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MONTANA'S FOREST INDUSTRY EMPLOYMENT AND INCOME TRENDS

DECLINING HARVEST VOLUMES AND INCREASING PRODUCTIVITY

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Introduction

Forest related industries have long played a major role in Montana's economy – especially in the western part of the state. The decades-long drum roll of layoffs, reduced employment and mill closings have been the subject of many discussions and headlines in the media. This paper takes a systematic view of Montana's forest industry during the past few decades and identifies the major causes of industry trends. The conclusion is that timber harvest volumes in Montana are the major factor impacting industry conditions, including employment and labor earnings. Labor productivity has generally increased in Montana's larger timber-processing facilities, but these gains are not driving reduced employment and labor earnings in Montana's forest industry.

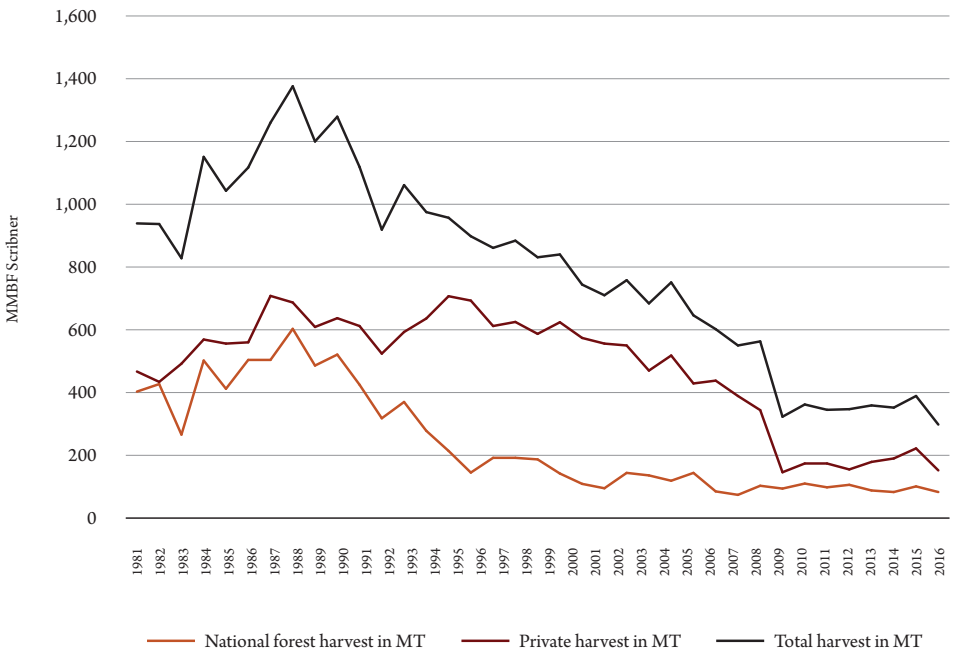
This analysis utilizes the unique data collected and maintained at the University of Montana's Bureau of Business and Economic Research (BBER) since the 1970s. Quarterly surveys of the state's largest wood products facilities have been conducted by BBER since the early 1980s and provide monthly employment, wages, hours worked and production on a mill-by-mill basis. Periodic censuses of primary wood products facilities have been conducted since 1976 (Keegan 1980; Keegan et al. 1983, 1988, 1990, 1995, 2001; Spoelma et al. 2008; McIver et al. 2013; Hayes and Morgan 2017a, b; Marcille et al. 2017). With data from these surveys and other sources – U.S. Department of Commerce, Bureau of Economic Analysis (BEA 2018 a,b) and the U.S. Department of Labor, Bureau of Labor Statistics (BLS 2018) – BBER researchers were able to describe trends and provide details about timber harvest and use, the structure of the primary wood products industry and economic contributions of the forest industry across the state. Timber harvest information came from BBER mill surveys, as well as U.S. Forest Service (USFS) cut and sold reports and Montana Department of Natural Resources and Conservation (DNRC) cut by county reports. National lumber prices came from Random Lengths (various years). Statewide lumber production information came from BBER's surveys and the Western Wood Products Association (WWPA 2017).

Trends in Montana's Timber Harvest and Forest Industry

Timber harvests in Montana have declined substantially since peaking in the late 1980s (Figure 1). The decline was led by a 70 to 80 percent reduction in National Forest Systems (NFS) timber harvests during the 1990s, with continued historically low harvest levels from NFS lands in Montana throughout the 2000s. Private harvest declines began in the late 1990s and continued until private harvests bottomed-out in 2009 as a consequence of the housing collapse and low wood product (e.g., lumber) demand during 2008 and 2009. Total timber harvest levels in Montana have changed little from 2009. In fact, the 2016 harvest was less than 300 MMBF, which is 8 percent lower than during 2009.

Following the trend in timber harvests, lumber production and sales from Montana's primary wood products industry declined substantially since the late 1980s (Figure 2). Lumber production in 2016 (506 MMBF) was one-third of what it was in 1989 (1,567 MMBF) and total primary product sales in 2016

Figure 1. Montana timber harvest, 1980-2016. Source: Bureau of Business and Economic Research.



($563 million) were likewise less than one-third of what they were in 1989 ($1.78 billion – in constant 2016 dollars). Lumber production in Montana has been limited by constrained timber availability and reduced harvest levels. As a result, it has been fairly unresponsive to growth in wood products demand and increased lumber prices.

During the 1990s and early 2000s – a period of relatively high but volatile lumber prices and record levels of new home construction in the U.S. – lumber production in Montana fell dramatically (Keegan et al. 2001; McIver et al. 2013). Since the bottom of the Great Recession in 2009, new home construction in the U.S. has more than doubled and lumber prices have risen 40 to 60 percent (Random Lengths 2018), but lumber production in Montana is up just 20 percent and sales value from Montana's primary wood products facilities are down 10 to 15 percent.

Figure 2. Montana timber harvest, lumber production, primary wood product sales and lumber price. Sources: Bureau of Business and Economic Research, WWPA and Random Lengths.

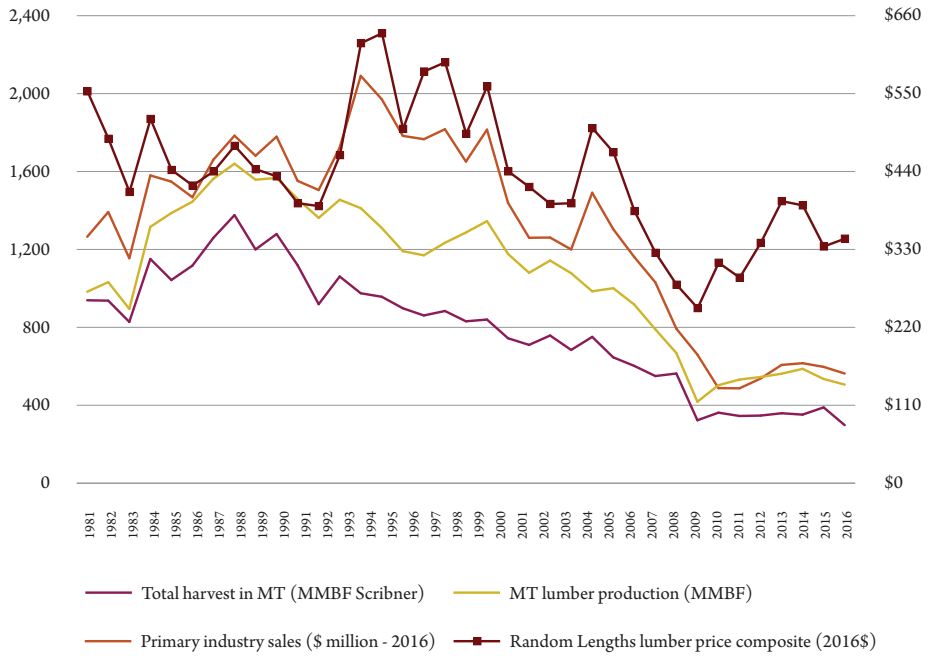
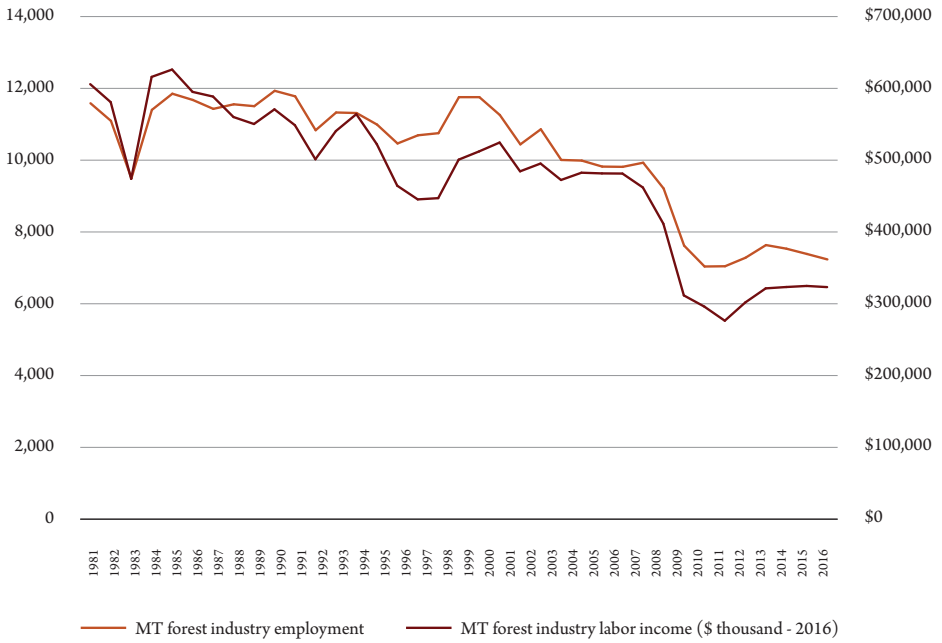


Figure 3. Employment and labor income in Montana's Forest Industry. Sources: Bureau of Business and Economic Research, BEA and BLS.



Throughout the West and the U.S., the Great Recession had a major impact on the wood products industry, reducing production, sales value and employment (Keegan et al. 2012). However, in Montana, like several other states in the interior west (Sorenson et al. 2016a), there is a disconnection between the state's wood products industry activity and the national market for wood products. Constrained local timber availability and harvest volumes in Montana are not responding to broader market conditions (e.g., increases in new home construction and rising lumber prices).

Employment and labor income in Montana's forest industry have also been declining since the late 1980s (BEA 2018a, b; Marcille et al. 2017), with a pronounced drop off during the Great Recession (Figure 3). And, like timber harvests, lumber production and wood product sales, employment and labor income have recovered little since the Great Recession.

Forest industry employment in 2016 (7,235) was just 2.7 percent higher than the 2010 low point (7,038) and labor income in 2016 ($320.5 million) was only 17 percent higher (in inflation adjusted terms) than the 2011 low ($273.7 million). Most mills in Montana have been running only one shift for many years because they have been unable to get enough logs to run a second shift. Thus, many mills in Montana are operating at only 50 to 70 percent of capacity (Hayes and Morgan 2017b) during periods of relatively high lumber prices.

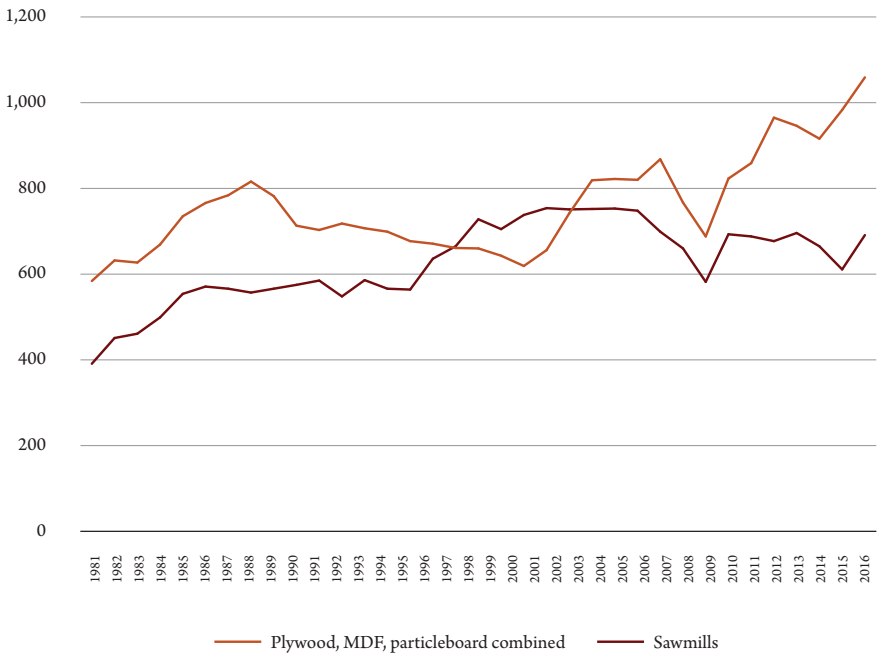
Productivity (defined here as the amount of output per unit of input) has generally, but not consistently, increased over the past 35 years among Montana's larger wood products facilities – sawmills, plywood plants, MDF and particleboard plants. Two types of productivity are discussed in this analysis: material productivity, often referred to as recovery or overrun in sawmills, is the amount of output per unit of raw material input (e.g., MBF of lumber per MBF Scribner of logs) and labor productivity is the amount of output per unit of labor (e.g., MBF of lumber per employee).

Increases in lumber overrun and recovery at Montana sawmills are well documented (Keegan et al. 2010a,b; Blatner et al. 2013; McIver et al. 2013; Hayes and Morgan 2017b). For example, lumber recovery (MBF of lumber produced per cubic foot of log input) in Montana increased more than 10 percent between 1981 and 2009 (McIver et al. 2013), and overrun and recovery increases in Montana and Oregon between the 1970s and early 2000s were among some of the highest in the western U.S. (Keegan et al. 2010b).

Since the 1980s, labor productivity has increased among Montana's sawmills and panel producers (i.e., plywood, MDF & particleboard). However, there have been extended periods of declining or flat productivity in both segments of the industry (Figure 4). Quarterly and annual data collected and maintained at BBER for the largest mills in Montana quantify the changes in labor productivity at both sawmills and panel producers.

Annual panel production per production employee (the orange line in Figure 4) rose during the 1980s, fell throughout the 1990s, rose again from 2002 through 2007, fell off sharply during the Great Recession and has generally been increasing since 2010, with the last five years being the highest recorded. Annual lumber production per production employee (the red line in Figure 4) rose during the early 1980s and late 1990s,

Figure 4. Montana lumber and panel production per production employee. Source: Bureau of Business and Economic Research.



peaked during the 2002 through 2005 U.S. homebuilding blitz, fell during the Great Recession and has been variable but below its peak for the past decade.

If it were not for gains in productivity, Montana's sawmills and panel facilities would not be competitive and thus not able to stay in business; and it is possible that Montana's industry would be even smaller than it is today. Sawmills and plywood plants consistently use the majority of the timber processed in the state (72 to 97 percent) and employ the majority of wood products workers in the state (McIver et al. 2013; Hayes and Morgan 2017b). Productivity gain, however, has not been the major cause of declining employment and labor income in Montana's forest industry, as implied by Headwaters Economics (Rasker 2017; Haggerty 2018).

Statistical Analysis and Findings

To quantify the relationship between timber harvest volumes, changes in productivity and lumber prices and forest industry employment and labor income, the statistical method called linear regression was used. This procedure enabled formal statistical testing of whether or not a relationship existed among the variables and which of the variables were most important in determining the employment and labor income trends in Montana's forest industry. Regression models were developed to determine the relationship of forest industry employment and labor income (dependent variables) as a function of statewide log supply, milling productivity (lumber output per employee) and market trends (Random Lengths composite lumber price) for the period 1982 through 2016.

Regression equations were examined for violations of statistical assumptions (normality, constant variance and collinearity) using standard regression diagnostic techniques in order to validate the quality of the final models. Standardized regression betas (β) are used to determine the relative importance of the independent variables. They are unitless coefficients and are considered weights that display the relative importance of each independent variable in explaining the variation in employment and labor income (Freedman 2009). The possibility of simultaneity (i.e., the independent variables influence the dependent variable, but the dependent variable also influences the independent variables) was investigated using lagged independent and dependent variable model specifications. The analysis did not show indication of simultaneity.

A number of alternative regression analyses were performed and the final form is presented in Table 1 for both the forest industry employment and labor income models. The forest industry employment regression model consists of three significant independent variables: 1) lumber output per sawmill employee, which is a measure of productivity; 2) Random Lengths composite lumber price, which is a measure of wood product market trend; and 3) Montana timber harvest from all ownership sources, which is a measure of log supply. The employment model explains 86 percent of the variation in Montana total forest industry employment over the 1982 to 2016 period. All variables are significant at probability level of alpha = 0.10.

The most important variable in explaining forest industry employment in Montana is total timber harvest. The standardized

Table 1. Regression results. Source: Bureau of Business and Economic Research.

Dependent variable	Independent variables	Regression coefficients	(Prob. Level)	Standardized β
Forest industry employment				
	Constant	2,614.95	0.0254	--
Model summary statistics	Timber harvest volume	5.06	0.0000	0.9506
R^2=0.8693	Lumber production per sawmill employee	3.93	0.0084	0.2248
Adjusted R^2=0.8566	Lumber price (2016$)	2.40	0.1007	0.1370
Forest industry labor income (2016$)				
	Constant	136,880.7	0.0763	--
Model summary statistics	Timber harvest volume	303.95	0.0000	0.9470
R^2=0.8384	Lumber production per saw mill employee	114.79	0.2294	0.1090
Adjusted R^2=0.8228	Lumber price (2016$)	44.78	0.6410	0.0424

β for the employment model is 0.951. The employment model standardized β indicates that total timber harvest is over four times more important than the productivity measure (0.951 vs 0.225).

For the labor income model, the same independent variables were used to explain the relationship. However, only the total harvest variable was significant at the alpha = 0.10. Approximately 82 percent of the labor income variation is explained by the model. The standardized β again indicate that total harvest is the most important of the three factors. Total harvest is over eight times more important than the productivity measure and over twenty times more important than lumber price.

These results are important and support the hypothesis that the log supply situation in Montana is the most important factor in determining the reduction in forest industry employment and labor income. Labor productivity, measured as lumber output per sawmill employee, is statistically important in explaining total forest industry employment but not labor income. And the models indicate that total employment and labor income increase with increasing productivity.

In other words, given the other factors of log supply and market conditions, increasing worker productivity at sawmills contributes to increasing forest industry employment, not lower employment. The regression analyses show that the dependent variables – Montana's forest industry employment (or labor income) – are most strongly correlated with Montana's timber harvest volume, and less correlated with Montana sawmill labor productivity and Random Length's national composite lumber price. Thus, dispelling the myth that productivity gains are the reason for declining forest industry employment in Montana.

Conclusion

The overall trend in timber harvests in Montana has been downward since the late 1980s. And declining timber harvests are the main cause of similarly declining employment and labor income in Montana's forest industry. Regardless of new technology and process improvements that increase productivity, timber input is still required and is the most important factor in determining the size and economic contribution of Montana's forest industry.

Increased harvest levels have direct employment and labor income impacts on the forest industry (Sorenson et al. 2016b), as well as indirect and induced effects on the broader economy (see Marcille et al. 2017). Without substantial increases in timber availability and timber harvest volume in Montana, we can expect the industry to erode further, employ fewer people and generate less labor income.

Perhaps more importantly, with the loss of its forest industry, Montana is losing its ability to manage forests, reduce wildfire risk to communities and provide income to forest landowners. With additional timber, mills in Montana could not only increase wood product sales, but also increase employment, adding workers and increasing hours per employee, which would increase labor income.

References

Blatner, K.A., Keegan, C.E., Daniels, J.M., and T.A. Morgan. 2013. Trends in lumber processing in the western United States Part 3: Residue recovered vs. lumber produced. Forest Products Journal 62(6):429-433.

Freedman, D.A. 2009. Statistical Models: Theory and Practice, Second Edition. Cambridge University Press, London.

Haggerty, M. 2018. Testimony of Mark Haggerty, Headwaters Economics, to the Joint Subcommittee on The Changing Economy and Impacts to the Long-Term Viability of Montana's Tax Structure. https://headwaterseconomics.org/wp-content/uploads/Montanas_Economy_FiscalImplications.pdf

Hayes, S. W.; Morgan, T. A. 2017a. The Forest Products Industry in Montana, Part 1: Timber Harvest, Products and Flow. Forest Industry Brief No. 3. Missoula, MT: University of Montana, Bureau of Business and Economic Research.

Hayes, S.W.; Morgan, T.A. 2017b. The Forest Products Industry in Montana, Part 2: Industry Sectors, Capacity and Outputs. Forest Industry Brief No. 4. Missoula, MT: University of Montana, Bureau of Business and Economic Research.

Keegan, C.E. 1980. Montana's Forest Products Industry: A Descriptive Analysis. Missoula, MT: Bureau of Business and Economic Research. 107 p.

Keegan, C.E.; Gebert, K.M.; Chase, A.L; Morgan, T.A.; Bodmer, S.E.; VanHooser, D.D. 2001. Montana's Forest Products Industry: A Descriptive Analysis 1969-2000. Missoula, MT: Bureau of Business and Economic Research. 67 p.

Keegan, C.E., Jackson, T.P.; Johnson, M.C. 1983. Montana's Forest Products Industry: A Descriptive Analysis. Missoula, MT: Bureau of Business and Economic Research. 85 p.

Keegan, C.E., T.A. Morgan, K.A. Blatner, and J.M. Daniels. 2010a. Trends in lumber processing in the western United States, part 1: board foot Scribner volume per cubic foot of timber. Forest Products Journal 60 (2):133-139.

Keegan, C.E., T.A. Morgan, K.A. Blatner, and J.M. Daniels. 2010b. Trends in lumber processing in the western United States, part 2: overrun and lumber recovery factors. Forest Products Journal 60 (2):140-143.

Keegan, C.E.; Sorenson, C.B.; Morgan, T.A.; Hayes, S.W.; Daniels, J.M. 2012. Impact of the Great Recession and Housing Collapse on the Forest Products Industry in the Western United States. Forest Products Journal 61(8):625-634.

Keegan, C.E.; Swanson, L.D.; Wichman, D.P.; VanHooser, D.D. 1990. Montana's Forest Products Industry: A Descriptive Analysis 1969-1988. Missoula, MT: Bureau of Business and Economic Research. 52 p.

Keegan, C.E.; Wichman, D.P.; Hearst, A.L.; Polzin, P.E.; VanHooser, D.D. 1995. Montana's Forest Products Industry: A Descriptive Analysis 1969-1994. Missoula, MT: Bureau of Business and Economic Research. 49 p.

Marcille, K. C.; McIver, C. P.; Hayes, S. W.; Morgan, T. A. 2017. The Forest Products Industry in Montana, Part 3: Sales, Employment and Contribution to the State's Economy. Forest Industry Brief No. 6. Missoula, MT: University of Montana, Bureau of Business and Economic Research.

McIver, C.P.; Sorenson, C.B.; Keegan, C.E.; Morgan, T.A.; Menlove, J. 2013. Montana's Forest Products Industry and Timber Harvest, 2009. Resour. Bull. RMRS-RB-16. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42 p.

Neter, J. W. Wasserman, and M.H. Kutner. 1990. Applied Linear Regression Models. Richard D. Irwin, Inc. Homewood, IL.

Office of Management and Budget. 1998. North American Industrial Classification System. Lanham, MD: Executive Office of the President. 705 p.

Sorenson, C.B., S.W. Hayes, T.A. Morgan, E.A. Simmons, M.G. Scudder, C.P. McIver, and M.T. Thompson. 2016a. The Four Corners timber harvest and forest products industry, 2012. Resour. Bull. RMRS-RB-21. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Research Station. 62p.

Sorenson, C.B., C.E. Keegan, T.A. Morgan, C.P. McIver and M.J. Niccolucci. 2016b. Employment and wage impacts of timber harvesting and processing in the United States. Journal of Forestry 114 (4): 485-493.

Spoelma, T.P.; Morgan, T.A.; Dillion, T.; Chase, A.L.; Keegan, C.E., III; DeBlander, L.T. 2008. Montana's Forest Products Industry and Timber Harvest, 2004. Resour. Bull. RMRS-RB-8. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 36 p.

Random Lengths. Various years 1990 to 2018. Random Lengths Yardstick: the monthly measure of forest products statistics. Eugene, OR: Random Lengths Publications, Inc.

Rasker, R. 2017. The Transition from Western Timber Dependence: Lessons for Counties. https://headwaterseconomics.org/economic-development/trends-performance/timber-transition/

U.S. Department of Commerce, Bureau of Economic Analysis (BEA), 2018a. Table SA05N. Personal income by major source of earnings by NAICS industry. http://www.bea.gov/, (June 2018).

U.S. Department of Commerce, Bureau of Economic Analysis (BEA), 2018b. Table SA25N. Total Full-time and Part-time Employment by NAICS industry. http://www.bea.gov/. (June 2018).

U.S. Department of Labor, Bureau of Labor Statistics (BLS), 2018. Quarterly Census of Employment and Wages (QCEW). https://www.bls.gov/cew/. (June 2018).

Western Wood Products Association (WWPA). 2017. 2016 Statistical Yearbook of the Western Lumber Industry. Portland, OR: Western Wood Products Association. 22 p.