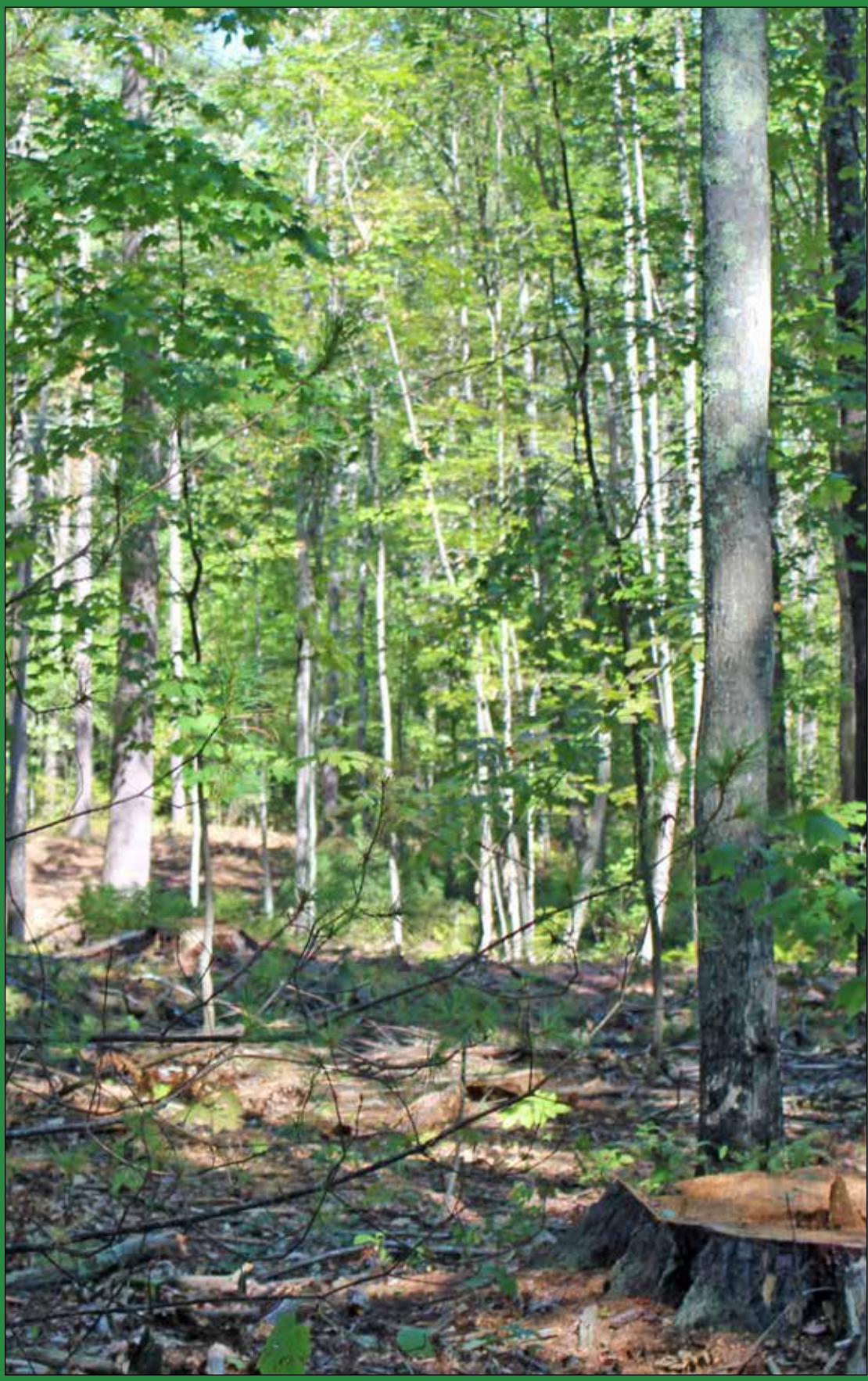
Maine's Forest Economy

Est. 2016 Economic impact: $8.5 billion

Wood is the most environmentally sound building material on earth

Millions of acres of working forest open for recreation



Maine forest industry at a glance

Economic impact	2011*	2014	Est. 2016**	Employment	2011	2014	Est. 2016
Total impact	$8.5 billion	$9.8 billion	$8.5 billion	**Direct jobs**	17,075	16,551	14,563
Total payroll	$2.0 billion	$2.1 billion	$1.8 billion				
Total state/local taxes paid	$320.1 million	$318.5 million	$278.4 million	**Total jobs**	38,789	38,956	33,538
**2014 dollars. ** 2016 dollars.*	*Source: Economic contribution of Maine's forest products industry 2014 and 2016 (estimated).*						

Maine forest products exports

Industry rank among total state exports		2013	2014	2015	% Change 2013- 14	% Change 2014- 15
1	Paper	$599 million	$484 million	$461 million	-19.27	-4.67
5	Forestry Products, NESOI*	$199 million	$199 million	$199 million	-0.10	-0.02
11	Wood Products	$80 million	$78 million	$77 million	-2.73	-1.59
Totals		$879 million	$761 million	$737 million	**Not elsewhere specified or indicated*	
% Total Maine exports		33%	28%	27%	***Source: Maine: International Trade Center***	

Forestland acres and ownership 2015

Total acres forested	17.6 million	Percent of total Maine land: 89%
Privately owned	15.9 million	90.7% of forested land
State and local government	1.4 million	8.1% of forested land
U.S. Forest Service	60,902	0.3%
Other federal agencies	162,392	0.9%

Source: Maine Forest Service - USDA Forest Service Forest Inventory EVALIDator web-application, Version 1.6.0.03, 6/16/2016

Certified acres

8.3 million acres statewide are certified as sustainably managed by independent auditors of the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC) and American Tree Farm System (ATFS). That's about 50 percent of Maine's working forest.

This report was produced by the Maine Forest Products Council, 535 Civic Center Drive, Augusta ME 04330, 207-622-9288, www.maineforest.org, smccarthy@maineforest.org.

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The forest products industry is reinventing itself

Patrick Strauch
Executive Director
Maine Forest Products Council

Maine's forest products industry certainly has reached a turning point, but there's more to talk about than closed pulp and paper mills and biomass energy plants. Technology and changing demands have transformed the global market, but also created opportunities. The Maine Forest Products Council is working with the University of Maine to develop a road map to help our state grasp those opportunities.

In this second edition of *Maine's Forest Economy*, the Council brings together updated facts and figures on our industry, including new University of Maine research on its economic impact. Because the latest available data in IMPLAN (the industry standard) is from 2014 and significant market events have taken place since then, we asked Dr. Mindy Crandall to estimate the 2016 impact of those events.

Why should you care about our industry? First, because whether you live in rural, urban or suburban Maine, the forest economy's estimated 2016 impact of $8.5 billion and 33,538 jobs matter. Second, forest landowners are essential to Maine's tourism industry because most adhere to a unique Maine tradition – allowing public access for recreation on millions of acres of forestland.

Another reason to care is the industry's sustainability efforts, including 8.3 million acres certified as sustainably managed by independent, third-part auditors, one of the highest percentages in the nation. An important measure of sustainable management is the relationship between how much timber is grown and how much is harvested. In 2015, estimated growth exceeded harvest by 55 percent, the highest level since 1971, just before our forests were devastated by spruce budworm.

Finally, Maine is still a great place for a forest industry. I'm sure you'll be heartened, as I was, when you read an essay by Dr. Robert Wagner, former director of the Center for Research on Sustainable Forests at the University of Maine, about our state's "incredible assets" and why they will only become more valuable as the world's population increases.

Now to everyone's second question: What the heck is going on in our paper sector? Globally, paper/paperboard is still a ***growth*** industry, increasing 1.7 percent annually, according to industry analyst Brian McClay of Montreal. So why are the mills along the Penobscot gone, leaving a pulp wood market gap of about 20 percent or 2 million tons?

It's because of a fundamental change in the marketplace. Smaller mills that haven't specialized and produce less than 200,000 tons annually are closing not only in U.S., but in Canada and other countries.

Although China has hardly any forest resources, it accounted for 26 percent of global consumption and production of paper/paperboard, and 93 percent of the growth in demand for pulp in the past decade, McClay said. Massive pulp mills, some producing 2 million tons annually, are opening around the world to meet China's demand. Add in the strong U.S. dollar and it's not surprising smaller paper/pulp mills find it hard to compete.

Maine's larger mills are diversifying as quickly as our capital intensive industry allows. Much of the global growth is in tissue, such as toilet paper and paper towels. That's why Woodland Pulp in Baileyville invested $120 million in two tissue machines. Markets for packaging and specialty papers are growing, too, so those products have been added in Madawaska, Skowhegan, Westbrook, Jay and Rumford.

In the solid wood sector, our sawmills are well capitalized. Irving opened its Ashland mill in 2014 because of the anticipated increase in housing starts. The Huber and Louisiana Pacific panel facilities are hiring more staff to meet demand.

Our biomass energy sector (including wood pellets) has been affected by lower costs for oil and natural gas, creating a market that has decreased by almost 2 million tons. Loggers, landowners and sawmills depend on biomass fuel outlets for their sawdust and bark, so they're working together to revive these important markets.

The global economy is evolving rapidly and there are clearly many challenges ahead, but in the following pages you'll see how Maine's forest products industry is reinventing itself to meet them.

Economic contribution of Maine's forest products industry 2014 and 2016 *(estimated)*

By James L. Anderson III and Mindy Crandall
School of Forest Resources, University of Maine

Report completed June 30, 2016

SUMMARY OF MAIN FINDINGS: 2014

➢ The Maine forest products industry (FPI) had a total estimated 2014 statewide economic impact contribution, including multiplier effect, of $9.8 billion in sales output, 38,956 supported full- or part-time positions, and $2.1 billion in labor income *(Table 1, Page 4)*.

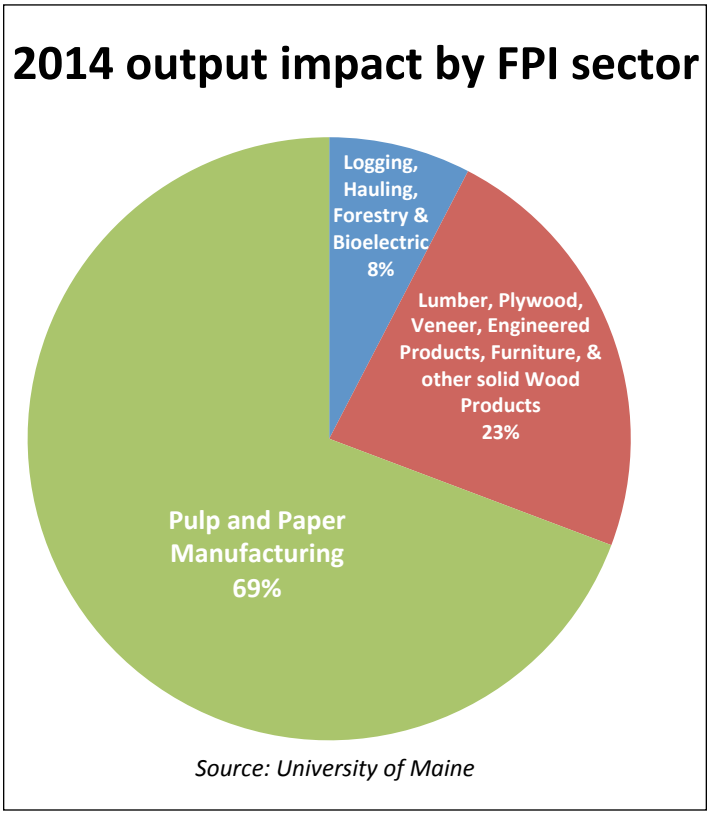
➢ The total direct employment in the forest product industry of 16,551 jobs supported an additional 22,405 jobs in Maine, for a total of 38,956 jobs associated with the forest products industry. This was 4.81 percent of the employment in Maine. About one out of 20 jobs in Maine were associated with the forest product industry *(Table 2, Page 4)*.

➢ The total economic impact contributions of Maine's forest product industry provided an estimated $318.5 million in state and local taxes.

➢ Maine's forest product industry contributed an estimated $3.1 billion in value added impact. This made up 5.56 percent of Maine's gross domestic product (GDP) for 2014.

SUMMARY OF MAIN FINDINGS 2016 (est.)[1]

➢ The Maine forest products industry has a total estimated 2016 statewide economic impact contribution, including multiplier effect, of $8.5 billion in sales output, 33,538 supported full- or part-time positions, and $1.8 billion in labor income *(Table 3, Page 5)*.



➢ The total direct employment in the forest product industry of 14,562.5 jobs supports an additional 18,975 jobs in Maine, for a total of 33,538 jobs associated with the forest products industry. This is 4.13 percent of the employment in Maine. About one out of 24 jobs in Maine are associated with the forest product industry *(Table 4, Page 5)*.

➢ The total economic impact contributions of Maine's forest product industry provides an estimated $278.4 million in state and local taxes. The industry's tax base is about 3.3 percent of its output. This is comparable to the previous study in Maine and a study in Minnesota,

To download "Economic contribution of Maine's forest products industry 2014 and 2016 (estimated)," visit http://maineforest.org/wp-content/uploads/2016/08/Economic-Impact-report-1.pdf

1 *Direct output, employment, and labor income in pulp and paper and biomass electricity sectors were adjusted to account for known mill closures in 2014, 2015 and January through May of 2016 (see Mill/Plant Changes Table, Page 5) to arrive at a "current" estimate. The 2016 estimate numbers therefore assume no changes in output, employment, and labor income between 2014 and May 2016 in the other six primary sectors (except for reductions in multiplier effect due to the adjusted output). Actual 2016 data, when released, will differ from that used here, as will final calculations of 2016 economic impact. Additional explanatory information Page 9.*

from 2013 and 2011, respectively. The tax base for these studies was 3.8 percent and 3.6 percent, respectively.

➢ Maine's forest product industry contributes an estimated $2.7 billion in value added impact. This makes up 4.96 percent of Maine's gross domestic product for 2016. About $1 out of every $20 of Maine's GDP is associated with the forest products industry.

➢ The forest products industry impacts business of every type in Maine. The industry makes specific purchases based on operational needs. However, forest industry employees have a much wider range of purchases and bring forest product industry dollars to all aspects of Maine's economy *(Table 5, Page 6)*.

➢ The impact of the forest products industry on every county in the state can be seen in the statewide distribution of employment (*Table 6, Page 7)*.

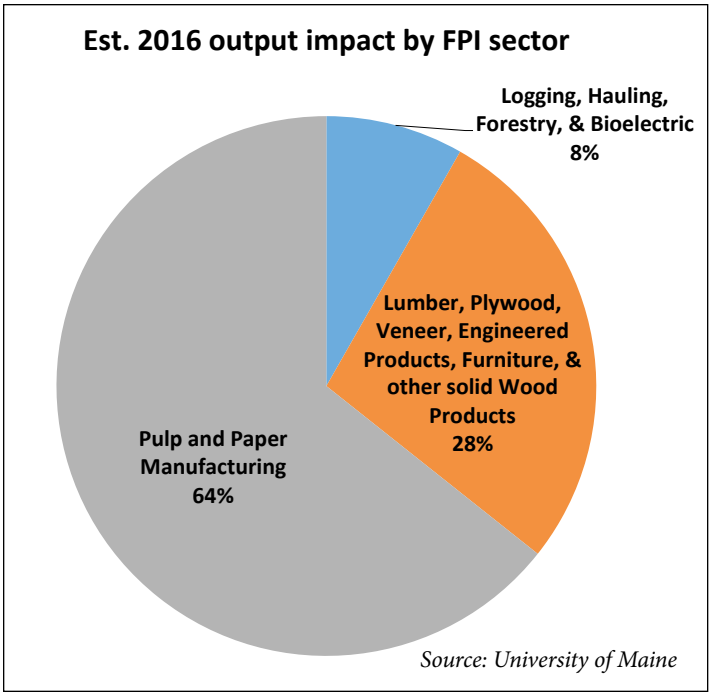


Table 1. Estimated annual economic impact of the forest products industry (FPI) in Maine, 2014

2014 *(in 2014 U.S. dollars)*	Direct and indirect contributions	Total multiplier effects (indirect and induced)		Total impact
	FPI	FPI support	Non-FPI	Total
Output	$6,319,276,078	$467,789,920	$2,987,544,490	$9,774,610,488
Employment	16,551	1,223	21,182	38,956
Labor income	$1,014,316,513	$94,567,956	$960,904,224	$2,069,788,693

Table 2. Comparison of 2011 and 2014 estimates of economic impact in 2014 U.S. dollars

	2011	2014	Percent change
Maine Gross Domestic Product (GDP)	$55.1 billion	$55.8 billion	+1.3
FPI value added	$3.5 billion	$3.1 billion	-11.4
Percent of GDP	6.38% (1 out of 15.7)	5.56% (1 out of 18.0)	-12.9
Total economic impact	$8.5 billion	$9.8 billion	+15.3
All Maine Jobs	794,279	810,672	+2.1
FPI jobs	38,789	38,956	+0.4
Percent of employment	4.88% (1 out of 20.5)	4.81% (1 out of 20.8)	-1.5
Total payroll	$1,978.9 million	$2,069.8 million	+4.6
Total state and local taxes	$320.1 million	$318.5 million	-0.5

Table 3. Estimated annual economic impact of the forest products industry (FPI) in Maine, 2016				
Est. 2016 *(in 2016 U.S. dollars)*	**Direct and indirect contribution**	**Total multiplier effects (indirect and induced)**		**Total impact**
	FPI	**FPI support**	**Non-FPI**	**Total**
Output	$5,506,841,557	$414,408,861	$2,620,051,284	$8,541,301,702
Employment	14,562.5	1,040.1	17,935.4	33,538
Labor income	$904,980,706	$83,910,010	$844,146,645	$1,833,037,361

Table 4. Comparison of 2011 and 2016 estimates of economic impact in 2016 U.S. dollars			
	2011	**Est. 2016**	**Percent change**
Maine Gross Domestic Product (GDP)	$55.7 billion	$55.4 billion	-0.5
FPI value added	$3.5 billion	$2.7 billion	-21.7
Percent of GDP	6.38% (1 out of 15.7)	4.96% (1 out of 20.2	-22.2
Total economic impact	$8.6 billion	$8.5 billion	-1.2
All Maine jobs	794,279	811,321	+2.1
FPI jobs	38,789	33,538	-13.5
Percent of employment	4.88% (1 out of 20.5)	4.13% (1 out of 24.2)	-15.3
Total payroll	$1,999 million	$1,833 million	-8.3
Total state and local taxes	$323.4 million	$278.4 million	-13.9

Mill/plant changes and downsizing accounted for in 2016 estimates*			
Mill	**Location**	**Est. employment loss**	**Date**
Lincoln Tissue & Paper	Lincoln	180	November 2013
Katahdin Fuel & Fiber	East Millinocket	200	February 2014
Verso	Bucksport	500	December 2014
Lincoln Tissue & Paper	Lincoln	210	September 2015
Verso Androscoggin	Jay	300 (downsize)	October 2015
Expera	Old Town	200	November 2015
Covanta Energy (2)	West Enfield and Jonesboro	44	March 2016
Madison Paper	Madison	200	May 2016

**The adjustments made accounted for five closures and two downsizings of pulp and/or paper mills and two biomass electricity generating plants. Decreases in employment numbers were taken from published media reports or industry knowledge. To estimate decreased output, estimates of aggregate input for the closed mills were calculated by MFPC and the ratio of employment to input for closed mills was used to adjust estimated reductions in output. The 2014 output amount was adjusted downward by 35 percent.*

Table 5. **Top 25 Employment impacts on other sectors of Maine's forest products industry estimated for 2016**

Sector description	Indirect	Induced	Total
Wholesale trade	1,569.5	220.7	1,790.2
Management of companies and enterprises	848.7	64.2	912.9
Full-service restaurants	266.7	521.0	787.7
Transportation	681.3	49.6	730.9
Hospitals	0.0	603.5	603.5
Limited-service restaurants	203.5	384.1	587.6
Services to buildings	423.6	126.2	549.8
Maintenance and repair construction of nonresidential structures	451.4	69.9	521.3
Retail - Food and beverage stores	21.9	314.3	336.2
Architectural, engineering, and related services	299.2	32.2	331.3
Automotive repair and maintenance, except car washes	145.2	184.1	329.3
Retail - General merchandise stores	73.7	253.8	327.5
Business support services	271.4	52.4	323.8
Accounting, tax preparation, bookkeeping, and payroll services	261.4	61.6	323.0
Independent artists, writers, and performers	221.9	77.3	299.1
Nursing and community care facilities	0.0	293.1	293.1
Landscape and horticultural services	211.8	76.3	288.1
All other food and drinking places	46.2	240.9	287.1
Employment services	199.3	86.9	286.1
Monetary authorities and depository credit intermediation	143.4	141.2	284.6
Offices of physicians	0.0	280.2	280.2
Warehousing and storage	228.6	43.8	272.4
Individual and family services	0.0	239.0	239.0
Marketing research and all other miscellaneous professional, scientific, and technical services	187.0	30.00	217.0
Retail - Motor vehicle and parts dealers	70.4	135.2	205.6

Table 6. Employment impacts of the Forest Products Industry by county

County	Direct FPI county employment			Multiplier employment due to FPI in county			Total impact employment due to FPI in county		
	2014	Est. 2016	Change	2014	Est. 2016	Change	2014	Est. 2016	Change
Androscoggin	1,131.6	941.2	-16.8%	2,170.5	1,773.2	-18.3%	3,302.1	2,714.4	-17.8%
Aroostook	1,910.5	1,722.0	-9.9%	3,256.3	2,878.3	-11.6%	5,166.8	4,600.3	-11.0%
Cumberland	905.7	802.2	-11.4%	1,532.2	1,328.1	-13.3%	2,437.9	2,130.3	-12.6%
Franklin	1,324.3	1,061.5	-19.8%	2,830.8	2,289.7	-19.1%	4,155.1	3,351.2	-19.3%
Hancock	531.6	417.2	-21.5%	1,123.8	898.3	-20.1%	1,655.4	1,315.5	-20.5%
Kennebec	695.2	559.6	-19.5%	1,409.1	1,141.7	-19.0%	2,104.3	1,701.3	-19.2%
Knox	306.9	306.9	0.0%	209.1	209.1	0.0%	516.0	516.0	0.0%
Lincoln	73.9	73.9	0.0%	96.2	96.2	0.0%	170.1	170.1	0.0%
Oxford	1,662.1	1,446.9	-12.9%	3,152.0	2,727.7	-13.5%	4,814.1	4,174.6	-13.3%
Penobscot	1,777.8	1,598.4	-10.1%	2,563.8	2,188.3	-14.6%	4,341.6	3,786.7	-12.8%
Piscataquis	312.1	311.0	-0.4%	328.7	324.5	-1.3%	640.8	635.5	-0.8%
Sagadahoc	78.3	78.3	0.0%	64.2	64.2	0.0%	142.5	142.5	0.0%
Somerset	1,868.2	1,633.8	-12.5%	3,153.5	2,691.3	-14.7%	5,021.7	4,325.1	-13.9%
Waldo	206.4	206.4	0.0%	246.1	246.1	0.0%	452.5	452.5	0.0%
Washington	861.6	715.8	-16.9%	1,538.1	1,250.6	-18.7%	2,399.7	1,966.4	-18.1%
York	724.2	697.3	-3.7%	911.3	858.3	-5.8%	1,635.5	1,555.6	-4.9%
Totals	14,370.4	12,572.4	-12.5%	24,585.7	20,965.6	-14.7%	38,956.1	33,538.0	-13.9%

Source: Economic contribution of Maine's forest products industry 2014 and 2016 (estimated)

Table 7. Impacts of forestry, logging, hauling, and bioelectric, 2014					
2014 *(in 2014 U.S. dollars)*	Direct contribution	Total multiplier effects (indirect and induced)			Total impact
	FPI	FPI	FPI support	Non-FPI	Total
Output	$345,070,608	$75,535,725	$50,902,398	$273,048,888	$744,567,619
Employment	3,611.5	351.7	127.9	2,157.5	6,248.6
Compensation	$161,237,254	$15,236,889	$6,768,542	$78,271,049	$261,513,734
Proprietor income	$49,633,616	$13,707,439	$5,312,626	$10,568,922	$79,222,603

Table 8. Impacts of lumber, plywood, veneer, engineered products, furniture and other solid wood products, 2014					
2014 *(in 2014 U.S. dollars)*	Direct contribution	Total multiplier effects (indirect and induced)			Total impact
	FPI	FPI	FPI support	Non-FPI	Total
Output	$1,146,523,300	$282,908,419	$106,129,887	$724,534,977	$2,260,096,583
Employment	4,837.2	1,060.5	265.2	5,322.4	11,485.3
Compensation	$181,735,234	$45,866,586	$12,329,385	$211,707,791	$451,638,996
Proprietor income	$21,114,056	$27,776,047	$8,540,486	$27,169,624	$84,600,213

Table 9. Impacts of pulp and paper manufacturing, 2014					
2014 *(in 2014 U.S. dollars)*	Direct contribution	Total multiplier effects (indirect and induced)			Total impact
	FPI	FPI	FPI support	Non-FPI	Total
Output	$4,150,697,445	$318,530,586	$310,757,639	$1,989,960,616	$6,769,946,286
Employment	5,921.7	768.1	829.4	13,702.7	21,221.9
Compensation	$420,670,385	$38,493,441	$38,480,039	$562,514,350	$1,060,158,215
Proprietor income	$24,002,103	$14,843,447	$23,136,879	$70,672,503	$132,654,932

Table 10. Impacts of each forest products sector, 2014			
	Employment impact	Total impact	Value added impact
Forestry, logging, hauling, and bioelectric	6,248.6	$744,567,619	$482,003, 719
Lumber, plywood, veneer, engineered products, furniture and other solid wood products	11,485.3	$2,260,096,583	$788,963,456
Pulp and paper manufacturing	21,221.9	$6,769,946,286	$1,854,139,878
Total Maine impact	38,955.9	$9,774,610,488	$3,125,107,053

Explanatory information

1. This study was requested by the Maine Forest Products Council to update information last generated in 2013 from 2011 data.

2. The forest products industry in Maine consists of businesses, organizations, and individuals involved in one of eight primary industries. These are harvesting (including forestry); biomass electricity generation; sawmills; plywood and veneer (and engineered wood product manufacturing); pulp and paper manufacturing; wood furniture; wood products (other non-glued products), and the Maine Forest Service.

3. Direct impacts arise from the sector's employment of workers, wages, production value (direct sales), and the value they add to the inputs in the production process. Indirect impacts result from the sector's purchases of goods and services from supporting sectors as a part of doing business – for example, the purchase of a piece of harvest equipment from an equipment dealer that sells to other industries as well. As these supporting sectors produce the goods and services needed by the sector of interest, they generate indirect employment, wages, production, and value-added. Value added is made up of employee compensation, proprietor income or profit, other incomes, and taxes on imports and production. Induced impacts are those generated by the household purchases of goods and services of employees in both the primary and support sectors. The direct effect of production activity in a sector thus has additional effects that are larger and are collectively called multiplier effects (multiplier = indirect + induced effects).

4. The Forest Products Industry (FPI) has both direct and multiplier effects because the sectors within the FPI purchase from other FPI sectors. For example, some of the multiplier impact of sawmills occurs in the pulp and paper sector as sawmills purchase paper in order to conduct business. Harvesting and forest management support all other sectors of the industry.

5. Total economic impact, including multiplier effects, were estimated using an economic impact model (IMPLAN), based on known information on total employment, total labor income and total output of the sectors of interest.

6. Total output, employment and labor income numbers are derived from the most recent available data (in general, 2014) from the U.S. Bureau of Labor Statistics, U.S. Census Bureau Nonemployer Statistics, U.S. Census Bureau Survey of Manufacturers, Maine Forest Service, and IMPLAN.

7. Direct output, employment, and labor income in pulp and paper and biomass electricity sectors were adjusted to account for known mill closures in 2014, 2015 and January through May of 2016 to arrive at a "current" estimate. The 2016 estimate numbers therefore assume no changes in output, employment and labor income between 2014 and May 2016 in the other six primary sectors (except for reductions in multiplier effect due to the adjusted output). Actual 2016 data, when released, will differ from that used here, as will final calculations of 2016 economic impact.

8. The adjustments made accounted for five closures and two downsizings of pulp and/or paper mills and two biomass electricity generating plant closures. *(See "Mill/Plant Changes Table, Page 5.)* Decreases in employment numbers were taken from published media reports or industry knowledge. To estimate decreased output, estimates of aggregate input for the closed mills were calculated by MFPC and the ratio of employment to input for closed mills was used to adjust estimated reductions in output. The 2014 output amount was adjusted downward by 35 percent.

9. All prices were adjusted to 2014 or 2016 $USD directly in IMPLAN or using published price indices. The IMPLAN adjustment adjusts each sector individually while the CPI method uses a single conversion factor for everything. For this reason, using the IMPLAN adjustment is preferred to the CPI adjustment when available since it is based on much more detail information. The 2014 and 2016 results could be directly adjusted in IMPLAN, while the 2011 results were adjusted using published CPI.

10. County level employment impact estimates for 2014 and 2016 were calculated based on the share of direct employment in the county in the primary forest products sectors.

11. Direct employment counts employment in the county in the FPI sectors (*(Table 6, page 7)*. FPI county employment due to multiplier refers to the state-level employment impact of the FPI activities occurring within the county. For example, in 2014, Aroostook County had the highest direct county-level employment in the industry (1,910.5). In addition, the FPI business activity occurring in Aroostook County supported an additional 3,256.3 jobs across the state, for a total impact of 5,166.8 jobs resulting from the forest products industry in Aroostook County. In contrast, Cumberland County has lower direct FPI employment (905.7) and therefore FPI activity within the county supports fewer multiplier jobs across the state (1,532.2). However, the presence of the FPI in the state results in a large amount of multiplier impact employment that occurs in Cumberland County – 6,639.6 (not shown). This is due to the preponderance of support industries such as financial services, hospitals, restaurants, etc. that are located in the county.

How is economic impact determined?

Dr. Mindy Crandall

Assistant Professor, Forest Management and Economics University of Maine

Maine has long been a state with an economy very tied to using our forest resource – from ship masts, to lumber, to pulp and paper. It's useful to know just how much that resource means to our state, in dollar terms, and there are many ways to go about generating that dollar amount. Below is a brief overview of how we generated the numbers in this report.

Economic impact analysis attempts to quantify the additional or net economic changes that occur when an industry brings new revenues into a region. Since Maine's forest products industry (FPI) is export driven – the majority of our forest-derived output is consumed out of the state – it would be easy to add up the value of those products sold or the number of people employed directly in the industry.

However, if we count just the direct effects, we risk missing the additional economic activity that we know the FPI generates by spending those revenues within Maine. When we sell exports to the rest of the country (and the world), some of the revenue received stays in and supports our local economy, through many channels. To track that total value, we used IMPLAN.

IMPLAN is an industry standard input-output model that accounts for both the direct and indirect economic impact of an industry. IMPLAN was developed by the U.S. Forest Service in the 1970s to deliver accurate and timely estimates of economic impacts of forest resources. It is now a private company, but the ease with which users can adjust the underlying data and models is a direct result of its publicly funded origins. It is important to understand that input-output analysis are static, not dynamic, and that they assume that the relationship between inputs and outputs remains the same over the short term.

The state of Maine has a highly inter-dependent FPI comprised of multiple sectors. For our analysis, we identified seven sectors as core: Harvesting; Biomass Electricity Generation; Sawmills; Plywood and Veneer; Pulp and Paper, Wood Products Manufacturing, and Wood Furniture. These sectors are all directly linked to the use of the forest resource.

We then defined five key FPI support sectors: Regeneration and Management; Machinery Repair and Lease; Transportation; Research, and Land Lease. While the FPI relies on inputs from these sectors, they also contribute to other industries; trucking, for example, moves all kinds of products around the state, not just forest products. Our analysis takes this into consideration, along with impacts that ripple through the whole economy.

IMPLAN breaks down the impact of a sector into three components: direct, indirect, and induced. It also tracks these impacts across multiple categories: employment, income (compensation and profits), output (sales), and value added (output minus the cost of intermediate inputs; this includes payments made to employees, interest, profits, and indirect business taxes).

Direct impacts are straightforward and easy to count. Indirect impacts result from the sector's purchases of goods and services from supporting sectors as a part of doing business – for example, a paper mill purchasing electricity and chemicals to make paper. As these supporting sectors produce goods and services, they generate indirect employment, wages, production, and value added.

Finally, induced impacts are those generated by the household purchases of employees in both the primary and support sectors. For example, imagine a sawmill worker taking her family out to dinner, which provides income to a local restaurant owner. The direct effect of production activity in a sector thus has additional effects that are larger and are collectively called multiplier effects (multiplier = indirect + induced effects). Industries that are more labor intensive or pay higher wages will tend to have larger induced effects and smaller indirect effects.

You can see multiplier effects in the difference between the estimated direct employment in the FPI in 2016 (14,562) and the total impact, in terms of employment, of the FPI (33,538).

Once we capture the indirect and induced impacts, the FPI's estimated direct output in 2016 of $5.5 billion represents a much larger economic impact to the state of Maine – $8.5 billion.[1] That's a number that communicates how important the industry is to the state.

1 2016 numbers are estimated from 2014 results and known changes in the industry. Actual employment, output, and labor income information necessary for calculating impact for 2016 will not be available until 2018.

Where Maine's wood goes

In 2014, 459 million cubic feet of wood was harvested from the state's forests. It was converted into:

Sawlogs 27.5% *(for lumber)*

Pulpwood 50%
(for paper, tissue and packaging)

Biomass 19.9%
(for electricity)

Firewood/pellets 2.6%
(to heat homes)

Market forces are good at finding balance over time

Jason Brochu
Co-President
Pleasant River Lumber Maine

There has been a lot of dialogue recently about the current state of our industry. Most of it has been negative with the announcement of several mill closures over the last few years. We have been through this before and, in a variety of ways, the future will resemble the past.

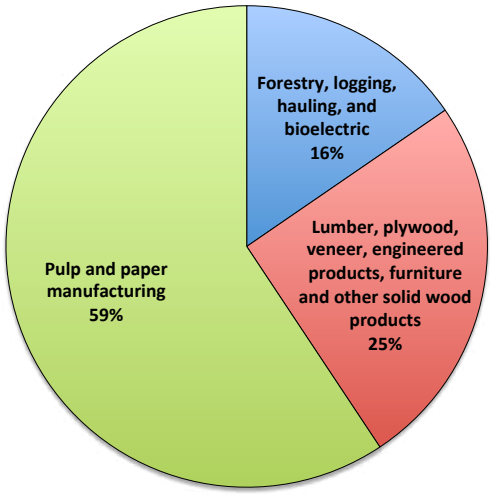
While there is no question that we have experienced a dramatic short-term change, we believe that over the long term the industry will not only survive but will strengthen, diversify and expand. As we move forward the raw material consumers in the industry will remain a mix of large-scale manufacturers and small-scale, value -added facilities.

Value-added products are frequently discussed as a key component to the future success of our industry. The term *value added* is often used to refer to products that are made from other products that one can sell for more money than the original product.

We currently have a large quantity of value-added activity in Maine. We produce toothpicks, tongue dispensers, golf tees, hardwood floors, furniture, baseball bats, drum sticks, pepper mills, etc. The list goes on and on.

We have a thriving value-added industry that creates jobs and helps drive the economy of the state. We don't talk enough about the variety of products produced in Maine from our forest resources. These will continue to expand as opportunities arise and innovative people find ways to capitalize.

Value added impact of forest products sectors, 2014



Source: University of Maine

These products will be a very important part of our future; however the role they play will always be a supporting one. Their success and the future success of the industry is dependent on the strength of the large consumers of forest products that keep the engine turning on the industry as a whole.

Existing industries such as paper mills, sawmills, and oriented strand board (OSB) plants will continue to provide the highest total value to our state and our forests for years to come. The biggest factor is volume. An individual tree will have a very high value if you make it into toothpicks, tongue dispensers or golf tees. Each of these industries creates tremendous value from each tree, but they require relatively few trees.

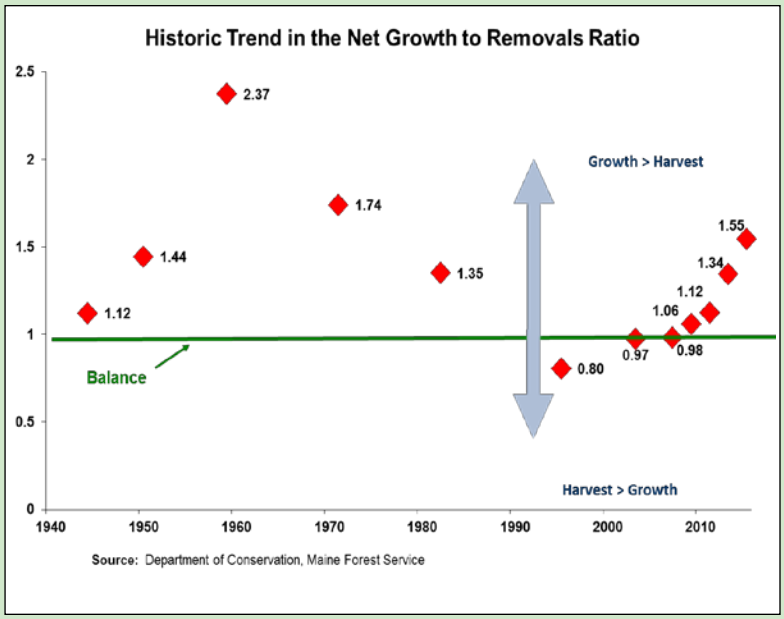
In order to maintain healthy forests, we need to harvest a significant volume. To capture the highest value of a large volume of wood you need a facility capable of processing it into a relatively high value product. To accomplish this nothing compares to these facilities.

Paper mills and OSB plants process an incredibly high volume of what is considered low-value timber. From low-value timber, they create a very high value product.

Sawmills consume high volumes of slightly higher value timber with the same result. For this high volume of timber to be available, you need a lot of infrastructure in the form of loggers, truckers, foresters, parts suppliers, equipment vendors, etc., which adds substantially to the value stream created by these industries. If you look at total value added to the forest and the economy, the highest volume products are on top of the list.

These industries have also been the driving force behind the way forests have been managed in Maine. We have millions of acres of sustainably harvested, well-managed land to fuel the industry. Economic forces ultimately dictate how these forests are harvested and managed, and balance is always achieved through these forces.

In 2015, growth exceeded harvest by 55 percent



One of the measures of sustainable forest management is the relationship between how much timber is grown and how much is harvested. In the long run, the desirable net growth to harvest ratio is 1:1, meaning annual growth and harvest are balanced. A value greater than one indicates that growth is greater than harvest.

Since 2008, growth has exceeded harvest in Maine and, in 2015, the net growth ratio was 1.55:1, meaning growth exceeded harvest by 55 percent, the highest level since 1971.

In the past decade, markets have been strong for certain products from the forest, which raised their price to the point that consumers went bankrupt. Now demand is soft, consumption is low, and the forest gets a break. As the price of raw material adjusts to the level of demand, new investments will be more economically feasible.

We appear to be entering a period of soft demand and low energy prices. These two items have been the biggest factor in many of the recent mill closures. They will also be the biggest factor in encouraging new investments in the state.

Market forces are tremendously good at finding balance over the long term in our industry. High costs drove part of the industry out; low costs will bring it back.

The pace of change appears to have accelerated somewhat over the past few years. Bad news seems like a daily occurrence. In reality, these changes have always occurred. It used to take hundreds of sawmills to produce what our few modern mills can do today. We have always dealt with shutdowns, consolidations, bankruptcies, etc. These occurrences are not unique to our industry nor are they unique to today. They are the markets way of flushing things out and allowing room for change to occur.

So what will our industry look like in the future? We believe it will look similar to the present. We have a great mix of traditional industries like paper and lumber, a variety of value-added products and several wood-to-energy facilities. They all complement each other in some way or another and are all supported by the loggers and landowners of our state.

Many of these individual components will change hands, cease to exist, expand or consolidate. New facilities will be built and new products will be produced. It has always happened and will continue in the future. We have the raw material to support the industry, and the industry will consume it. We will have good years and bad years, but on average we believe the industry will continue to strengthen, grow and increase in value.

The forest products industry has been the backbone of the state for hundreds of years and will continue to thrive over the long term in Maine. Short-term fluctuations in markets, as we are currently experiencing, will happen. However, the key components exist in Maine to ensure a healthy industry over the long term. The resource available and the resourcefulness of our people will be the key factors in the success of the industry, as they have always been. Some components of the industry will change, but the core will remain the same into the future.

Changing markets are a challenge and an opportunity

Dr. Robert Wagner
Former Director, Center for Research on Sustainable Forests, University of Maine

It is very clear Maine's forest products industry has reached a turning point. The closure of five pulp and paper mills across Maine in recent years has economically overwhelmed the rural communities and families that have depended on them for many decades. It also has significantly altered wood markets and created a new reality for Maine's forest products sector. To put the magnitude of these changes into historical perspective, this is the first time that paper has not longer been made in the Penobscot River Valley since the mid 1800s.

The fundamental cause is a changing marketplace, including new products, new demands, but also new opportunities. The question is whether Maine will capture those opportunities. What Maine's forest economy needs most is a "road map" to guide us into the new frontiers of the global market.

The European Union, Sweden, Finland and the state of Minnesota already have developed strategic plans for their forest industries, including a comprehensive analysis of the forest products sector, the current and potential markets, and what must be done to capture these markets.

Working together, the University of Maine and the forest products industry can build a research-based vision for the forest-based economy that also can serve as a blueprint for Maine manufacturing industries.

Some say that this is the end of Maine's forest products industry and that it will just disappear like the shoe industry did years ago. When shoe factories close, the means of producing shoes disappears with them. However, Maine's 17 million acre forest is not a shoe factory. The forest will keep producing 6 to 7 million cords of wood per year, can do so indefinitely, and can store that wood for future use when it is not used in a given year.

In fact, Maine has incredible assets:

- Wood is the most environmentally sound material on earth – sustainable, greenhouse-gas friendly, highly versatile, grown with relatively little effort, and most important produced and stored in the form of forests that provide clean water and air, biodiversity, wildlife habitat, and beautiful places for recreation and tourism opportunities at little or no cost. About half of our forests are under sustainable forest certification.
- The demand for wood products, including various kinds of paper and wood products, will increase as human population and standards of living increase.
- Cross-laminated timber panels; tall wood buildings; high-tech paper, panel, and packaging materials; wood-derived chemicals; bioenergy, and nanomaterials all promise a new revolution in wood products markets.
- Maine has a wide variety of hardwood and softwood tree species with different product potentials.
- Our state is a day's drive from a market with 70 million of the richest people on the planet, has access to ports near major ocean shipping lanes, and has a diverse and highly integrated wood processing and transportation system.

Thus, Maine has the opportunity to be a significant player in the 21st century global forest and wood products economy. A new local wood movement can help usher in an era where the state's economy, industry, rural communities and the environment all benefit simultaneously. To do so, Maine must find a way to attract and nurture capital investments in ways that it has not done before.

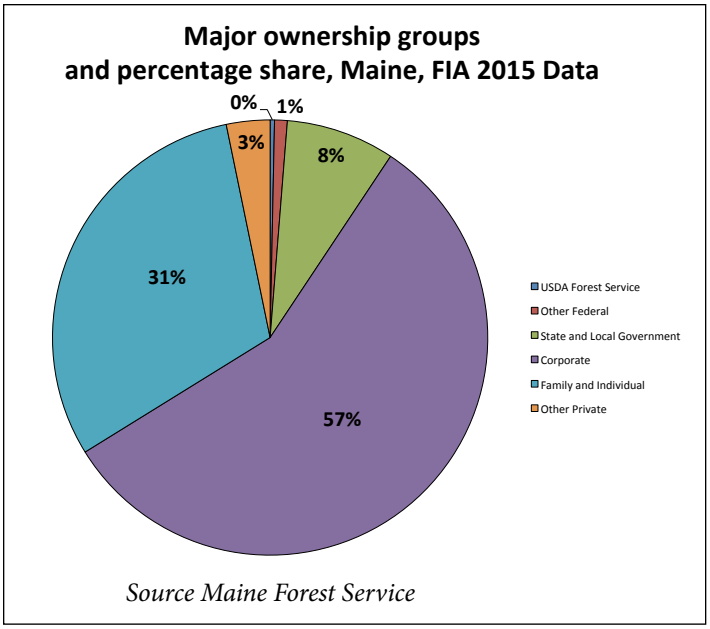
Creating our road map is possible, but it will require a substantial level of leadership and collaboration from Maine's political and industrial leaders.

RESOLVED (April 16, 2016): That We, the Members of the One Hundred and Twenty-seventh Legislature now assembled in the Second Regular Session, on behalf of the people we represent, acknowledge and commend the collaboration between the University of Maine Center for Research on Sustainable Forests and representatives of Maine's forest-based industry, including woodland owners, wood-using mills and businesses and loggers, to develop and implement a strategic vision and road map to increase economic development in the State's forest products sector.

The world needs Maine's 'incredible' forest assets

Sources: Dr. Robert Wagner, University of Maine; USDA Forest Service Forest Inventory, Maine Forest Service and the Sustainable Forestry Initiative (SFI).

- The largest, contiguous, privately owned, working forest in the United States.
- Nearly as much forestland (89 percent) as when Europeans arrived in the 1600s.
- Recent studies of working forests and forest products show that both are important in helping reduce greenhouse gas pollution to the atmosphere.
- Nearly 91 percent of the state's forestland is privately owned.
- Maine's forestland contains more than 24 billion live trees at least 1.0 inches in diameter, an increase of 2 percent since 2010. That computes to 18,331 trees for each of the state's 1.33 million people.[1]
- Nearly twice the standing timber volume today as in 1953.
- Can sustainably produce an estimated 726 million cubic feet of merchantable wood each year.
- 2015 net growth exceeded harvest statewide by 55 percent.



Source Maine Forest Service

1 *USDA Forest Service Forest Inventory EVALIDator web-application Version 1.6.0.03, downloaded 6/17/2016).*

What is forest certification?

"The process of verifying that forests are planted, grown, and/or harvested and wood products are produced, based on a set of sustainable standards."

Source: USDA Forest Service.

Maine certification by SFI, FSC, dual, and ATFS

Organization	Acres
Sustainable Forestry Initiative only	2,874,277
Forest Stewardship Council only	1,680,701
Both SFI and FSC	3,378,242
American Tree Farm System (ATFS)	375,000
Non-duplication total for Maine	**8,308, 220**

Source: Maine Forest Service, August 2016

For more information visit: www.sfiprogram.org *or* www.sfimaine.org; us.fsc.org/en-*us*; www.treefarmsystem.org

- 98.1 percent of the area harvested is rapidly returned to a forest by natural regeneration methods. Only 1.9 percent of the forest is regenerated by planting.
- Independent auditors have certified that 8.3 million acres – about 50 percent of Maine's working forests – are managed sustainably.
- One of the most diverse and best integrated forest products processing systems in the nation.
- Within the 20 states that comprise the USDA Forest Service Northern Research Station, Maine is ranked #11 in land acreage, #3 in forestland acreage (behind New York and Michigan), and #1 in forestland percentage at 89 percent. New Hampshire, West Virginia, and Vermont follow, being respectively 83 percent, 78 percent, and 76 percent forested. These are the only four states in the U.S. that are more than 75 percent forested.[2]
- The acreage of forest land has been quite stable since 1960.

2 *Ibid.*

Private employment and wages for selected Maine fo

	Average Annual Employment				Total Payroll			
Industry	**2001**	**2007**	**2011**	**2015**	**2001**	**2007**	**2011**	**2015**
Timber tract operations	99	91	81	60	$4,473,341	$4,760,514	$3,884,116	$3,584,731
Support activities for forestry	258	182	173	211	$8,065,595	$8,689,574	$8,799,435	$11,316,724
Construction equipment merchant wholesalers	531	600	481	521	$23,809,007	$31,953,986	$27,910,174	$32,665,499
Plywood and engineered wood product mfg.	1,166	1,010	495	609	$39,188,058	$38,368,249	$20,353,548	$28,505,384
Converted paper product mfg.	2,048	1,808	1,576	1,335	$71,766,308	$76,407,884	$76,707,724	$74,293,774
Sawmills/wood preservation	2,365	2,229	1,776	1,966	$70,596,996	$81,579,957	$68,232,258	$84,999,820
Other wood product manufacturing	3,613	2,674	1,857	2,083	$92,422,367	$80,896,373	$58,889,277	$72,510,243
Logging	2,558	2,564	2,304	2,227	$70,189,345	$91,519,682	$90,481,345	$100,735,958
General freight trucking*	4,164	3,902	3,293	3,278	$136,410,398	$151,267,009	$131,486,281	$152,638,923
Pulp, paper, and paperboard mills	10,208	6,713	5,723	4,069	$564,673,771	$435,008,902	$396,177,153	$336,133,627
Sum, forest products industries	27,010	21,773	17,759	16,359	$1,081,595,186	$1,000,452,130	$882,921,311	$897,384,683

Source: *Maine Department of Labor Center for Workforce Research and Information, Forest Products Cluster 5-17-2016.*

orest products industries 2001, 2007, 2011 and 2015

Average Annual Wage				Change 2001 to 2015					
2001	2007	2011	2015*	Employment		Payroll		Annual Wage	
				Net	Percent	Net	Percent	Net	Percent
$45,185	$52,313	$47,952	$59,746	-39	-39%	-$888,610	-20%	$14,560	32%
$31,262	$47,745	$50,864	$53,634	-47	-18%	$3,251,129	40%	$22,372	72%
$44,838	$53,257	$58,025	$62,698	-10	-2%	$8,856,492	37%	$17,860	40%
$33,609	$37,988	$41,118	$46,807	-557	-48%	-$10,682,674	-27%	$13,198	39%
$35,042	$42,261	$48,672	$55,651	-713	-35%	$2,527,466	4%	$20,609	59%
$29,851	$36,599	$38,419	$43,235	-399	-17%	$14,402,824	20%	$13,384	45%
$25,581	$30,253	$31,712	$34,810	-1,530	-42%	-$19,912,124	-22%	$9,230	36%
$27,439	$35,694	$39,271	$45,234	-331	-13%	$30,546,613	44%	$17,795	65%
$32,759	$38,767	$39,929	$46,565	-886	-21%	$16,228,525	12%	$13,805	42%
$55,317	$64,801	$69,225	$82,608	-6,139	-60%	-$228,540,144	-40%	$27,292	49%
$40,044	$45,949	$49,717	$54,856	-10,651	-39%	-$184,210,503	-17%	$14,811	37%

Maine offers a trained, experienced, safe workforce

By Mike St. Peter
Executive Director
Certified Logging Professional

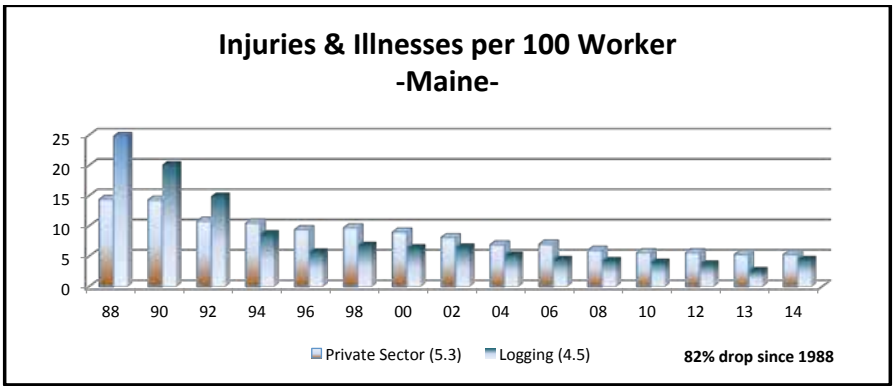
Technology and changing demands have transformed Maine's forest products industry as well as the global market.

Across the industry, there are fewer workers, but they're more productive, much safer, have high-tech skills, make more money and enjoy longer careers than ever before.

The mission of the Certified Logging Professional (CLP) is to provide the best possible training and education to people working in the Maine logging industry.

The program was founded in 1991 as a combined effort of loggers, landowners, environmental specialists and safety consultants to establish a standard for professionalism in the Maine woods. An immediate goal of the program was to combat the high rate of logging accidents and the resulting Worker's Compensation costs for logging contractors.

Numbers Don't Lie
Figures from the Maine Department of Labor show a steady decline in the number of logging injuries and illnesses since the CLP program began in 1991. While several factors may have influenced this decline, the CLP program's emphasis on safety, and its requirement that CLPs maintain a high level of skill have played an undeniable role.

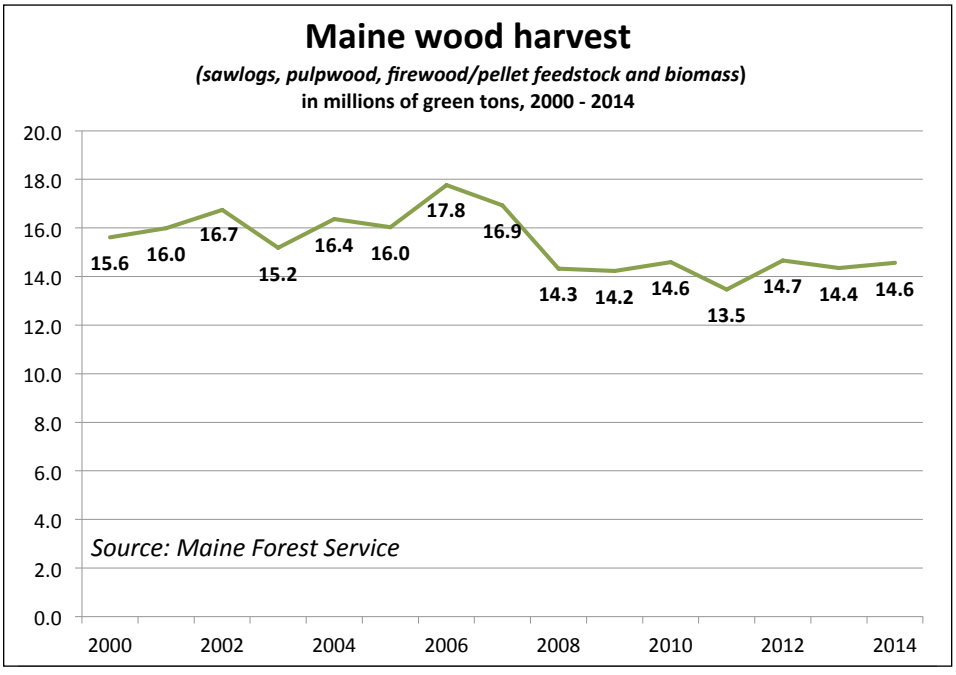


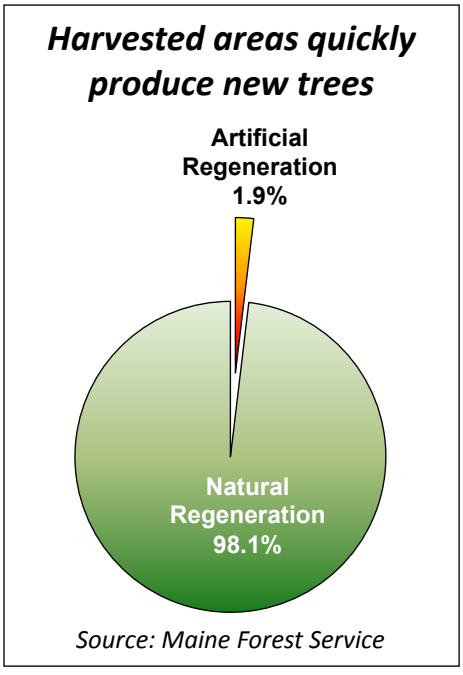
Source: Certified Logging Professional Program Summary, July 2016

Today, under the sponsorship of the Maine TREE Foundation, the program takes pride in the fact that the accident rate for loggers is less than what it was when the program began. As a result, mechanical certified loggers have earned a Workers Compensation rate less than that on non-CLPs. Equally important, participants have helped CLP meet its overall objective of cultivating skill, knowledge and pride in the Maine woods.

The program is equally committed to recognizing the skill and professionalism of those who meet and exceed the CLP standard. CLP continues to evolve to reflect changes in the industry and provide a means for continued professional growth.

Contact Mike St. Peter, clploggers@myfairpoint.net.





Small woodland owners are vital to forest economy

Tom Doak
Executive Director, Small Woodland Owners Association of Maine

Maine's small woodland owners have always been an important part of the forest economy of Maine. From the early days of farming and ship building, through the expansion of the sawmill industry, to creation of the pulp and paper industry, to the diversification of wood markets, small woodland owners have played a vital role in the forest industry and economy. What started as supplying mast and timbers for ships, lumber to build houses and firewood to heat homes has transformed into an expanding role in today's forest economy.

Today there are more small woodland owners and more land owned by small woodland owners than at any time in Maine's history. Small woodland owners hold about a third of all commercial forest land in Maine, but own about 40 percent of the total wood, including a substantial percentage of the most valuable tree species.

The majority of Maine woodland owners are interested in forest management. A recent study by the University of Maine of small woodland owners in Kennebec County found that 86 percent would consider a timber harvest. This is an encouraging number as it relates to future wood supply for Maine mills.

Maine woodland owners as a group are older than the average Maine citizen. A full 40 percent of the land held by Maine's small woodland owners belongs to people 65 years old or older, and nearly two thirds is owned by woodland owners 55 years and older. This means a lot of land will change hands in the next couple of decades and understanding those new owners will be important.

Maine's small woodland owners own land for multiple reasons. Enjoyment of the outdoors, wildlife viewing and habitat, privacy, and recreation are listed near the top. Timber production, while often not the primary reason small woodland owners own land, is an important factor. Successfully engaging small woodland owners means addressing multiple landowner objectives.

Diverse forest products markets are just as important to small woodland owners as large ones. While a typical small woodland owner may only have one or two harvests during his or her ownership, access to markets is an important factor in deciding when to harvest. Reliable, diverse markets are also important considerations when making investments, including management plans, precommercial activities, road upgrades and construction.

Important to many small woodland owners is the concept of legacy. Thousands of owners in Maine are multigenerational owners who see themselves as stewards with a desire to pass their land along to the next generation in as good, if not better condition, than when they acquired it. But many have concerns that those who follow them will not be able to afford to own woodland.

The Tree Growth Tax Law program is under constant attack, threatening woodland ownership. This program makes it possible for many of Maine's small woodland owners to afford to keep their land as forestland. These attacks occur despite review after review of the program showing extremely high compliance rates by enrolled landowners. There is also clear evidence that those landowners enrolled in the Tree Growth Tax Law program are much more likely to be interested in timber harvesting and long-term forest management than landowners who are not enrolled. Finding ways to encourage more woodland owners to enroll in the program, instead of efforts to undermine it, would do more to help ensure a long-term wood supply from small woodland owners than any other action that could be taken.

Multiple studies have shown that woodland owners, as opposed to residential owners, pay more in taxes than they receive in benefits. In short, woodland owners pay more than their fair share of property taxes. ***(See Chart, Page 28.)*** In the future, the forest industry will rely even more on small woodland owners to supply wood. Today's mills are concentrated in the southern half of the state, which is also the area of greatest concentration of small woodland owners. Additionally, the type of wood being used in Maine mills has changed dramatically over the years. The pulp and paper industry once used almost exclusively spruce and fir to make paper. Today, the vast majority of paper made in Maine uses hardwood species. And a significant amount of that hardwood resource is located on small ownerships.

Small woodland owners clearly will play a vital role in the forest industry's future. The challenge will be to understand their expectations and needs.

Nearly 90 percent of families happy with harvesting

By Andy Shultz
Landowner Outreach Forester
Maine Forest Service

AUGUSTA – Nearly 90 percent of Maine's family woodland owners are happy with the results of recent timber harvesting on their land, according to a 2014 survey conducted by the Maine Forest Service to help understand how family woodland owners view timber harvests.

The survey was drawn from a random sample of family woodland owners who own less than 1,000 acres statewide and who had recently completed a harvest on at least a portion of their woods.

"We're very pleased with the results of this survey," said Doug Denico, Maine Forest Service director. "Maine's family woodland owners are quite satisfied with the outcomes of timber harvesting on their land, including aesthetics, wildlife habitat, recreation and income."

The survey was conducted in support of Maine's Healthy Forests Program. Its goals are to:

1. Identify strategies that lead to active forest management on Maine family woodlands, particularly in the southern part of the state.
2. Improve wood availability, wildlife habitat, forest health, recreational opportunities, water quality, aesthetics, etc.
3. Increase landowner enjoyment and support jobs and the state's economy.

The program is a partnership that includes the Maine Forest Service, Maine's Sustainable Forestry Initiative, the Certified Logging Professional program, and others with an interest in a healthy forest.

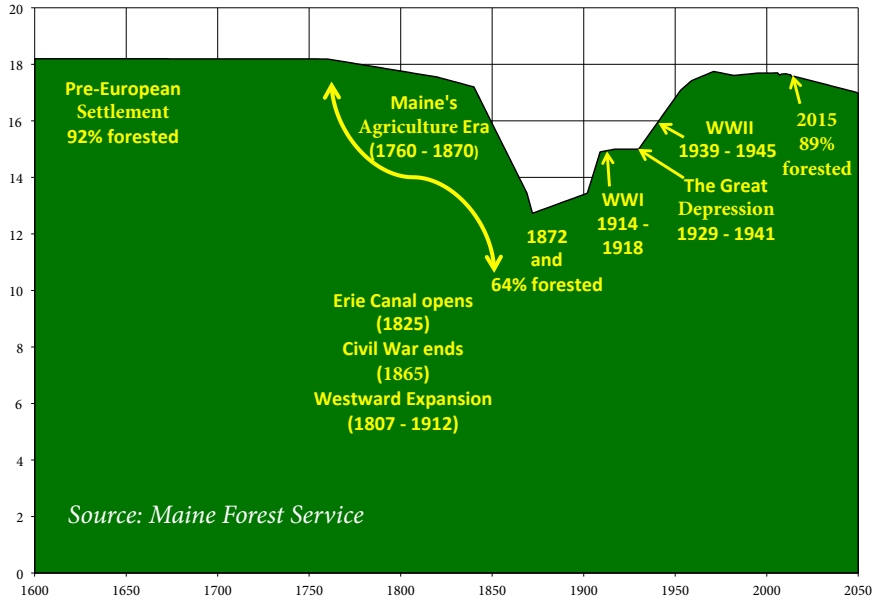
"Healthy forests are vital to our economy and way of life," said Governor Paul R. LePage. "Effective strategies for active forest management improve forest health, wood availability, wildlife habitat, water quality, recreational opportunities and our overall quality of life."

Survey Results:

- More than 63 percent of woodland owners were "very satisfied" and more than 27 percent were "somewhat satisfied" with the overall outcome of their harvest.
- Nearly 59 percent were "very satisfied" and more than 29 percent were "somewhat satisfied" with the overall condition of their woods after the harvest.
- 56 percent were "very satisfied" and nearly 30 percent were "somewhat satisfied" with the financial outcomes of their harvests.
- 78 percent felt the logger understood their objectives and respected the owner's vision for their woodlands "very well," and 84 percent said they would work with the same logger again.
- 77 percent of woodland owners said they would harvest again when conditions were right.

"Timber harvests in Maine are being conducted by a highly professional logging work force, often in consultation with licensed foresters, and the outcomes are largely positive for the customer, the landowner," said Pat Sirois, coordinator of the Maine Sustainable Forestry Initiative. "The good news for landowners is that this survey indicates a good job occurs on nine out of every 10 harvests."

Estimates of Maine's forestland past, current and projected
(million acres)



New uses for wood bring opportunities for Maine

Recently, I was reading about the high cost of birch for automobile manufacturing – in 1923. The U.S. Forest Products Laboratory had published a report about other wood species that could be used for car frames.

Stephen Shaler
Director, School of Forest Resources, University of Maine

People have been using wood forever and we're always finding ingenious ways to make new products from it. It's a natural process. Since change happens, it's best to be proactive and part of it. So here are some new uses of wood that Maine could consider now and in the future.

Now: Cross laminated timber (CLT)

One of most talked about uses is cross laminated timber (CLT), which is being used to construct ever higher tall buildings around the world. CLT is an opportunity that needs to be looked at in Maine.

CLT isn't competing for construction of one- to two-story stick-built houses. Developed in Austria and Switzerland in the past two decades, CLT competes with steel and concrete in buildings from four to 17 stories.

Basically, layers of wood are glued or nailed (then it's NLT) together under pressure to form panels up to 50 feet in length that are exceptionally strong. Using a computerized machine, openings for doors and windows can be cut out and special joints added. Then panels are assembled at building sites with cranes, speeding up construction. For example, they've been putting up a floor a day on a building in Portland, Oregon. Compared to the speed of erecting a steel or concrete building, that's a cost savings and a real advantage.

CLT is increasingly accepted in the marketplace and is getting a lot of attention from architects and construction firms. That's driven in large part by its cost competitiveness with steel and concrete, but also because using it sequesters carbon. When a tree grows it takes carbon dioxide out of the atmosphere. It ends up in wood, which is about 50 percent carbon and 25 percent oxygen. So by using the lumber in a building, you're sequestering that carbon.

You might not even realize you're looking at a tall wood building, because the wood may be exposed or covered. I'm familiar with a building in Oregon, where all the floors are made with wood along with the vertical elements, such as walls and columns, but the outside is a lot of glass. In some cases the wood is totally covered.

I was talking with a person in Oregon who mentioned that a lot of people are willing to live in a wood building – and even pay more rent – compared to living in a steel and concrete building, because of the contribution to sustainability. So that is a driver in the market.

Europe is the strongest market for CLT, but globally it's an established and rapidly growing market. In North America, there are only four manufacturing plants – in Quebec, British Columbia, Oregon and Montana.

It should be technically possible to produce CLT in

Maine. It's made from softwood dimension lumber and Maine is the largest manufacturer of softwood lumber in the Northeast with close proximity to the huge New York-Boston market. But specific business questions need to be looked at in detail – market distance, resource, tax climate, energy, you name it. There's no time to waste, because other people in other parts of the country are asking the very same questions.

2-5 years: Nanocellulose

Another exciting new use for wood is nanocellulose. There are various technologies being used to make it and the markets that use this material are rapidly expanding. It's certainly feasible in Maine.

The University of Maine Product Development Center is in the forefront of nanocellulose manufacturing, making about a ton of nanocellulose a day. There are about 40 manufacturing sites around the world, but UMaine's is one of the largest, shipping to more than 30 countries and a wide variety of industries, including electronics, automotive, paper manufacturing, building products and plastics.

To make nanocellulose, you start by "pulping" wood, which means using chemicals, heat and pressure to remove lignin and hemicellulose. After it's bleached, you're left with the wood fiber, which is primarily cellulose. There are several ways of doing this, but, in the UMaine process, pulp fiber in refined in a special way to break it down to much, much smaller pieces, measured in nanometers (one billionth of a meter). When the process is complete, the resulting slurry is about 3 percent nanocellulose and 97 percent water.

Nanocellulose is much stronger than a normal wood fiber. In fact, it's strength exceeds that of steel at that scale. It provides a lot of surface area, which allows it to form strong hydrogen bonds. In many cases, you end up with very exceptional and unique properties, including optical and electrical, which opens up new markets.

In papermaking, for example, it changes the rate at which water drains and can increase production rates. In cosmetics, it absorbs water and increases hydration. It's benign for human health, so it can be used to thicken foods much better than what is currently on the market. A company in Japan is using nanocellulose to produce low-calorie bread, which bakes, looks and tastes the same as regular bread.

When complete, 475 West 18th, a 10-story residential building, will be the first structural timber building in New York City. The design by SHoP Architects was one of two winners of the U.S. Tall Wood Building Prize, sponsored by the Department of Agriculture.

Photos courtesy SHoP Architects.

It's also used to make foam for wall insulation or ceiling tiles and, in this case, it's competing with petroleum-based products, which have toxicity issues. There is also interest in its use with concrete and as a compound for use in the oil and gas industry (fracking).

Sustainable, renewable products that are cost effective have a lot of market appeal. Many manufacturers are actively looking for them.

The state of Maine already has the resources, handling systems, understanding of the chemical processing, and UMaine's background and expertise in producing nanocellulose. So it would be a natural place to take the next step and try to develop or attract production facilities.

5-10 years: Cellulose-based plastics

In a petroleum refinery, you bring in crude oil and make many products, including gasoline, diesel, tars, kerosene, and the precursors to plastics. In a biorefinery, you can use the different chemical components of wood to make bioplastics or biofuels.

Wood is made up basically out of three kinds of chemicals – cellulose, hemicellulose and lignin. If you look at the chemical structure of cellulose and hemicellulose, they're predominantly combinations of two sugars – glucose or xylose – that can be used to make polylactic acid (PLA), a biopolymer that's already on the market.

The world's first and still largest PLA facility opened in 2001 in Blair, Nebraska, producing bioplastic from corn. But there's interest in making bioplastic from wood, be-

475 West 18th, New York

cause then you're not competing with the use of corn as a food. With the world population now 7.4 billion and predicted to hit 10 billion by 2056, global food demands are going to be very important. You're also displacing petroleum-based plastic with sustainable, renewable wood, which has pull in the marketplace.

PLA products already include food containers, packaging and more. It's also used in 3D printing, which is a kind of the nexus between biopolymers and nanocellulose. Again, there's work going on at UMaine in that area, but people around the world are also looking at it.

To make most of the parts we use today, you get a big block of something and then cut away the parts you don't want to use. In 3D printing, also called additive manufacturing, you add layers of plastic again and again to make very complex parts with no waste. The Department of Energy (DOE) has even 3D printed a car! DOE says it has combined PLA and nanocellulose to create a material with 97 percent the strength of aluminum.

So bioplastics are another value-added technology to consider for Maine's sustainably managed, renewable wood resources. If you're going to make things from wood, you're not going to do it in Kansas. You're going to do it in places like Maine.

10-20 years: Biofuels

Driven by the cost of energy, a tremendous amount of work has gone into making ethanol, aviation fuel and diesel fuels from wood. Again it's a chemical process to break wood down and create a liquid. It's been technically demonstrated – they've flown planes on it. The U.S. Navy has looked at it to replace fuel for ships. But right now it doesn't make sense economically.

The cost of manufacturing biofuels has to be a competitive and that depends on the price of oil. What's it going to be a year from now? Five years from now? Ten years from now? There also could be less demand for petroleum fuels in the future. Maybe we'll all have electric cars running off solar and won't use gasoline, except for planes or ships, which need high energy density fuel.

Can new and traditional uses coexist?

Some new uses fit right in with traditional uses and some may not. CLT can because it's a new customer for the already existing sawmill industry. That's value added. That's positive.

Nanocellulose can fit in because you're still making pulp, whether you turn it into paper, into nanocellulose or a combination of both. CLT and nanocellulose also require fairly little capital – $5 million to $15 million – to manufacture at an existing plant, diversifying products and providing new outlets.

Bioplastics and biofuels could be direct competitors for wood resources if you had 100 percent conversion into those products. However, technology developed at UMaine, which was demonstrated and running at the now-closed Old Town mill, turned 10 percent of the wood into sugars and then continued to make pulp. So in that case, it's value added.

Maine's wood resources already have tremendous value to many industries and more industries could be added to that list. So it's important to keep looking at new applications, new markets and new technologies. Some of these markets also may represent new types of ownership, including ones not typically associated with the forest products industry.

Being open is important because it's better to be ahead of the curve, than behind the curve. Nobody wants to be first, but a lot of people want to be second and you definitely don't want to be 15th.

This Shelby Cobra was 3D printed at the Department of Energy's Manufacturing Demonstration Facility at the Oak Ridge National Laboratory.

Recreational access is a byproduct of working forests

Bob Meyers
Director, Maine Snowmobile Association and Chairman of Board Maine Tourism Association

A few years ago I was renting a car at the Salt Lake City airport and, when the agent saw my driver's license, he immediately started asking me questions about things he had heard about Maine. It turned out he was a hunter and had heard what he thought were unbelievable stories about people being able to take advantage of virtually unlimited access to private land for hunting, fishing and other outdoor activities. I was equally amazed when he started talking about paying to access land, waiting lists and permits, and bemoaning the fact that he would likely never be able to afford to pay for access to prime hunting areas.

Those of us who have lived in Maine most of our lives tend to take for granted Maine's remarkable tradition of nearly unfettered public recreational access on private land in our state. That tradition, however, is the basis for an outdoor recreation industry that generates more than a billion dollars in economic activity every year and sustains thousands of jobs.

A 14,000 mile web of snowmobile trails covers the state from Sanford to Allagash. A 6,000 mile all-terrain vehicle trail system is attempting to do the same. About 95 percent of those trails are located on private land.

Hunters, trappers and fishermen rely on a system of woods roads to reach far-flung areas of the state. Again, most of those roads are on private land.

Creating this access was fairly easy as it evolved over generations, but maintaining it is increasingly complex and requires the cooperation not only of the beneficiaries of the tradition, but the landowners as well.

Bob Meyers enjoying access to the northern forest.

First, recreationists need to always be aware that whatever they are doing is secondary to the primary management goals of any particular piece of land. That beautiful snowmobile trail through the forest is likely a tote road that could be opened at any time to accommodate a logging operation. Snowmobile clubs respect and prepare for possible trail relocations at any time. Ditto for the agricultural lands where trails are located. This is particularly important with ATV use, where operators can unwittingly spread crop diseases between potato fields.

Second, **respect** is the guiding principle for all interactions between land users and land owners. There's a cost to landowners for providing recreational access on their property and, at the very least, land users should do whatever they can to mitigate those costs. This would include cleaning up after themselves, never cutting trees without permission and observing whatever usage rules a landowner has on their land.

That beautiful old pine might make a great support for a tree stand, but sooner or later it will be headed to the mill where its value could be greatly diminished by screws or bolts that had been driven into it. A log yard at the side of a road may be empty when you park your truck and trailer before heading out for a day of fun, but there could be truckloads of logs on their way there under a tight schedule.

It's not your place to question temporary posted or no hunting signs or gates. Just because a hunter hasn't seen anyone in an hour doesn't mean nothing is going on out there. Usually there is.

Third, we have a responsibility to be stewards of the land on which we're recreating. Maine forest landowners are serious stewards of the land they own. That can be seen in lands that sustain harvests for generations.

Maine's tradition is the basis of an outdoor recreation industry that generates more than a billion dollars in economic activity every year and sustains thousands of jobs. *Photo courtesy of Maine Snowmobile Association*

Even with the outstanding care they take with their property, landowners are also subject to endless rules and laws which are intended to keep Maine's high level of environmental quality.

Folks heading out for a trip in the woods cannot decide that it's also an opportunity to get rid of that old refrigerator or bald tires that have been sitting out behind the garage. Illegal dumping on private land has become an epidemic in recent years. In spite of organized clean-up efforts by recreation groups, landowners are often faced with significant costs to remove someone else's trash from their property. Every little bit helps (or hurts). This includes beer cans, cigarette butts and candy wrappers. You wouldn't throw them on your yard, would you?

It can even be taken a step further. Many snowmobile clubs are now learning best practices for bridges and stream crossings with the help of the forest products industry. A lot of forestland in Maine is certified by third parties and certification is subject to every activity taking place on that land. If it's good enough for the landowners, it's certainly good enough for land users.

And finally, get involved. People across the state are working on an almost daily basis to promote good relations. The Maine Department of Inland Fisheries and Wildlife has a full-time Landowner Relations coordinator, and every warden in the state has a "triage" bag in his or her vehicle that allows quick response and immediate action to help landowners protect their property.

The Landowner Relations Program and organized user groups have distributed tens of thousands of bright orange trash bags to people heading out to recreate on private land and everyone should carry one in the outdoors. And after you pick up your trash, don't forget to grab what some slob left behind.

I had an old friend who would look out on places when we were in the woods and always turn to me and say, "Aren't you glad for where you live?"

Yes, I am. Yes, we are. We all need to work to keep it that way.

"Maine has a land-use tradition that is unique in the nation. In Maine, landowners have traditionally allowed members of the public to use their property for a wide variety of recreational activities free of charge."

– James M. Acheson, Professor of Anthropology, University of Maine, Maine Policy Review (2006)

Tree Growth Tax is essential for forest conservation

Without the state's Tree Growth Tax program, Maine would not have the scenic forestlands desired by the public for hunting, hiking and watershed protection. Voters recognized that in 1970, when the Constitution of Maine was amended by referendum to permit current use valuation for real property for tax purposes. In 1972, the Maine Tree Growth Tax Law went into effect.

In 2015, there were 27,373 parcels statewide (municipalities and unorganized territory). The average parcel size across the state, including all municipalities, was 151 acres. The average parcel size in the unorganized territory was 2,535 acres. But parcels and acreage varied greatly by county *(see chart following page)*.

Under the Tree Growth Tax Law land values are assessed by the state by a formula that takes into account average stumpage prices, average annual growth, deduction for wood that cannot be harvested and a capitalization rate. There are currently six valuations for the entire state as several counties have been lumped together due to similar forest types and timber markets. The municipalities apply the local tax rate, while in the unorganized townships the rate is assessed by Maine Revenue Services.

Since 1972, there have been many changes to the Tree Growth Tax Law. One of the most significant changes was the 1989 amendment that required the landowner to have a forest management and harvest plan, prepared or certified by a licensed professional forester. This plan must be updated every 10 years.

Fred Huntress
Consulting Forester
and MFPC Board Member

There is a penalty for withdrawing land from Tree Growth equal to 30 percent of the difference between Tree Growth valuation and the fair market value of the property at date of withdrawal. If the land has been classified for more than 10 years the percentage of penalties can be reduced to 20 percent.

Changes are proposed at nearly every session of the Maine Legislature, but most have been defeated.

Considerable controversy has arisen in recent years over accusations that Tree Growth is a tax dodge used by some landowners who do not intend to harvest timber. Most of the problem has occurred in coastal towns where the assessed value of land not in Tree Growth can greatly exceed Tree Growth values. As a practical matter, most of the ocean and river front owners also own a very substantial building on the same property, which brings in significant tax revenue to the towns.

In suburban towns, the Tree Growth Law has been more accepted as a provider of open space, wildlife habitat, watershed protection and prevention of urban sprawl. Without the hundreds of parcels of land in Tree Growth there would surely be many more homes and cottages in what are now forested areas.

FAQ about Tree Growth Tax

Q. What's the goal of the Tree Growth Law? To provide an incentive for landowners to manage forestland on a sustained yield basis and not to strip and sell the land for development. Studies show forestland taxed at its current use pays more than its fair share of municipal taxes because it requires few services, such as trash disposal, roads or utilities.

Q. How are standards enforced? Municipal officials determine and enforce compliance. The Maine Forest Service can assist municipalities by reviewing the required management plans prepared by a licensed forester. MFS also can determine if management is consistent with the plan.

Q. Are there landowners in the program who don't commercially harvest trees? There are some allegations of abuse, but the system provides municipal officials with expert advice to investigate allegations and determine compliance. Ultimately, municipal officials make the final determination on compliance.

Q. How are municipalities reimbursed? Every year municipalities apply for reimbursement from the state for 90 percent of the difference in valuation from local rates and the Tree Growth rate. There are significant penalties, collected by municipalities, for withdrawal from the program.

The purpose of the Tree Growth Tax Law is to enable landowners to own forest land for the long periods of time necessary to grow trees to marketable size, especially for saw logs. The fact that a landowner does not harvest timber in a reasonable time should ***not*** be a reason for disqualification and payment of penalties.

There are many reasons for allowing timber to grow for long rotations, such as financial needs, landowner's age, and timber markets. An elderly landowner, who has owned land for many years and has very little timber depletion allowance in the land would have to pay a very large capital gains tax for stumpage sold, whereas the heirs in a few years would get the benefit of the step-up in valuation and pay little or no capital gain tax.

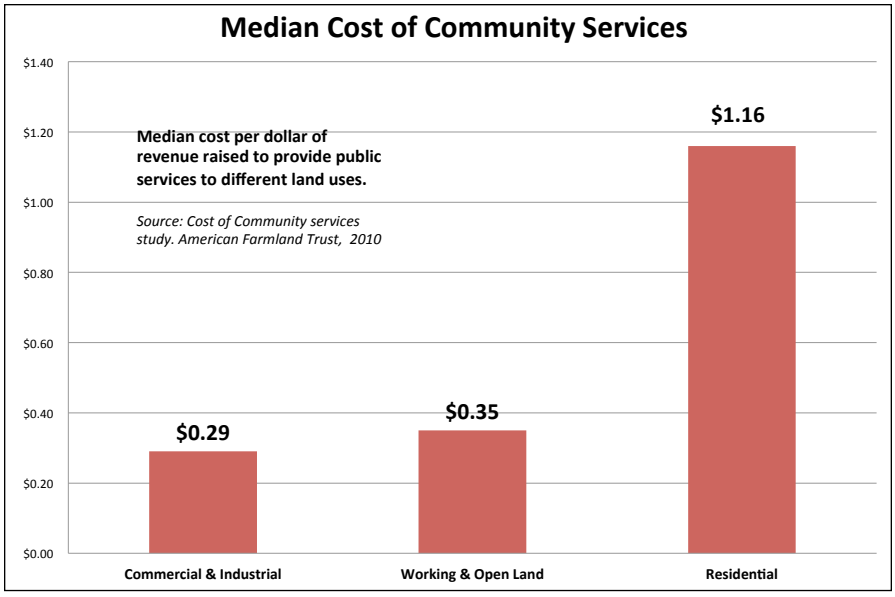
Very few woodlots ever reach the stage of dying from over maturity as the children and grandchildren who inherit the land will cash in on their inheritance at first opportunity!

It is not difficult to imagine what the forest of Maine would look like today if the Maine Tree Growth Tax Law had not been enacted nearly fifty years ago.

There would be less saw timber available for our mills as many landowners would have sold timber for firewood and pulpwood long before it reached saw log size.

There would be less taxable income to the state as lower value forest products return less income to landowners.

There would be more subdivisions in suburban towns, more classrooms needed and more traffic on the roads as commuters head for the cities to work.



Tree Growth summary for unorganized territory 2015

County	# of parcels	Total acres	Total Value	Acres first classified	Acres withdrawn	Penalties assessed
Aroostook	386	2,314,624	$312,707,518	0	109	$16,537
Franklin	287	438,415	$106,997,037	0	11	$3,452
Hancock	108	241,323	$29,310,959	0	115	$5,053
Kennebec	9	4,874	$1,245,689	0	0	$0
Knox	0	0	$0	0	0	$0
Lincoln	5	188	$38,805	0	0	$0
Oxford	213	285,289	$70,446,340	0	147	$8,977
Penobscot	391	714,574	$87,204,661	0	164	$30,232
Piscataquis	374	1,525,943	$204,469,566	0	8	$14,704
Somerset	819	1,459,839	$196,672,398	0	296	$45,112
Washington	392	579,525	$70,339,350	0	12	$10,811
State totals	2,984	7,564,594	$1,079,432,323	0	862	$134,878

Tree Growth summary for municipalities 2015

County	# of parcels	Total acres	Total Value	Acres first classified	Acres withdrawn	Penalties assessed
Androscoggin	689	35,464	$10,468,775	327	9	$903
Aroostook	1,774	702,564	$94,476,355	2,697	1786	$13,708
Cumberland	1,669	83,124	$26,379,826	224	150	$83,515
Franklin	1,630	292,083	$71,229,559	787	144	$25,549
Hancock	1,486	229,388	$26,991,741	304	80	$49,195
Kennebec	1,445	73,376	$18,424,670	972	154	$46,837
Knox	395	18,955	$4,990,039	304	0	$0
Lincoln	706	36,476	$9,438,958	64	201	$56
Oxford	3,505	460,812	$110,337,627	2,434	779	$82,088
Penobscot	3,092	531,911	$64,340,524	2,381	253	$41,589
Piscataquis	1,431	292,640	$39,506,689	330	162	$7,311
Sagadahoc	409	18,345	$5,550,560	152	31	$10,609
Somerset	2,311	388,983	$51,615,096	1,599	575	$4,430
Waldo	876	57,115	$14,505,825	74	40	$9,412
Washington	1,532	369,950	$44,295,688	1,481	483	$11,983
York	1,439	92,785	$28,868,289	850	292	$31,472
State totals	24,389	3,683,971	$621,420,221	14,980	5,139	$418,657

Source: Maine Revenue Services

Forest products play a key role in a sustainable society

By Robert Wagner and Stephen Shaler

Every week, the global population increases by more than the number of people living in Maine. The food, shelter and other resources needed by this rapidly increasing population can come from either renewable (e.g. solar, wind, forests) or nonrenewable (e.g. oil, coal, metals) sources. But if a sustainable quality of life is to be achieved for future generations, these increasing resource demands must be met by renewable – rather than nonrenewable – resources.

Substantial scientific research over the past 40 years has examined the carbon impacts of using forest biomass for energy and other uses. A recently published summary of these decades of research had four general conclusions about forest bioenergy and carbon impacts:

- As long as the land where woody biomass is harvested remains as forest, the long-lived wood products and the associated forest bioenergy produced will reduce overall fossil fuel use and long-term carbon emissions to the atmosphere.
- Increasing demand for wood of all types stimulates global investment in forestland, leading to increased forest area and productivity, thus reducing overall carbon emissions.
- Although using forest biomass for bioenergy can sometimes produce small and short-term increases in carbon emissions relative to other sources, cumulative carbon emissions from using forest bioenergy are typically lower when calculated over the long-term, which has been shown to be the best predictor of future peak global temperatures.
- When assessed using the proper framework, the type of woody biomass used for bioenergy in the U.S. typically has low (and sometimes zero) impact on carbon emissions.

Based on this research, more than 100 forest scientists from across the country recently signed a letter to the U.S. EPA strongly supporting the use of woody biomass a significant part of a renewable energy future.

Robert Wagner is a former forestry professor and Stephen Shaler is director of the School of Forest Resources and a professor at the University of Maine. Professors Ivan Fernandez and Aaron Weiskittel also contributed to this essay.

Because using forest biomass encourages the use and expansion of working forests, a wide variety of other social and environmental benefits are provided to the people of Maine. Working forests provide much needed jobs for rural communities. They also provide clean water and air, biodiversity, wildlife habitat, carbon storage and cultural values, and are great places for recreation.

Maine's forest products sector has relied on wood energy to run its mills, as well as to provide electricity for Maine citizens. In fact, Maine is a national leader in the production of electricity from non hydro, renewable sources, providing 26 percent of the state's total electrical generation in 2015, according to the U.S. Energy Information Administration. This use of forest biomass can also help reduce dependence on fossil fuel. Using locally grown wood from Maine's 8.3 million acres of sustainably certified working forests also reduces the amount of wood coming from other countries, where laws governing forestry practices are often far less stringent and can promote deforestation.

Use of forest biomass to produce bioenergy is not only carbon friendly over the long-term, but also provides a wide range of other social and environmental benefits for Maine's people and the nation. What is clear is that forest biomass has a significant "carbon advantage" over fossil energy sources as we move toward renewable sources of energy and materials.

"Wood is the most environmentally sound material on earth – sustainable, greenhouse-gas friendly, highly versatile, grown with relatively little effort, and most important produced and stored in the form of forests that provide clean water and air, biodiversity, wildlife habitat, and beautiful places for recreation and tourism opportunities at little or no cost." – Dr. Robert Wagner, head of Forestry and Natural Resources, Purdue

Capital investment is the key to success

Peter Triandafillou
Vice President, Woodlands
Huber Resources

Unlike many parts of the U.S., Maine is blessed with a fully functioning forest products industry cluster. That means that we have all the pieces of the puzzle that lead to economic efficiency and success.

What are the parts of a forest products cluster? They are a sustainably managed working forest; a professional logging force that can get product from the forest to the mill, and manufacturing facilities that turn wood from the forest to value-added, finished products. Forest products manufacturing includes facilities that produce pulp and paper; lumber; shingles; plywood;, pellets and firewood for heat; furniture; energy and other products.

The elements of the cluster are tightly bound and very interdependent. Without loggers, wood cannot get to the mill. Without working forests, there is no wood for loggers or mills. Pulp mills consume lower value wood from the forest and residual products from sawmills to produce highly value-added paper products. Sawmills convert higher value wood from the forest into lumber and other solid wood, but need pulp mill markets for their residual chips and energy markets for sawdust, bark and shavings. Landowners need markets for low-quality wood, which makes up the bulk of the wood in the forest.

Each part of the cluster depends on the others for survival and success. Remove any one of these industry parts and the forest economy becomes less efficient or can even cease to function.

Maine has a remarkably successful industry cluster that has functioned for decades. However, recent mill closures and changes in the industry have put that cluster under stress and highlight the need for our industry to constantly modernize and innovate in order to survive.

It takes many things to maintain our forest products cluster. One of the most important is investment capital. The forest products industry is very capital intensive. Billions of dollars are invested in timberland. A single logging crew represents over a million dollars of investment in machinery. New sawmills and pulp mills can cost hundreds of millions of dollars. In order to be successful, Maine has to be attractive to investment capital.

Maine has the resources and the infrastructure to attract investment, but how do we stack up for business friendliness?

Unfortunately, not very well. The 2015 Forbes list of business friendly states ranks Maine 48th. Notoriously tax-heavy states such as Massachusetts and New York rank 18th and 29th, respectively. Competitors for forest products investment, such as Georgia and Wisconsin, are ranked 11th and 31st, respectively.

Why are we ranked so low? Maine is ranked 41st for the cost of doing business. There's some good news here: We've improved and are the 2nd lowest cost state in New England, and our cost of doing business is only 9.5% higher than the national average, but we still rank poorly. Our regulatory environment is ranked 45th, and we come in dead last at 50th for economic climate.

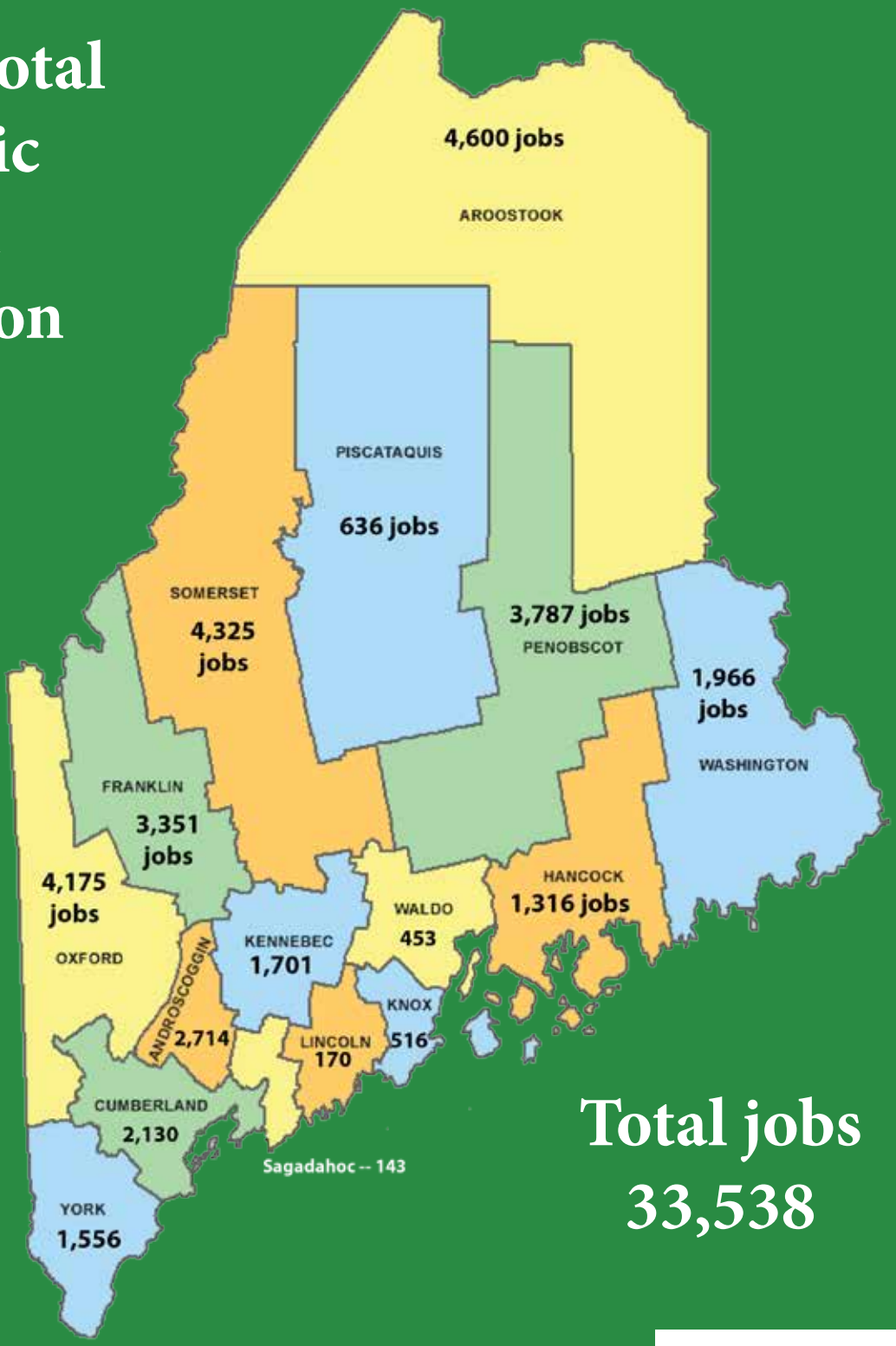
Data from the Tax Foundation confirms this. Maine ranks 34th for tax climate and 45th for corporate taxes.

Some complain that the rankings are biased or inaccurate, but that does not explain our consistently poor rankings across a spectrum of reports. Maine will not succeed in the long term if it remains at the bottom of the pack for business friendliness. Unless we take difficult, but necessary steps to improve the state's business climate, our industry and all of Maine, will suffer. We are in danger of entering a cycle of business loss, resulting in a poorer business climate, which will drive more business losses. If this happens, we will lose one of the few rankings where we excel – 17th – for quality of life.

It is both necessary and possible to improve Maine's business climate. The first step is for all of us to recognize that we are not competitive at attracting capital. The next step is to debate and make some difficult choices to improve our competitiveness. It will take time, but it can be done. We can make significant improvements if we pull our heads out of the sand and take the first steps.

Maine's Forest Economy

Est. 2016 total economic impact $8.5 billion



Source: Economic contribution of Maine's forest products industry 2014 and 2016 (estimated)

Total jobs 33,538