ECONOMIC IMPACT OF TENNESSEE FOREST PRODUCT EXPORTS IN 2021

Andrew Muhammad, Professor and Blasingame Chair of Excellence, Department of Agricultural and Resource Economics
Chad M. Hellwinckel, Research Associate Professor, Department of Agricultural and Resource Economics
Savant Nzayiramya, Graduate Student, Department of Agricultural and Resource Economics
Adam Taylor, Professor, School of Natural Resources

INTRODUCTION

U.S. forest product exports were negatively impacted by the U.S. trade war with China in 2018 and 2019, and the COVID-19 pandemic in 2020. Muhammad and Taylor (2020) note that the pandemic had a significant impact on U.S. and Tennessee forest product exports due to supply and demand disruptions in the global market for finished wood products (e.g., furniture) and the interrelated market for raw materials and inputs (e.g., logs and lumber). These effects were in addition to the negative impact of China's retaliatory tariffs on U.S. timber (Muhammad et al., 2022). In 2021, U.S. companies expected a recovery due to the U.S. Phase One Trade Agreement with China signed on January 2020, which included exemptions from related retaliatory tariff for forest products shipped to China (Inouye, 2020). In addition, the lifting of pandemic-imposed measures such as port closures and shutdowns in construction and manufacturing suggested a recovery for U.S. exports overall (Susskind and Vines, 2020).

In this report, we focus on the post-pandemic period and its impacts on Tennessee forest product exports. We examine the export changes in 2021 (relative to 2020) across destination countries and product categories, and further assess the full economic impact of export sales on income and jobs at the state level. The impacts of the trade war and the COVID-19 pandemic on U.S. and Tennessee forestry exports have been discussed in previous reports (Muhammad and Taylor, 2020; Muhammad and Smith, 2020; and Muhammad et al., 2022).

Forest product exports from 2018 to 2021 at the national, regional and state level are reported in Table 1. From 2018 to 2020, U.S. forest product exports decreased by $2.2 billion. In 2021, however, exports increased by $2.1 billion when compared to the previous year. The increase was mostly in southern states ($829 million), followed by Western states ($677 million). The gains in 2021 were a welcomed recovery from the decrease in exports the previous years.

Table 1. U.S. Forest Product Exports: 2018-2021

Country/Region/ State	2018	2019	2020	2021	$ Change 2021-2020	% Change 2021-2020
			$ million			
United States	$9,865	$8,324	$7,655	$9,731	$2,076	27.1%
South	3,875	3,297	3,057	3,886	829	27.1%
West	2,654	2,139	1,922	2,598	677	35.2%
Midwest	1,507	1,276	1,241	1,561	320	25.8%
Northeast	1,511	1,295	1,150	1,381	231	20.1%
Tennessee	257	177	139	185	46	33.1%

Source: *U.S. Department of Agriculture, Foreign Agricultural Service (2022)*

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 under appreciated. When examining the wood products, wood pulp and paper industries, as well as associated upstream and downstream activities, Menard, English and Jensen (2017) estimate that forestry in Tennessee provides over 85,000 jobs and has annual economic impact of almost $21 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, since hardwoods have a higher value than softwoods, the value of the forest industry in Tennessee is comparable (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 as used to produce 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).

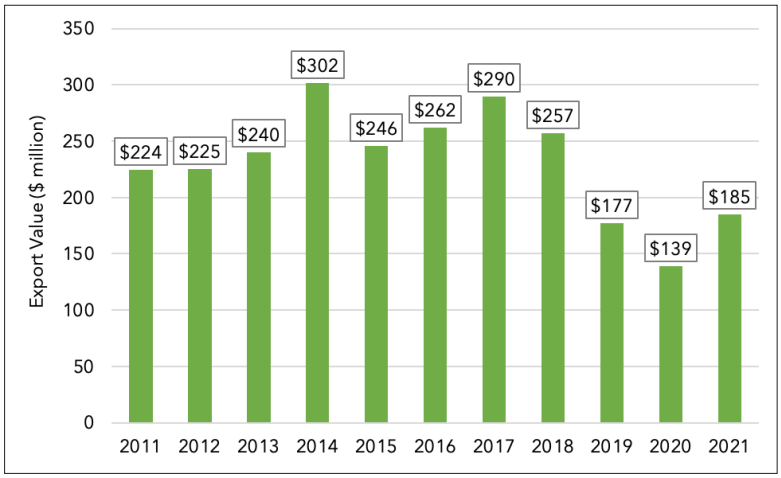
Despite the current importance of the forest products industry in Tennessee, there has been a long-term trend toward fewer sawmills and reduced hardwood lumber production. Production levels are very dynamic; however, a record low level was set in 2020, and, while production has rebounded to a large extent,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

The sudden surge of prices for softwood lumber to all-time 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).

Overview of Tennessee forest product exports

In 2021, estimated export sales for Tennessee forest products were $185 million, which was an increase of $46 million (33.1 percent increase) when compared to the previous year (U.S. Department of Agriculture, Foreign Agricultural Service, 2021). Given the state's dependence on foreign export sales of hardwoods, gains for Tennessee in percentage terms exceeded the national and regional average (See Table 1 and Figure 1). In 2018, Tennessee forest product exports were valued at $257 million but decreased to $177 million in 2019 and $139 million in 2020. The decrease since 2018 was due to two important factors, the trade war, which started in 2018, and the COVID-19 pandemic in 2020. Note that 2020 ($139 million) was the lowest export year in the last decade (Figure 1).

Figure 1. Tennessee Forest Product Exports: 2011-2021

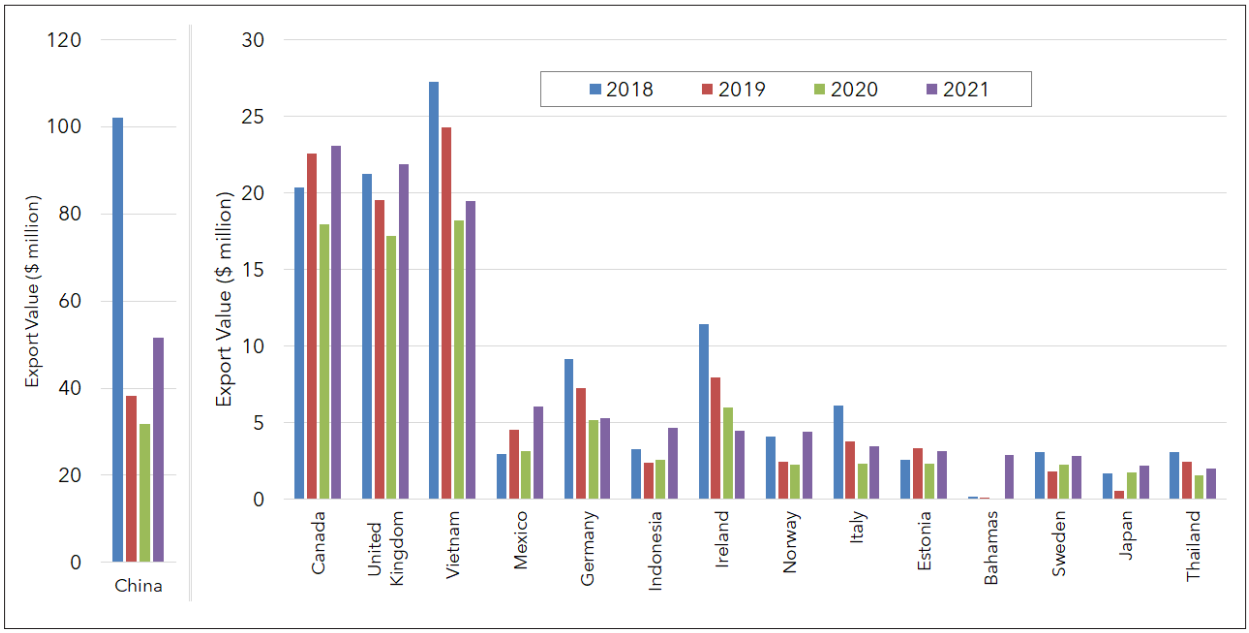


Source: *USDA, Foreign Agricultural Service's Global Agricultural Trade System (GATS)*

Tennessee's forest product exports by top destination countries (2018-2021) are reported in Figure 2. The importance of China to Tennessee export cannot be overstated. In 2018, over $102 million of Tennessee forest product exports went to China, which was about 40 percent of total exports that year. In 2019, however, the retaliatory tariffs caused Tennessee's exports to China to decline significantly to less than $40 million. In 2020, exports to China declined even further to about $32 million but rebounded in 2021 to about $52 million. Other than Ireland, exports to most countries increased in 2021 relative to the previous year.

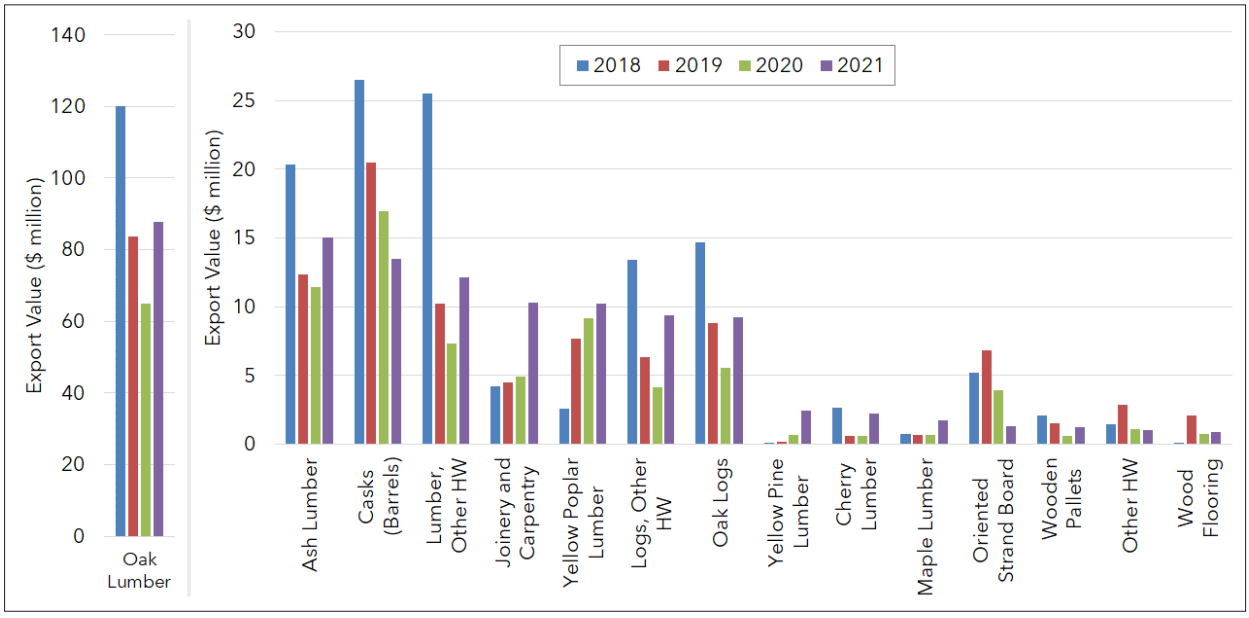
Oak lumber is Tennessee's largest forest product export (see Figure 3). In 2018, oak lumber generated approximately $120 million in exports but decreased to less than $84 million in 2019 and further decreased to $65 million in 2020. In 2021, oak lumber exports increased to $88 million. Although positive, this result is still significantly lower than pre-trade war levels. The other major products in general followed a similar pattern. Exports of most products increased in 2021 when compared to the previous year, with exports of casks (barrels) and oriented strand board being the exceptions. Interestingly, yellow poplar lumber and joinery/carpentry are the only categories with increased exports sales every year since 2018.

Figure 2. Tennessee Forest Product Exports by Top Destination Countries: 2018-2021



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

Figure 3. Tennessee Forest Product Exports by Top Products: 2018-2021



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

Next, we consider Tennessee exports by major product category for the top five destination markets (China, Canada, EU-27, United Kingdom and Vietnam) (See Table 2). Table 2 also includes the percentage change in exports in 2021 relative to the previous year. Oak lumber is the leading export to the top destinations, with Canada being the only exception. Joinery/carpentry was the leading export category for Canada in 2021 ($8.9 million, up 82.8 percent). In 2021, oak lumber exports increased across all major destinations, ranging from an annual increase of 3.8 percent in EU-27 to 97.8 percent in the United Kingdom. Casks (barrels) were down 37.2 percent and 23.6 percent in the EU-27 and the United Kingdom. This result is likely due to a shortage of white oak for barrel production and not a decrease in demand (Larson, 2022). By and large, exports to the major markets were up across most product categories, except for a few categories (e.g., casks and other SW lumber). Noted increases include a 1,481.8 percent increase in maple lumber exports to Vietnam, a 754.8 percent increase in pine lumber exports to Canada and a 457.2 percent increase in oak log exports to China (Table 2).

Table 2. Tennessee Forest Product Exports by Major Destination Country and Product Category: (2021 and Percent Change from the Previous Year)

Product Category	China	Canada	EU-27	United Kingdom	Vietnam
Export Value in 2021 ($ millions)					
Oak Lumber	$23.6	$4.1	$15.5	$12.4	$9.9
Ash Lumber	5.8	0.3	3.2	1.8	1.2
Casks (Barrels)	0.3	0.5	3.3	6.4	
Other HW Lumber	5.8	0.7	1.1	0.1	2.1
Joints and Carpentry		8.9			
Popular Lumber	0.7	1.6	1.5	1.2	3.5
Other HW Logs	5.8		1.8		0.7
Oak Logs	6.4		0.1		1.4
Cherry Lumber	2.0				0.1
Maple Lumber	0.3				0.3
Other SW Lumber	0.4				
Pallets		0.3	0.8		
Oriented Strand Board		1.2			
Pine Lumber	0.6	1.6			
Plywood (HW)		0.8			
% Change in 2021 (from previous year)					
Oak Lumber	32.2%	74.1%	3.8%	96.8%	9.5%
Ash Lumber	48.4%	39.4%	35.9%	70.0%	-4.0%
Casks (Barrels)	-58.5%	17.3%	-37.2%	-23.6%	
Other HW Lumber	112.3%	20.7%	95.6%	7.1%	-10.7%
Joints and Carpentry		82.8%			
Popular Lumber	39.9%	25.4%	45.2%	-7.1%	-19.0%
Other HW Logs	179.3%		48.2%		378.6%
Oak Logs	457.2%		-97.4%		190.0%
Cherry Lumber	268.6%				7.3%
Maple Lumber	49.3%				1,481.8%
Other SW Lumber	-70.3%				
Pallets		65.7%	155.1%		
Oriented Strand Board		-69.6%			
Pine Lumber	-30.9%	754.8%			
Plywood (HW)		17.1%			

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

ECONOMICS IMPACTS OF FOREST PRODUCT EXPORTS ON TENNESSEE

Model overview and data

IMPLAN® (Version 3.0 using basic data for 2020) is used in estimating the economic impact of forestry export sales at the state level. Using state export data from the Foreign Agricultural Service's Global Agricultural Trade System (GATS), the level and increase in export sales in 2021 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 using the Commodity Translation Wizard (DataWeb, 2022). In a few instances where more than one NAICS code matched the same HS code, the NAICS sector that upon inspection is 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, 2022). Sales by IMPLAN codes based on state exports are reported in Table 3.

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

	IMPLAN Code and Sector	2020 ($)	2021 ($)	Direct Revenue Change ($)	Direct Revenue Change (%)
132	Sawmills	$96,484,561	$132,316,762	$35,832,201	37.1%
16	Commercial logging	10,789,127	19,716,303	8,927,176	82.7%
140	Wood container and pallet mfg.	17,772,566	15,024,066	-2,748,500	-15.5%
135	Engineered wood member and truss mfg.	4,952,062	10,319,964	5,367,902	108.4%
134	Veneer and plywood manufacturing	1,439,613	2,158,569	718,956	49.9%
143	All other miscellaneous wood product mfg.	1,060,268	1,900,458	840,190	79.2%
136	Reconstituted wood product mfg.	4,451,884	1,635,274	-2,816,610	-63.3%
139	Other millwork, including flooring	1,080,989	1,084,904	3,915	0.4%
137	Wood windows and door mfg.	221,561	429,065	207,504	93.7%
133	Wood preservation	194,000	321,253	127,253	65.6%
163	Other basic organic chemical mfg.	594,065	250,365	-343,700	-57.9%
391	All other miscellaneous mfg.	4,453	0	-4,453	-100.0%
	Total Direct Income from Exports	**$139,045,149**	**$185,156,983**	**$46,111,834**	**33%**

Note: *These sectors and their county level direct income change are used to shock the IMPLAN model to derive total income and employment changes. Sector 163 included wood-based charcoal and 391 included wooden frames for painting, pictures and mirrors.*

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 can contain over 540 industries that are classified based on the economy and measures the economic transactions (buying/selling relationships) among industries in the economy. For each type of business category, expenditure and employment data can be used to estimate state level multipliers for all sectors in the economy under analysis. 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 federal and state-county level.

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 components of the multiplier effect in the model for every industry. First is the initial impact or direct impact due to direct sales. Second is the indirect multiplier effects, which indicate 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) because of changing consumer income and the rippling effect of local purchases.

Economic impacts of export sales in 2021

The total impact of export sales in 2021 is reported in Table 4. Impact is measured by output (value of production by industry in a calendar year) or employment (industry-specific mix of full-time, part-time and seasonal employment). Tennessee's forestry exports in 2021 were $185.16 million, which led to an estimated total impact of $266.31 million ($54.72 million indirect impact and $26.44 million induced impact). Estimates indicate that forestry exports support a total of 1,407 jobs statewide (785 direct, 413 indirect and 209 induced). Given the composition of Tennessee's export sales, the milling sector (sawmills) ($191.58 million and 864 jobs), commercial logging sector ($29.89 million and 322 jobs) and the engineered wood and manufacturing sector ($20.68 million and 116 jobs) are the most supported sectors.

How did the increase in exports in 2021 (relative to 2020) impact the state (Table 5)? The $46 million increase in forestry exports in 2021 led to an estimated total impact of $67.58 million ($13.86 million indirect and $7.61 million induced gain). Estimates indicate that this increase led to the increase of 394 jobs statewide (217 direct, 118 indirect and 60 induced increases). The largest gains were in the milling sector (sawmills) ($51.88 million and 234 additional jobs) and the commercial logging sector ($13.52 million and 146 additional jobs).

Table 4. Total Impacts of Exports in 2021 with Inclusion of Indirect and Induced Multiplier Effects and State-Wide Total Impacts.

			Total Impact	
Rank	Industry		Output ($ mill.)	Employment (jobs)
1	132	Sawmills	191.58	864.39
2	16	Commercial logging	29.87	322.47
3	140	Engineered wood member and truss manufacturing	20.68	115.95
4	135	All other miscellaneous wood product manufacturing	13.74	60.75
5	134	Veneer and plywood manufacturing	2.93	13.05
6	143	Wood windows and door manufacturing	2.74	14.10
7	136	Wood preservation	1.96	4.45
8	139	Other millwork, including flooring	1.54	7.48
9	137	All other miscellaneous manufacturing	0.58	2.68
10	133	Other basic organic chemical manufacturing	0.39	0.99
11	163	Wood container and pallet manufacturing	0.32	0.61
12	391	Reconstituted wood product manufacturing	0.00	0.00
		Total Impact	**266.31**	**1406.93**

Table 5. Total Impacts of the Change in Exports in 2021 with Inclusion of Indirect and Induced Multiplier Effects and State-Wide Total Impacts.

			Total Impact	
Rank	Industry		Output ($ mill.)	Employment (jobs)
1	132	Sawmills	51.88	234.08
2	16	Commercial logging	13.52	146.01
3	135	Engineered wood member and truss manufacturing	7.14	31.60
4	143	All other miscellaneous wood product manufacturing	1.21	6.23
5	134	Veneer and plywood manufacturing	0.98	4.35
6	137	Wood windows and door manufacturing	0.28	1.30
7	133	Wood preservation	0.15	0.39
8	139	Other millwork, including flooring	0.01	0.03
9	391	All other miscellaneous manufacturing	-0.01	-0.03
10	163	Other basic organic chemical manufacturing	-0.44	-0.84
11	140	Wood container and pallet manufacturing	-3.78	-21.21
12	136	Reconstituted wood product manufacturing	-3.37	-7.66
		State Total Impact	**67.58**	**394.24**

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 increase in 2021 export sales relative to the previous year (+$46 million) resulted in a total economic impact of +$67.6 million and 394 additional jobs. Note that the results of this study do not include activities that facilitate export sales, such as transportation from sawmills to the port.

REFERENCES

Dataweb. 2022. *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. 2022. 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.

Larson, Julia. 2022. "Impending American White Oak Shortage Threatens Bourbon Barrel Production, Study Says." *Vine Pair.* January 11, 2022. https://vinepair.com/booze-news/american-white-oak-shortage/

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." UT Extension, W 913. https://extension.tennessee.edu/publications/Documents/W913.pdf

Muhammad, A., C. M. Hellwinckel, E. Anosike, and A. Taylor. 2022. "Economic Impact of the COVID-19 Pandemic on Tennessee Forest Product Exports." UT Extension, W 1064. (No. 2325-2022-408).

Muhammad, A., and S. A. Smith. 2020. "The U.S.-China Phase One Trade Agreement: Implications for U.S. Forestry." UT Extension, W 888. https://extension.tennessee.edu/publications/Documents/W888.pdf

Pelkki, M., and G. Sherman. 2020. "Forestry's Economic Contribution in the United States, 2016." *Forest Products Journa*l 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.

Susskind, D., and D. Vines. 2021. "The Economics of the COVID-19 Pandemic: An Assessment." *Oxford Review of Economic Policy* 36(Supplement 1): S1-S13.

U.S. Department of Agriculture, Foreign Agricultural Service. 2021. Global Agricultural Trade System (GATS). https://apps.fas.usda.gov/GATS/default.aspx

UTIA.TENNESSEE.EDU

Real. Life. Solutions.™

W 1144 2/23 23-0105 Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and County governments cooperating. UT Extension provides equal opportunities in programs and employment.