The Forest Opportunity Roadmap for Maine Workforce Development Strategy

Technical Appendices

Prepared for Forest Opportunity Roadmap for Maine (FOR/ME)

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Overview

The technical appendices holds a collection of references, data, and resources that support the overall thesis and research findings outlined in the core report. The appendices represent the behind the scenes data analysis and research of the core report that can be used as a tool for the reader and stakeholders during strategy finalization and implementation.

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Appendix A: Statewide Labor Market and Demographic Context

This section provides an understanding of the underlying labor market context in Maine based on key economic and labor market measures including unemployment and employment trends, labor force participation rates, and population demographics.

Pre-CoVid, unemployment was at the lowest level on record; labor force participation at lowest levels in decades



Growth projections this year suggest we may quickly return to tight labor market conditions by 2022

Prepademic, unemployment conditions vary statewide and are generally highest in rim counties, while the coastal counties generally have below average unemployment rates



Source: Maine DOL Center for Workforce Research and Information (CWRI), 2018



Flat labor force growth and falling LF participation are a result of Maine's current population demographics; the pandemic triggered steep drops on participation.



Maine's age demographics suggest lower birth rates going forward; higher intensity in rural counties

The median age in Maine is the oldest in the US. It indicates the age at which one half of the population is over and one-half the population is under. At 45 years, we would expect the fertility rate to decline and natural population change to accelerate downwards (negatively).

The age demographics are spread differently across the state, which more rural counties more susceptible to workforce population declines due to retirements and workforce exits.



Source: U.S. Census Bureau, 2018 Population Estimates

The Natural Rate of Population Change is Negative

Since 2012, the natural rate of population change has been negative, meaning there are more deaths than births in state. Without inmigration to offset, we expect this trend to continue and intensify in the next 5-10 years. Population trends translate into workforce demographic trends, broadly speaking.



Births and Deaths per year in Maine

Sources: Maine Office of Data, Research, and Vital Statistics; U.S. Census Bureau Population Estimates Program

Natural population growth was negative for 14 out of 16 Maine counties between 2010 and 2018.



Net in-migration has been positive in recent years, keeping total population from declining altogether.

Net migration refers to whether more people moved into the state than moved out of. Net positive migration (more people moved into the state than left) was positive the last 4 years. Although 2020 was a disruptive year due to the COVID pandemic, anecdotal evidence suggests that more people moved to the state than usual. However, it is not yet clear which industries stood to benefit from these shifts, and whether they are temporary trends or whether increased remote work opportunities will enable more people to move to the state.



Components of Population Change, Maine

In recent years, more of Maine's counties are capturing positive net in-migration, though rim counties have seen the smaller numbers, while southern Maine, Kennebec, and Hancock have seen the large changes.

Over the long-term, it is critical that net inmigration rates increase in order to counter the demographic trends currently in place.

COUNTIES WITH POSITIVE NET MIGRATION

2010 - 2018

- Cumberland (10,151)
- York (9,412)
- Hancock (1,408)
- Waldo (1,200)
- Lincoln (1,083)
- Kennebec (1,067)
- Knox (911)
- Oxford (840)
- Sagadahoc (533)

Source: U.S. Census Bureau, Population Estimates Program

2017 - 2018

- York (1,856)
- Cumberland (1,080)
- Kennebec (386)
- Hancock (382)
- Oxford (366)
- Lincoln (304)
- Sagadahoc (288)
- Somerset (273)
- Franklin (155)
- Washington (85)
- Piscataquis (68)
- Penobscot (51)

-Coastal -Central -Rim 800,000 700,000 600.000 500.000 400,000 300,000 200,000 100,000 0 1900 1910 1920 1930 1940 1950 1970 1980 1990 2000 2010 2018 2021 2026 1960

Total Population, Regions of Maine

Sources: U.S. Census Bureau; State Economist population projections

Population change in Maine regions

- Population in Miane's rim counties have been modestly, though steadily declining since 1990.
- Central Maine county population has leveled off and is expected to remain relatively stable over the next 5 years.
- Coastal counties in Maine have by far seen the largest growth in population though even there population levels are projected to remain fairly flat.



Maine Population Trends by Age 1950-2026

- The population in core workforce age cohorts (24-64) has been decline over the past decade and is projected to fall as similar rates through 2026.
- Meanwhile, the population over 65, typically used as a threshold for retirement, has been rising rapidly and projected to continue to do so through 2026.

Sources: U.S. Census Bureau; State Economist population projections

As the population ages, older cohorts see labor force participation rates fall rapidly.

Labor force participation rates are expected to remain relatively consistent relatively to past and current rates into the foreseeable future.



Statewide Summary – Key points

- Population projections show a deficit of 63,000 working age people in 2026 over 2016 levels (*Domestic migration has slightly picked up recently)

- Scenarios will play out differently across the state – rim counties most effected, urban counties may fair slightly better

- Workforce and labor market conditions will continue to be biggest constraint to economic growth and competitiveness

- Geographically concentrated industries with specialized skill sets will need to target recruitment and attraction, both locally and from away

Appendix B: Current Workforce Trends of the Forest Product Sector in Maine

Current Workforce Trends of the Forest Product Sector in Maine

Introduction

The Forest Product Sector (FPS) is a core industrial driver of Maine's economy supporting an estimated \$8.5 billion in total annual economic output in 2016 and is the foundation of many communities across the state (Anderson and Crandall, 2017).¹ The recent closure and downsizing of several pulp and paper mills in the state has had ripple effects across the supply chain and challenged the sector to find new markets for the vast forest resources in the state. In response to this crisis, the Forest Opportunity Roadmap for Maine (FORME) initiative is working to support growth in the sector to \$12 billion in economic output by 2025 by identifying new market and technological opportunities to revitalize and diversify Maine's forest economy and communities. An integral part of this effort is to assess the current state of workforce needs and constraints in the forest product sector to enable growth.

This analysis is largely an update from an earlier report prepared in 2018 by the Center for Business and Economic Research (CBER) at the University of Southern Maine (USM). That report was prepared as a first step in providing a current understanding of the workforce and labor market conditions related to the forest economy. This report provides a general overview of labor market conditions in Maine and its regions followed by a review of industry employment and characteristics of the forest products sector. The report provides an occupational and skill analysis for jobs that are specific to the forest product sector which is followed by an analysis of recent trends in job demands for the sector. Lastly, we provide a summary of the workforce in supporting supply chain industries, such as transportation and shipping and projections for the potential mass timber (cross laminated timber) industry in Maine.

Report Methodology

For the purposes of this analysis we use a definition of the sector based upon the North American Industrial Classification System (NAICS) used by Anderson and Crandall (2017) and previous iterations of economic impact studies of the forest products sector. Throughout this report, we use the forest economy and the forest products sector interchangeably to refer to generally the same thing. The sector is broken down into three primary subsectors: harvesting, pulp and paper manufacturing, and wood product manufacturing. The analysis also considers critical supply chain industries, such as transportation, as well as other smaller forest products industries such as biomass energy generation.

Data used in this analysis are drawn from the EMSI 2020.4 dataseries, unless otherwise noted. Collectively, EMSI provides a wide array of labor market information that helps provide a robust overview of the employment, occupations, and skills in the FPS. EMSI draws upon several public data sources to produce estimates, including the US Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW), Occupational Information Network (O*Net), and Occupational Employment and Wages (OES), and US Census Non-Employer Statistics and the American Community Survey. Employment estimates include QCEW, non-QCEW, and self-employed persons. EMSI also uses proprietary methods to produce estimates of occupational demands and job postings.

¹Anderson III, James L. and Mindy S. Crandall. 2016. Economic Contributions of Maine's Forest Products Industry in 2014, with adjustments to 2016.

Structure of Report

The report that follows is organized into four sections:

Sector Employment provides a broad overview of employment in the Forest Products Sector compared to the rest of the state, the nation and some extent by county. The initial analysis is conducted using 30 six-digit North American Industry Classification System (NAICS) codes that define the FPS.

Occupational Employment provides a detailed look at employment, wage and typical skill level & educational requirements for two groups of occupations within the FPS. They are grouped between specialized occupations and non-specialized occupations (by employment level). Like most industries there are typically a core group of workers and skills that are specialized to a particular industry and not prevalent in others. Likewise, many occupations such as administrative or business operations jobs, require skills that are adaptable across most industries and are not specialized to the forest product sector. It is important to have an understanding of the occupational composition of an industry to identify those jobs and skills that are specialized, particularly for workforce development and training programs.

Specialized Occupations are jobs that require skill and knowledge sets that are mostly found in the forest products sector and subsectors. These are also the jobs that sector firms are most reliant upon for core operations and production. They are defined as occupations with 40% or more of their overall employment in the FPS, and have 30 or more employees within a detailed occupation in the FPS. Throughout this report specialized occupations and most concentrated occupations are used interchangeably and refer to the same group.

Non-specialized Occupations are comprised of jobs that are more commonly found across all multiple industries, including forest products. This includes jobs such as accountants and other front office jobs, general laborers, and helpers.

Standard Occupational Classification (SOC) codes are used to identify detailed occupations within the FPS. Employment and median wage figures are specific to the given occupation in Maines FPS – such figures will differ by industry. Typical skill levels and educational requirements are drawn from the US BLS Occupational Information Network (O*Net). These data are limited in that they provide occupational information from a national sample for those occupations across all industries. As a result, these data do not necessarily take into account differences in regional industry specific occupational requirements that may exist. Still these data provide a strong foundation from which to understand how occupational requirements and characteristics may differ.

Occupations and Skills in Demand. Based on occupations included in the two groups, we provide insight into the difficulties businesses face when it comes to hiring and highlight the top skills businesses seek compared to those available to the workforce. This information is based on EMSI's job posting data which is collected from various sources and processed and enriched by CareerBuilder. Job posting data includes posting intensities which serve as a proxy to business demand by showing the effort businesses are putting into hiring. We also highlight in-demand skills, also from EMSI's job postings data, which provides insight to the skills workers have (supply) compared to the skills businesses need (demand).

Employment Trends

As of 2020, Maine is home to 1.3 million people, an increase of 1.4% over the last 5 years though slower growth than the national average (3.0%). With a median age of 45, Maine has the oldest population nationwide, a particular challenge for the state's workforce as more baby boomers retire. Despite demographic challenges, from '15 to '20 employment increased from 687.5K to 714.7K in the state, a 4.0% increase (27,206 jobs) in line with the national average, but before the impacts of the pandemic impacted the state economy. Most of this growth is concentrated in healthcare/social services and professional and technical services. Hospitality and tourism was also a significant driver of employment growth through 2019 but has been most severely impacted by the pandemic. While overall workforce conditions continue to improve, a long-term decline in the manufacturing industry – and goods-producing industries – and an increase in more service-related industries, in the state and nationwide, have shifted employment and thus the skills and knowledge needed for today's workforce.





Note: November 2020, not seasonally adjusted

Forest Products Sector Employment

Employment & Industry growth

Regional concentration

Trends in annual median wage

Employment and Growth

Forest Product Sector (FPS) employment in Maine has fallen by 47 percent since 2001. Employment has largely tracked nationwide employment losses over this period until 2013, where Maine diverges from trends nationwide (Figure 2). After a steadying of employment trends in 2009, jobs losses in Maine have accelerated since 2013, while US employment has remained steady. The emergence of the coronavirus pandemic and the loss of a pulp digestor in Jay in April of 2020 have likely pushed employment losses somewhat lower*.

Despite these declines, forest products remains a critical sector in the state and accounts for a sizeable number of jobs across the state. The largest number of sector jobs are found in Aroostook County (2,037) followed by Somerset (1,888), Oxford (1,457), Androscoggin (1,323), and Franklin (1,290) County (Map 2).



Figure 2: Employment growth





* Employment data for 2020 are not yet available at the time of writing.

FPS Industries and Growth

For the purposes of this overview, the FPS is divided into four subsectors which comprise various components of the value chain. These include paper manufacturing– the largest source of employment in the sector – closely followed by wood products manufacturing, harvesting and wood furniture manufacturing. Since 2001, the FPS lost 12,406 jobs or 48% (Table 2), driven largely by job losses in paper manufacturing sector following closures at several mills in the state. This has had implications for the closely connected supply chain components employment with the loss of local markets for wood, such as logging and transportation. The harvesting subsector makes up a smaller (26%), but significant share of the workforce. This subsector has remained steady relative to others in the FPS, but employment has slowly declined since 2001 (22%), in part a result of mechanization and reduced demand during the period. While all subsectors have experienced long-term job losses, there had been some signs of leveling off in the harvesting and pulp and paper subsectors in recent years prior to 2020.

		Emp. Change Since 2001		Emp. Change Since 2017	
Subsector/Industry	Employment, 2019	Number	Percent	Number	Percent
Harvesting	3,624	(1,019)	-21.9%	89	3.0%
Paper Manufacturing	4,586	(7,673)	-62.6%	162	4.0%
Pulp, Paper, and Paperboard Mills	3,277	(6,935)	-67.9%	179	6.0%
Converted Paper Product Manufacturing	1,309	(739)	-36.1%	(17)	-1.0%
Wood Furniture	879	(593)	-40.3%	(43)	-5.0%
Wood Product Manufacturing	4,518	(3,100)	-40.7%	(296)	-6.0%
Veneer, Plywood & Engineered Wood Product	481	(667)	-58.1%	(158)	-25.0%
Other Wood Product Manufacturing	1,819	(1,895)	-51.0%	(248)	-12.0%
Sawmills and Wood Preservation	2,059	(562)	-21.4%	(49)	-2.0%
Forest Products Industry Total	13,718	(12,406)	-47.5%	(146)	-1.0%

Table 2: FPS Industries and Growth

Note: **Bold** indicates subsector. Despite growth in the paper manufacturing industry over the period (see Table 2) the industry continues to suffered more job losses. As of January 2021, 177 employees have lost their jobs due to a paper digester explosion in April of 2020 at Pixelle Specialty Solutions paper mill in Jay (Mainebiz, 2021).

Employment Growth by Maine County, 2001-19

Map 3: Employment Change, '01-'19



Job losses have been severe statewide, but some regions have experienced the most significant losses.

The largest number of job losses were felt in Penobscot (-2,714), followed by the rim counties of Oxford, Aroostook, Franklin, and Somerset (Map 3, left).

As a share of employment, Hancock (-87.6 percent) and Penobscot (-70.2 percent) Counties lost the greatest percentage of FP employment base (Map 4, right).

Map 4: Employment Percentage Change, '01-'19



Map 5: FPS Regional Concentration, 2019

Regional Concentration of the FPS

Industry concentration. Despite job decline, Maine's FPS still has a strong competitive advantage relative to the nation, as measured by the concentration of employment using location quotients (see below call out). Map 5 shows the FPS in most Maine counties is more concentrated than the nation (value greater than 1 – see below note). As a share of the county employment base in 2019, the sector is most concentrated in Somerset and Franklin counties, which are 15 times more concentrated than the nation. The rim counties of Oxford and Aroostook are close behind with very high rates of concentration.

Overall, the sector serves as an important economic base in virtually every county of the state with the exception of a few coastal counties.

Measuring concentration with location quotients. Concentration or location quotient (LQ) is a way to compare how specialized a region is to a larger reference region according to the number of people employed. An LQ of 1.0 indicates the region and the nation are equally specializing in a given industry; while an LQ of 0.8 means that the region has a lower concentration than the nation. An LQ of 1.2 or higher is considered highly concentrated.



Regional Subsector Concentration by County

Map 6: Paper Manufacturing



While employment in the FPS overall is concentrated in 13 of the state's 16 counties, regional concentration tells us which regions are reliant on particular subsectors, where the jobs are located, and how they differ across regions and subsectors.

Concentrated and distributed throughout the rim counties, employment in **paper manufacturing** is nearly 25 times more concentrated in Franklin County than in the nation, followed by Somerset and Washington County (Map 6, left).

Unsurprisingly, **harvesting** is the most highly concentrated subsector within the FPS given the location of forest resources. Harvesting is between 33 to 40 times more concentrated in the rim counties of Aroostook, Piscataquis, Somerset, Franklin and Oxford Counties, while Washington and Penobscot Counties also boast high concentrations of harvesting (Map 7, right).

Map 7: Harvesting



Regional Subsector Concentration by County

Map 8: Wood Products Manufacturing



Employment in **wood products manufacturing** is most concentrated in rim counties, with the exception of Washington County. This industry is around 12 times more concentrated in Aroostook and Oxford County, and nearly 11 times more concentrated in Somerset and Piscataquis County, when compared to the nation (Map 8, left).

Wood furniture is more comparative to the nation and is least concentrated relative to other FPS subsectors. Largest employment concentrations in wood furniture is in Knox and Waldo County (Map 9, right).

Map 9: Wood Furniture



Earnings and Wages

Relative to the nation, the average annual wage was slightly higher in Maine's FPS but varied by industry subsector (Figure 4). Workers in the pulp and paper subsector earned well above the annual average wage in Maine's FPS but were slightly lower compared to the nation (Figure 4). On average, annual wages differed the most for industries within the wood products manufacturing sector. Workers in the veneer, plywood & engineered wood products industry earned a little over \$8k more than their national counterparts while workers in other wood product industries earned nearly \$8k less. The average wage in Maine's FPS dropped by 3 percent since 2001 (Figure 5), driven in part by the loss of high earning jobs in paper manufacturing. At the same time, Maine's statewide annual wage increased by 12 percent to \$56,020 in 2019; and the nations FPS average wage increased by 6%.







Figure 5: Trend in Annual Average Wage (2019 \$)

Occupations

Specialized occupation and non-specialized occupation groups defined and overview Regional employment growth by occupation group Job posting In-demand skills

Occupational Groups Defined

A focus of this report is on the occupational skills specialized to the FPS and top employed occupations. To determine which detailed occupations are most concentrated in the FPS, and therefore specialized to the industry, we calculate employment in the FPS as a percentage of total occupational employment. Occupations with 40 percent or more of total employment in the FPS, and employ 30 or more workers are included in an occupation group called "specialized occupations", or occupations that are most specific to the FPS. Occupations that are more common across multiple industry sectors and are not specific to the FPS are included in a second occupational group, referred to as "non-specialized occupations." We show non-specialized occupations with the largest employment levels in the FPS.

By identifying occupations that are specialized to the sector, we are able to better identify skills and training needs that are also more likely specific to the FPS1. Occupations that are not necessarily specialized to the FPS but still make up a large share of employment in the sector, may have skills and training needs that transcend industries and may have less demand for tailored workforce development and training programs. Specialized occupations employ 33% of the FPS workforce and are primarily employed as general labor, transport, & support occupations followed by skilled production & trades, forestry & forest sciences, and engineering, science, & technical.

¹ To get a better sense of the amount of effort or time typically required for jobs specialized in Maine's FPS we consider several measures of job preparation – including level of education, work experience, and on-the-job-training, as well as industry specialization – to assign each occupation to a level of preparation (Table 2, right). Each preparation measure is assigned a score that is summed and then used to group into preparation category. Greater emphasis is placed on the typical on-the-job training score – for both specialized and non-specialized occupations – since it is occupation-specific rather than job-specific, which helps account for regional/industry specific needs of Maine's FPS.

Table 2: Preparation for Maine's ForestProducts Industry Jobs

Job Preparation Group	Level
Little or No Preparation	*
Some Preparation	**
Medium Preparation	***
Considerable	****
Preparation	
Extensive Preparation	*****

Specialized Occupations

Employment. Since these occupations are highly concentrated within the FPS, their growth or decline is closely related to its respective industries. Since 2001 employment declined by 42% in specialized occupations, yet job decline started to level off from the 2017 period (-2.5%). Given the recent number of paper mill closures, production occupations primarily found in the paper manufacturing industry, such as paper goods machine setters, have seen the greatest decline over the time-period. Meanwhile, occupations related to wood products manufacturing or harvesting, including logging equipment ops. or forestry supervisors have experienced less decline or and increase.

Median hourly wage. Wages vary from as low as \$11.02 for woodworkers (all other) to as high as \$26.28 per hour for foresters. Some occupations pay above the state and national median wage, \$18.36 and \$19.14 respectively.

Education, training, and experience. Job preparation levels are rated on average of 3 stars, primarily as a result of moderate on-the-job training demands. Formal education and previous work experience are typically not required for these occupations, except for foresters. Millwright workers require more on-the-job training and pay a higher wage – previously concentrated in paper manufacturing – workers are now more concentrated in wood products manufacturing and have experienced an increase 5.6% since 2017. Of course, these do not speak to the specific worker requirements of FPS firms and should not be assumed to be completely reflective of the needs of local firms. This information should be verified directly with FPS employers.

Table 3: Employment, wage & typical job experience & preparation, 2019

Occupation Group	Detailed Occupation	Emp. 2019	Emp. % Change from 2017	Median Hourly Wage	Job Preparation Level	Typical Measures of Job Preparation ¹
Engineering, Science, & Technical	Foresters	113	48.0%	\$26.28	***	Bachelor's degree None None**
Forestry & Forest Sciences	First-Line Supervisors (Forestry Workers)	367	28.8%	\$24.12	***	H.S./G.E.D ≤5 years None**
	Forest & Conservation Workers	71	-18.1%	\$15.84	***	H.S./G.E.D None Moderate*
	Log Graders & Scalers	46	-18.4%	\$18.78	***	H.S./G.E.D None Moderate
General Labor,	Logging Equipment Operators	1,721	7.2%	\$17.66	***	H.S./G.E.D None Moderate
Transport, & Support	Woodworking Machine (Setters, Operators & Tenders)	572	-5.8%	\$14.61	***	H.S./G.E.D None Moderate
	Sawing Machine (Setters, Operators & Tenders)	560	-25.2%	\$16.82	***	H.S./G.E.D None Moderate
	Cabinetmakers & Bench Carpenters	346	-2.6%	\$18.58	***	H.S./G.E.D None Moderate
	Machine Feeders & Offbearers	133	-4.6%	\$14.31	*	No formal cred. None Short
	Fallers	109	-21.8%	\$17.44	***	H.S./G.E.D None Moderate
	Logging Workers (All Other)	88	15.1%	\$14.22	***	H.S./G.E.D None Moderate
	Woodworkers (All Other)	76	1.1%	\$11.02	***	H.S./G.E.D None Moderate
Skilled Production & Trades	Stationary Engineers & Boiler Operators	157	9.0%	\$22.93	***	H.S./G.E.D None Long
	Millwrights	151	5.6%	\$25.18	****	H.S./G.E.D None Apprentice-ship
	Cutting & Slicing Machine (Setters, Operators & Tenders)	113	-20.9%	\$18.23	***	H.S./G.E.D None Moderate
	Utility/Furnace (Operators & Tenders)	39	-9.6%	\$19.68	***	H.S./G.E.D None Moderate
	Adhesive Bonding Machine (Operators & Tender)	32	-64.1%	\$16.42	***	H.S./G.E.D None Moderate
		4,694	-2.5%			

¹Measures of job preparation include: Typically required education, work experience, and on-the-job-training. An occupation denoted with an asterisk is considered knowledge (*) or technology-knowledge (**) intensive.

Non-specialized Occupations (top)

Occupations in this grouping include several production oriented jobs that are found across a variety of manufacturing and production oriented industries.

Employment and Wages. Since 2001 employment has declined significantly (46%), like FPS specialized occupations reflect the steep declines in paper manufacturing. Half of these occupations pay a wage equal or above Maine's median wage (\$16.58) and nearly half pay a wage equal or above the Nation's median wage (\$17.36).

Education, training & experience. Many of these occupations have relatively low barriers to entry in terms of the typical education or training required. Overall, the FPS employed more low-skill/education workers, most typically require employees to have a high school diploma or less, little to no work experience and expect to provide some on the job training.

A listing of top occupations (specialized and non-specialized) by subsector is located in the Appendices Tables A2 - A5.

Table 4: Employment, wage & typical job experience & preparation, 2019

Occupati on Group	Occupation Name	Emp. 2019	Emp. % Change from 2017	Median Hourly Wage	Job Preparation Level ¹	Typical Measures of Job Preparation ²
Business	General & Operations Managers	239	-7.40%	\$39.74	****	Bachelor's degree ≥ 5 years None**
	Office Clerks (General)	205	1.80%	\$16.71	*	H.S./G.E.D None Shore
	Ship, Receive & Inventory Clerks	152	15.40%	\$16.76	*	H.S./G.E.D None Shor
	Secretaries & Administrative Assistants	143	-21.66%	\$18.04	*	H.S. diploma None Shor
Operations	Industrial Production Managers	134	-3.88%	\$45.16	****	Bachelor's degree 5 years or more None
	Bookkeeping, Accounting & Auditing Clerks	125	0.82%	\$18.39	***	Some college, no degree None Moderate
	Heavy & Tractor-Trailer Truck Drivers	695	-4.10%	\$19.34	**	Postsecond nondegree award None Short
Conoral	Industrial Truck & Tractor Operators	575	32.50%	\$17.35	*	No formal edu, cred. None Shor
Labor	Production Workers (All Others)	488	16.50%	\$14.97	**	H.S./G.E.D None Moderate
Labor, Transport,	Miscellaneous Assemblers & Fabricators	474	-3.20%	\$17.21	**	H.S./G.E.D None Moderate
& Support	Production Work Helpers	346	-10.00%	\$15.11	*	H.S./G.E.D None Shor
	Laborers & Freight, Stock & Material Mover	336	-0.60%	\$13.67	*	No formal cred. None Short
	Supervisors (Production & Op.)	439	-3.40%	\$30.94	**	$H.S./G.E.D \le 5$ years None
	Industrial Machinery Mechanics	352	4.40%	\$24.43	***	H.S./G.E.D None Long
	Carpenters	238	-4.70%	\$19.95	***	H.S./G.E.D None Apprenticeship
	Maintenance & Repair Worker	214	0.60%	\$18.45	**	H.S./G.E.D None Moderate
Skilled Production & Trades	Electrical & Electronics Repairers	149	-13.10%	\$26.91	****	Postsecond nondegree award None Long
	Electricians	137	44.41%	\$26.17	***	H.S. diploma None Apprenticeship
	Package/Fill Machine (Operator & Tender)	117	-17.82%	\$16.53	**	H.S. diploma None Moderate
	Extrude/Form/Compact Machine (Setters, Operators & Tenders)	115	-9.00%	\$17.55	**	H.S. diploma None Moderate
		5,674	1.0%			

¹The level of job preparation needed for non-specialized occupations do not include a measure of FPI industry specialization. ²Measures of job preparation include: Typically required education, work experience, and on-the-job-training. An occupation denoted with **an** asterisk is considered knowledge (*) or technology-knowledge (**) intensive.

Occupational Demands Reflected in Online Job Postings

To understand which occupations are in highest demand by county, and the skills they require we use online job-posting data. We use average posting intensities which serve as a gauge of industry demand for certain types of jobs and skills. This information provides insight into the difficulties businesses face when it comes to hiring. A job posting intensity equal to 6:1 – statewide average for all occupations – indicates businesses are putting in average effort when it comes to hiring. A posting intensity greater than 6:1 suggests businesses are trying harder to find qualified employees, less than 6:1 means the opposite.

Map 12: Average posting intensity*



Statewide, specialized occupations had a 5:1 posting intensity indicating employers did not having a difficult time hiring, yet this differed by region. Businesses appeared to have a harder time finding employees in Penobscot Cumberland Countv and (Map 12). Occupations related to wood product manufacturing were in highest demand followed by paper manufacturing, despite decline in overall employment in the sector (Table 5).

It should be noted that this data is limited to jobs posted online, and given the nature of industry recruitment, likely is not a complete picture of sector demands. Still, this information provides a sense of the types of jobs employers are currently seeking.

Table 5: Posting intensity by occupation

Occupation	Posting Intensity (Jan 2018 - Dec 2020)
Logging Workers, All Other	18
Stationary Engineers and Boiler Operators	5
Forest and Conservation Workers	4
Foresters	3
First-Line Supervisors (Farming, Fishing & Forestry)	3
Millwrights	3
Sawing Machine Setters, Operators & Tenders, Wood	3
Furnace, Kiln, Oven, Drier & Kettle Operators/Tenders	3
Adhesive Bonding Machine Operators/Tenders	3
Cutting and Slicing Machine Setters, Operators & Tender	2
Machine Feeders and Offbearers	2
Cabinetmakers and Bench Carpenters	2
Logging Equipment Operators	2
Log Graders and Scalers	2

Average Job Postings for Non-specialized Occupations

Statewide, businesses appear to be having a harder time hiring for these occupations (7:1 posting intensity), similar by region. Businesses in Penobscot, Kennebec and York appear to be having an even harder time hiring for these positions than in Piscataquis and counties in Northern Maine (Map 13). Some of this difficulty can be explained by long-term population demographic trends, including declining natural growth rates (births versus deaths), and shifts in labor force participation. Job posting intensity by occupation shows that businesses had a harder time hiring carpenters, truck drivers and team assemblers, and production workers (Table 6).

Map 13: Average posting intensity*



Table 6: Posting intensity by occupation

	Posting
	Intensity (Jan
	2018 - Dec
Occupation	2020)
Laborers and Freight, Stock, and Material Movers, Hand	7
Industrial Machinery Mechanics	7
First-Line Supervisors of Production and Operating Workers	6
Production Workers, All Other	6
Industrial Truck and Tractor Operators	6
Maintenance and Repair Workers, General	5
Sales Reps, Wholesale/Manufacturing	5
HelpersProduction Workers	5
Carpenters	5
Shipping, Receiving, and Inventory Clerks	5
Miscellaneous Assemblers and Fabricators	5
Electrical & Electronics Repairers, Commercial/Industrial Equip.	5
General and Operations Managers	4
Heavy and Tractor-Trailer Truck Drivers	3

Resources

Includes several sections: NAICS codes that define the FPS, detailed occupation data by subsector, and lastly, we cover a few key industries that supply important inputs to the forest products industry in Maine and discuss the core occupations in each.

Defining the Forest Products Sector

Table A.1: Forest Products Sector (FPS) 4 and 6-digit NAICS Codes

			NAICS
FPI Subsector	Industry /NAICS code	Detailed Industry	code
Harvesting	Harvesting	Logging	1133
		Support Activities for Forestry	1153
		Timber Tract Operations	1131
		Forest Nurseries and Gathering of Forest Products	1132
Paper	Converted Paper Product	All Other Converted Paper Product Manufacturing	322299
Manufacturing	Manufacturing (3222)	Sanitary Paper Product Manufacturing	322291
		Stationery Product Manufacturing	322230
		Paper Bag and Coated and Treated Paper Manufacturing	322220
		Other Paperboard Container Manufacturing	322219
		Corrugated and Solid Fiber Box Manufacturing	322211
	Pulp, Paper, and	Newsprint Mills	322122
	Paperboard Mills (3221)	Paper (except Newsprint) Mills	322121
		Pulp Mills	322110
Wood Furniture	Wood Furniture	Nonupholstered Wood Household Furniture Manufacturing	337122
		Wood Kitchen Cabinet and Countertop Manufacturing	337110
		Custom Architectural Woodwork and Millwork Manufacturing	337212
Wood Product	Other Wood Product	All Other Miscellaneous Wood Product Manufacturing	321999
Manufacturing	Manufacturing (3219)	Prefabricated Wood Building Manufacturing	
		Wood Container and Pallet Manufacturing	321920
		Other Millwork (including Flooring)	321918
		Cut Stock, Resawing Lumber, and Planing	321912
		Wood Window and Door Manufacturing	321911
	Veneer, Plywood &	Reconstituted Wood Product Manufacturing	321219
	Engineered Wood Product	Truss Manufacturing	
	Manufacturing (3212)	Hardwood Veneer and Plywood Manufacturing	
	Sawmills & Wood	Wood Preservation	321114
	Preservation (3211)	Sawmills	
Harvesting Subsector Top Occupations (specialized and non-specialized)

Table A.2: Harvesting

			07	% of Jobs	Madian	Job Preparation		
		Fmp	% Change	In 10tal	Hourly	Level	Typical Measures of Job	
SOC	Description	2019	(2017 _19)	Group	Farning		Preparation	Occupation Group
45-4022	Logging Equipment	1 653	70/0	45 7%	\$17.66	Medium	H S /G E D None Moderate	General Labor
43-4022	Operators	1,055	770	ч3.770	ψ17.00	Preparation		Transport & Support
53-3032	Heavy & Tractor-Trailer	494	(5%)	13.7%	\$19.34	Some Preparation	Postsecond pondegree	General Labor
<u>55 5052</u>	Truck Drivers	<u>121</u>	<u>_(370)</u>	<u>15.770</u>	<u> </u>	bonne i reparadoni	award None Short	Transport & Support
45-1011	First-Line Supervisors	363	29%	10.1%	\$24.12	Some	H.S./G.E.D.Less than 5	Forestry and Forest
10 1011	(Forestry Workers)	000	_,,,,	1011/0	¥ = 111 =	Preparation	vears None**	Sciences
45-4021	Fallers	105	(25%)	2.8%	\$17.44	Medium	H.S./G.E.D None Moderate	General Labor.
			()	,.	+	Preparation		Transport, & Support
45-4029	Logging Workers (All	88	15%	2.4%	\$14.22	Medium	H.S./G.E.D None Moderate	General Labor,
	Other)				·	Preparation		Transport, & Support
49-3042	Mobile Heavy Equipment	<u>85</u>	(4%)	<u>2.3%</u>	<u>\$20.64</u>	Medium	H.S./G.E.D None Long	Skilled Production and
	Mechanics					Preparation		Trades
19-1032	Foresters	77	71%	2.1%	\$26.28	Some	Bachelor's	Engineering, Science,
						Preparation	degree None None*	& Technical
45-4011	Forest & Conservation	71	(16%)	2.0%	\$15.84	Some	H.S./G.E.D None Moderate	Forestry and Forest
	Workers					Preparation	*	Sciences
51-9199	Production Workers (All	48	8%	1.4%	\$14.97	Some Preparation	H.S./G.E.D None Moderate	General Labor,
	Others)							Transport, & Support
53-7062	Laborers & Freight, Stock &	41	(10%)	1.1%	\$13.67	Little or No	No formal cred. None Short	General Labor,
	Material Mover					Preparation		Transport, & Support
51-7041	Sawing Machine (Setters,	34	(11%)	0.9%	\$16.82	Medium	H.S./G.E.D None Moderate	General Labor,
	Operators & Tenders)					Preparation		Transport, & Support
47-2073	Operating Engineers & Other	29	45%	0.8%	\$20.47	Some Preparation	H.S./G.E.D None Moderate	Skilled Production and
	Construction Equip.Operators							Trades

Bold occupations are specialized in FPS and mostly found in harvesting sector (50% or more). Occupations that are underlined are not specialized in the FPS but mostly found in harvesting sector.

Paper Manufacturing Subsector: Top Occupations (specialized and non-specialized)

Table A.3: Paper Manufacturing

SOC	Description	Emp. 2019	% Change (2017 -19)	% of Jobs in Total Industry Group	Median Hourly Earnings	Job Preparation Level	Typical Measures of Job Preparation	Occupation Group
<u>51-9199</u>	Production Workers (All Others)	<u>307</u>	<u>33%</u>	<u>6.7%</u>	<u>\$14.97</u>	Some	H.S./G.E.D None Moderate	<u>General Labor,</u> <u>Transport, & Support</u>
<u>49-9041</u>	Industrial Machinery Mechanics	<u>277</u>	<u>2%</u>	<u>6.1%</u>	<u>\$24.43</u>	Medium	H.S./G.E.D None Long	<u>Skilled Production and</u> <u>Trades</u>
<u>51-9198</u>	Production Work Helpers	<u>232</u>	<u>(8%)</u>	<u>5.1%</u>	<u>\$15.11</u>	<u>Little or No</u>	H.S./G.E.D None Short	<u>General Labor,</u> Transport, & Support
53-7051	Industrial Truck & Tractor Operators	230	32%	5.0%	\$17.35	Little or No	No formal cred. None Short	General Labor, Transport, & Support
<u>51-1011</u>	First-Line Supervisors (Production & Op.)	<u>228</u>	<u>7%</u>	<u>5.0%</u>	<u>\$30.94</u>	Some	H.S./G.E.D Less than 5 years None	Skilled Production and Trades
<u>49-9071</u>	Maintenance & Repair Worker	<u>142</u>	<u>5%</u>	<u>3.1%</u>	<u>\$18.45</u>	Some	H.S./G.E.D None Moderate	Skilled Production and Trades
<u>49-2094</u>	Electrical & Electronics Repairers	<u>137</u>	<u>(15%)</u>	<u>3.0%</u>	<u>\$26.91</u>	Considerable	Postsecond nondegree award None Long	Skilled Production and Trades
<u>51-8021</u>	Stationary Engineers & Boiler Operators	<u>129</u>	<u>16%</u>	<u>2.8%</u>	<u>\$22.93</u>	Medium	H.S./G.E.D None Long	Skilled Production and Trades
43-5071	Shipping, Receiving & Inventory Clerks	<u>111</u>	<u>22%</u>	<u>2.4%</u>	<u>\$16.76</u>	Little or No	H.S./G.E.D None Short	Business Operations
<u>51-9032</u>	Cutting & Slicing Machine (Setters, Operators & Tenders)	<u>109</u>	<u>(19%)</u>	<u>2.4%</u>	<u>\$18.23</u>	<u>Medium</u>	H.S./G.E.D None Moderate	<u>Skilled Production and</u> <u>Trades</u>
<u>51-9041</u>	Extrude/Form/Compact Machine (Setters, Operators & Tenders)	<u>102</u>	<u>(2%)</u>	<u>2.2%</u>	<u>\$17.55</u>	Some	H.S./G.E.D None Moderate	<u>Skilled Production and</u> <u>Trades</u>
<u>51-9012</u>	Separate/Filter/Clarify Machine (Setters, Operators & Tenders)	<u>98</u>	<u>(5%)</u>	<u>2.1%</u>	<u>\$22.04</u>	Some	H.S./G.E.D None Moderate	<u>Skilled Production and</u> Trades
53-7062	Laborers & Freight, Stock & Material Mover	98	0%	2.1%	\$13.67	Little or No	No formal cred. None Short	General Labor, Transport, & Support
11-1021	General & Operations Managers	96	9%	2.1%	\$39.74	Considerable	Bachelor's degree 5 years or more None**	Business Operations
<u>51-9111</u>	Packaging & Filling Machine (Operators &	<u>91</u>	<u>(12%)</u>	<u>2.0%</u>	<u>\$16.53</u>	Some	H.S./G.E.D None Moderate	Skilled Production and Trades

Occupations that are underlined are not specialized in the FPS but mostly found in Paper Manufacturing (50% or more). There are several occupations unique to paper manufacturing that do not show among the top occupations including, electricians, industrial engineers, Industrial Production Managers, Production, Planning & Expediting Clerks, and First-Line Supervisors of Mechanics. As well as several Skilled Production and Trades occupations including: Installers/Repairers/Inspecto rs/Testers etc. Samplers & Weighers, Printing Press Operators, Crush/Grind &

Polishing Machine (Setter, Operator & Tenders), and Mix & Blend Machine

(Setter, Operator & Tenders)

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Wood Furniture Manufacturing Subsector: Top Occupations (specialized and non-specialized)

Table A.4: Wood Furniture Manufacturing

SOC	Description	Emp. 2019	% Change (2017 -19)	% of Jobs in Total Industry Group	Median Hourly Earnings	Job Preparation Level	Typical Measures of Job Preparation	Occupation Group
51-7011	Cabinetmakers & Bench	239	(1%)	27.2%	\$18.58	Medium	H.S./G.E.D None Moderate	General Labor,
	Carpenters							Transport, & Support
51-2098	Miscellaneous Assemblers &	76	2%	8.5%	\$17.21	Some	H.S./G.E.D None Moderate	General Labor,
	Fabricators							Transport, & Support
47-2031	Carpenters	55	4%	6.3%	\$19.95	Medium	H.S./G.E.D None Apprenticeshi	Skilled Production and
							р	Trades
<u>51-7021</u>	Furniture Finishers	<u>50</u>	<u>16%</u>	<u>5.7%</u>	<u>\$14.98</u>	<u>Little or No</u>	H.S./G.E.D None Short	<u>General Labor</u> ,
								<u>Transport, & Support</u>
51-7042	Woodworking Machine	32	(24%)	3.6%	\$14.61	Medium	H.S./G.E.D None Moderate	General Labor,
	(Setters, Operators &							Transport, & Support
51-1011	First-Line Supervisors	32	(17%)	3.6%	\$30.94	Some	H.S./G.E.D Less than 5	Skilled Production and
	(Production & Op.)						years None	Trades
<u>51-6093</u>	<u>Upholsterers</u>	<u>18</u>	<u>42%</u>	<u>2.0%</u>	<u>\$13.76</u>	Some	H.S./G.E.D None Moderate	<u>General Labor,</u>
								<u>Transport, & Support</u>
11-1021	General & Operations	15	(19%)	1.7%	\$39.74	Considerable	Bachelor's degree 5 years or	Business Operations
	Managers						more None**	

Bold occupations are specialized in FPS and mostly found in Wood Furniture Manufacturing (50% or more). Occupations that are underlined are not specialized in the FPS but mostly found in Wood Furniture Manufacturing.

Wood Products Manufacturing Subsector: Top Occupations (specialized and non-specialized)

Table A.5: Wood Products Manufacturing

SOC	Description	Emp. 2019	% Change (2017 -19)	% of Jobs in Total Industry Group I	Median Hourly Earnings	Job Preparation Level	Typical Measures of Job Preparation	Occupation Group
51-7042	Woodworking Machine (Setters, Operators & Tenders)	527	(4%)	11.8%	\$14.61	Medium	H.S./G.E.D None Moderate	General Labor, Transport, & Support
51-7041	Sawing Machine (Setters, Operators & Tenders)	504	(26%)	11.0%	\$16.82	Medium	H.S./G.E.D None Moderate	General Labor, Transport, & Support
51-2098	Miscellaneous Assemblers & Fabricators	<u>356</u>	(4%)	<u>8.0%</u>	<u>\$17.21</u>	Some	H.S./G.E.D None Moderate	<u>General Labor, Transport, & Support</u>
53-7051	Industrial Truck & Tractor Operators	<u>319</u>	<u>33%</u>	<u>7.0%</u>	<u>\$17.35</u>	Little or No	No formal cred. None Short	<u>General Labor, Transport, & Support</u>
53-7062	Laborers & Freight, Stock & Material Mover	<u>185</u>	<u>2%</u>	<u>4.1%</u>	<u>\$13.67</u>	Little or No	No formal cred. None Short	General Labor, Transport, & Support
47-2031	Carpenters	<u>177</u>	<u>(11%)</u>	<u>4.0%</u>	<u>\$19.95</u>	Medium	H.S./G.E.D None Apprenticeship	Skilled Production and Trades
51-1011	First-Line Supervisors (Production & Op.)	174	(11%)	3.9%	\$30.94	Some	H.S./G.E.D Less than 5 years None	Skilled Production and Trades
53-3032	Heavy & Tractor-Trailer Truck Drivers	145	(4%)	3.2%	\$19.34	Some	Postsecond nondegree award None Short	General Labor, Transport, & Support
51-9199	Production Workers (All Others)	119	(8%)	2.6%	\$14.97	Some	H.S./G.E.D None Moderate	General Labor, Transport, & Support
51-7011	Cabinetmakers & Bench Carpenters	106	(6%)	2.4%	\$18.58	Medium	H.S./G.E.D None Moderate	General Labor, Transport, & Support
51-9198	Production Work Helpers	102	(13%)	2.2%	\$15.11	Little or No	H.S./G.E.D None Short	General Labor, Transport, & Support
11-1021	General & Operations Managers	99	(14%)	2.2%	\$39.74	Considerable	Bachelor's degree 5 years or more None**	Business Operations
49-9044	Millwrights	82	17%	1.8%	\$25.18	Considerable	H.S./G.E.D None Apprenticeship	Skilled Production and Trades
53-7063	Machine Feeders & Offbearers	77	(4%)	<u>1.7%</u>	<u>\$14.31</u>	<u>Little or No</u>	No formal cred. None Short	General Labor, Transport, & Support
51-7099	Woodworkers (All Other)	70	2%	1.5%	\$11.02	Medium	H.S./G.E.D None Moderate	General Labor, Transport, & Support
47-2111	Electricians	46	30%	1.0%	\$26.17	Medium	H.S./G.E.D None Apprenticeship	Skilled Production and Trades
51-9061	Inspectors/Testers/Sorters/Samplers & Weighers	45	(8%)	1.0%	\$21.53	Some	H.S./G.E.D None Moderate	Skilled Production and Trades
11-3051	Industrial Production Managers	37	(14%)	0.8%	\$45.16	Considerable	Bachelor's degree 5 years or more None	Business Operations
45-4023	Log Graders & Scalers	35	(11%)	0.8%	\$18.78	Medium	H.S./G.E.D None Moderate	Forestry and Forest Sciences

Bold occupations are specialized in FPS and mostly found in Wood Products Manufacturing (50% or more). Occupations that are underlined are not specialized in the FPS but mostly found in Wood Products Manufacturing .

Supply Chain (1 of 2)

The following slides highlight industries (Table A.6) that supply important inputs to the forest products industry in Maine. Since these industries are important to the success of FPS, the health of the workforce they employ is important as well.

General Freight and Specialized Freight Trucking. The transportation and warehousing industry is a key supplier to the forest products industry in Maine. Since 2011, employment in the two industries increased by 3% and 5%, respectively. However, employment in the state's general freight industry is expected to slightly decrease (6%) over the next decade while at the same time increasing nationwide, according to EMSI employment projections. The top occupations in the two industries overlap and include Heavy Tractor-Trailer Truck Drivers, Bus & Truck Mechanics/Diesel Engine Specialists, Dispatchers (except Police, Fire & Ambulance), and Laborers/Freight, Stock & Material Movers. Employment in these occupations has increased by 5% to 7%, since 2011. Over the next decade overall employment in the 'specialized freight trucking industry' is expected to slightly increase for the first few years and then remain flat. Locating and hiring qualified workers in these two industries, particularly truck drivers, has proven a significant challenge for the industry.

Rail Transportation. Employment in rail transportation has increased since 2011 and is expected to continue rising over the next 10-years. The top 3 occupations within this industry include Railroad Conductors and Yardmasters, Locomotive Engineers, and Railroad Brake, Signal & Switch Operators. Employment in these occupations has grown by 3% since 2011. There appears to be a mismatch in the supply of available workers hard/common skills, and what businesses are looking for, however, job posting activity for this industry is not easily captured by EMSI job posting services since federal jobs are typically not advertised through Career Builders or the sites used by EMSI.

Supply Chain (2 of 2)

Electric Power Generation, Transmission & Distribution. Industry employment decreased by 3% since 2011 and is expected to decrease (11%) over the next decade across the state. However, the top 3 occupations employed within this industry (Electrical Power-Line Installers and Repairers, Power Plant Operators, and Customer Service Representatives) have together increased by 3% since 2011. Employment for Customer Service representatives and Electrical Power-Line Installers & Repairers and are expected to increase over the next decade while power plant operators are expected to decline (23% or by 50 jobs). Businesses had an average (6:1) time hiring for these occupations.

Architectural, Engineering & Related Services. Industry employment increased by 10% since 2011 and is expected to increase over the next decade in both the state and nation. Even though, employment in the top 3 occupations (Civil Engineers, Architectural & Civil Drafters, and Surveying & Mapping Technicians) increased by 5% since 2011 employment for Architectural & Civil Drafters and Surveying & Mapping Technicians) increased by 5% since 2011 employment for Architectural & Civil Drafters and Surveying & Mapping Technicians is expected to decrease over the next decade while Civil Engineer occupations are expected to increase. From 2012 to 2017, and over the last year, businesses have put in an average amount of effort to hire for the three occupations (6:1). Since 2012, most of this is activity is for civil engineers (6:1) occupations but over the last year, most of this is activity is for architectural & civil drafters (7:1), suggesting they're now having a harder time than average hiring for this occupation.

					Employment
		Total	In-	Out of	change since
NAICS	Purchases from	Purchases	Maine	Maine	2017
4841	General Freight Trucking	\$64,488,844	67%	33%	0%
2211	Electric Power Generation, Transmission	\$58,411,190	58%	42%	-3%
4821	Rail Transportation	\$49,861,050	60%	40%	21%
5413	Architectural, Engineering & Related	\$23,391,107	58%	42%	5%
	Services				
4842	Specialized Freight Trucking	\$19,586,569	75%	25%	-4%

Table A.6: Top Industries in FPS Supply Chain

Appendix C: Replacement Labor Demand and Occupational Projections

Estimation Methods for Replacement Demand

This section provides the estimates of labor demands in the forest product sector over the next 15 years. Based on FOR/Maine target growth rates of 40%, this estimation focuses on two components. The first estimates the labor demand for replacement workers in the current industry composition, which assumes modest to flat growth over the forecast period. The second provides estimates of the magnitude of workforce demands in emerging technology industries, which we assume will account for virtually all of FOR/Maine's growth targets over the next 15 years.

Replacement Demand

Workforce demand projections for the existing industry structure are estimated based the age composition and economic forecast of for the current industry structure, workforce replacement demands for the core sub-sectors are projected across 2 scenarios; a base case that assumes constant output and labor productivity, and a second case that accounts for modest increases in labor productivity for the same level of output. The first scenario assumes current output and productivity levels are held constant. The second scenario assumes modest productivity improvements per unit of Labor. We assume 5% improvement in labor unit productivity during the intermediate time horizon. It is possible and likely that production and output levels will vary over the forecast as a result of various macro-economic, industry-specific, and market demand conditions change.

it is possible that productivity levels may increase at a faster rate. In fact we do expect to see significant investments in technology over the long term. Labor constraints should continue to pressure firms to invest in technology to replace labor. Over time, technology labor substitution will likely reduce labor requirements, while increasing labor productivity and wages. These scenarios assume relatively modest real growth in output of existing industries over the 10-year period. The vast majority of sector growth driving the FOR/ME targets are assumed to result from emerging technology industries. Any significant growth in the existing industries would likely have a proportional increase in labor demands presented here. No increase in productivity is assumed under transportation under either scenario. However, over the longer-term horizon as autonomous transportation emerges, there will be obvious implications for labor demands.

Replacements are estimated by sub-sector and including immediate needs and intermediate needs. Immediate needs refer to replacements likely to occur within the next 5 years due to the share of population expected to retire from the industry. Intermediate demands refer to Replacements likely to occur between 5 and 15 years due to the share of the workforce expected to retire from the industry. Estimates are reported for a range plus or minus 5% from the middle estimate. The forecasts relied on are derived from our economic model developed by Regional Economic Modeling Inc (REMI) and are considered a baseline forecast without addition of emerging technology industries.

Emerging Technology Growth Demand

We assume that the output and employment growth in the forest products sector will be sourced from emerging technology commercialization and operations in Maine. Because of uncertainty in which technologies will establish a commercial presence in Maine, emerging technology industries are excluded from the baseline forecast. However, there will likely be impact on existing value chain industry labor demand as emerging technologies take shape. We account for those labor demands under the emerging technology labor projections.

This section first starts with a review of the current age composition of the existing workforce as a predicate for estimating replacement demand. After presenting replacement demand projections, the composition of replacement demand occupations, skill sets, and specialization are discussed. Estimates for emerging technology labor demands follow, which includes an example of labor composition for a cross-laminated timber (CLT) firm. The section then turns to profiling the potential labor supply pools the industry can the form, both in-state and out-of-state.

Aging workforce will drive labor replacement demands

- By 2030 over 26% of the forest products workforce will have reached retirement age
- By 2035, 37% of workers will have reached retirement age
- Currently, almost 800 workers are over 65
- In most subsectors, there is inadequate numbers of younger entrants to replace
- Most urgent in harvesting and transportation
- Pulp & paper with most intense intermediate-term needs

Subsector Employment Share by Age Cohort



Workforce demand replacement projections under two scenarios

	Short-term	/Immediate	Medium-te	erm Horizon	Total targe	ting 2030-35
	Low	High	Low	High	Low	High
Harvesting	280	309	994	1,099	1,274	1,409
Pulp & Paper Manufacturing	127	141	1,614	1,784	1,742	1,925
Wood Product Manufacturing	215	238	906	1,002	1,121	1,239
Transportation*	93	103	263	291	356	394
Other	51	57	227	251	278	308
Forest Products Sector Total	767	847	4,005	4,427	4,772	5,274

Base Case Replacement Projections

Notes: Range is based on 5% confidence intervals. Units include full-time and part-time employment. Assumes no significant change to labor productivity over the projection period. Transportation refers to employment in supply chain and does not include FP firm transportation. Other refers to residual FP industry employment, including biomass.

/ · ·						
	Short-term	/ Immediate	Medium-te	erm Horizon	Total targe	ting 2030-35
	Low	High	Low	High	Low	High
Harvesting	274	303	895	989	1,169	1,292
Pulp & Paper Manufacturing	125	138	1,453	1,606	1,578	1,744
Wood Product Manufacturing	211	233	816	901	1,026	1,134
Transportation*	93	103	263	291	356	394
Other	50	56	204	226	255	281
Forest Products Sector Total	753	833	3,631	4,013	4,384	4,846

Modest Labor Productivity Imporoivement Case Replacement Projections

Notes: Range is based on 5% confidence intervals. Units include full-time and part-time employment. Assumes a 2% increase in labor productivity in the short-term and 10% increase in labor productivity over the 10 year intermediate period (excludes Transportation). Transportation refers to employment in supply chain and does not include FP firm transportation. Other refers to residual FP industry employment, including biomass.

Geography of Labor Demand: Concentration by County

Pulp & Paper Manufacturing



Wood Product Manufacturing



Harvesting / Logging



Harvesting jobs most specialized to that subsector; Pulp & Paper jobs are share more commonality with jobs across industries

Occupational Groupings by Subsector Industry



Share of Jobs Specialized (Unique) to Subsector



Top Occupations & Most Common Transferable Industries, by Subsector

Harvesting & Transport

Logging Equipment Operators Heavy and Tractor-Trailer Truck Drivers First-Line Supervisors Fallers Logging Workers, All Other Mobile Heavy Equipment Mechanics Foresters

Transferable industries

Sawmills & Other Forest Products Heavy Equipment Operations Construction Operators

Wood Product Mfg.

Machine Setters, Operators, and Tenders Sawing Machine Setters, Operators, Tenders Miscellaneous Assemblers and Fabricators Industrial Truck and Tractor Operators Laborers and Freight Movers First-Line Supervisors Heavy and Tractor-Trailer Truck Drivers

Transferable industries

Forest Products Ship & Boat Building Plastics Mfg. Residential Building Consruction

Pulp & Paper Mfg.

Production Workers, All Other Industrial Machinery Mechanics Various Machine Setters, Operators, and Tenders General Laborers & Freight Movers Industrial Truck and Tractor Operators Maintenance and Repair Workers

Transferable industries

Forest Products Ship & Boat Building Plastics Mfg. Warehouse & Storage Skill requirements are evolving; increased automation & technology will drive long-term trends

- Soft skills generally ranked highest
 - more tacit skills harder to teach and are often learned by doing
- Implies greater emphasis for apprenticeship internships, and applied learning
 - done in conjunction with 'in-classroom learning'
- Over the long-term, automation will replace some of current jobs but demand new ones and technologies
- Lost tacit knowledge from retirements



Emerging Technologies Labor Demands

- High degree of uncertainty around which technologies will land
- Most firms that locate in Maine will bring an initial cohort of skilled workers, and supplement with local labor
- Over time as processes and technology becomes more standardized, a need for a workforce pipeline & targeted training programs will emerge
- Expect upstream supply labor demands to increase
 - Harvesting and trucking
 - Depending on tech > Sawmills and/or Pulp & Paper, other

	Short-term	/Immediate	Ten Year Ho	orizon (2030)	То	tal
	Low	High	Low	High	Low	High
Emerging Technology Industries	274	303	895	989	1,169	1,292
Harvesting	125	138	1,453	1,606	1,578	1,744
Emerging Industries Total	660	730	3,368	3,722	4,028	4,452

CURRENT & EMERGING WOOD PRODUCTS -PULP AND PAPER SAWN TIMBER awn Timber will continue to be a critical componen of Maine's forest economy. Demand in the US is argely driven by the number of housing starts, which Pulp and Paper Manufacturing continues to be the lead expected to continue to strengthen. Lumber is the n contributing to Maine's forest economy. Maine's paper oundation of forest land ownership and the final mills are shifting production away from print media and product of long-term forest management into tissue, labeling and packaging grades of paper. ORIENTATED LAMINATED **STRAND BOARD (OSB) VENEER LUMBER (LVL)** prientated Strand Board (OSB) is an alternative to Laminated Veneer Lumber (LVL) is an engineered wood lywood. It is used extensively as a structural panel in product used in residential construction that uses nstruction. This technology is produced by two lavers of dried wood veneer. No manufacturing naior facilities in Maine currently exists in Maine MEDIUM DENSITY FIBERBOARD (MDF Medium Density Fiberboard (MDF) is a reconstituted wood-based panel product, manufactured from pulpwood and sawmill residues. Over the past 20 years, laminate flooring and modern furniture has become a major end Current Wood Products use for MDF. No manufacturing capacity exists in Maine CELLULOSIC SUGARS **CROSS-LAMINATED** Cellulosic sugars are a platform chemical for **IMBER** bioplastics such as Polylactic acid, Lactic acids which can be used as a preservative in food and beverages and Succinic acid which is used in resins and cross-laminated Timber is an engineered wood coatings.Cellulosicsugars are a platform chemical fo roduct that is especially well-suited for buildings etween 6-18 stories tall. It is very early in the growth bioplastics such as Polylactic acid, Lactic acids which can be used as a preservative in food and beverages, curve in North America and rapid growth is expected. and Succinic acid which is used in resins and coatings Two CLT facilities have announced they will be opening NANOCELLULOSE **PYROLYSIS OIL** Nanocellulose consists of incredibly light and strong Pyrolysis oil is a liquid fuel produced from wood, that can fibers that can be used in a variety of applications, from be used in heat and power production to substitute for coatings for packaging papers to high performance fossil-based-oil extiles and medical products. The University of Maine is obal leader in the R&D of nanocellulose application DISSOLVING PULP INSULATING WOOD FIBER Dissolving Pulp can be made into textiles (Viscose) and Insulating wood fiber composites is an alternative competes with cotton and synthetics (nylon and based insulating product for homes acrylic). There are no facilities with this capability rently in Maine **Emerging Wood Products**

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Mass Timber Labor Requirements: Expected job category breakdown of a CLT facility/industry



Example business critical occupations:

- Adhesive Bonding Machine Operators & Tenders
- Woodworking Machine Setters, Operators, & Tenders
- Sawing Machine Setters, Operators, & Tenders
- Wood Assemblers and Fabricators
- Industrial Machinery Mechanics
- Log Graders and Scalers
- Drafters & Architects
- Engineers & Engineer Technicians

Example education and job training entry level credentials of CLT business critical occupations





Appendix D: Forest Products Sector Sources of Labor Supply

Sources of Labor Supply / Labor Pools

Core target groups

- In-state youth and secondary school students/graduate pipeline
- In-state post-secondary/certification graduates (community colleges, universities, etc.)
- Short-term displaced workers / transferable industries
- Youth entrants in New England region
- Competitor US regions looking for compatibility, scale, and competitive advantage
- Transient populations military transitions

Other populations to consider

- In-state long-term displaced workers
- Formerly incarcerated

Emphasize targeting groups disproportionately represented in current workforce

- Female population
- Diversity of populations

Supply: In-state youth pipeline will continue to decline in most regions across the state, following demographic shifts; competition for shrinking pool of labor across industries

Youth Population Growth Projections





- Emphasis of education system on post-secondary educational attainment
- Career opportunities are overlooked

Labor Supply

CTE HS Locations

Northern New England CTE Programs

Program	Maine	Massachusetts	New Hampshire	Vermont
Natural Resources	183	1,501	249	281
Architecture & Construction	1,127	5,184	676	331
Manufacturing	969	2,000	610	250
STEM	258	5,651	415	140
Transportation, Distribution,	852	2,373	609	355
& Logistics				
Total 2019 CTE enrollment	3,389	16,709	2,559	1,357

- Career & Technical Education (CTE) program enrollment in northern NE show scale of labor pool potential
- Few forestry specific programs exist outside of Maine; manufacturing, building, and other skilled trade programs are in more abundance.



Transient Populations: Military to Civilian Transitions

- Approximately 200,000 US service members transition to civilian life every year
- Seek employment opportunities, quality of life, support services, and other amenities
- Maine hosts some of highest percentages of veteran populations in the country
- Sector businesses view ex-service members as being closely aligned with qualities they seek in their workforce





Harvesting/Logging Top US Competitor Regions

Employment in Forestry Cluster by County, 2017

Forestry & Logging (113)				
			Average	
	Employment	Growth	Annual	
County, State	level	Rate	Wage	Targeted
Douglas County, Oregon	884	-5.2%	\$48,099	*
Lane County, Oregon	667	-9.0%	\$53 <i>,</i> 482	*
Aroostook County, Maine	574	8.5%	\$49 <i>,</i> 066	
Coos County, Oregon	465	-12.6%	\$53 <i>,</i> 549	*
Penobscot County, Maine	454	-7.3%	\$48,887	*
Cowlitz County, Washington	447	-24.2%	\$69 <i>,</i> 603	*
Lewis County, Washington	425	-9.6%	\$60,787	*
Linn County, Oregon	414	-0.5%	\$54,904	*
Humboldt County, California	382	27.3%	\$63 <i>,</i> 480	
Clallam County, Washington	380	5.8%	\$56 <i>,</i> 050	
Jackson County, Oregon	358	-11.2%	\$49,237	*
Winn Parish, Louisiana	346	-9.7%	\$45 <i>,</i> 853	*
Georgetown County, South Caroli	r 326	-6.9%	\$51,077	*
Shasta County, California	304	2.4%	\$57,226	

BLS QCEW Annual Private Employment (2016, 2019)



Wood Product Mfg. Top US Competitor Regions

Wood Product Manufacturing (321)

			Average	
	Employment	Growth	Annual	
County, State	level	Rate	Wage	Targete
Maricopa County, Arizona	3,573	7.2%	\$47,344	
Lane County, Oregon	3,566	7.9%	\$55 <i>,</i> 550	
Elkhart County, Indiana	3,500	8.9%	\$49 <i>,</i> 780	
Douglas County, Oregon	3,076	2.5%	\$53 <i>,</i> 379	
Los Angeles County, California	2,988	-3.0%	\$45,931	*
Dallas County, Texas	2,878	25.2%	\$48,160	
Riverside County, California	2,856	29.6%	\$46,712	
Harris County, Texas	2,812	3.7%	\$46,549	
Lancaster County, Pennsylvania	2,712	8.7%	\$49,107	
Winston County, Alabama	2,605	18.5%	\$45,064	
Tarrant County, Texas	2,432	29.0%	\$47,120	
San Bernardino County, California	2,205	12.6%	\$43,417	
Linn County, Oregon	2,156	21.5%	\$53,748	
Marathon County, Wisconsin	2,105	-4.2%	\$43,060	*
Jackson County, Oregon	2,095	-2.7%	\$50,352	*
Polk County, Florida	1,920	9.8%	\$38,664	
Fulton County, Georgia	1,770	91.8%	\$87,903	
Franklin County, Virginia	1,763	-0.7%	\$40,542	*
Cook County, Illinois	1,653	34.9%	\$51,457	
Pierce County, Washington	1,618	-1.5%	\$54,184	*
Kent County, Michigan	1,525	-8.3%	\$68,963	*

BLS QCEW Annual Private Employment (2016, 2019)



Pulp & Paper Mfg. Top US Competitor Regions

Paper Manufacturing (322)

			Average	
	Employment	Growth	Annual	
County, State	level	Rate	Wage	Targetee
Cook County, Illinois	8,679	-5.1%	\$63 <i>,</i> 058	*
Los Angeles County, California	6,394	-6.9%	\$66,893	*
Brown County, Wisconsin	5,615	-5.0%	\$67 <i>,</i> 093	*
Winnebago County, Wisconsin	4,787	-8.7%	\$77,604	*
Outagamie County, Wisconsin	3,015	-14.5%	\$65,408	*
Dallas County, Texas	2,901	5.9%	\$57 <i>,</i> 605	
DuPage County, Illinois	2,661	7.7%	\$75 <i>,</i> 907	
Tarrant County, Texas	2,315	-3.1%	\$66 <i>,</i> 022	*
Worcester County, Massachusetts	2,263	-5.8%	\$70,482	*
Cowlitz County, Washington	2,084	2.4%	\$99,406	
York County, Pennsylvania	2,052	-19.1%	\$73 <i>,</i> 555	*
Wood County, Wisconsin	2,025	-0.5%	\$74,925	*
Orange County, California	1,998	-19.1%	\$77,417	*
Middlesex County, New Jersey	1,943	4.0%	\$66,532	
Maricopa County, Arizona	1,910	18.5%	\$53 <i>,</i> 325	
Wayne County, Michigan	1,852	6.7%	\$53 <i>,</i> 074	
Ouachita Parish, Louisiana	1,824	-7.2%	\$77 <i>,</i> 038	*
San Bernardino County, California	1,804	21.9%	\$64,228	
Hennepin County, Minnesota	1,755	-11.3%	\$70,162	*

BLS QCEW Annual Private Employment (2016, 2019)



Annual average wage in Maine & U.S., 2017



Relative wages are key for recruitment and attraction.

Some of the sectors industries hold a significant advantage in their ability to provide higher wage rates.

Cultivating internal pipeline includes bringing displaced workers back into the job market



Appendix E: Firm and Stakeholder Interview Protocol and Description

FP Workforce Interview

Before questioning:

1. Remember to thank the participant for the time and participation.

2. Remind them that the information they provide will protected and they will remain anonymous and all information provided is confidential. No firm specific (or person specific) information will be used to in our reporting.

2. Ask the person if they know of someone whose feedback would be very important to have included and should be interviewed; we can cross check with our lists.

* Required

1. Person Interviewed:

Mark only one oval.

2.

Option 1

- 3. 1. What industry do you consider your company in?
- 4. 2. Briefly describe your core business line(s).
- 5. 3. List each company location and best estimate of the number of employees at each location. (If the list is exceedingly long, list how many locations inside Maine and the number of employees, how many outside Maine and the number of employees.)

6. 4. We recognize these are currently uncertain times, but what is your best estimate of revenue growth (% is fine) over the next 3-5 years?

- 7. 5. What is your best estimate of the longer revenue growth (%) beyond 5 the year outlook?
- 8. 6a. Do you expect employment demand to increase (or decrease) proportionally with with revenue over time?

Mark only one oval.

\square	\supset	YES
\square	\supset	NO

9. 6b. If answered "No" to Question 6, how do you expect to see it change if not with revenue?

Current workforce

The question in this section pertain to your firm's current workforce.

 7. Using the list from Question 2, what proportion of workers fall into each of the 4 categories below: Business Operations, Non-Specialized Production, Specialized Production, Engineering/Science/Technical at each facility?

Business Operations	Non-Specialized Production, Transport, & Support	Specialized Production	Engineering, Science, & Technical
Accountants & clerks	Assemblers & fabricators	Carpenters	Bio-sciences
Buyers	General technicians	Control system specialists	Chemical engineers
Corporate leadership	Heavy truck drivers	Environmental supervisors	Electrical engineers
Env. health & safety	Helpers	Heavy duty mechanics	Forestry professionals
Financial professionals	Industrial truck operators	Heavy equipment operators	Industrial engineers
General managers	Laborers & freight, stock,	Industrial electricians	Mechanical engineers
Human resource	& material movers	Industrial instrumentation	Power plant operators
IT specialists	Logging truck drivers	Industrial mechanics &	
Manufacturing	Machine feeders &	technicians	Forestry & Forest
managers	Material handlare	Industrial production managers	Sciences
Occupational health	Material handlers	Machine tool operators	
Sales representatives	shipping & receiving, watehouse clerks	Millwrights	Fallers
Regulatory analysts	A delivery energy	Saw filers	Foresters
Risk analysts		Sawing machine operators	Forestry technologists
		Stationary engineers & boiler	Graders
		operators	Silviculturists (forest
		Steamfitters & pipefitters	managers)

FP Occupational Groupings & Example Occupations

11. 8. On average over the last 5 years, how many new employees has your firm hired annually? And, what proportion of new hires are replacements versus new positions?

12. 9a. On average, what is your best estimate of the number of new hires per year you will need over the next 5 years? And, what is your estimate of the number or ratio of retirements/replacements versus new positions?

13. 9 b. Can you describe which types of positions or occupations you expect the new positions to be in?

14. 10. What skills are most important to your production workers? Others?

15. 11a. What new skills or capabilities will you be hiring significantly more of in the next 5 years?

16. 11b. Which skills sets do you anticipate will be the most difficult to recruit?

17. 11c. Do any of you positions require licenses, degrees or certifications? If so approximately how many employees (number or percent) have them?

18. 12. What types of in-house training do you typically do for new hires? How long? What percent of new hires participate in such training?

19. 13. Reflecting on the workforce training programs your company has engaged in with other organizations or institutions (non-inhouse training), what were the most challenging or problematic aspects?

20. 14. Have any of these non-inhouse training venues been particularly effective/successful? If so, why? What aspect of the engagement made it successful for your company?

21. 15. Do you provide any incentives or support for employees to pursue their own skill development? If so what kind? (for example tuition reimbursement or time off to attend training/classes)? (Check all that apply)

Check all that apply.

In person workshops & seminars
Online workshops, courses or seminars
Tuition Reimbursement
Offsite training during paid work hours
Other:

22. 16. How has your organization measured the efficacy of the workforce training? Specifically, how do you measure or evaluate whether a training or skills development program is worth continuing or expanding. What criteria is the most important?

23. 17a. Recalling past experiences with workforce training programs, what features of the training programs do you wish you did not have to deal with or you could eliminate?

24. 17b. Again, recalling past experiences with workforce training programs, what features or aspects do you wish could be expanded? (i.e. what would an ideal arrangement be?)

Hiring and Recruitment

25. 18a. What resources do you use to recruit job candidates for Production Workers Positions ? (Check all that apply)

Check all that apply.

	In State	Out of State
Professional Recruiters		
Online websites (Indeed, Monster, LinkedIn)		
Incentives to Employees for Referrals		
Job Fairs		
Conferences or Industry Meetings		
Internships with a training/college program		

- 26. 18a. Any resources not listed above
- 27. 18b. What resources do you use to recruit job candidates for Non-Production Workers Positions ? (Check all that apply)

Check all that apply.

	In State	Out of State
Professional Recruiters		
Online websites (Indeed, Monster, LinkedIn)		
Incentives to Employees for Referrals		
Job Fairs		
Conferences or Industry Meetings		
Internships with a training/college program		

28. 18b. Any resources not listed above

29. 19. If you answered YES to recruitment out of state to any part of Question 18, are some methods more effective in-state, and other methods out-of-state? Why do you believe a different recruitment strategy is necessary?

30. 20. Referring again to Question 18 regarding recruitment techniques, which method has proven the most effective at generating new hires? (Choose One)

Mark only one oval.
Professional Recruiters
Online websites (Indeed, Monster, LinkedIn)
Incentives to Employees for Referrals
Job Fairs
Conferences or Industry Meetings
Internships with a training/college program
None have been particularly effective
Other:

31. 21. Do you recruit different age groups or skill groups differently? *

32. 22. If you are unsatisfied with any aspect of recruitment and hiring, what is your biggest challenge or frustration? *
- 33. 23. What percent of new hires come from your own industry? What percent come from other industries? *
- 34. 24. Other than your own industry, what industry do you hire from the most? *
- 35. 25. Are there specific companies that you have repeatedly hired new employees from? *
- 36. 26a. Which industries do you typically lose people to? *
- 37. 26b. Are there specific companies you believe you are losing employees to, or have difficulty competing with to retain current employees)? (Note: If subject is not comfortable with naming the competing company, then record if the firm is in the same industry and inside or outside of Maine). *
- 38. 27a. Do you actively recruit from outside of Maine? *

Mark only one oval.

Yes

- 39. 27b. If "Yes" they actively recruit from outside of Maine, what states and regions? Do you focus on specific regions? Where and why these areas? *

40. 28. Consider instances of when you have hired new employees from within Maine, is recruitment easier in parts of Maine than others? If so, where? Is it particularly hard in some areas? If so, where? Could you briefly discuss why you think this difference exists? Do you recruit differently in your home region "commutershed"? *

41. 29. Does your company have specific hiring efforts, programs, or incentives to recruit people from diverse groups? If yes, what efforts specifically? If no, why not? (Diverse can be inferred by the interview subject and may only represent workers that were not traditionally represented, for example, female truck drivers). *

42. 30. What aspects do you believe to be the most attractive aspects of jobs in your industry? *

43. 31. Do you feel there is sufficient awareness of jobs in your industry as a desirable career option for workers? *

44. 32. Are there any recruitment, marketing, industry awareness strategies or support that your firm is currently NOT engaging that you believe could be beneficial to your company? If yes, what support would you prioritize as the highest priority? What has prevented your firm from engaging with or seeking this support up to this time? *

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Appendix F: Workforce and Training Delivery System Capacity Mapping

Statewic
de Program

Adapted from Maine Apprenticeship Program Current Sponsors (2021)

Sponsor/website link	Note
Bath Iron Works	
Panolam Industries, Inc.	
Cianbro	Statewide Program
Associated General Contractors of Maine, Inc.	Statewide Program
Thos. Moser Cabinetmakers	
Jordan Custom Carpentry	
Blaiklock Carpentry	
Cianbro	Statewide Program
Mountain View Correctional Facility	Prison Program
Mountain View Correctional Facility	Prison Program
Mountain View Correctional Facility	Prison Program
Mountain View Correctional Facility	Prison Program
Bath Iron Works	
Nestle Waters North America	
Associated General Contractors of Maine, Inc.	Statewide Program
Associated General Contractors of Maine, Inc.	Statewide Program
Casella Resource Solutions	
Panolam Industries, Inc.	
DeBlois Electric, Inc.	
IBEW 567, Portland Electrical JATC	
Ken L. Electric, Inc.	
Allagash Brewing Company	
Casco Bay Electric, LLC	
Favreau Electric	
ReVision Energy, Inc.	
Seabee Electric, Inc.	
IBEW 1253, Augusta Electrical JATC	
Interstate Electrical Services, Inc.	
Cianbro	Statewide Program
	Sponsor/website link Bath Iron Works Jordan Custom Carpentry Clanbro Mountain View Correctional Facility Mountain Netsers North America Associated General Contractors of Maine, Inc. Associated General Contractors of Maine, Inc. DeBlois Electric, Inc. IBEW 567, Portland Electrical JATC Keng Electric, Inc. Pareau Electric Revision Energy, Inc. Seabee El

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Electrician	Wayne J. Griffin Electric	Statewide Program
Electrician (Ship & Boat)	Bath Iron Works	
Engineering Assistant	RCBI Apprenticeship Works -Maine	
Front Line Supervisor - Production	Bath Iron Works	
Industrial Manufacturing	Nestle Waters North America	
Industrial Sewing Machine Operator	Maine Correctional Industries	Prison Program
Ironworker	Cianbro	Statewide Program
Layout Manufacturing Production Technician	SMCC - in partnership w/ BIW	
Line Installer-Repairer	Cianbro	Statewide Program
Lineworker	Cianbro	Statewide Program
Logger, Allround	Correctional Facility	Prison Program
Machinist	Midstate Machine	
Machinist	Bath Iron Works	
Machinist	Pratt & Whitney	
Machinist, Outside (Ship)	Bath Iron Works	
Maintenance Electrician	Bath Iron Works	
Maintenance Mechanic	Panolam Industries, Inc.	
Maintenance Mechanic	Bath Iron Works	
Maintenance Supervisor	Casella Resource Solutions	
Maintenance Technician	Barrette Outdoor Living, Inc.	
Manufacturing & Production Technician I	WCCC - in partnership w/Paradigm Windows & St. Croix Tissue	
Manufacturing & Production Technician I	T&D Wood Energy, LLC	
Master Oil Burner, Solid Fuel, Propane & Natural Gas Technician	Estes Oil & Propane	
Materials Collector - Lead Driver	Casella Resource Solutions	
Mechanical Maintenance Technician	Nestle Waters North America	
Millwright	Cianbro	Statewide Program
Operations Management	Casella Resource Solutions	
Pipe Fitter (Ship & Boat)	Bath Iron Works	
Pipefitter	Plumbers and Pipefitters UA Local 716	
Pipefitter	Cianbro	Statewide Program
Refuse and Recyclable	Casella Resource Solutions	
Truck Crane Operator	Cianbro	Statewide Program
Wood Pellet Plant Operator	T&D Wood Energy, LLC	

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Program	CMCC	EMCC	KVCC	NMCC	SMCC	WCCC	YCCC	
Diesel, Truck, & Heavy Equipment		A						
Heavy Truck & Equipment Systems		С						
Heavy Equipment Maintenance						C		A: Associate Degree
Heavy Equipment Operation					C	C		C: Certificate
Mechanical Technology						A/C		
Diesel Hydraulics Technology				A/C				
Geographic Information Systems						A		
Building Construction Technology	A/C	A/C		C	A/C			
Woodworking & Cabinet Making		A/C						
Sustainable Construction			Þ					
Sustainable Construction- Framing & Craftsmanship			С					
Sustainable Construction- Carpentry & Building Science			С					
Outdoor Adventure Recreation & Tourism					A/C			
Electrical & Automation Technology		A						
Electrical Construction & Maintenance				A/C				
Electrical Engineering Technology					A			
Electrical/Electricians Technology		С	A/C		С			
Electromechanical Technology	A/C							
Electromechanical Instrumentation Technology						Þ		
Residential & Commercial Electricity						D		
Applied Engineering Technology			Þ					
Architectural & Civil Engineering Technology	A							
Architectural Drafting & Design						С		
Architectural & Engineering Design					A		A	
Energy Services & Technology			A/C					
Trade & Technical Occupations		Þ	A	Þ	A	A	A	
Water Treatment Technology				Þ	A			
Additive Manufacturing							C	
Production Technology						A/C		
Facilities Maintenance & Management	A							
Mechanized Logging Operations				С				
Customized training programs		1	2	ω	4	б	6 7	•
Notes								

1: Includes Trade-specific Training, Trades & Technical Occupations

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Workforce and Training Delivery System Capacity Mapping

4: Incudes mechanized logging operations, commercial driver, high pressure boiler operator, Trades & Technical Occupations 3: Includes high pressure boiler, Industrial Electrician, and Heavy Equipment Operator, Trades & Technical Occupations

5: Includes facility maintenance technician, Trades & Technical Occupations

6: Includes Certified Production Technology, Electromechanical instrumentation tech (PLC & automation), heavy equipment 7: Includes Trades & Technical Occupations

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St Croix Regional Technical Center Sanford Regional Technical Center

Tri-County Technical Center

Presque Isle Reg Career & Tech Ctr Coastal Wash Cty Inst of Tech Waldo County Tech Ctr-Region 7 Region 9 Sch of Applied Technology **Oxford Hills Tech - Region 11** Foster Regional Applied Tech Ctr Capital Area Technical Center

Portland Arts & Technology H S Mid-Coast Sch of Tech-Region 8 **Bath Regional Career & Technical** Westbrook Regional Technology Ctr

Lake Region Vocational Center Lewiston Regional Technology Ctr

Biddeford Regional Ctr of Tech

Somerset Career & Technical Center United Technologies Ctr-Region 4

Bath Regional Career & Technical Sanford Regional Technical Center Waldo County Tech Ctr-Region 7 Capital Area Technical Center

Electricity program

Electricity Program

Mid-Maine Technical Center Region Two Sch of Applied Tech Lewiston Regional Technology Cti Sanford Regional Technical Center

Lewiston Regional Technology Ctr

Caribou RegionalTechnology Ctr Caribou RegionalTechnology Ctr Westbrook Regional Technology Ctr

Region 9 Sch of Applied Technology St John Valley Technology Center Maine Region Ten Technical High Sch

Lake Region Vocational Center

Somerset Career & Technical Center

Caribou RegionalTechnology Ctr

Biddeford Regional Ctr of Tech Hancock County Technical Center United Technologies Ctr-Region 4 No Penobscot Tech-Region 3 Mid-Maine Technical Center

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CTE Center/Region (weblink)

Lewiston Regional Technology Ctr Lewiston Regional Technology Ctr Presque Isle Reg Career & Tech Ctr

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Bath Regional Career & Technical Maine Region Ten Technical High Sch St Croix Regional Technical Center **Biddeford Regional Ctr of Tech** Portland Arts & Technology H S Oxford Hills Tech - Region 11 CTE Center/Region (weblink) Region Two Sch of Applied Tech No Penobscot Tech-Region 3 Hancock County Technical Center Sanford Regional Technical Center **Biddeford Regional Ctr of Tech** Caribou RegionalTechnology Ctr Mid-Coast Sch of Tech-Region 8 Foster Regional Applied Tech Ctr Westbrook Regional Technology Ctr No Penobscot Tech-Region 3 Caribou RegionalTechnology Ctr Lewiston Regional Technology Ctr United Technologies Ctr-Region 4 **Oxford Hills Tech - Region 11** Lewiston Regional Technology Ctr Portland Arts & Technology H S **Capital Area Technical Center** Foster Regional Applied Tech Ctr Somerset Career & Technical Center **Oxford Hills Tech - Region 11** Sanford Regional Technical Center Mid-Maine Technical Center **Biddeford Regional Ctr of Tech** Mid-Coast Sch of Tech-Region 8 **Capital Area Technical Center** Van Buren Regional Technology Ctr United Technologies Ctr-Region 4 Waldo County Tech Ctr-Region 7 Hancock County Technical Center Region 9 Sch of Applied Technology Foster Regional Applied Tech Ctr Region Two Sch of Applied Tech St John Valley Technology Center Lewiston Regional Technology Ctr Westbrook Regional Technology Ctr Tri-County Technical Center Tri-County Technical Center Region 9 Sch of Applied Technology

Plumbing/Heating Program Plumbing & Heating Technology Program Pre-Engineering program Advanced Manufacturing program Diesel Technology Program Mechanical & Manufacturing Engineering/Robotics Welding and Metal Fabrication Program Welding and Metal Fabrication Program Welding & Fabrication Program Metal Fabrication & Welding Program **Commercial Truck Driving Program Commercial Truck Driving Program** Commercial Drivers License program CDL Truck Driving program Sheet Metal/Welding Program Plumbing program Plumbing and HVAC Program Plumbing and Heating program Plumbing & Heating Program Pre-Engineering program Precision Machining Program Precision Machining Program Metals Manufacturing Program Metal Trades Program Manufacturing Technology Program Machine Tool Program Machine Tool & Welding program Diesel Technology Program Forestry & Wood Harvesting Electricity Program Welding Program Welding Program Welding Program Welding / Metal Technology **Metal Fabrication Program** Commercial Driving Program Plumbing Technology program Manufacturing Technology Program Heavy Equipment Technology Program Forestry & Wood Harvesting program Forestry & Heavy Equipment program Forest Management and Operations Forest Resource Management Welding Program Program name 48.0501 15.0805 48.0508 48.0501 48.0508 48.0508 48.0508 48.0508 48.0508 48.0508 48.0508 48.0508 48.0508 49.0205 49.0205 49.0205 49.0205 49.0205 48.0506 46.0503 46.0503 46.0503 46.0503 46.0503 46.0503 46.0503 15.0613 48.0501 48.0501 48.0501 48.0501 48.0501 48.0501 48.0501 47.0302 47.0302 47.0302 03.0511 03.0511 03.0511 03.0511 03.0506 15.0000 46.0302 CIP **CIP** Title Welding Technology/Welder Truck and Bus Driver/Commercial Vehicle Operation Truck and Bus Driver/Commercial Vehicle Operation Sheet Metal Technology/Sheetworking Plumbing Technology/Plumber Mechanical Engineering/Mechanical Technology/Technician Manufacturing Technology/Technician Machine Tool Technology/Machinist Heavy Equipment Maintenance Technology/Technician Forest Technology/Technician Forest Technology/Technician Forest Technology/Technician Forest Management/Forest Resources Management Engineering Technology, General Electrician Welding Technology/Welder Truck and Bus Driver/Commercial Vehicle Operation Machine Tool Technology/Machinist Machine Tool Technology/Machinist Heavy Equipment Maintenance Technology/Technician Heavy Equipment Maintenance Technology/Technician Forest Technology/Technician Truck and Bus Driver/Commercial Vehicle Operation Truck and Bus Driver/Commercial Vehicle Operation

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CTE Center/Region (weblink)	Program name	CIP CIP Title
St Croix Regional Technical Center	Welding Program	48.0508 Welding Technology/Welder
St John Valley Technology Center	Welding Program	48.0508 Welding Technology/Welder
Portland Arts & Technology H S	Welding Technology Program	48.0508 Welding Technology/Welder
Somerset Career & Technical Center	Welding Technology Program	48.0508 Welding Technology/Welder
United Technologies Ctr-Region 4	Welding Technology Program	48.0508 Welding Technology/Welder
Waldo County Tech Ctr-Region 7	Welding Technology Program	48.0508 Welding Technology/Welder
Region 9 Sch of Applied Technology	Commercial Drivers License program	
Somerset Career & Technical Center	Commercial Truck Driving Program	
Tri-County Technical Center	Computer-Aided Drafting and Design	
Van Buren Regional Technology Ctr	Construction Trades Program	
St John Valley Technology Center	Electrical Construction program	
Van Buren Regional Technology Ctr	Engineering & Architectural Design program	
St John Valley Technology Center	Heavy Equipment Operation program	
Portland Arts & Technology H S	Woodworking Program	

CIP = Classification of Instructional Programs

Appendix G: Career Pathway Resources

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Operation (Contor		
Focus	overview of resource value	Nesolai de Ellik
GREAT EXAMPLE	Describes general occupation category – such as Logging crew then describes various occupations within including chaser, choker setter, coiler, etc. – this info is available for a vast majority of the industry. Well worded, describes basic and detail work conditions, requirements, entry points into and out of jobs. Includes "Find your path" videos	The Pacific Forest Foundation
	Trom Uregon Forest Resource Institute. Website flows/nas modern/attractive feel.	
GREAT EXAMPLE	List all careers then shows careers by category – not extensive shows 30 occupations. Gives job overview, education needed, earning potential, responsibility, and "this job is right for you if" section, and video. Does not	Forest Workforce Training Institute
	highlight entry/exit points, not true career pathways. Slick site, attractive, easy to navigate and understand.	(Alabama)
Forestry & harvesting sector	Tells the story of various forest-sector employees' journeys throughout their career path offering advice and short job-descriptions. This booklet highlights 18 occupations including Millwright, field forester, forest manager, logging	<u>"Finding Your</u> Path" from
	crew, harvest process (log equip. operator). Contains some traditional elements included in a career pathway but	Oregon Forest
	not a traditional career pathway document. Final product is visually appealing and has been cited and referred to	Resources
))	by numerous other groups.	Institute.
Forestry &	Focuses on career pathways within Agriculture, Food, and Natural Resources industries - this is an example of	Illinois Career
narvesung sector	elements include: Overview of occupation (i.e., median wage, employment size, 10-yr growth, annual openings),	System (CIS)
	Preparation (typically needs from ONET education/experience/OTJT details; licensing/certs.), Work conditions	
	(couple bullet points). Specific occupations: Foresters; Forestry tech; Fallers/Buckers; Choker setters; log	
	grade/scale, logging workers (all other).	
Popular logging	Highlights a range of most popular occupations available and what the different jobs entail. Uses SOC/ONET	What You Can Do
occupations	occupation titles and common career pathway elements including brief summary of job, median \$, est. job growth,	with a Forestry
	and education/skills needed (ONET stuff). Includes overall pro/cons list. Slick site. While informational it is very	Degree
	academic.	

Occupation/Sector	Overview of Resource Value	Resource Link
Millwright (and	Extensive info for multiple career "families" but not focused on forestry sector. Still, this is a great resource for the	Detro Chemical
other trade	non-specialized, yet important, jobs and careers in the FPS. Dynamic, slick website, functions include a job match Λ	Works
occupations)	tool, career maps, jobs organized by level of entry (entry, mid, and senior) and/or by career family.	
Forestry sector	Uses industry-related job titles, slick website, group's jobs and careers into occupation groups (I.e., operations &	Idaho Forest
	general labor, skilled, etc.). Includes "Find your path" videos, profiles industry workers, how to find jobs etc. $\frac{1}{2}$	Products
		<u>Commission</u>
Forestry sector	Uses a story-telling approach by highlighting pathways of forestry professionals (many feature female stories). \pm	#ItTakesAForest
	Featured stories include links to education entities etc. Slick website design/flow.	(Canada)
Logging Workers	More traditional career pathways layout. Pathways sorted by qualifications (i.e., no edu. required or HS/GED). Key	RaiseMe
(all); Forest &	elements include: edu. Required, training, job outlook, advancement, Licenses/certifications, median \$, what they 🔟	(general)
Conservation	do, list of careers (other titles), similar careers by entry level (i.e., higher paid/less edu./more edu.). Includes	
	individual detail for: Buckers, choke setters, fallers, log graders & scalers, sorters/markers/movers & chippers,	
	equipment operators, rigging slingers, and tree climbers. RaiseMe partners with universities to offer students	
	scholarships for their achievements during high school and college.	
Woodworkers	Career profile key elements include median \$, job and workplace descriptions	<u>Truity (general)</u>
Resource; career	Career Profile Cards, show career pathways and typical work day for: 1. Assistant Forester, 2. Forest Engineer,	The Pacific
profile cards	3.Resource Forester, 4. Senior Resource Information Forester, and 5. Silviculture Forester. Career cards for Scientist	Education
	& Engineers in forests can be found here.	Institute
Workforce	Resources and helpful links that can be helpful for job seekers and job posters throughout the entire forest supply	Forest Resources
Connection	chain.	Association (FRA)
Resources		
Forest Products (wood manu.)	https://keystonewoodpa.org/careers-wood-products-industry/	PA Hardwood

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2 of 2

Table X: Actual example for Logging equipment operators

Job title	Logging equipment operator
Other job titles	Logger, Logging Machinery Operator, Feller-Buncher Operator, Log Loader Operator
Occupation Group	General Labor, Transport, & Support
Maine Facts	Nearly half (45.7%) of Maine's harvesting industry is employed as a logging equipment operator.
	Jobs have increased by 2.5% from 2010 to 2020
Median Hourly	\$17.66
Earning	
Typical Measures of Job Preparation	H.S./G.E.D None Moderate; Completion of an equipment operator training program is typically preferred.
Training	Check out this 12-week Mechanized Logging Operations certificate training program offered at Northern Maine Community College!!
Job Preparation	Medium
This job is right for	Like the outdoors, big machine, and are a team player
you if	Watch the following video to learn more about the job

				8
	Entry-Level/Early Career		Mid-Level	Late Career
	\$			0 0 0 5 \$ \$
	Yea	ars of work experi	ence and/or OTJT	
	1 year or less	2 to 3 years	3 to 4 years	5+ years
No formal	*Laborers & Freight, Stock & Material Mover			
education	*Forestry Worker/Laborer			
H.S. diploma	*Production Workers (All Others)	*Forest &	*First-Line Supervisors (Forestry	
or equal	*Logging Workers (All Other)	Conservation	Workers)	
	*Sawing Machine (Setters, Operators & Tenders)	Technicians	*Mobile Heavy Equipment Mechanics	
	*Forest & Conservation Workers			
	*Operating Engineers & Other Construction Equip.			
	Operators			
	*Logging Equipment Operators			
	*Fallers			
1-year	*Heavy & Tractor-Trailer Truck Drivers			
certificate				
Associate's				
7 degree				
Bachelor's	*Foresters			
S degree				
WAGE (2019) in	MAINE & LINK TO DETAILED CAREER INFORMATION FR	OM O-NET		
	No formal education H.S. diploma or equal or equal Associate's Associate's degree Bachelor's Bachelor's MAGE (2019) in	Entry-Level/Early Career Vea I year or less I year or less 1 education * Laborers & Freight, Stock & Material Mover education * Production Worker/Laborer H.S. diploma * Production Workers (All Others) or equal * Production Workers (All Other) * Sawing Machine (Setters, Operators & Tenders) * Forest & Conservation Workers * Operating Engineers & Other Construction Equip. Operators Operators * Logging Equipment Operators Tenders) * Lyear * Heavy & Tractor-Trailer Truck Drivers Fallers Sachelor's * Foresters * Foresters Bachelor's * Foresters * Foresters Bachelor's * Foresters * Foresters	Entry-Leve//Early Career Vears of work experient of the experient of t	Entry-Leve//Early Career Mid-Level Image: Second Sec

MEDIAN WAGE (2019) in MAINE & LINK TO DETAILED CAREER INFORMATIO	N FROM O-NET
Logging Equipment Operators	\$17.66
Heavy and Tractor-Trailer Truck Drivers	\$19.34
First-Line Supervisors of Farming, Fishing, and Forestry Workers	\$24.12
Fallers	\$17.44
Logging Workers, All Other	\$14.22
Mobile Heavy Equipment Mechanics, Except Engines	\$20.64
Foresters	\$26.28
Forest and Conservation Workers	\$15.84
Production Workers, All Other	\$14.97
Laborers and Freight, Stock, and Material Movers, Hand	\$13.67

Career
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Entry level education

operation." Source: http://maineloggereducation.org/?page_id=46 graduates. These programs accept high school sophomores, juniors and seniors. Training lasts between one and three years depending on the individual school. All have a strong hands on component operating various types of logging equipment (from chain saws and cable skidders to Cut to Length harvester) on a school logging "Currently there are four Forestry/Wood Harvesting programs in Maine, all offer Certified Logging Professional (CLP) Apprenticeship certification to successful High School CTE's

Oxford Hills Tech School – Norway, Maine Region 9 School of Applied Technology – Rumford, Maine

Maine Community College System

log or supervise loggers). Includes: foresters, truckers, others. Programs vary from welding, to equipment operation, to diesel engine mechanic, to hydraulics and "Community Colleges offer programs that may be of interest to a prospective logger or associated worker (i.e., anyone with interest in logging but does not actively

Region Two School of Applied Technology – Dyer Brook, Maine

Foster Technology Center – Farmington, Maine

more." Source: http://maineloggereducation.org/?page_id=46 Northern Maine Community College Presque Isle, ME

Washington County Community College Calais, ME Eastern Maine Community College Bangor, ME

York County Community College Wells, ME Southern Maine Community College South Portland, ME Central Maine Community College Auburn, ME

University of Maine - Forestry education and research

University of Maine at Orono - four year undergraduate and post graduate degrees

University of Maine at Fort Kent - A two year associates degree - Applied Forest Management Program

Post-secondary training

Mechanized Logging Operations

12-week certificate training program of the Maine Community College System (MCCS) in collaboration with the Professional Logging

Professional Training Contractors of Maine (PLC)

Certified Logging Professional Program (CLP)

To learn more click here

workshop includes three days of classroom instruction in first-aid/CPR, forest management and silviculture, safe and efficient wood "To be certified, candidates must attend a CLP-sponsored four-day workshop (32 hours total) and then pass a work-site evaluation. The

a nationally recognized logging training system." [16] harvesting, and business/utilization. The final day for conventional loggers is devoted to on-site instruction and hands-on tree felling using

Northeast Master Logger Certification (NEMLC) **Qualified Logging Professional (QLP)**

To learn more click here To learn more click here

This is my office video

Master Logger Video

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	Manage	
MEDIAN WAGE (2019) in MAINE &	& LINK TO DETAILED CAREER INFORMATION FROM O-NET	
Production Workers, All Other	\$14.97	
Industrial Machinery Mechanics	\$24.43	
HelpersProduction Workers	\$15.11	

(() (())		E	ntry-Leve	l Educ	ation						()				
Bachelor's degree	Associate's degree	1-year certificate							H.S. diploma or equal		No formal education				
			Operators & Tenders) *Cutting & Slicing Machine (Setters, Operators & Tenders)	*Production Workers (All Others) *Separate/Filter/Clarify Machine (Setters,	*Packaging & Filling Machine (Operators & Tenders)	*Maintenance & Repair Worker	"Extrude/Form/Compact Machine (Setters, Operators & Tenders)	*Shipping, Receiving & Inventory Clerks	Production Work Helpers	*Industrial Truck and Tractor Operators	*Laborers & Freight, Stock & Material Mover	1 year or less	Ye	8	Entry-Level/Early Career
		*Electrical & Electronics Repairers				-	"Stationary Engineers & Boller Operators		*Industrial Machinery Mechanics			2 to 3 years	ars of work experience and/or OTJT		Mid-Leve
								(Production & Op.)	*First-Line Supervisors			3 to 4 years			į
*General & Operations Managers												5+ years		÷ \$ \$ \$ \$	Late Career

Appendix X

	\$25.88	Production, Planning, and Expediting Clerks
	\$12.97	Stockers and Order Fillers
	\$17.21	Miscellaneous Assemblers and Fabricators
	\$20.31	Maintenance Workers, Machinery
	\$19.34	Heavy and Tractor-Trailer Truck Drivers
	\$14.31	Machine Feeders and Offbearers
	\$16.80	Printing Press Operators
	\$21.30	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders
	\$21.53	Inspectors, Testers, Sorters, Samplers, and Weighers
	\$16.06	Customer Service Representatives
	\$25.18	Millwrights
	\$30.38	First-Line Supervisors of Mechanics, Installers, and Repairers
	\$45.16	Industrial Production Managers
	\$40.46	Industrial Engineers
	\$26.17	Electricians
	\$16.53	Packaging and Filling Machine Operators and Tenders
	\$39.74	General and Operations Managers
	\$13.67	Laborers and Freight, Stock, and Material Movers, Hand
	\$22.04	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders
	\$17.55	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders
	\$18.23	Cutting and Slicing Machine Setters, Operators, and Tenders
	\$16.76	Shipping, Receiving, and Inventory Clerks
	\$22.93	Stationary Engineers and Boiler Operators
	\$26.91	Electrical and Electronics Repairers, Commercial and Industrial Equipment
	\$18.45	Maintenance and Repair Workers, General
	\$30.94	First-Line Supervisors of Production and Operating Workers
90	\$17.35	Industrial Truck and Tractor Operators
		MEDIAN WAGE (2019) IN MAINE & LINK TO DETAILED CAREER INFORMATION FROM O-NET

MEDIAN WAGE (2019) in MAINE & LINK TO DETAILED CAREER INFORMATION FROM O-NET	
Woodworking Machine Setters, Operators, and Tenders	\$14.61
Sawing Machine Setters, Operators, and Tenders, Wood	\$16.82
Miscellaneous Assemblers and Fabricators	\$17.21
Industrial Truck and Tractor Operators	\$17.35
Laborers and Freight, Stock, and Material Movers, Hand	\$13.67
Carpenters	\$19.95

Entry-Leve	Entry-Leve	Entry-Leve	11	Edu	catio	n										
ar certificate ciate's degree	ar certificate			equal	. diploma or				שמכמנוטוו		lo formal					
		*Heavy & Tractor-Trailer Truck Drivers	*Production Workers (All Others) *Miscellaneous Assemblers & Fabricators *Woodworking Machine (Setters, Operators & Tenders)	*Cabinetmakers & Bench Carpenters	*Log Graders & Scalers	*Sawing Machine (Setters, Operators & Tenders)	*Woodworkers (All Other)	*Production Work Helpers	*Industrial Truck & Tractor Operators	*Laborers & Freight, Stock & Material Mover	*Machine Feeders & Offbearers	1 year or less	Years	\$	Entry-Level/Early Career	Occupation Matrix: Wood
												2 to 3 years	of work experier		Mi	Product Man
			(Production & Op.)	Supervisors	*First-Line	*Carpenters	*Millwrights	*Electricians				3 to 4 years	ice and/or OTJT		d-Level	utacturing
												5+ years		A AA AAAA AAAAAAAAAAAAAAAAAAAAAAAAAAAA	Late Career	

MEDIAN WAGE (2019) in MAINE & LINK TO DETAILED CAREER INFORMATION FROM O-NET		
First-Line Supervisors of Production and Operating Workers	\$30.94	92
Heavy and Tractor-Trailer Truck Drivers	\$19.34	
Production Workers, All Other	\$14.97	
Cabinetmakers and Bench Carpenters	\$18.58	
HelpersProduction Workers	\$15.11	
General and Operations Managers	\$39.74	
Office Clerks, General	\$16.71	
Millwrights	\$25.18	
Machine Feeders and Offbearers	\$14.31	
Woodworkers, All Other	\$11.02	
Industrial Machinery Mechanics	\$24.43	
Logging Equipment Operators	\$17.66	
Maintenance and Repair Workers, General	\$18.45	
Electricians	\$26.17	
Inspectors, Testers, Sorters, Samplers, and Weighers	\$21.53	
Coating, Painting & Spraying Machine Setters, Operators, Tenders	\$21.30	
Industrial Production Managers	\$45.16	
Log Graders and Scalers	\$18.78	

Appendix H: Professional Logging Contractors of Maine Occupational Wage Analysis

Professional Logging Contractors of Maine Occupational Wage Analysis

This appendix is adapted from a CBER analysis of logging and related occupations conducted in 2019. This analysis provides in-depth data on the logging (harvesting) subsector, though some components will be redundant of sections in Appendix C.

Professional Logging Contractors of Maine Occupational Wage Analysis: Data Appendix

Prepared by



Maine Center for Business and Economic Research

University of Southern Maine

Revised March 2019

MAINE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

UNIVERSITY OF SOUTHERN MAINE

Overview and data methods

Recent expansions announced at several mill facilities in Maine, in addition to the potential development of mass timber production facilities located in the state over the next several years, will continue to increase the demand for harvested wood fiber. The logging industry, which contracted following a slew of mill shutdowns in the state over the past decade and impacted by the severe economic recession in 2008-2009, has been challenged in ramping up production and harvests because of workforce constraints despite rising demand for wood. Likewise, the logging workforce is rapidly aging and large numbers of workers will be retiring in the near future needing replacement. Stagnant or negative population growth and aging population across Maine's regions, particularly rural areas, only limit the potential pool of workers. Competition for workers across the state is intensifying and reaching crisis levels in many industries, including the logging industry and other manufacturing and production oriented sectors.

Competition in attracting and retaining workers is highly dependent upon the compensation workers can receive for a set of skills in one job compared to another, or for the same job in a different industry. Maine's logging industry has been challenged in offering competitive wages to attract and retain workers to the industry and compete against other industries vying for the same dwindling pool of workers. Although capital costs in the logging industry have risen across the board, prices paid for wood product at mill facilities have not. This scenario has left little room for businesses to offer higher, more competitive wages to workers or to entice new businesses to enter the industry. If the industry is to meet continued and projected demand for harvested wood fiber, a significant boost to the logging workforce pipeline will be required, which will largely be dependent on the ability of the industry to attract and retain workers with higher wages in an intensely competitive labor market.

This analysis considers the competitiveness of occupational wages of key logging industry occupations in comparison to other key industries competing for similarly skilled labor. We also estimate the relationship between harvested production and labor requirements with respect to announced and planned expansions at mill facilities in Maine and the projected workforce replacement requirements over the next 10 years as older workers age out of the workforce. Lastly, we provide a summary update of estimates of the economic impact of the logging industry in Maine on the state economy in terms of jobs and earnings.

Our analysis relies upon several sources of labor market and occupational wage and employment data to compare wages in key logging occupations to wages of occupations with comparable skill sets and related industries. We report wages by median hourly and wage distributions for the 10th, 25th, 75th, and 90th percentiles. While secondary data reported through government and proprietary sources are limited in the level of occupational detail and do not provide a window into every scenario, they do provide a robust representation of the competitiveness of wages across similar occupations and industries.

It is important for the reader to understand that we draw upon two primary datasets to present a picture of wage and employment data of Logging Industry jobs and comparable jobs in other industries. As a result, some estimates for the same occupation may vary from Table to Table or Figure to Figure. Data sources are noted for each Table and Figure and the type of employment included, whether inclusive of self-employed or limited to traditional wage employment. This is important because a large share of the Logging Industry includes sole-proprietors or small employer shops that is less common for other comparable industries and occupations. The datasets include Occupational Employment Series Research Estimates for Occupations by Industry for 2017 from the US Bureau of Labor Statistics and data from Economic Modeling Specialists Inc. (EMSI) 2019.1 dataseries, which relies on public secondary data for their reported estimates. We also draw upon data from the Maine Department of Labor CWRI.

Labor Force Trends and Logging Industry Employment and Wage Overview Employment in the logging industry totaled an estimated 3,652 workers in 2018; a decline of 9.4 percent since 2010 (Table 1). Employment in the industry is comprised of self-employed (non-employers) which comprised a little over 1/3 of all workers. Traditional employment (paid employees) continues to make up the bulk of jobs in the industry. Self-employed workers declined by 70 jobs between 2010 and 2018 (-5.2%) while traditional employment declined by about 300 jobs or -11.6% over the same period (Figure 5). While traditional employment has been a bit more cyclical reaching a peak of 1,588 jobs in 2015 before falling back to current levels.

Table 1: Employment for logging by class of worker, 2010 to 2018

	Emp	oloyment	
	Number Pct. Chan		
Class of Worker	2018	2010-18	
Self-employed	1,320	-5.2%	
Employed (covered)	2,332	-11.6%	
All Employed	3,652	-9.4%	

Figure 5: Employment growth for logging by class of worker, 2010-2018



Source: EMSI dataseries 2019.1. Note: Self-employed includes workers with no paid employees (non-employer); Employed includes all employment "covered" under the state and federal unemployment insurance program and reported in Quarterly Census of Employment and Wages (QCEW) employment statistics reported by US Bureau of Labor Statistics and Maine Department of Labor.

Regional employment continues to be concentrated in the northern rim and Penobscot counties, where industry-wide wages are typically also highest. Table 2 provides employment, employment change, hourly median wage, number of establishments, and regional concentation (measured by location quotients in which the higher above 1 a value is, the greater the concentration of the industry as a share of the overall employment base). Regional concentration by county is shown in Figure 6.

Table 2: Regional employment trends in Maine, 2018

	Number	PCT Change	Hourly Median	Establish	Location
County Name	Jobs	2010-18	Wage	ments	Quotient
Aroostook	702	-146	\$25.91	141	38.5
Penobscot	683	-161	\$27.35	68	14.7
Somerset	453	-135	\$25.37	51	40
Oxford	381	53	\$24.40	42	32
Franklin	280	-134	\$23.60	26	38.2
Kennebec	160	32	\$19.09	23	4
York	149	35	\$22.12	22	2.9
Washington	145	-99	\$20.77	18	18.4
Piscataquis	129	-67	\$21.98	15	32.7
Hancock	104	-40	\$18.09	10	6
Waldo	103	7	\$15.35	7	11.7
Cumberland	92	-17	\$18.46	17	0.7
Androscoggin	80	7	\$19.33	11	2.5
Lincoln	59	-1	\$15.27	3	6.9
Knox	57	12	\$17.10	6	4.3
Sagadahoc	25	-23	\$17.28	1	2.3
[Maine, county not reported]	50	-26	\$18.44	4	7.3
Total	3602	-703		465	

Figure 6: Regional industry employment concentration, 2018



The average earnings for all employment in Maine's logging industry has increased by 5% since 2010 (Figure 7), an average increase of just over \$2,100 per worker. This followed a pattern of declining prices for wood fiber products delivered to mills in Maine.^[1] Average earnings peaked in 2015 for the industry at \$50,637 before dipping back down to current levels following a drop in production and demand for wood fiber resulting from mill closures in Maine. Over the same period, average earnings have grown by an average of \$5,500 in comparative sectors and industries competing for similarly skilled labor, including various construction industries, truck transportation, and other forest product industries. Average earnings in Paper Manufacturing are more than twice the average earnings in Logging.

^[1] A recent report by the James W. Sewall Company titled "Historic and Predicted Wood Costs in Maine for Selected Species and Products" December 2018 prepared for FOR/Maine found that mill delivered rates for various pulpwood products peaked in 2015 and fell in subsequent years following mill closures. While prices for hardwood pulpwood are predicted to rise steadily through 2022, prices for spruce-fir pulpwood and other softwood pulpwood are predicted to remain relatively flat from 2017 prices, both well below price levels from just a few years ago. Figure 7: Average earnings in Logging and a selection of comparative industries for 2010, 2014, and 2018. Earnings expressed in 2018 dollars.



Source: EMSI dataseries 2019.1 – Includes QCEW Employees, Non-QCEW Employees, and Self-Employed. Average earnings are adjusted for inflation and expressed in 2018 dollars. Note: Historical wage data over time for occupations rather than industry wide employment is not available.

The 15 occupations in Table 3 employed 92% of the logging industry in 2018. Wages vary by class of worker for several key occupations. Relative to QCEW employees, heavy truck drivers and laborers earned more when self-employed whereas as logging equipment operators and first-line supervisors earned a lower hourly wage (Table 4). One out of every 2 jobs in the logging industry is some type of logging equipment operator.

Table 3: Key logging industry occupations summary, 2018

Table 4: Wages by class of worker for several key occupations, 2018

Occupation	All	QCEW Employees, Non-QCEW Employees	Self- Employed
Logging Equipment Operators	\$16.47	\$17.20	\$15.67
Laborers and Freight, Stock, and Material Movers, Hand	\$12.29	\$12.03	\$15.15
Heavy and Tractor-Trailer Truck Drivers	\$18.54	\$18.30	\$19.40
First-Line Supervisors of Farming, Fishing, and Forestry Workers	\$20.31	\$24.86	\$19.31

SOC	Occupation	Employed in	%	% of Total	% Jobs in	Median	Typical Entry Level
		Industry	Change	Jobs in	Total	Hourly	Education
		(2018)	01 - 18	Industry	Occupation	Earnings	
45-4022	Logging Equipment Operators	1,732	19%	50.5%	95.5%	\$16.47	H.S. diploma
53-3032	Heavy and Tractor-Trailer Truck Drivers	485	9%	14.1%	5.0%	\$18.54	Postsecondary nondegree
45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	270	(6%)	7.9%	56.6%	\$20.31	H.S. diploma
45-4021	Fallers	130	(57%)	3.8%	88.8%	\$18.47	H.S. diploma
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	86	16%	2.5%	7.3%	\$19.74	H.S. diploma
45-4029	Logging Workers, All Other	70	(53%)	2.1%	91.8%	\$16.14	H.S. diploma
45-4011	Forest and Conservation Workers	67	(46%)	1.9%	85.2%	\$13.02	H.S. diploma
43-6014	Secretaries and Administrative Assistants, Except Legal, Med.	65	(2%)	1.9%	0.5%	\$16.79	H.S. diploma
43-9061	Office Clerks, General	63	15%	1.8%	0.5%	\$15.59	H.S. diploma
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	62	(6%)	1.8%	1.0%	\$12.29	No formal edu. cred
19-1032	Foresters	40	3%	1.2%	28.2%	\$25.23	Bachelor's degree
51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	38	(81%)	1.1%	4.4%	\$15.39	H.S. diploma

Source: EMSI dataseries 2019.1 – Includes QCEW Employees, Non-QCEW Employees, and Self-Employed. Note: Full list of occupations in forestry and logging industry, including wage percentiles, in detailed tables section at end of slide deck.



Figure 8: Percentile hourly earnings for key logging industry occupations summary, 2018

Source: EMSI dataseries 2019.1 – Includes QCEW Employees, Non-QCEW Employees, and Self-Employed

Available secondary data is somewhat limited in the variety and specificity of occupations in the industry. Public secondary occupational data is collected through surveys and reported under the Standard Occupational Classification (SOC) System, although a much larger sample of job titles are reported by survey respondents. A sample of job titles reported by survey respondents are provided for several key industry occupations that follow in this report. For instance, embedded within the occupational title Logging Equipment Operators are Loader, Yarder, Delimmer, and Skidder operators among others. Consquently, many of those occupations vary in the wages received which are not able to be directly captured in the reported statistics. However, the range in hourly wages reported provides a means of comparison across reported occupational titles.

Throughout this wage analysis, hourly wages are reported as a median wage, as well as for the 10th, 25th, 75th, and 90th percentiles of wages reported in the occupational secondary data. The result is that for every SOC reported occupation, wages for 80 percent of employed persons in a respective occupation earn an hourly wage between the 10th and 90th percentile wage. The boxed area represents the interguartile range (between the 25th and 75th percentile) in which 50 percent of employed persons earn wages for a respective occupation. The extending "whisker" lines from each box plot represent the 10th and 90th percentiles, with the 90th percentile being greater than the median wage, and the 10th percentile being below the median wage. The median wage is denoted by the middle line of each box plot, or in the case of Figure 8 the change in colr scheme in each box.

Occupational Wage Profile

- Logging Equipment Operators
- Competitive Occupation Wage Analysis
 - Compatible and Competitor Occupations
 - Operators and General Technologists in Pulp and Paper Manufacturing
 - Operators and General Technologists in Wood Product Manufacturing
- Heavy Truck Drivers

Figure 9: Regional employment, 2018



Logging Equipment Operators (SOC 45-4022):

Drive logging tractor or wheeled vehicle equipped with one or more accessories, such as bulldozer blade, frontal shear, grapple, logging arch, cable winches, hoisting rack, or crane boom, to fell tree; to skid, load, unload, or stack logs; or to pull stumps or clear brush. Logging truck drivers are included in 'Heavy and Tractor Trailer Truck Drivers' (53-3032).

Sample of Reported Job Titles:

- Loader Operator
- Grapple Skidder Operator
- Feller Buncher Operator
- Tree-Shear Operator
- Processor Operator

- Logging Shovel Operator
- Log Processor Operator
- Delimber Operator
- Yarder Operator
- Skidder Operator

Growth for Logging Equipment Operators (45-4022)

1,594	1,813	219	13.7%	,
2001 Jobs	2018 Jobs	Change (2001-2018)	% Change (2001-2018)	

Figure 10: Regional hourly wage, 2018



In counties with a higher median wage, traditionally employed workers (QCEW) earn a wage higher than self-employed workers – the difference is typically less in areas where employment levels are lower.

		Pct. 25 Hourly	Median Hourly	Pct. 75 Hourly	
County Name	2018 Jobs	Earnings	Earnings	Earnings	
Aroostook	366	\$14.23	\$16.70	\$19.82	
Penobscot	312	\$14.10	\$16.53	\$19.23	
Oxford	210	\$14.65	\$17.11	\$19.71	
Somerset	200	\$14.27	\$16.69	\$19.12	
Franklin	141	\$14.27	\$16.68	\$18.95	
Kennebec	83	\$13.42	\$15.59	\$17.55	
Washington	77	\$13.58	\$15.80	\$17.75	
York	76	\$13.69	\$15.97	\$18.02	
Piscataquis	64	\$14.31	\$16.68	\$18.62	
Hancock	56	\$13.58	\$15.74	\$17.56	
Waldo	53	\$13.54	\$15.64	\$17.49	
Cumberland	48	\$14.37	\$16.78	\$18.58	
Androscoggin	42	\$13.45	\$15.60	\$17.54	
Lincoln	32	\$13.69	\$15.77	\$17.44	
Knox	31	\$13.43	\$15.59	\$17.51	
Sagadahoc	14	\$13.83	\$15.99	\$17.58	
Maine	1,804	\$14.10	\$16.47	\$18.66	

Table 5: Hourly percentile earnings by region, 2018

Table 6: Hourly median earnings for by class of worker and region, 2018

Madian Hourly Farnings 2019

We ular Houry Earnings, 2018									
County Namo	All Employed	OCEW/Workers	Solf Employed						
County Name	All Ellipioyeu	QCEW WORKERS	Sell-Employed						
Androscoggin	\$15.60	\$15.48	\$15.65						
Aroostook	\$16.70	\$17.09	\$15.67						
Cumberland	\$16.78	\$19.11	\$15.62						
Franklin	\$16.68	\$17.61	\$15.69						
Hancock	\$15.74	\$15.94	\$15.66						
Kennebec	\$15.59	\$15.48	\$15.64						
Knox	\$15.59	\$15.48	\$15.63						
Lincoln	\$15.77	Insf. Data	\$15.65						
Oxford	\$17.11	\$19.03	\$15.67						
Penobscot	\$16.53	\$16.97	\$15.69						
Piscataquis	\$16.68	\$18.17	\$15.69						
Sagadahoc	\$15.99	Insf. Data	\$15.69						
Somerset	\$16.69	\$17.50	\$15.69						
Waldo	\$15.64	\$15.48	\$15.68						
Washington	\$15.80	\$15.96	\$15.68						
York	\$15.97	\$16.30	\$15.60						

Source: EMSI dataseries 2019.1 – Includes QCEW, Non-QCEW, and Self-Employed workers. Note: Employment levels reflect total logging equipment operators

The occupations in Table 7 are identified as having compatible skill sets and ocupational requirements as logging equipment operators based on a compatability index ranking, where 100 is a full match. These jobs are closely related to logging equipment operators in which their skill sets could be applied with some short to moderate term training. Employers of these jobs compete for workers from a pool of labor with skill sets that translate well across occupations. While these do not represent the full spectrum of compatable occupations, this summary represents occupations which employed greater than 100 workers and paid a median hourly wage higher than that reported for logging equipment operators. These jobs are found across a number of production oriented industries in the forest products sector and manufacturing more broadly. Also includes in Table 7 are the employment projections for each occupation through 2026, including the net new jobs (growth) and the average number of annual openings. The latter measure includes replacements, or workers retiring or existing the labor force, and is the most appropriate measure of anticipated labor demands.

Wage competitiveness is showed in Figure 11 on the following page.

				Percent	Job Projections 2018-26		2018 Hourly Wages by Percentiles				
		Compat	Jobs	Change	Net	Annual					
SOC	Occupation	Index	2018	2010-18	Change	Openings	10th	25th	Median	75th	90th
45-4022	Logging Equipment Operators	100	1,813	-1.6%	(180)	228	\$12.45	\$14.10	\$16.47	\$18.66	\$23.08
47-2071	Paving, Surfacing, & Tamping Equipment Operators	93	446	-3.9%	2	49	\$12.59	\$14.42	\$17.08	\$20.44	\$23.52
47-2073	Operating Engineers & Other Construction	93	1,801	1.0%	11	200	\$13.59	\$15.83	\$18.34	\$22.09	\$25.22
	Equipment Operators										
47-2131	-2131 Insulation Workers, Floor, Ceiling, & Wall		385	36.5%	(10)	42	\$13.15	\$15.30	\$19.04	\$22.53	\$24.45
51-4021	Extruding & Drawing Machine Setters, Operators, &	94	217	-17.8%	(29)	21	\$10.80	\$13.29	\$17.52	\$21.27	\$23.79
	Tenders, Metal & Plastic										
51-4031	Cutting, Punching, & Press Machine Setters,	95	244	-21.8%	(3)	29	\$10.67	\$13.47	\$16.89	\$20.20	\$23.12
	Operators, & Tenders, Metal & Plastic										
51-4033	Grinding, Lapping, Polishing, & Buffing Machine	94	246	6.0%	(13)	26	\$9.75	\$11.51	\$17.05	\$23.51	\$29.19
	Tool Setters, Operators, & Tenders, Metal & Plastic										
51-4072	Molding, Coremaking, & Casting Machine Setters,	93	224	23.1%	(12)	25	\$10.71	\$13.90	\$18.77	\$25.99	\$28.07
	Operators, & Tenders, Metal & Plastic										
51-5112	Printing Press Operators	92	471	-10.6%	(29)	47	\$11.58	\$14.04	\$17.06	\$19.88	\$23.66
51-9021	Crushing, Grinding, & Polishing Machine Setters,	94	149	-29.4%	(17)	16	\$12.89	\$15.36	\$17.96	\$21.39	\$25.04
	Operators, & Tenders										
51-9022	Grinding & Polishing Workers, Hand	93	120	18.8%	(13)	13	\$12.92	\$14.65	\$17.21	\$20.08	\$23.58
51-9032	Cutting & Slicing Machine Setters, Operators, &	94	357	-29.2%	(43)	38	\$14.16	\$17.19	\$23.17	\$27.66	\$29.91
	Tenders										
51-9121	Coating, Painting, & Spraying Machine Setters,	95	394	-4.4%	(17)	41	\$12.21	\$15.93	\$23.66	\$28.22	\$31.87
	Operators, & Tenders										
51-9122	Painters, Transportation Equipment	92	488	25.8%	(5)	53	\$13.02	\$15.04	\$17.70	\$21.58	\$24.44
51-9196	Paper Goods Machine Setters, Operators, &	93	142	-68.0%	67	28	\$17.69	\$22.88	\$30.22	\$38.16	\$44.92
	Tenders										
53-7011	Conveyor Operators & Tenders	95	154	-44.4%	(10)	20	\$12.71	\$13.81	\$16.97	\$22.80	\$25.67
53-7021	Crane & Tower Operators	95	314	3.3%	(8)	33	\$16.27	\$19.96	\$25.07	\$28.33	\$30.35
53-7032	Excavating & Loading Machine & Dragline Operators	94	770	-11.9%	(18)	84	\$14.68	\$16.32	\$18.70	\$22.97	\$26.88
53-7051	53-7051 Industrial Truck & Tractor Operators		2.689	-3.5%	(38)	303	\$12.67	\$14.73	\$17.44	\$20.55	\$23.37

Table 7: Compatible occupations to logging equipment operators wage and employment, 2018-2026

Source: EMSI dataseries 2019.1 – Includes QCEW, Non-QCEW, and Self-Employed workers. Note: "Compat Index" measures the relative skill and job requirement compatibilities of Logging Equipment Operators to other occupations. A measure of 100 is a full match. We include a selection 18 occupations that score high job requirements compatible with Logging Equipment Operators. Projections include employment across all industries.

Figure 11: Wages of compatible production occupations for logging equipment operator skill sets, 2018

Paper Goods Machine Setters, Operators, and Tenders Crane and Tower Operators Coating, Painting, and Spraying Machine Setters, Operators, and Tenders Cutting and Slicing Machine Setters, Operators, and Tenders Insulation Workers, Floor, Ceiling, and Wall Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic Excavating and Loading Machine and Dragline Operators Operating Engineers and Other Construction Equipment Operators Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders Painters, Transportation Equipment Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic Industrial Truck and Tractor Operators Grinding and Polishing Workers, Hand Paving, Surfacing, and Tamping Equipment Operators Printing Press Operators Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic Conveyor Operators and Tenders Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic Logging Equipment Operators \$10 \$20 \$30 \$40 Hourly Wage

Median and Percentile (10, 25, 75, 90) Hourly Wages of Logging Operators Compatable Occupations, 2018
Table 8: Wage comparison of logging equipment operators to production occupations in Pulp and Paper Manufacturing, 2017

The pulp and paper manufacturing industry employs a number of production jobs and general technologists, virtually all of which earned median wages above logging equipment operators. Many of these jobs have similar or adaptable skill sets to logging equipment operators, a few of which are identified in Table 7 as having a high compatability score. Logging equipment operators are included for comparison purposes only.

Wages of pulp and paper manufacturing production occupations are illustrated in Figure 12 on the following page.

			Job Projection	2017 Hourly Wages by Percentiles					
		Jobs	Numeric	Annual					
SOC	Occupation	2017	Change	Openings	10th	25th	Median	75th	90th
49-2094	Electrical and Electronics Repairers,	130	(37)	80	\$24.58	\$26.24	\$28.82	\$33.52	\$38.59
	Commercial and Industrial Equipment								
49-9041	Industrial Machinery Mechanics	270	20	124	\$22.21	\$25.13	\$27.36	\$29.62	\$30.99
49-9044	Millwrights	130	(29)	27	\$23.01	\$25.14	\$27.04	\$28.96	\$30.11
49-9071	Maintenance and Repair Workers, General	240	47	482	\$13.63	\$16.14	\$23.20	\$34.67	\$37.57
51-1011	First-Line Supervisors of Production and	190	(73)	279	\$25.96	\$30.49	\$40.50	\$48.09	\$56.38
	Operating Workers								
51-9012	Separating, Filtering, Clarifying,	140	1	34	\$25.06	\$26.15	\$27.98	\$29.80	\$31.00
	Precipitating, and Still Machine Setters,								
	Operators, and Tenders								
51-9023	Mixing and Blending Machine Setters,	170	(35)	29	\$19.86	\$21.95	\$25.27	\$29.30	\$34.39
	Operators, and Tenders								
51-9032	Cutting and Slicing Machine Setters,	200	(44)	37	\$17.02	\$20.71	\$25.79	\$28.61	\$30.33
	Operators, and Tenders								
51-9111	Packaging and Filling Machine Operators	130	2	226	\$12.48	\$14.05	\$24.73	\$28.10	\$30.12
	and Tenders								
51-9121	Coating, Painting, and Spraying Machine	180	(57)	41	\$21.00	\$24.47	\$27.33	\$30.13	\$35.67
	Setters, Operators, and Tenders								
51-9198	HelpersProduction Workers	430	72	310	\$13.29	\$15.78	\$19.43	\$22.35	\$24.37
51-9199	Production Workers, All Other	460	(65)	195	\$11.55	\$19.17	\$22.06	\$24.59	\$28.49
53-7051	Industrial Truck and Tractor Operators	140	(57)	205	\$15.41	\$19.28	\$21.82	\$23.98	\$26.20
45-4022	Logging Equipment Operators	990	(271)	195	\$12.35	\$14.41	\$17.09	\$21.36	\$26.46

Source: US Bureau of Labor Statistics, Occupational Employment and Wages (OES) by Industry Research Estimates, 2017. Includes employment and wage information for occupations only employed in the Pulp and Paper Manufacturing industry. Does not include self-employment. Note: Does not include all relevant occupations in Pulp and Paper Manufacturing industry, such as "Paper goods machine setter" as shown in Table 7 and Figure 11. Data on some occupations in BLS OES dataset are suppressed and not reported due to nondisclosure rules. *Projections data sourced from Maine Department of Labor Center for Workforce Research and Information Job Outlook to 2026.

Figure 12: Wage comparison of logging equipment operators to production occupations in Pulp and Paper Manufacturing, 2017 Median and Percentile (10, 25, 75, 90) Hourly Wages of Paper Manufacturing Production Jobs, 2017



Source: US Bureau of Labor Statistics, Occupational Employment and Wages (OES) by Industry Research Estimates, 2017.

Table 9 provides wage and employment data for key production oriented occupations reported in the wood product manufacturing industry; a key employment industry in Maine's forest products sector. Sawmill (machine) operators are the largest number of employed workers (750), followed by other machine operators (540). Logging equipment operators are included for comparison purposes only. Wages of wood product manufacturing production occupations are illustrated in Figure 13 on the following page.

Job Projections 2016-2026* 2017 Hourly Wages by Percentiles Jobs Numeric Annual 2017 Median 75th 90th Occupation Change SOC Openings 10th 25th 51-1011 First-Line Supervisors of Production and Operating Workers (73) \$16.37 \$19.93 \$25.51 \$29.61 180 279 \$33.61 51-2098 Assemblers and Fabricators, All Other, Including Team 110 \$11.50 \$13.23 \$14.97 \$18.87 \$22.89 Assemblers 51-7041 Sawing Machine Setters, Operators, and Tenders, Wood 750 (86) \$10.86 \$12.52 \$15.08 \$19.18 \$23.02 74 \$10.56 \$12.36 51-7042 Woodworking Machine Setters, Operators, and Tenders, 540 69 \$9.60 \$15.90 \$18.92 (44) Except Sawing 51-9061 Inspectors, Testers, Sorters, Samplers, and Weighers \$11.89 \$13.07 \$14.49 \$16.75 \$20.62 170 (217) 118 53-3032 Heavy and Tractor-Trailer Truck Drivers (137) \$12.81 \$14.62 \$17.11 \$20.82 \$27.48 100 984 53-7021 Crane and Tower Operators 30 (7) \$15.86 \$16.61 \$17.82 \$19.14 \$20.61 18 53-7051 Industrial Truck and Tractor Operators 240 (57) 205 \$10.62 \$12.67 \$14.99 \$18.01 \$21.95 45-4022 Logging Equipment Operators 990 (271) 195 \$12.35 \$14.41 \$17.09 \$21.36 \$26.46

Table 9: Wage comparison of logging equipment operators to production occupations in Wood Product Manufacturing, 2017

Source: US Bureau of Labor Statistics, Occupational Employment and Wages (OES) by Industry Research Estimates, 2017. Includes employment and wage information for occupations only employed in the Wood Product Manufacturing industry. Does not include self-employment. Note: Data does not necessarily include all relevant occupations in the Wood Manufacturing industry. Data on some occupations in BLS OES dataset are suppressed and not reported due to nondisclosure rules. *Projections data sourced from Maine Department of Labor Center for Workforce Research and Information Job Outlook to 2026.

Figure 13: Wage comparison of logging equipment operators to production occupations in Wood Product Manufacturing, 2017



Median and Percentile (10, 25, 75, 90) Hourly Wages of Wood Product Manufacturing Production Jobs, 2017

Source: US Bureau of Labor Statistics, Occupational Employment and Wages (OES) by Industry Research Estimates, 2017.

Figure 14: Regional employment, 2018



Heavy and tractor-trailer truck drivers are a key occupation in the logging sector. The occupation is defined as:

"Drive a tractor-trailer combination or a truck with a capacity of at least 26,000 pounds Gross Vehicle Weight (GVW). May be required to unload truck. Requires commercial drivers' license."

Sample of Reported Job Titles:

- Over the Road Driver (OTR Driver)
- Truck Driver
- Mixer Driver
- Log Truck Driver
- Line Haul Driver
- Commercial Driver's

- License Truck Driver (CDL Truck Driver)
- Commercial Driver's License Driver (CDL Driver)
- Tractor Trailer Operator
- Semi Driver

Truck drivers are employed across a wide variety of industries and regions in the state. Total county employment in heavy truck drivers is shown in Figure 14 and median wages shown in Figure 15.

Occupation Summary for Heavy and Tractor-Trailer Truck Drivers

9,310	4.3%	\$18.54/hr
Jobs (2010)	% Change (2010-2018)	Median Hourly Earnings
18% above National average	Nation: 19.4%	Nation: \$19.88/hr

Figure 15: Regional hourly wage, 2018



Source: EMSI dataseries 2019.1 – Includes QCEW Employees, Non-QCEW Employees, and Self-Employed

Table 10 shows hourly percentile earnings and employment trends for heavy tractor trailer truck drivers by region for 2018, as well as employment and employment change in the logging industry only. Wages are only available aggregated across all industries. In total, wages for truck drivers are relatively consistent across all counties in Maine Industry specific wages are reported in Table 11 and Figure 16 that follow.

			Jobs in	2001 - 2018 %	2001 - 2018			
		2001 - 2018 %	Logging	Change (Logging	Change	Pct. 25 Hourly	Median Hourly	Pct. 75 Hourly
County Name	Total Jobs	Change	only	only)	(Logging only)	Earnings	Earnings	Earnings
Androscoggin	1,124	54%	<10	100%	4	\$16.48	<u>\$19.44</u>	\$24.29
Cumberland	2,335	1%	<10	17%	1	\$16.40	<u>\$19.35</u>	\$24.20
Oxford	351	14%	51	76%	22	\$16.14	<u>\$18.92</u>	\$23.07
York	741	5%	20	122	11	\$15.92	<u>\$18.83</u>	\$23.01
Sagadahoc	136	(43%)	<10	-67%	-4	\$16.02	<u>\$18.82</u>	\$23.30
Waldo	225	41%	<10	75%	3	\$15.45	\$18.42	\$21.82
Penobscot	1,406	(13%)	99	5.0%	5	\$15.49	\$18.37	\$22.74
Somerset	461	(19%)	54	-17%	-11	\$15.38	\$18.25	\$22.21
Kennebec	705	5%	19	138%	11	\$15.32	\$18.21	\$22.35
Piscataquis	89	(44%)	15	-12%	-2	\$15.33	\$18.20	\$21.60
Lincoln	163	19%	<10	0%	0	\$14.81	\$17.73	\$21.36
Hancock	286	10%	11	10%	1	\$14.83	\$17.70	\$21.56
Knox	185	(14%)	<10	250%	5	\$14.62	\$17.52	\$21.15
Washington	225	(30%)	19	-24%	-6	\$14.49	\$17.48	\$20.86
Franklin	162	(26%)	37	-20%	-9	\$14.35	\$17.18	\$20.77
Aroostook	903	(7%)	122	4%	5	\$14.26	\$17.02	\$20.88
Maine	9,712	(1%)	485	9	38	\$15.65	\$18.54	\$22.82

Table 10: Hourly percentile earnings for heavy tractor trailer truck drivers by region,

The labor shortage of truck drivers has been a long and persistent challenge and is well documented in Maine and nationally. Like logging equipment operators, heavy truck drives are a key occupation in the logging industry. Unlike logging equipment operators, heavy truck drivers are not unique to the logging industry and are found across a wide variety of industries. The ability of logging companies to attract and recruit truck drivers under an already scarce supply of workers is further challenged by wage competitiveness.

Table 11 shows the hourly median wage percentiles for heavy truck dirvers employed in respective industries, in addition to estimated employment in 2017 and the share of industry total jobs employment comprises. For example, the 300 jobs in forestry and logging industry comprises 16.7 percent of all employment in the industry.

Wage competitiveness is displayed graphically in Figure 16 on the following page.

						2017 Hourly Wages by Percentiles					
PCT Industry											
NAICS (3)	Industry	Jobs 2017	Jobs	10th	25th	Median	75th	90th			
113	Forestry and Logging	300	16.7%	\$9.31	\$10.11	\$15.23	\$17.61	\$19.00			
237	Heavy and Civil Engineering Construction	170	5.6%	\$11.77	\$14.18	\$16.69	\$19.28	\$23.29			
238	Specialty Trade Contractors	1,090	5.9%	\$13.20	\$14.94	\$16.77	\$18.61	\$21.37			
321	Wood Product Manufacturing	100	2.2%	\$12.81	\$14.62	\$17.11	\$20.82	\$27.48			
327	Nonmetallic Mineral Product Mnfg	280	17.8%	\$13.00	\$14.77	\$16.56	\$18.50	\$21.36			
423	Merchant Wholesalers, Durable Goods	260	3.0%	\$13.32	\$15.38	\$18.49	\$22.34	\$25.27			
424	Merchant Wholesalers, Nondurable Goods	580	7.3%	\$14.71	\$17.93	\$21.60	\$24.23	\$27.91			
444	Bldg Material & Garden Equip. & Supplies Dealers	260	3.3%	\$12.93	\$14.73	\$16.96	\$19.81	\$23.51			
454	Nonstore Retailers	840	16.8%	\$14.64	\$16.04	\$17.82	\$19.87	\$23.62			
484	Truck Transportation	3,390	58.7%	\$10.06	\$15.94	\$20.72	\$27.15	\$31.21			
488	Support Activities for Transport	130	8.9%	\$11.69	\$13.28	\$15.60	\$20.41	\$29.35			
493	Warehousing and Storage	190	5.0%	\$9.68	\$10.33	\$11.41	\$18.12	\$22.63			
532	Rental and Leasing Services	170	8.9%	\$17.04	\$19.30	\$21.92	\$25.59	\$29.43			
562	Waste Management and Remediation Svcs	390	18.8%	\$13.23	\$15.21	\$17.13	\$19.25	\$22.70			

Source: US Bureau of Labor Statistics, Occupational Employment and Wages (OES) by Industry Research Estimates, 2017. Note: OES Industry Research Estimates provide a relative comparison of wages for truck drivers across industries. However, wages for heavy truck drivers may vary from previous section due to difference in data source, vintage, and industry aggregation. Other data sources (EMSI) provide more recent and regional (county) reporting, but provide aggregated data for truck drivers across all industries.

Figure 16: Hourly wages of heavy truck drivers by industry, 2017

Median and Percentile (10, 25, 75, 90) Hourly Wages of Heavy Truck Drivers Across Industries, 2017



Across industries that employ heavy truck drivers, workers in the forestry and logging industry earned an hourly median wage ranked second lowest compared to other industries (Figure 16). This presents serious challenges in trying to recruit and attract truck drivers in the industry under current wage rates.

Occupational industry wage data is only provided at the state level and is not reported by sub-state region or county.