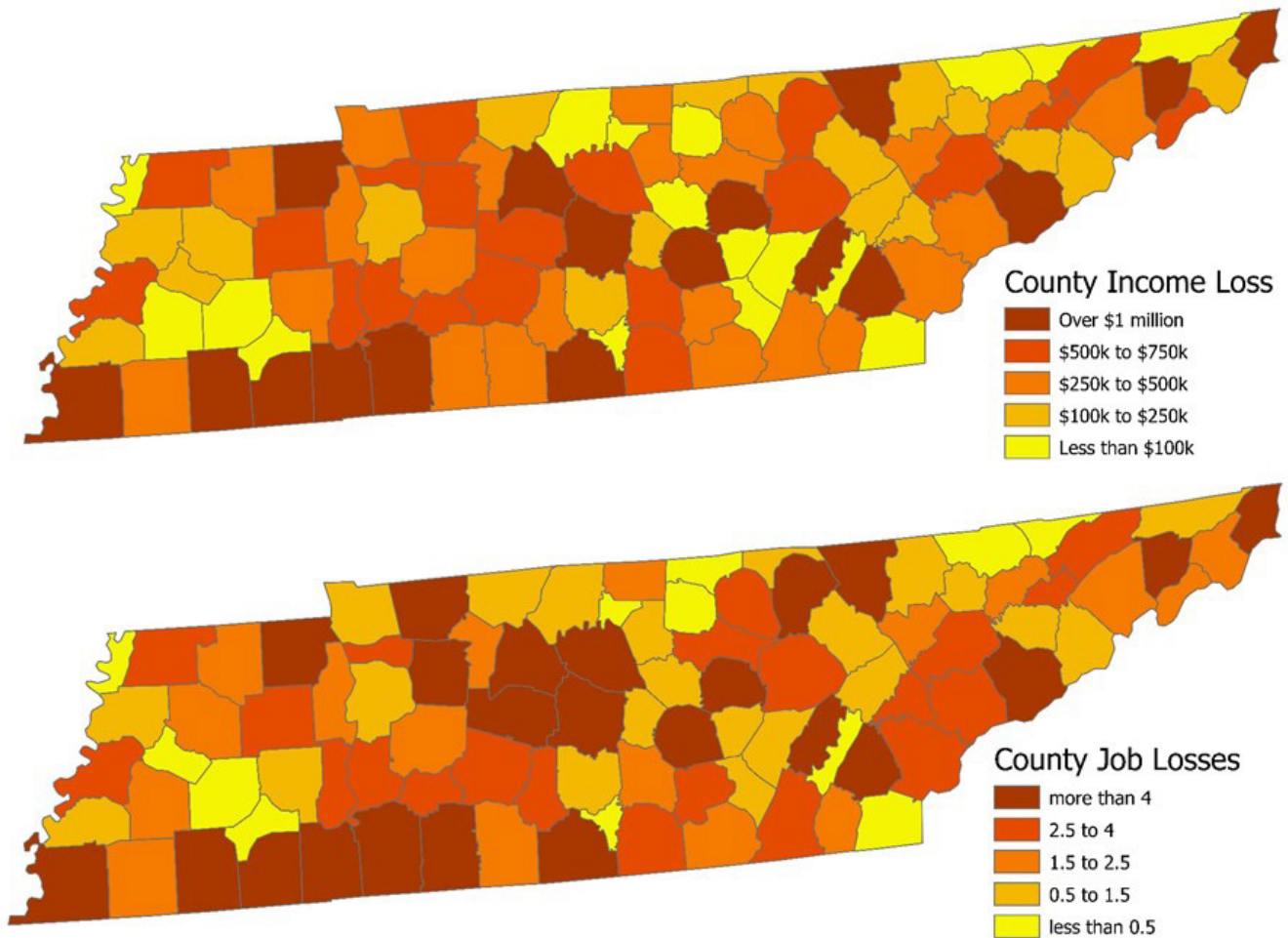
Table 4. Total impacts of export changes with the inclusion of indirect and induced multiplier effects and the state-wide total impacts.

Rank	Industry	Total Impact Change	
		Output (\$ million)	Employment (jobs)
1	132 Sawmills	-28.55	-128.83
2	16 Commercial logging	-9.60	-103.60
3	140 Wood container and pallet manufacturing	-6.07	-34.03
4	136 Reconstituted wood product manufacturing	-3.56	-8.09
5	139 Other millwork, including flooring	-2.60	-12.67
6	134 Veneer and plywood manufacturing	-1.95	-8.68
7	143 All other miscellaneous wood product manufacturing	-1.12	-5.76
8	137 Wood windows and door manufacturing	-1.11	-5.11
9	391 All other miscellaneous manufacturing	-0.05	-0.25
10	133 Wood preservation	0.04	0.10
11	135 Engineered wood member and truss manufacturing	0.34	1.50
12	163 Other basic organic chemical manufacturing	0.52	0.99
	State Total Impact	-53.71	-304.44

Table 5. Total Income and Job Losses by Counties Most Impacted by the Decrease in Forestry Exports.

Rank	County	Direct	Indirect	Induced	Total
Income Changes (\$ million)					
1	Rhea	-\$3.35	-\$0.43	-\$0.23	-\$4.01
2	Wayne	-2.18	-0.71	-0.21	-3.11
3	Macon	-1.66	-0.73	-0.39	-2.78
4	Lincoln	-1.54	-0.46	-0.24	-2.24
5	Hardeman	-1.44	-0.51	-0.24	-2.18
6	White	-1.31	-0.45	-0.14	-1.90
7	Shelby	-1.16	-0.38	-0.35	-1.89
8	Scott	-1.33	-0.28	-0.14	-1.74
9	Davidson	-0.93	-0.30	-0.23	-1.47
10	Madison	-0.78	-0.23	-0.15	-1.16
	State Total	-37.65	-10.07	-5.99	-53.71
Employment Changes (number of jobs)					
1	Wayne	-10.12	-7.03	-1.53	-18.68
2	Macon	-5.90	-4.46	-2.80	-13.17
3	Hardeman	-5.71	-4.01	-1.78	-11.50
4	White	-5.90	-4.17	-1.04	-11.11
5	Shelby	-6.58	-2.06	-2.29	-10.92
6	Rhea	-6.89	-1.57	-1.80	-10.26
7	Lincoln	-5.07	-2.34	-1.80	-9.22
8	Rutherford	-6.45	-2.08	-0.62	-9.16
9	Scott	-5.49	-1.82	-1.00	-8.30
10	Davidson	-4.94	-1.58	-1.29	-7.81
	State Total	-177.9	-80.6	-45.9	-304.4

Figure 3. Total County Level Income and Job Loss in 2020 from the Decrease in Export Sales.



Conclusion

The forestry sector is important to the Tennessee economy, and while exports are a small share of the total economic activity when considering all related activities such as furniture, flooring and paper production, global sales have a significant economic impact, primarily on the sawmill and logging sectors. Overall, the results of this report show that the decline in 2020 export sales relative to the previous year (-\$38 million) resulted in a total economic impact of \$54 million and a loss of 304 jobs. These negative impacts are mostly concentrated in counties with large sawmills and associated logging activities. Note that the results of this study do not include activities that facilitate export sales, such as transportation from sawmills to the port. However, export values often encompass transport cost to the point of exit.

The year 2020 was expected to be a recovery year for U.S. exports due to the U.S.-China Phase One Trade Agreement (signed January 2020), and the announcement in February 2020 by China's State Council Tariff Commission that U.S. commodities including forest products would be exempt from retaliatory tariffs (Inouye 2020). Thus, it is conceivable that Chinese imports would have returned to pre-trade war levels in 2020. However, the COVID-19 outbreak thwarted this potential recovery and resulted in even greater losses when compared to 2019.

References

- Baker, S.R., R.A. Farrokhnia, S. Meyer, M. Pagel, and C. Yannelis. 2020. "How Does Household Spending Respond to an Epidemic? Consumption during the 2020 COVID-19 Pandemic." National Bureau of Economic Research. NBER Working Paper No. 26949. <https://www.nber.org/papers/w26949.pdf>
- Dataweb. 2021. *Commodity Translation Wizard*. United States International Trade Commission. <https://dataweb.usitc.gov/classification/commodity-translation>
- Food and Agriculture Organization of the United Nations (FAO). 2019. Forest Products 2017. <http://www.fao.org/3/ca5703m/ca5703m.pdf>
- Hardwood Market Report (HMR). 2021. "How High are Current Hardwood Lumber Prices, Really?" *HMR Executive* 15(3).
- IMPLAN. 2021. Spreadsheet 17 NAICS TO IMPLAN 546 INDUSTRIES. <https://implanhelp.zendesk.com/hc/en-us/articles/360034896614-546-Sector-Industries-Conversions-Bridges-Construction-2018-Data>
- Inouye, A. 2020. "China Announces a New Round of Tariff Exclusions." Trade Policy Monitoring Report CH2020-0017. U.S. Department of Agriculture, Foreign Agricultural Service.
- Jackson, J.K., A.B. Schwarzenberg, M.A. Weiss, and R.M. Nelson. 2020. Global Economic Effects of COVID-19. Congressional Research Service. CRS Report R46270.
- Luppold, W., M. Bumgardner, K. Kottwitz, F. Maplesden, and I. Novoselov. Chapter 5: Sawn Hardwood. In: *Forest Products Annual Market Review 2017-2018*. Geneva, Switzerland: United Nations Publications.
- Menard, J., B. English, and K. Jensen. 2019. "Tennessee Ag & Forestry Stats 2017: Economic Contributions of Agriculture and Forestry in Tennessee." University of Tennessee Institute of Agriculture report. <https://ag.tennessee.edu/arec/Documents/publications/FullRpt2017.pdf>
- Muhammad, A., and A. Taylor. 2020. "Implications of COVID-19 on Tennessee Exports of Forest Products." University of Tennessee Extension publication W 913. <https://extension.tennessee.edu/publications/Documents/W913.pdf>
- Muhammad, A., and S.A. Smith. 2020. "The U.S.-China Phase One Trade Agreement: Implications for U.S. Forestry." University of Tennessee Extension publication W 888. <https://extension.tennessee.edu/publications/Documents/W888.pdf>
- Riddle, A.A. 2020. COVID-19 and the U.S. Timber Industry. Congressional Research Service. CRS Report R46636.
- Pelkki M., and G. Sherman. 2020. "Forestry's Economic Contribution in the United States, 2016." *Forest Products Journal* 70(1):28-38.
- Sarkodie, S.A., and P.A. Owusu. 2021. "Global Assessment of Environment, Health and Economic Impact of the Novel Coronavirus (COVID-19)." *Environment, Development and Sustainability* 23:5005-5015.



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