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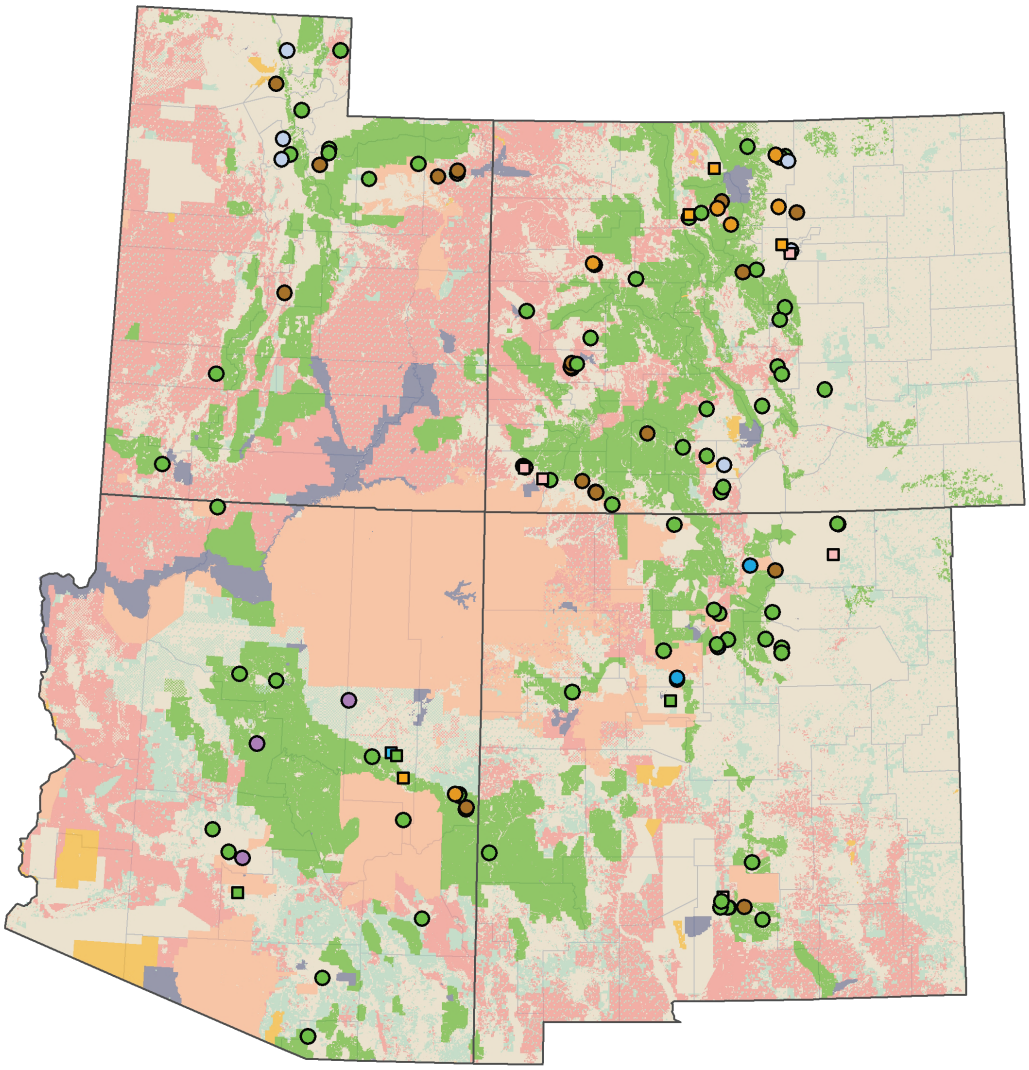
The Four Corners Timber Harvest and Forest Products Industry, 2016



Facility Type

- Sawmill
- Veneer
- Post/pole
- House log
- Firewood
- Log furniture
- Vigas/Latillas
- Biomass
- Bark Products
- Fuel Pellet/Presto Logs
- Excelsior
- Shavings

0 50 100 200 Miles

N

Selected Ownerships

- Indian/Tribal
- National Park Service
- State
- US Bureau of Land Management
- US Fish and Wildlife Service
- USDA Forest Service

Coordinate System: NAD 1983 Contiguous USA Albers
Cartographer: Philip Williams, Research Assistant BBER

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Abstract

This report traces the flow of timber harvested in the "Four Corners" States (Arizona, Colorado, New Mexico, and Utah) during calendar year 2016, describes the composition and operations of the region's primary forest products industry, and quantifies volumes and uses of wood fiber. Recent wood products industry changes are discussed, as well as trends in timber harvest, production, and sales of primary wood products.

Keywords: forest economics, lumber production, mill residue, primary forest products, timber products

C**over**—Map of Four Corners facilities, 2016. Courtesy image by Philip Williams, UM-BBER.

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Report Highlights

- During calendar year 2016, 244.4 million board feet (MMBF) Scribner of timber was harvested from Arizona, Colorado, New Mexico, and Utah. Most (65 percent) of the volume came from National Forest System lands, while 30 percent came from tribal and nonindustrial private timberlands.
- Ponderosa pine was the leading species harvested for timber in the Four Corners States during 2016, accounting for 41 percent of the total. Lodgepole pine accounted for 28 percent, followed by spruces and Douglas-fir at 15 and 7 percent, respectively.
- During 2016, the Four Corners States had a net outflow of timber. Four Corners timber outflow totaled 19 MMBF Scribner, while total timber inflow to Four Corners mills was 0.4 MMBF Scribner.
- Timber-processing capacity (i.e., the volume of timber that could be used by existing timber processors if demand for products were firm and sufficient raw material were available) in the Four Corners during 2016 was approximately 410 MMBF Scribner, representing a 9 percent decrease from 2012. The decrease in the region is primarily due to mill closures and reconfigured mills not operating at their designed capacity.
- This report identified 128 primary timber-processing facilities active during 2016 in the Four Corners. These facilities included 72 sawmills, 19 log home or house log manufacturers, 7 post and pole facilities, 6 log furniture producers, 4 viga and latilla producers, and 20 other wood utilizing facilities.
- During 2016, production of lumber and other sawn products exceeded 207 MMBF lumber tally. Lumber production in Arizona was 62 MMBF, Colorado was 110 MMBF, New Mexico was 24 MMBF, and Utah's lumber production was 11 MMBF.
- Four Corners timber processors produced 261,597 bone-dry units (BDU) of residue during 2016, of which just 1,860 BDU (0.7 percent) went unused. Sawmills generated 84 percent of mill residue in the region.
- The Four Corners primary wood product sales value (f.o.b. the producing mill), including mill residue, totaled $263 million during 2016. Nearly $162 million (61 percent) of sales were within the Four Corners States. Lumber and other sawn products sales totaled $93 million or 35 percent of sales.
- Approximately 22,690 workers were directly employed in the primary and secondary forest industry in the Four Corners States during 2016, up from about 21,360 during 2012. Forest Industry worker earnings also increased to almost $1.6 billion during 2016 (USDC BEA 2018b).

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Introduction

This report details timber harvest and describes the composition and operations of the primary forest products industry in the "Four Corners" States (i.e., Arizona, Colorado, New Mexico, and Utah) during calendar year 2016. The report focuses on trends and changes in timber harvest and timber processing since the last industry census of 2012 operations. More information on prior years and historical perspectives can be found in Sorenson et al. (2016).

Timber used in the direct manufacture of products is the focus of this report. Products directly manufactured from timber are referred to as "primary products" and include lumber, posts and poles, house logs, log furniture, vigas, latillas, and excelsior. Reconstituted products made from chipped or ground timber, as well as products from mill residue (i.e., bark, sawdust, log ends, chips, and planer shavings) generated in the production of primary products, are also included. These reconstituted products include wood pellets, bark and mulch products, and fuelwood. Mills manufacturing derivative, or "secondary" products (e.g., window frames, doors, trusses, and furniture) made from primary products, were not surveyed for this report.

The major source of data for this report was a census of primary wood products facilities in Arizona, Colorado, New Mexico, and Utah and mills in other States that received timber from the Four Corners States during calendar year 2016. Firms were identified through telephone directories, internet queries, directories of the forest products industries (Random Lengths 2016), and with the assistance of State forestry agencies, extension foresters, and the mills themselves. Firms cooperating in the Four Corners census, including out-of-state mills, processed virtually all of the commercial timber harvested from Arizona, Colorado, New Mexico, and Utah in 2016.

This report is the direct result of a cooperative effort between The University of Montana's Bureau of Business and Economic Research (BBER) and the USDA Forest Service, Interior West Forest Inventory and Analysis (IW-FIA) Program. Together, BBER and IW-FIA have been conducting periodic mill censuses in the Rocky Mountains since the 1970s. The Forest Industries Data Collection System (FIDACS) was developed by BBER and IW-FIA to collect, compile, and make available state and county level information on the operations of the forest products industry and the timber it uses. The FIDACS uses a written questionnaire or phone interview of forest products manufacturers to collect the following information for each facility for a given calendar year: production capacity and employment; volume of raw material received by county and ownership; species and live versus dead proportions of timber received; finished product volumes, types, sales values, and market locations; and utilization and marketing of manufacturing residue. Information collected through the FIDACS is processed, analyzed, and stored at the BBER in Missoula, Montana. Additional information is available by request; however, individual firm-level data are confidential and will not be released.

Four Corners Regional Summary

The following sections in this *Introduction* discuss the Four Corners region as a whole, providing information on the forest products industry and timber harvest in 2016, with some historical context. It presents ownership and species composition of harvested timber, types of timber products harvested and processed, and movement of timber within the Four Corners and between the region and other States. Timber-processing and production capacities, utilization of mill residues, forest products sales, and forest industry employment and worker earnings are also discussed at the regional level.

Timber Harvest

Harvest volumes presented in this report for calendar year 2016 came from the FIDACS census of Four Corners and out-of-state mills receiving timber harvested from the region. Periodic state-level reports (Green and Setzer 1974; Hayes et al. 2012; Keegan et al. 1995; Keegan et al. 2001a,b; McLain 1985; McLain 1988; McLain 1989; Morgan et al. 2006; Setzer 1971a,b; Setzer and Barrett 1977; Setzer and Shupe 1977; Setzer and Throssell 1977a,b; Setzer and Wilson 1970; Sorenson et al. 2016; Wilson and Spencer 1967) provided the bulk of historic timber harvest information. Small differences may exist between the numbers reported here and those in Bureau of Land Management (BLM) and U.S. Forest Service "cut and sold" reports. These differences are due to varying reporting units and conversion factors, rounding error, scaling discrepancies between sellers and buyers, and other reporting variations.

During calendar year 2016, approximately 244.4 million board feet (MMBF) Scribner of timber was harvested from Arizona, Colorado, New Mexico, and Utah. This harvest volume represents just 0.1 percent of the approximately 153 billion board feet of sawtimber inventory on nonreserved timberlands in the four States (USDA FIA 2018). Of the timber harvested in the Four Corners States in 2016, 53 percent was live and 47 percent was salvage or standing dead when harvested. Timber harvested from Four Corners timberland and manufactured into wood products came from three broad ownership classes: public lands, nonindustrial private forest (NIPF) land, and tribal lands. Most (69.5 percent) of the harvested volume came from public lands, while 30.5 percent came from NIPF and tribal timberlands (table 4C-1).

Ponderosa pine was the leading species harvested for timber in the Four Corners States during 2016, accounting for 41.4 percent of the total (table 4C-2). Lodgepole pine accounted for 28.4 percent, followed by spruces and Douglas-fir at 14.8 and 7.3 percent, respectively. Sawlogs were the leading component of the Four Corners timber harvest in 2016 at 76.6 percent of the total harvest (table 4C-3). This represents an increase compared to 2012, both in terms of volume and proportion of the total harvest. Trees harvested for fiber logs and industrial fuelwood were 15.8 percent of the total, a decrease from 2012, and house logs fell from 3.9 percent of the 2012 harvest to 2.8 percent of the harvest in 2016.

Table 4C-1—Four Corners timber harvest by ownership class, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016).

	2002		2007		2012		2016	
Ownership class	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**
Private and tribal timberland	234,456	72.5	117,708	55.9	47,739	23.7	74,630	30.5
Tribal	134,840	41.7	23,714	11.3	8,796	4.4	30,758	12.6
Private	99,616	30.8	93,994	44.7	38,942	19.3	43,872	18.0
Public timberland	89,105	27.5	92,700	44.1	153,943	76.3	169,720	69.5
National Forest	84,536	26.1	86,036	40.9	147,918	73.3	159,612	65.3
Other public	4,569	1.4	6,664	3.2	6,025	3.0	10,108	4.1
All owners	323,561	100	210,408	100	201,682	100	244,350	100

Table 4C-2—Four Corners timber harvest by species, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016).

	2002		2007		2012		2016	
Species	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**
Ponderosa pine	186,955	57.8	73,041	34.7	86,696	43.0	101,265	41.4
Lodgepole pine	21,822	6.7	50,648	24.1	52,115	25.8	69,517	28.4
Spruces	46,850	14.5	27,057	12.9	11,490	5.7	36,055	14.8
Douglas-fir	30,165	9.3	19,065	9.1	23,673	11.7	17,863	7.3
Aspen	20,399	6.3	28,088	13.3	18,748	9.3	12,091	4.9
Firs	16,882	5.2	12,351	5.9	6,005	3.0	6,380	2.6
Other species[a]	489	0.2	158	0.1	2,954	1.5	1,178	0.5
All species	323,562	100	210,408	100	201,682	100	244,350	100

[a]Other species include juniper, other softwoods, and hardwoods other than aspen.

Table 4C-3—Four Corners timber harvest by product, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016).

	2002		2007		2012		2016	
Product	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**	**MBF Scribner**	**Percentage of harvest**
Sawlogs	279,317	86.3	174,629	83.0	141,160	70.0	187,226	76.6
Fiber logs and industrial fuelwood	14,763	4.6	15,144	7.2	46,450	23.0	38,546	15.8
Posts and poles	4,104	1.3	5,497	2.6	3,801	1.9	9,821	4.0
House logs	20,695	6.4	12,495	5.9	7,906	3.9	6,737	2.8
Vigas	3,655	1.1	2,368	1.1	1,649	0.8	1,461	0.6
Other products[a]	1,029	0.3	275	0.1	717	0.4	559	0.2
All products	323,563	100	210,408	100	201,682	100	244,350	100

[a]Other products include furniture logs, pilings, and utility poles.

Timber Flow and Mill Receipts

During 2016, the Four Corners region had a net outflow of timber, with 7.9 percent (19,428 MBF; MBF = 1000 board feet) of the regional harvest flowing to States outside of the Four Corners region for processing (table 4C-4). Mills in Wyoming, Idaho, and Texas received most of the timber flowing out of the Four Corners. Over 96 percent (18,704 MBF) of this volume was sawlogs. By ownership, timber from National Forests flowed to States outside of the region in the largest volumes (18,528 MBF). This flow of timber out of the region accounts for the difference in the volume of timber harvested from the Four Corners and the volume received by the region's mills. The large majority (92.1 percent) of timber used by

primary forest products firms in the Four Corners came from within the four-state region. A small amount of additional volume came from Wyoming, Montana, Idaho, and Texas.

Table 4C-4—Four Corners timber product inflow and outflow[a], 2016.

Timber product	Inflow	Outflow	Net inflow (net outflow)
	Thousand board feet, Scribner		
Sawlogs	301	18,704	(18,403)
House logs	60	724	(664)
Other products[b]	47	0	47
All products	408	19,428	(19,020)

[a]Inflows are from other States and Canada. Outflows are to other States only.

[b]Other products include post and poles, fiber logs, firewood, furniture logs, vigas, and industrial fuelwood.

While the 2016 harvest was 244.4 MMBF, the total volume received by Four Corners mills was slightly more than 225 MMBF, a volume equivalent to 92 percent of the harvest. Sawlogs accounted for the majority (75 percent) of timber received by Four Corners mills (table 4C-5), followed by fuelwood/bioenergy logs (11.1 percent). National Forests supplied the largest share (63 percent) of timber received by mills in the four States, followed by NIPF owners (20 percent) and then tribal landowners (14 percent). Timber-processing capacity (the volume of timber that could be used by existing timber processors if demand for products were firm, and sufficient raw material were available) in the Four Corners during 2016 was approximately 410 MMBF, Scribner. Thus, approximately 55 percent of timber-processing capacity in the region was utilized during 2016. While overall timber-processing capacity decreased slightly between 2012 and 2016, capacity utilization increased from 43 percent in 2012 (Sorenson et al. 2016), indicating some facilities were taking

Table 4C-5—Timber received by the Four Corners primary forest products industry by ownership class and product, 2016.

Ownership class	Sawlogs	Fuelwood/ bioenergy	House logs	Post/pole	Other products[b]	All products
	Thousand board feet, Scribner					
Private and tribal timberland	59,897	3,151	1,851	3,392	6,417	74,708
Private	*33,521*	*1,570*	*1,791*	*1,839*	*5,230*	*43,950*
Tribal	*26,376*	*1,581*	*60*	*1,553*	*1,187*	*30,758*
Public timberland	108,925	21,883	4,222	6,430	9,162	150,622
National Forest	*103,313*	*20,109*	*4,222*	*5,718*	*8,052*	*141,414*
Other owners[a]	*5,612*	*1,774*	-	*712*	*1,110*	*9,208*
All owners	168,823	25,034	6,073	9,821	15,579	225,330
	Percentage of product by ownership					
Private and tribal timberland	35.5	12.6	30.5	34.5	41.2	33.2
Private	19.9	6.3	29.5	18.7	33.6	19.5
Tribal	15.6	6.3	1.0	15.8	7.6	13.7
Public timberland	64.5	87.4	69.5	65.5	58.8	66.8
National Forest	61.2	80.3	69.5	58.2	51.7	62.8
Other owners[a]	3.3	7.1	-	7.2	7.1	4.1
All owners	74.9	11.1	2.7	4.4	6.9	100

[a]Other owners include other public ownerships and Canadian imports.

[b]Other products include pulp logs, log furniture, vigas, latillas, and fiber logs.

advantage of improved markets and timber availability. The majority of the observed decrease in timber-processing capacity was capacity to process sawlogs and house logs, while products such as logs going to biomass energy facilities and fuel pellet manufacturers increased during the same period. The low level of capacity utilization in the region, particularly among sawmills, indicates an ability to increase production as timber availability and markets continue to improve. It also suggests that some mills are running at or below their financial operating limits and may face future closures without increases in available timber.

Forest Products Industry Composition and Operations

The FIDACS census identified 128 primary timber-processing facilities active during 2016 in the Four Corners region. These facilities included 72 sawmills, 19 log home or house log manufacturers, 7 post and pole facilities, 6 log furniture producers, 4 viga and latilla producers, and 20 other facilities.

Primary timber processors in the Four Corners produced an array of products including: dimension lumber, board and shop lumber, timbers, pallet stock, dunnage, excelsior, posts, poles, vigas, latillas, finished house logs, log homes, and log furniture, as well as wood pellets, biomass-generated electricity, firewood, bark, mulch, and pulp chips from mill residues. During 2016, production of lumber and other sawn products exceeded 207 MMBF lumber tally. State contributions included Colorado (110 MMBF), Arizona (62 MMBF), New Mexico (24 MMBF), and Utah (11 MMBF). Production of house logs, vigas, and latillas totaled nearly 2.2 million lineal feet (MMLF), and more than 7,000 pieces of log furniture, and millions of posts and poles, were produced by facilities in the Four Corners States.

Mill Residue: Quantity, Types, and Use

A substantial portion of the timber processed by primary forest products facilities ends up as mill residue. Three types of wood residues are typically generated by the primary wood products industry: coarse or chippable residue consisting of slabs, edging, trim, and log ends; fine residue consisting primarily of planer shavings and sawdust; and bark. The 2016 FIDACS census collected information on volumes and uses of mill residue. Residue quantities, reported in bone-dry units (BDU), were obtained from facilities that sold all or most of their residue. All mills reported how their residue was used on a percentage basis. One BDU is the equivalent of 2,400 pounds of oven-dry wood.

Four Corners timber processors produced 261,597 BDU of residue during 2016, of which just 1,860 BDU (under 1 percent) went unused (table 4C-6). Coarse residue was the region's largest residue component (54 percent of all residue), with just under 1 percent going unused. About 37 percent went to the energy sector, and an additional 63 percent went to other uses. Fine residue made up the second largest component (28 percent) in 2016, with sawdust comprising 19 percent and shavings 8 percent. All but 246 BDU (under 1 percent) of fine residue was used, primarily as mulch or animal bedding and for biomass energy. Four Corners facilities generated 48,570 BDU of bark while processing timber in 2016, of which 98 percent was utilized. About 75

percent of bark was used as mulch, while about 6 percent went to energy. During 2016, sawmills generated 219,258 BDU—84 percent of all mill residue in the region. Residue volume factors, which express mill residue generated per unit of lumber produced, were derived from production and residue output volumes provided by mills (table 4C-7).

Table 4C-6—Production and disposition of Four Corners mill residues, 2016.

Residue type	Total utilized	Pulp and board	Energy	Mulch/ bedding	Unspecified use	Unused	Total produced
			Bone-dry units[a]				
Coarse	140,314	-	51,697	-	88,617	851	141,165
Fine	71,616	-	14,362	44,547	12,706	246	71,862
Sawdust	50,436	-	*8,460*	*32,718*	*9,257*	*146*	50,582
Planer shavings	21,180	-	*5,902*	*11,829*	*3,449*	*100*	21,280
Bark	47,808	-	2,760	36,261	8,786	762	48,570
All residues	259,737	-	68,819	80,809	110,109	1,860	261,597
			Percentage of residue type by use				
Coarse	99.4	-	36.6	-	62.8	0.6	54.0
Fine	99.7	-	20.0	62.0	17.7	0.3	27.5
Sawdust	*99.7*	-	*16.7*	*64.7*	*18.3*	*0.3*	*19.3*
Planer shavings	*99.5*	-	*27.7*	*55.6*	*16.2*	*0.5*	*8.1*
Bark	98.4	-	5.7	74.7	18.1	1.6	18.6
All residues	99.3	-	26.3	30.9	42.1	0.7	100

[a]Bone-dry unit = 2,400 lb oven-dry wood.

Table 4C-7—Four Corners sawmill residue factors, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016).

	2002	2007	2012	2016
Type of residue	BDU per MBF	BDU per MBF	BDU per MBF	BDU per MBF
Coarse	0.56	0.56	0.63	0.65
Sawdust	0.19	0.19	0.19	0.23
Planer shavings	0.16	0.10	0.06	0.10
Bark	0.28	0.17	0.19	0.23
Total	1.19	1.02	1.07	1.21

[a]Bone-dry unit (BDU = 2,400 lb oven-dry wood) of residue generated for every 1,000 board feet of lumber manufactured.

Primary Forest Products Sales and Industry Employment

Mills responding to the FIDACS survey summarized their calendar year 2016 shipments of finished wood products, providing information on volume, sales value, and geographic destination. Mills usually distributed their products either through their own distribution channels or through independent wholesalers and selling agents. Because of subsequent transactions, the geographic destination reported here may not reflect the final delivery points of shipments.

The Four Corners primary wood product sales value (f.o.b. the producing mill), including mill residue, totaled $263 million during 2016 (table 4C-8). Over $161 million (61 percent) of these sales were within the Four Corners States, and 35 percent ($93 million) of all sales were lumber and other sawn products, up from 31 percent of

sales in 2012. Other products—which include shavings, electricity, fuel pellets, erosion control products, firewood, mulch, clean chips, animal bedding, utility poles, and mill residues—accounted for around $120 million or 46 percent of total sales, compared to 52 percent of sales in 2012 (Sorenson et al. 2016). Arizona led the region with more than $107 million in sales, of which approximately $80 million came from the other products sector (see table A18). Although Colorado's total of $102 million in sales is higher than in 2012, Colorado sales were about the same share of the Four Corners region total as in 2012. New Mexico and Utah had sales of approximately $33 million and $21 million, respectively, during 2016 (see tables C15, N17, and U17).

Table 4C-8—Destination and sales value of Four Corners primary wood products and mill residues, 2016.

Product	Within Four Corner States	Other Rocky Mtn States[a]	Far West[b]	Northeast[c]	South[d]	North Central[e]	Mexico, Canada, or other[f]	Total
	Thousand 2016 dollars							
Lumber, timbers, and other sawn products	40,176	8,225	4,028	1,868	12,519	8,185	18,123	93,125
House logs and log homes	9,812	1,181	353	1,304	2,893	2,852	-	18,394
Posts, poles, vigas, latillas, and log furniture	16,815	2,736	4,729	2,078	2,088	2,756	729	31,932
Other products[g]	94,573	3,821	4,844	2,236	5,666	6,492	2,231	119,863
Total	161,376	15,964	13,955	7,485	23,166	20,286	21,083	263,314
	Percentage of regional sales by product							
Lumber, mine timbers, and other sawn products	24.9	51.5	28.9	25.0	54.0	40.4	86.0	35.4
House logs and log homes	6.1	7.4	2.5	17.4	12.5	14.1	-	7.0
Posts, poles, vigas, latillas, and log furniture	10.4	17.1	33.9	27.8	9.0	13.6	3.5	12.1
Other products[g]	58.6	23.9	34.7	29.9	24.5	32.0	10.6	45.5
Total	61.3	6.1	5.3	2.8	8.8	7.7	8.0	100

[a]Other Rocky Mountain States include Idaho, Montana, Nevada.
[b]Far West includes Alaska, California, Hawaii, Oregon, and Washington.
[c]Northeast includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[d]South includes Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
[e]North Central includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[f]Other areas consist of products being shipped outside the United States.
[g]Other products include shavings, electricity, fuel pellets, erosion control products, firewood, mulch, clean chips, animal bedding, utility poles, and mill residues.

The primary forest products manufacturers characterized in BBER's periodic census are just one component of the broader forest industry in the Four Corners States. Data reported in the FIDACS mill census were used in conjunction with employment data from the Bureau of Economic Analysis (BEA) to identify employment in the Four Corners States' primary and secondary forest industry. The classification of the forest industry used here follows the North American Industry Classification System (NAICS) available from the U.S. Department of Commerce. In this report, the employment in the following categories comprises the forest products industry: NAICS 113—forestry and logging; NAICS 1153—forestry support activities; NAICS 321—wood product manufacturing; and NAICS 322—paper manufacturing. Data from the Bureau of Labor Statistics' (BLS) Quarterly Census of Employment and Wages (QCEW) are coupled with BEA data to determine employment and labor income associated with forestry support activities. It should be noted that the four NAICS categories used to characterize the forest industry

likely underestimate total employment and personal income because they do not reflect the additional employment stimulated through demand for services include log hauling (trucking) companies, lumber and construction material wholesalers, road construction and maintenance contractors, and forest management services performed by government agencies or nonprofit organizations.

Based on the four NAICS sectors, approximately 22,690 workers were directly employed in the primary and secondary forest industry in the Four Corners States during 2016, up from about 21,360 during 2012 (USDC BEA 2018a). While employment in the industry increased slightly from 29,880 in 2002 to 32,330 in 2007, the 2012 employment in the forest industry marked a 34 percent decline from 2007. The slow employment recovery in the forest industry since 2012 reflects the lingering market challenges of the Great Recession and U.S. housing collapse (Keegan et al. 2012), as well as timber availability issues associated with widespread tree mortality, wildfire, and federal forest management.

Worker earnings in the Four Corners' forest industry followed similar patterns as employment worker earnings totaled almost $1.7 billion (in 2016 inflation-adjusted dollars) during 2007, but fell to less than $1 billion during 2012 (USDC BEA 2018b). Earnings increased to slightly less than $1.6 billion during 2016, as employment grew and more workers got closer to full-time jobs.

The largest portion of the Four Corners' forest industry is the "secondary" industry, which employed about 18,710 workers during 2016, growing from 17,370 workers during 2012. The secondary wood and paper industry relies on the outputs of the primary industry from the Four Corners States and other regions; in contrast to the primary industry, which sources the majority of raw material (i.e., timber) from within the four-state region. Therefore, the primary industry is more closely linked to the timber resource and land management policies within the region. Nearly 3,980 workers were employed in the Four Corners primary industry—harvesting and processing timber or in private sector land management—during 2016, about the same as 2012 primary employment. Based on the periodic FIDACS census, employment in timber-processing facilities decreased from almost 2,200 in 2002, to 1,700 in 2007, to 1,350 in 2012, but grew to about 1,490 during 2016.

In addition to directly employing workers and their subsequent labor income, the forest industry located in the Four Corners States generates additional economic benefits by relying upon other industries for raw and intermediate inputs and services, thus bolstering employment and wages in additional sectors. Economic contribution analyses measure gross changes in economic activity that can be associated with an industry, event, or policy on an existing regional economy (Watson et al. 2007). Measuring the economic contribution of the forest products industry captures the direct economic activity associated with the operations of the industry, as well as the economic activity generated throughout the State due to the existence of the forest products industry. For this report, we assess the contribution of the forest industry in each of the Four Corners States as dollars spent on intermediate inputs, taxes, labor, and households, which generate economic opportunities as additional spending cycles through the state's economy. Specific economic contributions by forest industry sector can be found within each of the individual state sections.

Arizona

This chapter reviews Arizona's 2016 timber harvest and forest products industry activities and changes that occurred since the 2012 FIDACS census conducted by Sorenson et al. (2016). Details of timber harvest, flow, and use are followed by descriptions of the primary processing sectors, capacity and utilization statistics, and mill residue characteristics. The chapter concludes with information on primary wood products industry sales by Arizona mills.

Timber Harvest, Flow, and Use

In 2016, Arizona had 2.9 million acres of nonreserved timberland (USDA FIA 2018), with National Forests accounting for 72 percent, private and tribal owners accounting for 28 percent, and other public agencies accounting less than 1 percent (table A1). All private timberland was classified as NIPF timberland. With the exception of several Native American tribes, Arizona had no large tracts of timberland owned by entities operating primary wood-processing facilities. Sawtimber volume on nonreserved timberlands was approximately 5.2 billion cubic feet (USDA FIA 2018) or about 30 billion board feet Scribner in 2016.

Table A1—Arizona nonreserved timberland by ownership class (source: Miles 2018).

Ownership class	Thousand acres	Percentage of nonreserved timberland
National Forest	2,089	72
Private and tribal	822	28
Other public	8	0
Total	**2,919**	**100**

Timber Harvest

Arizona's 2016 timber harvest was 76.4 MMBF Scribner (table A2), up 7 percent from the 2012 harvest (Sorenson et al. 2016), and up 42 percent from the 2007 harvest (Hayes et al. 2012). Although overall harvest was up, the house log harvest was down by 94 percent and amounted to less than 1 percent of the 2016 total, compared to 2.1 percent in 2012 (Sorenson et al. 2016). The 2012 to 2016 time period saw major growth in timber harvest on tribal lands, while National Forest harvest decreased by 30 percent (table A3). This period saw increased forest management through stewardship contracts and coincided with implementation of the Four Forest Restoration Initiative (4FRI) that began in 2013. The increase in private and tribal harvest was influenced by the fact that Arizona's major users of tribal timber were inactive during 2012. Although salvage harvest of dead timber was prevalent in 2016, with 34 percent of the harvest coming from dead trees, the proportion is down from 56 percent in 2012.

Historically, 80 percent or more of the state's annual timber harvest has come from three counties: Apache, Coconino, and Navajo. Coconino County led Arizona's 2012 timber harvest with 37 percent of total volume. Both Apache and Navajo

Table A2—Arizona timber products harvested by ownership class, 2016.

Ownership class	Sawlogs	House logs	Other products[a]	All products
	Thousand board feet, Scribner			
National Forest	32,857	25	15,397	48,280
Tribal timberland	23,000	-	2,857	25,857
State	10	-	1,488	1,498
Private timberland	617	60	120	797
All owners	56,484	85	19,862	76,432
	Percentage of harvested product by ownership			
National Forest	58.2	29.4	77.5	63.2
Tribal timberland	40.7	-	14.4	33.8
State	0.0	-	7.5	2.0
Private timberland	1.1	70.6	0.6	1.0
All owners	73.9	0.1	26.0	100

[a]Other products include industrial fuelwood, fiber logs, energywood logs, posts and poles, and viga logs.

Table A3—Proportion of Arizona timber harvest by ownership class, selected years (sources: Hayes et al. 2012; Keegan et al. 2001a; McLain 1988; Morgan et al. 2006; Setzer 1971a; Setzer and Throssell 1977; Sorenson et al. 2016).

Ownership class	1966	1974	1984	1998	2002	2007	2012	2016
	Percentage of harvest							
Private and tribal timberland	25.0	41.0	33.5	63.0	84.4	59.0	3.8	34.9
Private	*1.0*	*-*	*33.5*	*3.0*	*1.6*	*51.0*	*0.6*	*1.0*
Tribal	*24.0*	*41.0*	*-*	*60.0*	*82.8*	*8.0*	*3.2*	*33.8*
Public timberland	75.0	59.0	66.5	37.0	15.6	41.0	96.2	65.1
National Forest	*75.0*	*59.0*	*66.2*	*37.0*	*15.6*	*40.0*	*96.1*	*63.2*
Other public	*-*	*-*	*0.3*	*-*	*-*	*1.0*	*0.2*	*2.0*
All owners	100	100	100	100	100	100	100	100

Counties followed, with each accounting for approximately 23 percent of total harvest in 2016 (table A4).

Ponderosa pine continued to be the leading species harvested among all product types in Arizona in 2016 (table A5), accounting for 91 percent of total harvest, up from 84 percent in 2012 (table A5). Douglas-fir, Engelmann spruce, and white and subalpine firs were harvested in relatively small quantities (table A6). Sawlog harvest in 2016 of 56.5 MMBF represents a 21 percent increase from 2012 (Sorenson et al. 2016). Meanwhile, the 2016 harvest of house logs and vigas fell by 85 percent; and other products fell by 15 percent from 2012. Other products include industrial fuelwood, fiber logs, and posts and poles (table A7).

Table A4—Arizona timber harvest by county, selected years (sources: Hayes et al. 2012; Keegan et al. 2001a; McLain 1988; Morgan et al. 2006; Sorenson et al. 2016).

County	1984	1998	2002	2007	2012	2016	1984	1998	2002	2007	2012	2016
	MBF Scribner						*Percentage*					
Apache	171,128	15,641	6,350	31,610	23,916	18,067	44.7	20.5	5.0	58.8	33.5	23.6
Coconino	150,727	15,314	14,889	14,353	32,118	28,491	39.4	20.1	11.6	26.7	45.0	37.3
Gila	931	5,405	39,960	1,960	2,729	8,157	0.2	7.1	31.2	3.6	3.8	10.7
Graham	-	-	1,100	1,100	-	0.2	-	-	0.9	2.0	-	a
Greenlee	4,623	1,515	-	-	-	54	1.2	2.0	-	-	-	0.1
Maricopa	-	-	-	-	-	-	-	-	-	a	a	-
Navajo	52,745	38,384	64,027	3,094	8,938	18,032	13.8	50.3	49.9	5.8	12.5	23.6
Pima	-	33	-	-	12	50	-	a	-	-	0.0	0.1
Santa Cruz	-	-	-	48	120	50	-	-	-	0.1	0.2	0.1
Yavapai	2,220	20	1,895	1,612	3,585	3,531	0.6	a	1.5	3.0	5.0	4.6
Total[b]	382,674	76,312	128,220	53,777	71,418	76,432	100	100	100	100	100	100

[a]Less than 0.05 percent.

[b]Percentage detail may not sum to 100 percent due to rounding.

Table A5—Proportion of Arizona timber harvest by species, selected years (sources: Hayes et al. 2012; Keegan et al. 2001a; McLain 1988; Morgan et al. 2006; Sorenson et al. 2016).

Species	1984	1998	2002	2007	2012	2016
	Percentage of harvest					
Ponderosa pine	90.6	87.5	94.8	86.4	83.6	91.0
Douglas-fir	4.5	6.9	2.4	3.6	8.1	5.0
Other species[a]	0.2	1.2	< 0.05	1.4	4.3	1.8
Engelmann spruce	2.3	3.1	1.2	5.5	1.4	1.2
White fir	2.4	1.3	1.5	3.1	2.6	1.0
All species[b]	100	100	100	100	100	100

[a]Other species include juniper, other softwoods, and hardwoods.

[b]May not sum due to rounding.

Table A6—Arizona timber harvest by species, selected years (sources: Hayes et al. 2012; Keegan et al. 2001a; McLain 1988; Morgan et al. 2006; Sorenson et al. 2016).

Species	1984	1998	2002	2007	2012	2016
	MBF Scribner					
Ponderosa pine	346,851	66,804	121,614	46,483	59,714	69,546
Douglas-fir	17,217	5,264	3,129	1,915	5,754	3,845
Other species[a]	722	943	26	769	3,053	1,351
Engelmann spruce	8,667	2,340	1,551	2,948	1,010	898
White fir	9,214	961	1,900	1,662	1,886	791
All species[b]	382,674	76,312	128,220	53,777	71,418	76,432

[a]Other species include juniper, other softwoods, and hardwoods.

[b]May not sum due to rounding.

Table A7—Arizona timber harvest by species and product, 2016.

Species	Sawlogs	House logs and vigas	Other products[a]	All products
	Thousand board feet, Scribner			
Ponderosa pine	53,067	192	16,288	69,546
Douglas-fir	2,297	-	1,548	3,845
Other species[b]	100	4	1,248	1,351
Engelmann spruce	230	32	636	898
True firs[c]	791	-	-	791
All species	56,484	227	19,720	76,432
	Percentage of product by species			
Ponderosa pine	93.9	84.6	82.6	91.0
Douglas-fir	4.1	-	7.9	5.0
Other species[b]	0.2	1.5	6.3	1.8
Engelmann spruce	0.4	13.9	3.2	1.2
True firs[c]	1.4	-	-	1.0
All species	73.9	0.3	25.8	100

[a]Other products include industrial fuelwood, fiber logs, energywood logs, and posts and poles.
[b]Other species include juniper, other softwoods, and hardwoods.
[c]True firs include white and subalpine fir.

Timber Flow

The majority (99 percent) of Arizona's 2016 timber harvest was processed in-state. Arizona had a net inflow of timber with just over 4.6 MMBF coming in from Utah and New Mexico, and a very small amount (35 MBF) of Arizona timber flowing to processing facilities in Colorado (table A8).

Timber processors in Arizona received 81,009 MBF of timber in 2016. While the majority (65 percent) of timber was from National Forest land in 2016, this represents an overall decline from 2012's historic high of 96 percent (table A9). Much of this difference comes from an increase in timber volume received from tribal lands, which contributed nearly a third of all timber processed in Arizona facilities in 2016 (table A9). While 2016 harvest from private and state lands increased from 2012, these ownerships represent only 1 percent and 1.8 percent, respectively, of timber volume received by Arizona facilities (table A10).

Table A8—Timber product flow into and out of Arizona, 2016.

Timber product	Log flow into Arizona	Log flow out of Arizona	Net inflow (net outflow)
	Thousand board feet, Scribner		
Sawlogs	2,498	-	2,498
Fiber Logs	2,114	-	2,114
House logs and viga logs	-	35	(35)
All products	4,612	35	4,577

Table A9—Ownership of timber products received by Arizona forest products industry, 1998, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 2001a; Morgan et al. 2006; Sorenson et al. 2016).

	1998	2002	2007	2012	2016	1998	2002	2007	2012	2016
Ownership class	**MBF Scribner**					**Percentage of total**				
Private and tribal timberland	48,102	58,108	31,706	2,623	26,644	71.1	76.3	60.8	3.8	32.9
Tribal	*45,964*	*56,150*	*4,400*	*2,220*	*25,847*	*68.0*	*73.8*	*8.4*	*3.2*	*31.9*
Private	*2,138*	*1,958*	*27,306*	*403*	*797*	*3.2*	*2.6*	*52.4*	*0.6*	*1.0*
National Forests	19,510	18,006	20,427	66,858	52,867	28.9	23.7	39.2	96.0	65.3
State lands	-	-	-	130	1,498	-	-	-	0.2	1.8
All owners	67,612	76,114	52,133	69,611	81,009	100	100	100	100	100

Table A10—Timber received by Arizona forest products industry by ownership class and product, 2016.

Ownership class	Sawlogs	Other products[a]	All products
	----------Thousand board feet, Scribner----------		
Private and tribal timberland	23,617	3,027	26,644
Private	*617*	*180*	*797*
Tribal	*23,000*	*2,847*	*25,847*
Public timberland	35,365	18,999	54,365
National Forest	*35,355*	*17,511*	*52,867*
State lands	*10*	*1,488*	*1,498*
All owners	58,982	22,026	81,009
	----------Percentage of product by owner----------		
Private and tribal timberland	40.0	13.7	32.9
Private	*1.0*	*0.8*	*1.0*
Tribal	*39.0*	*12.9*	*31.9*
Public timberland	60.0	86.3	67.1
National Forest	*59.9*	*79.5*	*65.3*
State lands	*0.0*	*6.8*	*1.8*
All owners	72.8	27.2	100.0

[a]Other products include industrial fuelwood, fiber logs, energywood logs, houselogs, posts and poles, and viga logs.

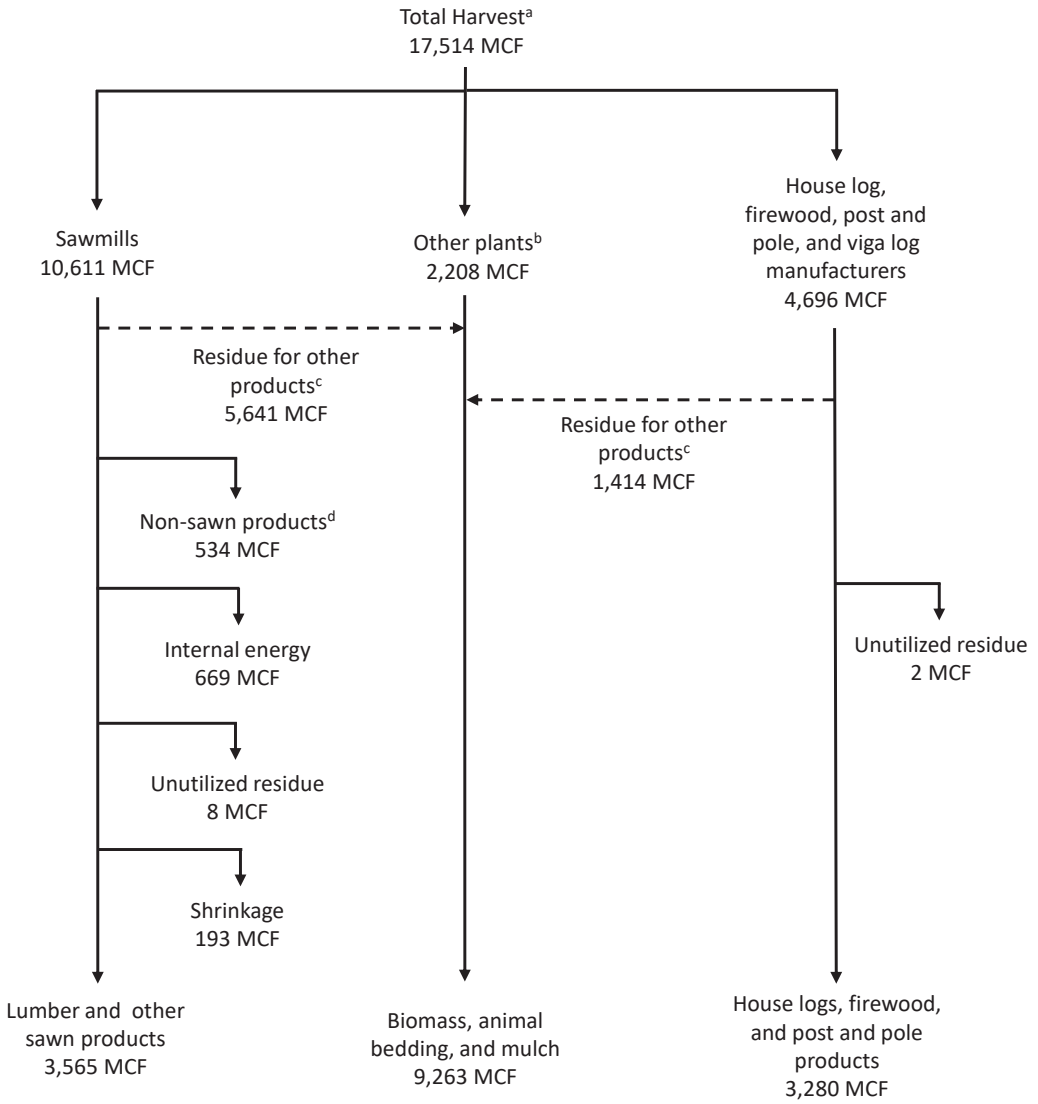
Timber Use

Arizona's 2016 timber harvest—17,514 thousand cubic feet (MCF), exclusive of bark (fig. A1)—was used by several manufacturing sectors both within and outside Arizona. Of this volume, 10,611 MCF was delivered as logs to sawmills, 4,696 MCF went to house log, firewood, post and pole, and viga log manufacturers, and 2,208 MCF went to other plants, including wood pellet manufacturers, as well as residue-utilizing facilities including bioenergy plants and mulch and animal bedding producers. Volumes are presented in cubic feet rather than board feet Scribner because both mill residue and timber products are displayed. The following conversion factors were used to convert Scribner board foot volume to cubic feet:

- 5.60 board feet per cubic foot for sawlogs;
- 2.52 board feet per cubic foot average for house logs and vigas; and
- 2.69 board feet per cubic foot average for all other products.

Of the 10,611 MCF of timber received by sawmills, 3,565 MCF (34 percent) was processed into finished lumber or other sawn products, 534 MCF went to nonsawn

products, and 193 MCF was lost to shrinkage during drying. The remaining 6,318 MCF (60 percent) yielded mill residue. About 5,641 MCF of sawmill residue was utilized by other sectors within Arizona and in other States. With major outlets for mill residue use in the State, including a biomass energy facility and a fuel pellet manufacturer, only 8 MCF of sawmill residue remained unused. House log, firewood, post and pole, and viga manufacturers received 4,696 MCF of timber of which 3,280 MCF (70 percent) became finished products. The remaining 1,416 MCF became mill residue. About 1,414 MCF of house log residue was used by other sectors, and about 2 MCF remained unused. Of the 2,208 MCF of timber received by other manufacturers, all was either utilized for residue-related products like mulch, livestock bedding, fuel pellets, or for biomass energy production.



[a]Harvest volume does not include bark.
[b]Other plants include wood pellet manufacturers, as well as residue-utilizing facilities including bioenergy, animal bedding and mulch producers.
[c]Other products include residue sold for energy, landscape, mulch, animal bedding, and unspecified use.
[d]Non-sawn products includes firewood, shavings

Figure A1—Arizona timber harvest and flow, 2016.

Forest Industry Sectors

Arizona's primary forest products industry in 2016 consisted of 23 active manufacturers in nine counties (table A11). Facilities tended to be located near the forest resource along the northern side of the Mogollon Plateau, with concentrations in southern Apache and Navajo Counties (fig. A2). The sawmill sector, manufacturing lumber and other sawn products, was the largest sector operating in 2016 with 14 facilities—the same number operating in 2012. One Arizona facility primarily produced house logs and log homes, compared to two reported in 2012. Three firewood producers, one post and pole plant, two bark and mulch producers, a biomass energy facility, and a fuel pellet manufacturer were also actively purchasing or utilizing timber in 2016. These eight firms were indicative of the trend of increased diversity in timber processors active in Arizona since the end of the 1980s.

Table A11—Active Arizona primary wood products facilities by county and product, 2016 (sources: et al. 2001a; McLain 1988; Morgan et al. 2006; Sorenson et al. 2016).

County	Lumber	House logs and vigas	Other products[a]	Pulp and paper	Total
Apache	3	1	1		5
Coconino	3				3
Graham	1				1
Maricopa	2		1		3
Navajo	3		4		7
Pima	1				1
Pinal			1		1
Santa Cruz	1				1
Yavapai			1		1
2016 Total	**14**	**1**	**8**	**0**	**23**
2012 Total	14	2	9	0	25
2007 Total	8	5	4	0	17
2002 Total	11	5	7	0	23
1998 Total	6	4	2	1	13
1990 Total	14	3	1	1	19
1984 Total	20	0	2	1	23

[a]Other products include industrial fuelwood, fuel pellets, biomass energy, posts and poles.

Primary wood products sales increased since 2012, with finished product sales in 2016 approximately 16 percent higher (in 2016 inflation-adjusted dollars) than the sales value reported in 2012 (table A12). The largest source of this increase was from sawmills, whose sales grew by over 34 percent since 2012. Although other mills' sales increased by less than 4 percent from 2012, this sector accounted for over 55 percent of total sales in 2016. Much of these increases were due to increased sales of residue-related products including biomass energy, fuel pellets, and bark products, as well as a higher price for sawn lumber.

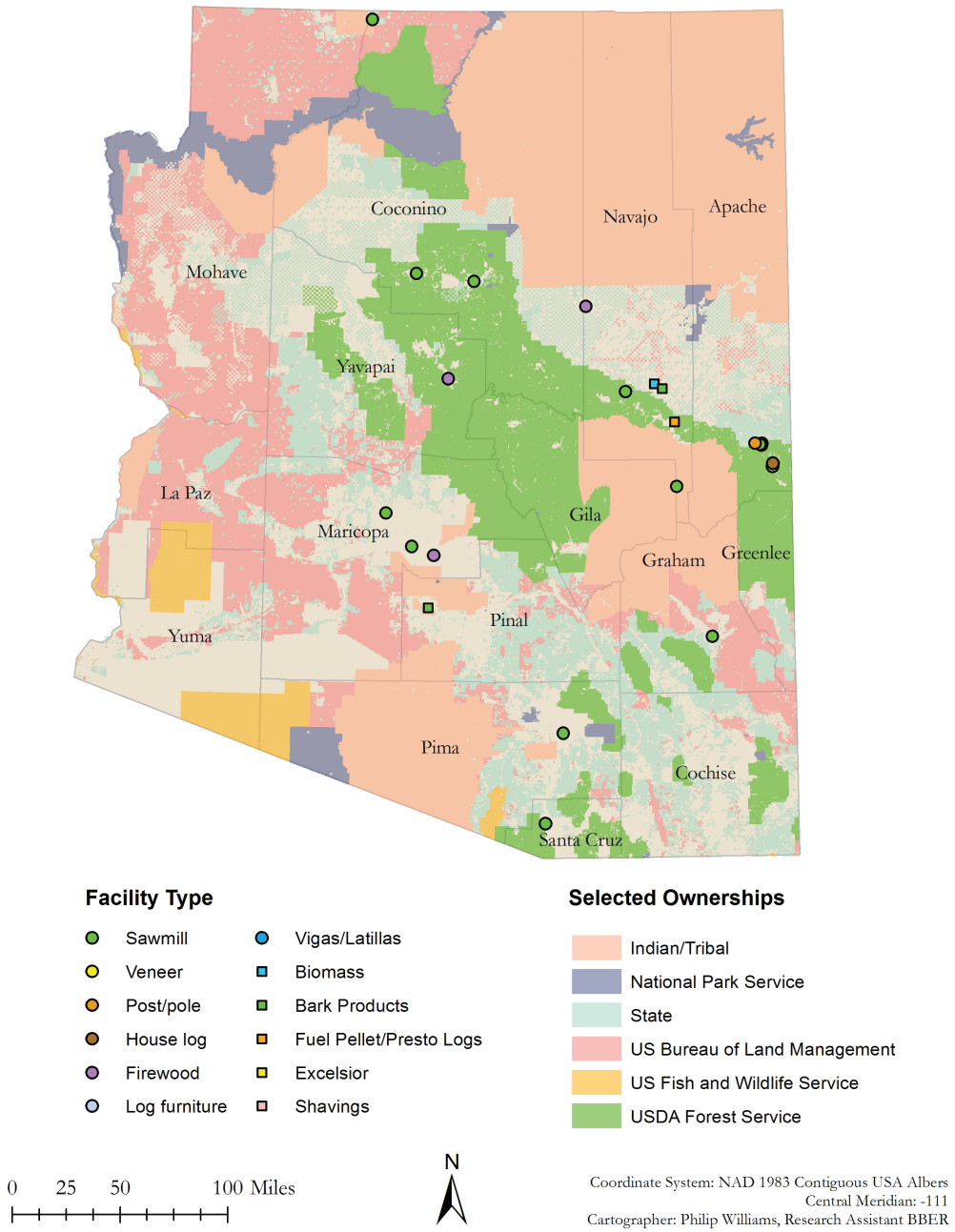


Figure A2—Map of Arizona primary timber processors.

Table A12—Finished product sales of Arizona's primary wood products sectors, selected years (sources: WWPA various years; Hayes et al. 2012; Keegan et al. 2001a; Morgan et al. 2006; Sorenson et al. 2016).

Sector	1984	1990	1998	2002	2007	2012	2016
	Thousands of 2016 dollars						
Sawmills	201,982	165,281	34,978	31,595	23,354	33,881	45,547
Log home and other sectors[a]	283	651	2,732	8,211	18,352	53,742	55,714
Total[b]	202,265	165,931	37,709	39,806	41,706	87,623	101,261

[a]Other sectors include producers of industrial fuelwood, fuel pellets, biomass energy, posts and poles, and viga logs.
[b]All sales are reported f.o.b. the manufacturer's plant. Sales of mill residues, mulch, and paper not included for comparison to previous years.

Sawmill Sector

The number of active Arizona sawmills remained the same at 14 between 2012 and 2016; however, total lumber production increased from 49 MMBF in 2012 to 62 MMBF in 2016 (table A13). Several of the state's largest sawmills closed between 1998 and 2012, and this trend continued through 2016 as a larger proportion of the state's lumber production shifted into small mills producing fewer than 10 MMBF annually. Although average annual lumber production per mill has declined every year since the 1990s peak of 28 MMBF, 2016 marks the end of this trend at 4.4 MMBF compared to a low of 3.5 MMBF in 2012 (table A14). The state's 4 largest sawmills in 2016 produced an average of 11.8 MMBF, accounting for 76 percent of the state's lumber production, while the remaining 10 sawmills had an average lumber production of nearly 1.5 MMBF (table A15).

Table A13—Arizona sawmills by production size class, selected years (sources: Hayes et al. 2012; Keegan et al. 2001a; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016; WWPA 1992, 1993).

Year	Under 10 MMBF[a]	Over 10 MMBF[a]	Total
	----------Number of sawmills----------		
2016	14	c	14
2012	14	c	14
2007	8	c	8
2002	9	2	11
1998	2	4	6
1990	5	9	14
1966	13	10	23
	----------Percentage of lumber output----------		Volume (MBF[b])
2016	100	c	62,228
2012	100	c	49,336
2007	100	c	54,860
2002	25	75	82,658
1998	1	99	80,970
1990	4	96	388,000
1966	11	89	437,000

[a]Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.

[b]MBF = thousand board feet lumber tally.

[c]All mills were included in < 10 MMBF to avoid disclosing individual operations.

Table A14—Number of Arizona sawmills and average lumber production, selected years (sources: Hayes et al. 2012; Keegan et al. 2001a; McLain 1988; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Year	Number of sawmills	Average lumber production
		MMBF[a]
2016	14	4.4
2012	14	3.5
2007	8	6.9
2002	11	7.5
1998	6	13.5
1990	14	27.7
1984	20	19.2
1966	23	19.0
1962	28	11.6
1960	38	8.7

[a]MMBF = million board feet lumber tally.

Table A15—Arizona lumber production by mill size, 2016.

Size class[a]	Number of mills	Volume	Percentage of total	Average per mill
		MBF[b]		*MBF*[b]
Over 5 MMBF	4	47,367	76	11,842
Under 5 MMBF	10	14,861	24	1,486
Total	14	62,228	100	4,445

[a]Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.
[b]MBF = thousand board feet lumber tally.

On average, Arizona sawmills produced approximately 1.20 board feet of lumber for every board foot Scribner of timber processed, for an average overrun of 20 percent in 2016. Overrun was also 20 percent in 2012 (Sorenson et al. 2016) and 12 percent in 2007 (Hayes et al. 2012). The changes in overrun over time coincide with shifts in the type of timber products processed and the resulting size, condition, and product mix that could be recovered from the harvested timber. In 2007, timbers, cants, or pallet stock constituted 93 percent of production, which produce a lower overrun than smaller dimension lumber products. In 2012, timbers, cants, and pallet stock decreased to 76 percent of products, and dimension and stud lumber increased to 23 percent of production, leading to a slight increase in overrun in 2012 compared to 2007. Continuing this trend in 2016, timbers, cants and pallet stock decreased to under 30 percent of total production, with dimension and stud lumber increasing to over 70 percent.

While the sawmill sector accounted for over 99 percent of Arizona wood products sales in the 1980s (Keegan et al. 2001a), that proportion had slipped to 56 percent in 2007 and 21 percent in 2012 (Sorenson et al. 2016). In 2016 this ratio rebounded, and sales from sawmills accounted for 45 percent ($45.5 million) of primary wood products sales in the State. Of the lumber and sawn products sales, timbers, pallet stock, utility poles, and shavings represented $23.8 million (52.2 percent), dimension lumber accounted for $21.6 million (47.4 percent), and furniture parts accounted for less than 1 percent of sawn products sales in 2016.

Log Home and Other Products Sectors

The 2016 FIDACS census of timber processors identified one facility that processed primarily house logs, compared to two facilities in 2012. To avoid disclosing confidential information for individual house log and log home facilities, house log, post and pole, and firewood manufacturers are combined. In 2016, the five Arizona facilities categorized as house log, post and pole, or firewood manufacturers processed 25 MMBF Scribner and generated $17.2 million in product sales.

Other products sectors in Arizona included a pellet mill, two producers of decorative bark or mulch, and a biomass energy plant. These facilities processed both timber and mill residue and sold their finished products for a total of $38.5 million in 2016.

Capacity and Utilization

Two aspects of capacity were examined for calendar year 2016 in Arizona and the other Four Corners States: production capacity and timber-processing capacity. Production capacity is defined as the amount of finished product that could be produced given sufficient supplies of raw materials and firm market demand for the products, considering normal maintenance and downtime. Primary wood products producers specified annual and 8-hour shift production capacities in units of output (for example, MBF of lumber, MLF (MLF = thousand linear feet) of house logs, number of vigas, etc.) for each firm. Product recovery ratios were calculated for each firm by using reported timber input and product output volumes. Timber-processing capacity was defined as the volume of timber reported in MBF Scribner that could be processed given sufficient supplies of raw materials and firm market demand for the products, and was estimated for each firm by applying the product recovery ratios to production capacity.

Arizona's annual sawmill production capacity was 103.8 MBF of lumber in 2016, a 4.5 percent reduction from 2012. Producing 62.2 MBF of lumber, sawmills utilized about 60 percent of their production capacity, compared to 51 percent of lumber production capacity used in 2012. Across all industry sectors, total timber-processing capacity was 107.7 MBF Scribner in 2016. Accounting for changes in log inventories, a total of 84 MBF Scribner was processed by Arizona firms in 2016, with timber-processing capacity utilization of about 78 percent, up from 58 percent utilization across the industry in 2012.

Mill Residue Volumes, Types, and Uses

In 2016, Arizona mills produced 79,780 BDU, or 7,996 MCF of mill residue, with 99.9 percent utilized (table A16). Three types of wood fiber residue have been produced by Arizona mills: coarse residue (chips) consisting of: slabs, edging, trim, peelings, and log ends; fine residue consisting of planer shavings and sawdust; and bark. Coarse residue was the state's largest residue component at 45,411 BDU (56.9 percent) of all residues in 2016; 16,845 BDU of the coarse material were used for energy, while 28,535 BDU went to other various uses (table A16). Fine residue comprised the second largest component at 22,506 BDU (28.2 percent) of mill residue. Most of the fine residue was used for mulch or animal bedding, with a smaller amount (28.7 percent) being used for energy. Bark accounted for 15 percent of all residue and was largely used for mulch or landscape applications (57 percent) or various uses (37 percent) in 2016.

The amount of residue per MBF of lumber produced by sawmills increased in 2016, compared to 2012 (table A17). Most of the increase was due to an increase of course residue from an increase in sawmill production.

Table A16—Production and disposition of Arizona mill residues, 2016.

Residue type	Total utilized	Pulp and board	Energy	Mulch/ bedding	Unspecified use	Unused	Total produced
				Bone-dry units[a]			
Coarse	45,380	-	16,845		28,535	31	45,411
Fine	22,454	-	6,462	11,689	4,303	52	22,506
Sawdust	*16,552*	*-*	*560*	*11,689*	*4,303*	*50*	*16,602*
Planer shavings	*5,902*	*-*	*5,902*	-	-	*2*	*5,904*
Bark	11,832	-	713	6,781	4,338	30	11,862
Total	79,667	-	24,020	18,470	37,176	113	79,780
				Percentage of residue type			
Coarse	99.9	-	37.1	-	62.8	0.1	56.9
Fine	99.8	-	28.7	51.9	19.1	0.2	28.2
Sawdust	*99.7*	*-*	*3.4*	*70.4*	*25.9*	*0.3*	*20.8*
Planer shavings	*100.0*	*-*	*100.0*	*-*	*-*	*0.0*	*7.4*
Bark	99.7	-	6.0	57.2	36.6	0.3	14.9
Total	99.9	-	30.1	23.2	46.6	0.1	100

[a]Bone-dry unit = 2,400 lb oven-dry wood.

Table A17—Arizona sawmill residue factors, 1998, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 2001a; Morgan et al. 2006; Sorenson et al. 2016).

Type of residue	1998	2002	2007	2012	2016
			BDU/MBF lumber tally[a]		
Coarse	0.50	0.44	0.68	0.65	0.71
Sawdust	0.22	0.15	0.17	0.18	0.20
Planer shavings	0.19	0.14	0.12	0.00	0.01
Bark	0.21	0.23	0.25	0.24	0.21
Total	1.12	0.96	1.22	1.07	1.13

[a]Bone-dry unit (BDU = 2,400 lb oven-dry wood) of residue generated for every 1,000 board feet of lumber manufactured.

Primary Forest Products Sales

Sales from Arizona's primary wood products industry in 2016 totaled $107.7 million, including finished products and mill residues (table A18). The 2016, FIDACS census detected a large upswing in sales of products other than lumber. Lumber, timbers, and other sawn products accounted for almost 26 percent ($27.6 million) of total sales; house logs and log homes accounted for less than 1 percent ($418,000); while other products and mill residues accounted for 74 percent ($79.6 million). Foreign countries, primarily Mexico, were the leading destination for lumber and other sawn products, followed by in-state sales and sales to customers in the other Four Corners States (Colorado, New Mexico, and Utah). Arizona was the leading market area for the house logs and the other products category.

Table A18—Destination and sales value of Arizona's primary wood products and mill residues, 2016.

Product	Arizona	Other Four Corners States	Other Rocky Mtn States[a]	Far West[b]	Northeast[c]	South[d]	North Central[e]	Other[f]	Total
				Thousand 2016 dollars					
Lumber, timbers, and other sawn products	5,869	1,561	277	3,563	0	681	533	15,134	27,618
House logs and other products[g]	61,937	10,403	1,636	5,869	51	0	156	7	80,058
Total	67,806	11,964	1,913	9,433	51	681	688	15,141	107,676
				Percentage of regional sales by product					
Lumber, timbers, and other sawn products	8.7	13.0	14.5	37.8	-	100.0	77.4	-	25.6
House logs and other products[g]	91.3	87.0	-	62.2	-	-	22.6	-	74.4
Total	63.0	11.1	1.8	8.8	0.0	0.6	0.6	14.1	100.0

[a]Other Rocky Mountain States include Idaho, Montana, Nevada.
[b]Far West includes Alaska, California, Hawaii, Oregon, and Washington.
[c]Northeast includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[d]South includes Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
[e]North Central includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[f]Other areas consist of products being shipped outside the United States.
[g]Other products include mulch, shavings, posts, poles, utility poles, log homes, firewood, fuel pellets, and mill residues.

Forest Industry Employment and Labor Income

Between 2012 and 2016, Arizona experienced the largest overall increase in forest industry employment of the Four Corners States. Based on the available BEA and BLS data, over 7,500 full- and part-time workers were directly employed in the primary and secondary forest products industry in Arizona during 2016 (fig. A3) (USDC BEA 2018a). This marked a 13 percent increase from 2012 employment in the industry, with the growth occurring in wood products manufacturing (25 percent) and forestry and logging (22 percent), which increased by 980 and 71 employees, respectively. Over the same period, employment in both paper manufacturing and forestry support activities decreased in Arizona. More than 830 workers were employed in the primary sector, either in harvesting and processing timber or in private sector land management in 2016, representing a 7 percent increase over primary sector employment in 2012. While total forest industry employment is only 66 percent of what it was during 2007, primary sector employment has increased 8 percent from 2007 to 2016.

Labor income or worker earnings in Arizona's forest industry were estimated at $897 million during 2016, up more than 180 percent (adjusted for inflation) from 2012, and $275 million higher than 2007 earnings (fig. A4). Labor income includes wages and salaries, some benefits, and earnings of the self-employed. Since 2012, inflation-adjusted earnings (2016 dollars) in forestry support activities has decreased by more than 50 percent, while earnings in wood products manufacturing and forestry and logging have both increased by 66 and 16 percent, respectively. The (secondary) paper manufacturing sector experienced more than $475 million (310 percent) growth since 2012 in worker earnings.

In addition to employing more than 7,500 people earning approximately $897 million in labor income, Arizona's forest products manufacturers generate additional economic benefits by relying upon other industries for raw and intermediate inputs and services, thus bolstering employment and earnings across other sectors. This reliance requires subsequent purchasing of inputs by those supporting industries, expanding the ripple effect of the forest products industry across a multitude of sectors within Arizona's economy.

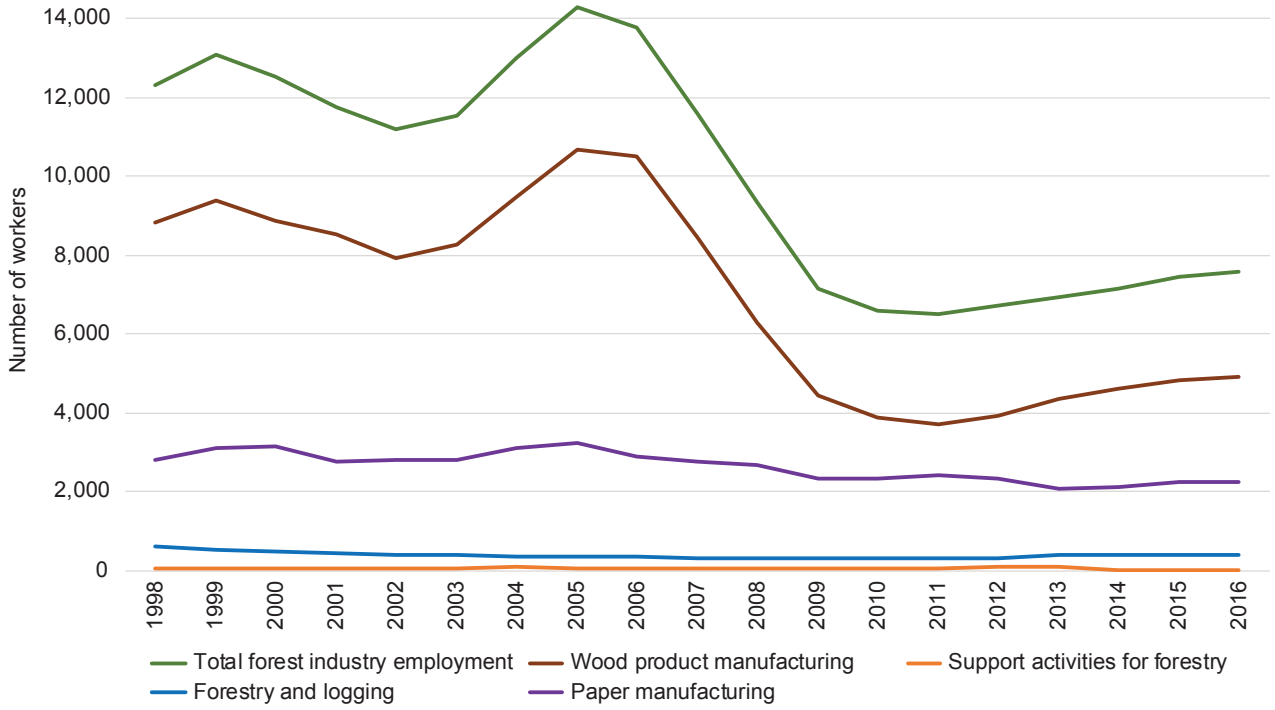


Figure A3—Employment in Arizona's forest industry, 1998–2016.

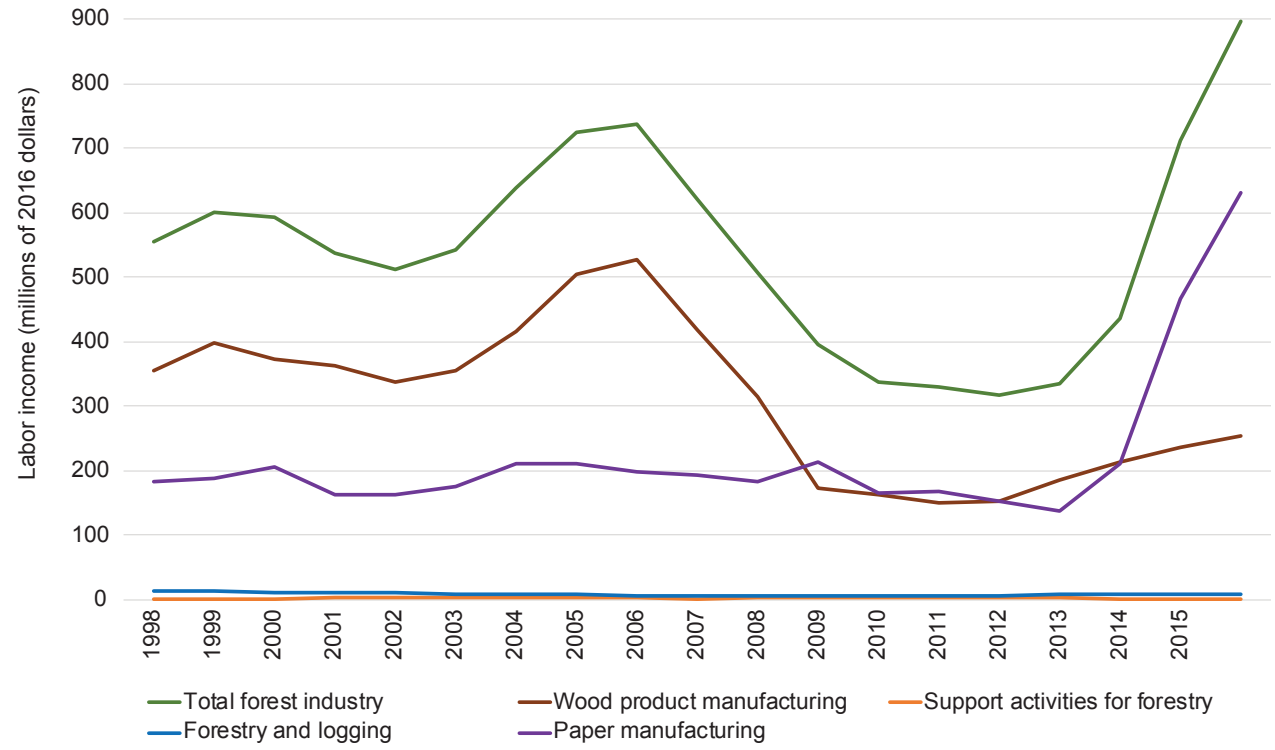


Figure A4—Inflation-adjusted earnings in Arizona's forest industry, 1998–2016.

Using the Bureau of Economic Analysis' (BEA) RIMS II multipliers [1], BBER estimates that primary and secondary forest products manufacturing in Arizona support more than 11,000 full- and part-time jobs, and an associated $585 million dollars in labor income (table A19). Thus, for every wood products manufacturing job in the State, another 1.24 jobs are supported in related sectors, while for every $1.00 paid in labor income by wood products manufacturers, another $1.30 is paid in supporting sectors, including forestry and logging, forestry support, trucking, wholesale trade, and management.

Table A19—Average annual employment and labor income contributions from Arizona's forest industry.

Sector	Direct employment	Indirect and induced employment	Total employment contribution[a]	Direct labor income	Indirect and induced labor income	Total labor income contribution[a]
				thousand 2016 dollars		
Wood products manufacturing[b]	4,904	6,108	11,012	254,619	330,674	585,293
Forestry and logging	400	355	755	8,442	7,394	15,836
Forestry support activities	32	13	45	1,586	819	2,405
Paper manufacturing	2,250	4,631	6,881	632,419	856,295	1,488,714
Total forest industry	**7,586**	[a]	[a]	**897,066**	[a]	[a]

[a]Indirect and induced employment and labor income should not be summed for multiple sectors due to some employment and income showing up as both direct contributions to their sector and indirect contributions to other sectors.
[b]Includes employment and labor income for both primary and secondary wood products manufacturing.

Likewise, BBER estimates that the 400 people employed in the forestry and logging sector support an additional 355 full- and part-time jobs along with $7.4 million dollars in labor income in supporting sectors such as equipment sales and repair. It should be noted that we do not aggregate sectors and we avoid providing estimates of the total employment and labor income contribution for the entire forest industry to avoid double counting, since some employment and labor income show up as both direct contributions to their sector as well as indirect contributions to other sectors. For example, some or all of the direct employment and labor income in the forestry and logging sector would be included with the indirect and induced contributions from wood products manufacturing since these manufacturers rely upon forestry and logging business to supply their raw material inputs.

Colorado

This chapter focuses on Colorado's timber harvest and forest products industry during 2016. Details of timber harvest, flow, and use are followed by descriptions of the primary processing sectors, capacity and utilization statistics, and mill residue characteristics. The chapter concludes with information on primary wood products industry sales by Colorado mills. Comparisons with previous years are provided where possible. Limited historical information is available about timber harvesting and mill production and residues in Colorado. The last comprehensive report on the state's industrial roundwood production and mill residues was conducted in 2012 (Sorenson et al. 2016), and data for previous years include 1962 (Spencer and Farrenkopf 1964), 1969 (Setzer 1971b), 1974 (Setzer and Shupe 1977), and

[1] The Bureau of Economic Analysis does not endorse any resulting estimates and/or conclusions about the contribution of a given sector on an area.

1982 (McLain 1985). Lynch and Mackes (2001) published a study on wood use in Colorado from 1997 to 2000, Morgan et al. (2006) reported on the Colorado forest products industry for calendar year 2002, and Hayes et al. (2012) reported for calendar year 2007.

Timber Harvest, Flow, and Use

In 2016, Colorado had approximately 10.52 million acres of nonreserved timberland (USDA FIA 2018), with National Forests accounting for 71 percent, private owners accounting for 20 percent, and other public agencies accounting for the remaining 9 percent (table C1). All private timberland was classified as NIPF timberland. Colorado had no large tracts of timberland owned by entities operating primary wood-processing facilities. Sawtimber volume on timberland was estimated at 14.5 billion cubic feet or approximately 69 billion board feet Scribner in 2016 (USDA FIA 2018).

Table C1—Colorado nonreserved timberland by ownership class (source: USDA FIA 2018).

Ownership class	Thousand acres	Percentage of nonreserved timberland
National Forest	7,427	71
Private	2,150	20
Other public	942	9
Total	**10,519**	**100**

Timber Harvest

Colorado's 2016 commercial timber harvest was 116.7 MMBF Scribner (table C2), a 42 percent increase from the 2012 harvest of 82 MMBF Scribner (Sorenson et al. 2016). The 2016 harvest was 35 percent more than the 2007 harvest of 86.5 MMBF (Hayes et al. 2012). Increases in Colorado's total annual timber harvest occurred in conjunction with increased salvage of dead timber, accounting for 64 percent (74.5 MMBF) of the 2016 harvest volume, an increase from 2012 when 56 percent (46.3 MMBF) was dead (Sorenson et al. 2016). Just 26 percent (20 MMBF) of the harvest was dead timber in 2002 (Morgan et al. 2006).

Table C2—Colorado timber harvest by ownership class, 1982, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; McLain 1985; Morgan et al. 2006; Sorenson et al. 2016).

	1982	2002	2007	2012	2016	1982	2002	2007	2012	2016
Ownership class	**MBF Scribner**					**Percentage of total**				
Private and tribal timberland	14,814	45,723	41,334	24,332	33,881	14.3	57.4	47.8	29.6	29.0
Private	*14,814*	*45,223*	*40,810*	*24,332*	*33,881*	*14.3*	*56.7*	*47.2*	*29.6*	*29.0*
Tribal	*-*	*500*	*524*	*-*	*-*	*0.0*	*0.6*	*0.6*	*0.0*	*0.0*
Public timberland	88,618	33,989	45,206	57,737	82,775	85.7	42.6	52.2	70.4	71.0
National Forest	*83,106*	*30,631*	*43,179*	*54,789*	*75,614*	*80.3*	*38.4*	*49.9*	*66.8*	*64.8*
State lands	*4,977*	*2,749*	*1,837*	*1,479*	*3,492*	*4.8*	*3.4*	*2.1*	*1.8*	*3.0*
Other public	*535*	*609*	*190*	*1,469*	*3,669*	*0.5*	*0.8*	*0.2*	*1.8*	*3.1*
All owners	103,448	79,711	86,540	82,070	116,656	100	100	100	100	100

While the National Forest share of Colorado's timber harvest had decreased from over 80 percent in 1982 (McLain 1985) to less than 40 percent in 2002 (Morgan et al. 2006), this trend reversed in the last three periodic mill censuses of the industry. The National Forest share of the harvest increased to 50 percent in 2007 (Hayes et al. 2012), 67 percent in 2012 (Sorenson et al. 2016), and 65 percent for 2016 (table C2). Private and tribal landowners provided 29 percent of Colorado's timber harvest for 2016, similar to 2012. National Forests provided the majority of all product categories harvested in 2016 (table C3): sawlogs (64 percent); house logs (66 percent); post and poles (68 percent); and other products (68 percent).

Table C3—Colorado timber products harvested by ownership class, 2016.

Ownership class	Sawlogs	House logs	Post & pole	Other products[a]	All products
	Thousand board feet, Scribner				
National Forest	59,723	2,199	4,300	9,392	75,614
Private timberland	27,635	1,148	1,363	3,735	33,881
Other public lands	5,827	-	712	622	7,161
Tribal timberland	-	-	-	-	-
All owners	93,185	3,347	6,375	13,749	116,656
	Percentage of harvested product by ownership				
National Forest	64.1	65.7	67.5	68.3	64.8
Private timberland	29.7	34.3	21.4	27.2	29.0
Other public lands	6.3	-	11.2	4.5	6.1
Tribal timberland	-	-	-	-	-
All owners	79.9	2.9	5.5	11.8	100

[a]Other products include furniture logs, fiber logs, viga logs, and industrial fuelwood.

Sawlogs accounted for about 80 percent (93.4 MMBF) of the total volume harvested. Other products and posts and poles accounted for about 12 and 5 percent, respectively; and house logs were just under 3 percent of the harvest in 2016.

During 2016, timber harvest was widely distributed throughout Colorado, occurring in 38 different counties but with 13 counties providing over 75 percent of the volume. Hinsdale County led Colorado's timber harvest with 11 percent (12.9 MMBF Scribner) of the volume; Routt and Grand Counties followed with 8 and 7 percent, respectively (table C4). For comparison, Hinsdale County's 2012 timber harvest, was zero; Grand was just over 24 percent (19.4 MMBF Scribner) of the volume, and Routt again provided 8 percent (9.5 MMBF).

As in 2007 and 2012, lodgepole pine was the leading species harvested in Colorado, accounting for 55 percent of the volume during 2016 (table C5). The continued harvest of lodgepole pine at higher rates than other species is likely due to the massive quantity of the species either killed or threatened by mountain pine beetle attack. At 23 percent of the total, spruce was the second leading species harvested in 2016, followed by ponderosa pine with 7 percent of the total and aspen at 7 percent. Lodgepole pine and spruce were the leading species harvested for sawlogs in 2016, accounting for 53 and 25 percent, respectively (table C6). Spruces comprised 73 percent of the house log harvest, while lodgepole pine was also the leading species harvested for posts and poles (82 percent) and other products (63 percent).

Table C4—Colorado timber harvest by county, selected years (sources: Hayes et al. 2012; McLain 1985; Morgan et al. 2006; Setzer and Shupe 1977; Sorenson et al. 2016).

County	1974	1982	2002	2007	2012	2016	1974	1982	2002	2007	2012	2016
	MBF Scribner						*Percentage of harvest*					
Adams	-	-	8	2	1	5	-	-	a	a	a	a
Alamosa	397	800	-	-	-	1,125	0.2	0.8	-	-	-	1.0
Archuleta	24,856	300	1,640	260	890	3,548	11.6	0.3	2.1	0.3	1.1	3.0
Boulder	90	514	44	3	2	766	a	0.5	0.1	a	a	0.7
Chaffee	-	252	595	48	-	915	-	0.2	0.7	0.1	-	0.8
Clear Creek	-	500	-	-	3,500	92	-	0.5	-	-	4.3	0.1
Conejos	6,007	1,221	740	618	1,355	7,518	2.8	1.2	0.9	0.7	1.7	6.4
Costilla	-	-	3,684	4,986	2,418	875	-	-	4.6	5.8	2.9	0.8
Custer	2,383	2,526	300	717	150	2,585	1.1	2.4	0.4	0.8	0.2	2.2
Delta	1,324	933	2,376	13,195	3,462	674	0.6	0.9	3.0	15.2	4.2	0.6
Dolores	12,687	7,801	5,907	3,275	3,000	2,869	5.9	7.5	7.4	3.8	3.7	2.5
Douglas	213	1,600	40	417	306	195	0.1	1.5	0.1	0.5	0.4	0.2
Eagle	5,221	1,500	200	-	144	4,866	2.4	1.5	0.3	-	0.2	4.2
Elbert	265	-	-	-	-	-	0.1	-	-	-	-	-
El Paso	285	470	240	49	-	-	0.1	0.5	0.3	0.1	-	-
Fremont	-	1,100	1,673	348	-	220	-	1.1	2.1	0.4	-	0.2
Garfield	2,218	500	9,321	1,924	622	530	1.0	0.5	11.7	2.2	0.8	0.5
Gilpin	-	-	20	-	-	-	-	-	a	-	-	-
Grand	18,406	618	3,113	30,387	19,381	8,538	8.6	0.6	3.9	35.1	23.6	7.3
Gunnison	12,431	2,336	4,249	4,110	4,243	2,147	5.8	2.3	5.3	4.7	5.2	1.8
Hinsdale	-	-	-	-	-	12,898	-	-	-	-	-	11.1
Huerfano	2,192	1,800	500	500	-	5,284	1.0	1.7	0.6	0.6	-	4.5
Jackson	20,786	16,273	4,373	2,916	2,610	8,483	9.7	15.7	5.5	3.4	3.2	7.3
Jefferson	-	1,881	361	21	2	186	-	1.8	0.5	a	a	0.2
La Plata	39,950	1,271	2,312	321	510	2,497	18.7	1.2	2.9	0.4	0.6	2.1
Lake	-	-	844	-	-	335	-	-	1.1	-	-	0.3
Larimer	5,219	2,497	3,145	528	1,152	1,270	2.4	2.4	3.9	0.6	1.4	1.1
Las Animas	993	1,600	7,057	2,300	170	-	0.5	1.5	8.9	2.7	0.2	-
Logan	33	-	-	-	-	-	a	-	-	-	-	-
Mesa	5,252	1,765	8,660	4,973	4,798	7,602	2.5	1.7	10.9	5.7	5.8	6.5
Mineral	11,876	6,531	372	683	629	1,257	5.5	6.3	0.5	0.8	0.8	1.1
Moffat	158	-	124	-	399	186	0.1	-	0.2	-	0.5	0.2
Montezuma	4,169	15,001	4,495	3,242	2,202	2,995	1.9	14.5	5.6	3.7	2.7	2.6
Montrose	2,714	7,735	3,029	1,625	7,335	5,628	1.3	7.5	3.8	1.9	8.9	4.8
Ouray	-	2,565	30	8	129	25	-	2.5	a	a	a	a
Park	252	2,456	4,369	2,432	911	951	0.1	2.4	5.5	2.8	1.1	0.8
Pitkin	331	-	-	-	149	104	0.2	-	-	-	0.2	0.1
Pueblo	176	-	306	48	-	1,012	0.1	-	0.4	0.1	-	0.9
Rio Blanco	370	10	730	-	-	81	0.2	a	0.9	-	-	0.1
Rio Grande	10,857	9,277	557	100	4,313	5,418	5.1	9.0	0.7	0.1	5.3	4.6
Routt	10,442	1,976	1,143	2,008	6,593	9,465	4.9	1.9	1.4	2.3	8.0	8.1
Saguache	11,426	4,802	520	1,459	-	3,494	5.3	4.6	0.7	1.7	-	3.0
San Juan	-	-	274	-	-	-	-	-	0.3	-	-	-
San Miguel	-	2,131	1,020	-	25	230	-	2.1	1.3	-	0.0	0.2
Summit	-	193	289	2,606	1,072	6,265	-	0.2	0.4	3.0	1.3	5.4
Teller	46	713	1,049	432	9,598	3,522	a	0.7	1.3	0.5	11.7	3.0
Total	214,025	103,448	79,711	86,540	82,070	116,656	100	100	100	100	100	100

[a]Less than 0.05 percent.

Table C5—Colorado timber harvest by species, selected years (sources: Hayes et al. 2012; McLain 1985; Morgan et al. 2006; Setzer and Shupe 1977; Sorenson et al. 2016).

County	1974	1982	2002	2007	2012	2016	1974	1982	2002	2007	2012	2016
	MBF Scribner						*Percentage of harvest*					
Lodgepole pine	42,187	15,500	12,457	45,026	41,091	64,105	19.7	15.0	15.6	52.0	50.1	55.0
Spruce[a]	91,638	41,877	19,908	10,203	15,488	26,578	42.8	40.5	25.0	11.8	18.9	22.8
Ponderosa pine	34,306	22,716	22,526	6,899	10,983	8,505	16.0	22.0	28.3	8.0	13.4	7.3
Aspen	4,825	12,737	15,292	17,319	7,727	8,192	2.3	12.3	19.2	20.0	9.4	7.0
Douglas-fir	26,927	6,574	6,959	3,946	5,334	6,948	12.6	6.4	8.7	4.6	6.5	6.0
True firs[b]	14,142	3,986	2,512	3,132	1,350	2,301	6.6	3.9	3.2	3.6	1.6	2.0
Other species[c]	-	58	58	14	96	27	-	0.1	0.1	0.0	0.1	0.0
All species	214,025	103,448	79,711	86,539	82,070	116,656	100	100	100	100	100	100

[a]Spruce includes Engelmann and blue spruce.
[b]True firs include white and subalpine fir.
[c]Other species include cottonwood, western redcedar, gambel oak, Rocky Mountain juniper, and pinyon.

Table C6—Colorado timber harvest by species and product, 2016.

Species	Sawlogs	House logs	Posts and poles	Other products[a]	All products
	Thousand board feet, Scribner				
Lodgepole pine	49,635	502	5,256	8,713	64,105
Spruce[b]	23,221	2,454	600	93	26,368
Ponderosa pine	7,146	71	199	1,089	8,505
Aspen	5,095	274	9	2,814	8,192
Douglas-fir	6,046	46	215	640	6,948
True firs[c]	1,806	-	95	400	2,301
Other species[d]	237	-	-	-	237
All species	93,185	3,347	6,375	13,749	116,656
	Percentage of product by species				
Lodgepole pine	53.3	15.0	82.4	63.4	55.0
Spruce[b]	24.9	73.3	9.4	0.7	22.6
Ponderosa pine	7.7	2.1	3.1	7.9	7.3
Aspen	5.5	8.2	0.1	20.5	7.0
Douglas-fir	6.5	1.4	3.4	4.7	6.0
True firs[c]	1.9	-	1.5	2.9	2.0
Other species[d]	0.3	-	-	-	0.2
All species	79.9	2.9	5.5	11.8	100

[a]Other products include furniture logs, fiber logs, viga logs, and industrial fuelwood.
[b]Spruce includes Engelmann and blue spruce.
[c]True firs include white and subalpine fir.
[d]Other species include gambel oak, Rocky Mountain juniper, pinyon, cottonwood, and western redcedar.

Timber Flow

The majority (86 percent) of Colorado's 2016 timber harvest was processed in-state. During 2016, Colorado had a net outflow of about 12 MMBF of timber. In 2016 about 16 MMBF of timber from Colorado was processed in Wyoming, Utah, and New Mexico, while there was an inflow of about 4 MMBF of timber from New Mexico, Utah, Arizona, Wyoming, Montana, and Idaho for processing in Colorado (table C7).

Timber processors in Colorado received 104,499 MBF of timber in 2016, including 3,965 MBF that was harvested outside the State. National Forests provided about 59 percent (61,734 MBF) of the timber delivered to Colorado mills in 2016, with 35 of Colorado's timber processors—more than 64 percent—receiving timber cut from National Forests. Private and tribal timberlands provided 34 percent of

timber receipts with 35,851 MBF coming from private lands and 60 MBF from tribal lands (table C8). The remaining 7 percent of timber receipts were provided by state lands and other public ownerships. During 2016, National Forests provided Colorado with the majority of all product categories – 63 percent of sawlogs and 63 percent of the house log volume processed in-state by log home manufacturers; private and tribal landowners provided 31 percent of sawlogs and 37 percent of house logs. Public timberlands also provided the majority of the posts and poles processed in Colorado, along with the timber for other products (table C8).

Table C7—Timber product flow into and out of Colorado, 2016.

Timber product	Log flow into Colorado	Log flow out of Colorado	Net inflow (net outflow)
	---------Thousand board feet, Scribner----------		
Sawlogs	380	15,646	(15,266)
House logs	225	476	(251)
Other products[a]	3,360	-	3,360
All products	3,965	16,122	(12,157)

[a]Other products include fiber logs, post and pole logs, energywood logs, and industrial fuelwood.

Table C8—Timber received by Colorado forest products industry by ownership class and product, 2016.

Ownership class	Sawlogs	Posts and poles	House logs	Other products[a]	All products
		----------Thousand board feet, Scribner----------			
Private and tribal timberland	29,800	1,653	1,308	5,525	35,911
Private	*29,800*	*1,653*	*1,248*	*5,525*	*35,851*
Tribal	-	-	*60*	-	*60*
Public timberland	66,298	5,032	2,264	11,564	68,588
National Forest	*60,471*	*4,320*	*2,264*	*10,349*	*61,734*
State lands	*2,827*	*330*	-	*928*	*4,085*
Other public	*3,000*	*382*	-	*287*	*2,769*
Other owners	-	-	-	-	-
Other mills	-	-	-	-	-
Canada	-	-	-	-	-
All owners	96,098	6,685	3,572	17,089	104,499
		----------Percentage of product by owner----------			
Private and tribal timberland	31.0	24.7	36.6	32.3	34.4
Private	*31.0*	*24.7*	*34.9*	*32.3*	*34.3*
Tribal	-	-	*1.7*	-	*0.1*
Public timberland	69.0	75.3	63.4	67.7	65.6
National Forest	*62.9*	*64.6*	*63.4*	*60.6*	*59.1*
State lands	*2.9*	*4.9*	-	*5.4*	*3.9*
Other public	*3.1*	*5.7*	-	*1.7*	*2.6*
Other owners	-	-	-	-	-
Other mills	-	-	-	-	-
Canada	-	-	-	-	-
All owners	92.0	6.4	3.4	16.4	100

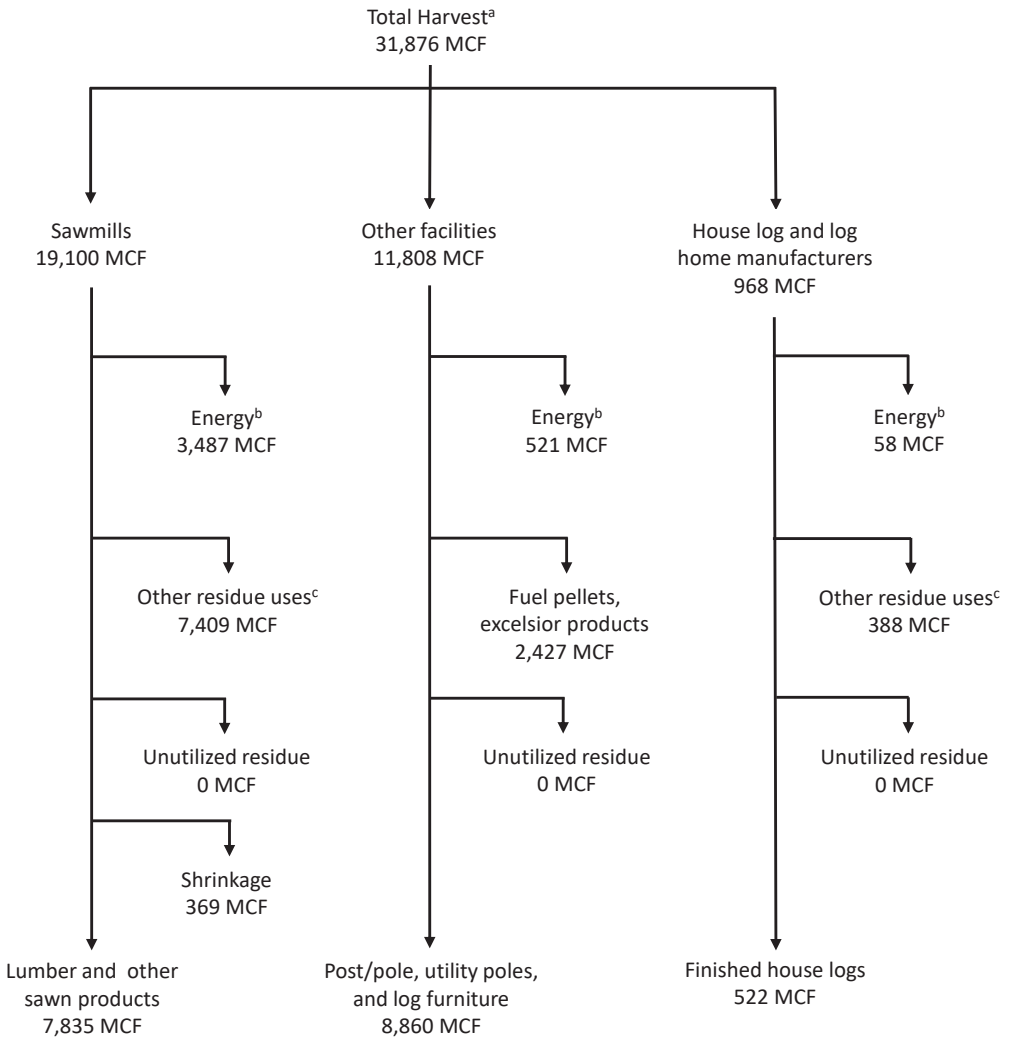
[a]Other products include energywood logs, fiber logs, furniture logs, and industrial fuelwood.

Timber Use

Colorado's 2016 timber harvest—approximately 31,876 MCF, exclusive of bark (fig. C1)—was used by several manufacturing sectors both within and outside of Colorado. Of this volume, 19,100 MCF went as logs to sawmills, 968 MCF went

to log home manufacturers, and 11,808 MCF went to post, pole, log furniture, fuel pellet, and excelsior manufacturers. The following conversion factors were used to convert Scribner board foot volume to cubic feet:

- 4.80 board feet per cubic foot for sawlogs;
- 4.54 board feet per cubic foot for house logs; and
- 1.72 board feet per cubic foot average for all other products.



[a]Harvest volume does not include bark.
[b]Energy includes residue used internally for energy and residue sold for hog fuel, wood pellets, and energy logs.
[c]Other uses include landscape, mulch, and animal bedding.

Figure C1—Colorado timber harvest and flow, 2016.

Of the 19,100 MCF of timber received by sawmills, 7,835 MCF (41 percent) was processed into finished lumber or other sawn products, and about 369 MCF was lost to shrinkage. The remaining 10,896 MCF (57 percent) became mill residue. In 2016, all of the sawmill residue was utilized: 3,487 MCF for internal energy production and the remaining 7,409 MCF was utilized for other uses such as landscaping, mulch, and animal bedding. Of the 968 MCF of timber received by log home manufacturers, about 522 MCF (54 percent) was manufactured into house logs, while the remaining 446 MCF became mill residue. All of the house log residue was utilized. Of the 11,808 MCF of

timber received by other facilities, 8,860 MCF was utilized in solid wood products (such as posts, poles, and log furniture) and 2,427 MCF was used in the production of fuel pellets and excelsior. About 521 MCF of residues was used for internal energy production and no residue went unused.

Forest Industry Sectors

Colorado's primary forest products industry in 2016 consisted of 55 active manufacturers in 25 counties (table C9). Facilities tended to be located near the forest resource in the central and southwestern portions of the State (fig. C2). The sawmill sector, manufacturing lumber and other sawn products, was the largest sector operating in 2016 with 30 mills; 10 facilities produced house logs and log homes. There were three log furniture producers, five post and pole firms, two excelsior producers and five energy/fuel pellet facilities operating in 2016. Sorenson et al. (2016) identified 58 primary wood-processing plants in 2012: 31 sawmills, 12 house log plants, 6 post and pole facilities, and 9 facilities producing log furniture and other products including an excelsior manufacturer. Changes in Colorado's industry structure over the past 25 years were similar to those experienced throughout the West, with the number of sawmills decreasing (Morgan et al. 2006) and the number of log home facilities declining, particularly after the Great Recession.

Table C9—Active Colorado primary wood products facilities by county and product, 2016 (sources: Hayes et al. 2012; McLain 1985; Morgan et al. 2006; Sorenson et al. 2016).

County	Lumber	House logs and log homes	Other products	Total
Alamosa			1	1
Arapahoe			1	1
Archuleta	2			2
Boulder	1	1	1	3
Conejos	2			2
Custer	1			1
Delta	1			1
Denver			1	1
Eagle	1			1
Fremont	2			2
Garfield	2	1	1	4
Grand	2	1	3	6
Jackson			1	1
Jefferson			1	1
La Plata	1	2		3
Larimer	3		2	5
Mesa	1			1
Mineral		1		1
Montezuma	3		2	5
Montrose	2	2		4
Park	1	1		2
Pueblo	1			1
Rio Grande	1		1	2
Saguache	1	1		2
Teller	2			2
2016 Total	**30**	**10**	**15**	**55**
2012 Total	31	12	15	58
2007 Total	30	19	15	64
2002 Total	50	46	37	133
1982 Total	84	5	6	95

[a]Other products include excelsior, fuel pellets, posts, poles, log furniture, and biomass/energy.

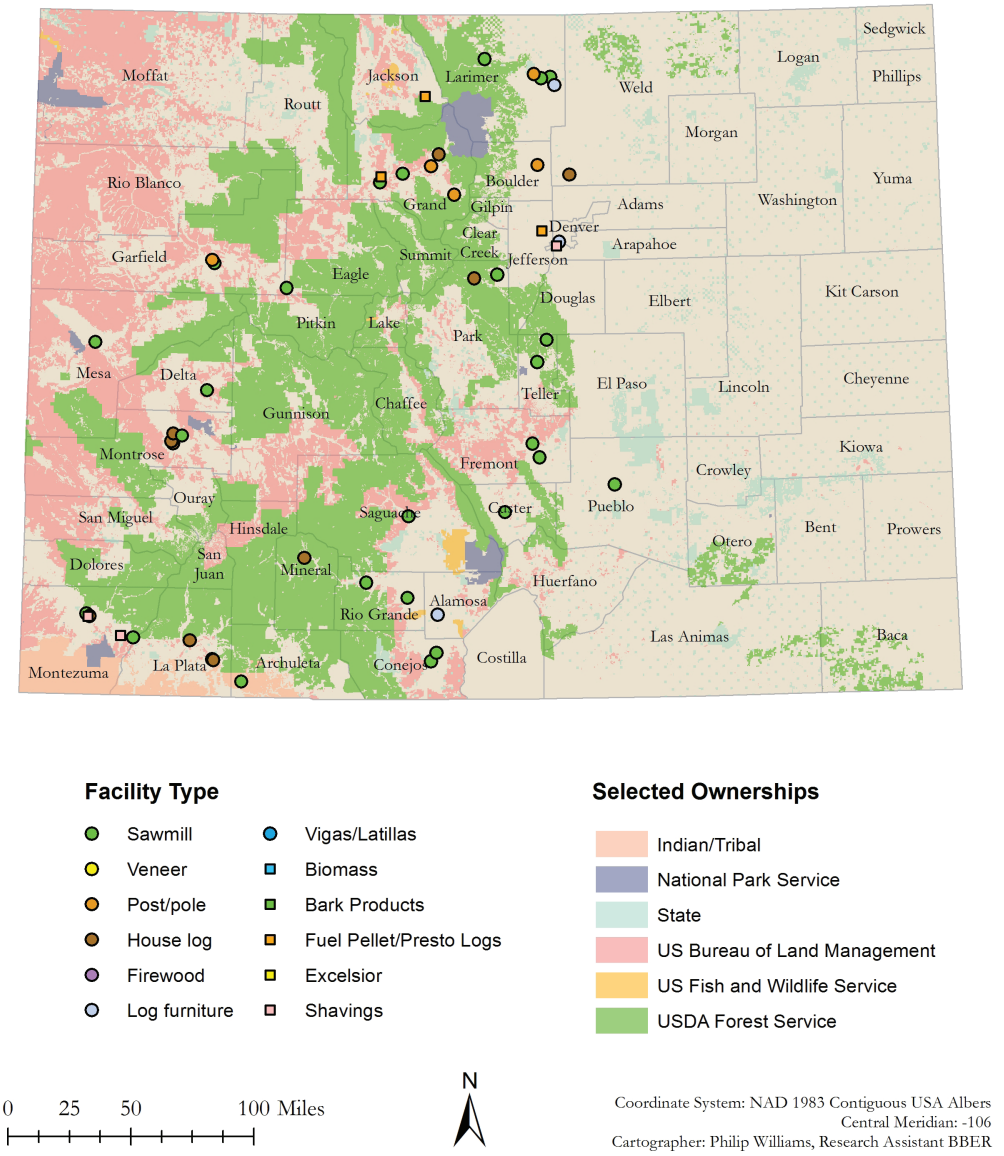


Figure C2—Map of Colorado primary timber processors.

Table C10—Finished product sales of Colorado's primary wood products sectors, 2016 (sources: Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016).

Sector	2002	2007	2012	2016
	Thousands of 2016 dollars[a]			
Sawmills	53,895	51,439	40,656	47,856
House logs and log homes	36,325	22,223	14,146	8,440
Other sectors[b]	34,416	41,857	36,051	41,831
Total	124,635	115,520	90,854	98,127

[a]All sales are reported f.o.b. the manufacturer's plant.
[b]Other sectors include producers of posts, poles, log furniture, fuel pellets, biomass/energy and excelsior.

In 2016, sales value of finished products from Colorado's primary wood products industry totaled $98.1 million. This compares to 2012 sales of $90.9 million, 2007 sales of $115.5 million, and 2002 sales of $124.6 million, in 2016 dollars (table C10). Sales from sawmills accounted for 49 percent of total sales, with about an 18 percent higher sales value than in 2012; house log and log home manufacturers accounted for 8 percent, a $5.7 million drop from 2012; and other products sectors accounted for about 43 percent, up about $5.8 million from 2012.

Sawmill Sector

After declining from a total of 84 sawmills in 1982 (McLain 1985) to 50 in 2002, and 30 and 31, respectively, in 2007 and 2012 (Hayes et al. 2012, Sorenson et al. 2016), 30 sawmills were identified as producing lumber in 2016 (table C11). While there was one less sawmill in the State in 2016 compared to 2012, Colorado lumber production increased 16 percent from about 95 MMBF in 2012 (Sorenson et al. 2016) to 110 MMBF in 2016, with average production increasing from 3.1 MMBF to 3.7 MMBF per sawmill during the period. The state's 8 largest sawmills produced an average of 12.6 MMBF in 2016, with 5 of these mills producing between 2 and 5 MMBF, and the remaining 22 sawmills averaged 398 MBF in 2016 (table C12).

Table C11—Number of Colorado sawmills and average lumber production, selected years (sources: Hayes et al. 2012; McLain 1985; Morgan et al. 2006; Sorenson et al. 2016; WWPA 1983).

Year	Number of sawmills	Average lumber production
		MMBF[a]
2016	30	3.7
2012	31	3.1
2007	30	3.9
2002	50	1.7
1982	84	1.4

[a]MMBF = million board feet lumber tally.

Table C12—Colorado lumber production by mill size, 2016.

Size class[a]	Number of mills	Volume	Percentage of total	Average per mill
		MBF[b]		*MBF*[b]
Over 2 MMBF	8	101,166	92	12,646
Under 2 MMBF	22	8,757	8	398
Total	30	109,923	100	3,664

[a]Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.
[b]MBF = thousand board feet lumber tally.

Technological improvements have made Colorado mills more efficient. Thinner kerf saws reduce the proportion of the log that becomes sawdust. Additionally, mill-delivered log diameters are believed to have decreased over the past 25 years, with reduced old-growth harvesting and increased use of restoration and fuels treatments that favor retention of larger trees and the removal of smaller stems. As log diameters

decrease, the Scribner log rule, which is used in Colorado, underestimates—by an increasing amount—the volume of lumber that can be recovered from a log, thus increasing overrun. On average, Colorado sawmills produced approximately 1.49 board feet of lumber for every board foot Scribner of timber processed for an average overrun of 49 percent in 2016, lower than the 58 percent overrun in 2012 (Sorenson et al. 2016) or the 54 percent overrun in 2007 (Hayes et al. 2012). This change in overrun may indicate mill-delivered logs were on average a larger diameter because of salvage logging of beetle-killed trees happening during the survey period.

Sales from sawmills increased from 2012 to 2016, from $41 million to $48 million (constant 2016 dollars). With increasing overall sales from Colorado timber processors, the sawmill share of total primary mill sales in the State increased by 4 percent at 49 percent in 2016, versus 45 percent in both 2012 and 2007 (Hayes et al. 2012; Sorenson et al. 2016). In comparison, sawmill sales accounted for 45 and 39 percent of timber processors' finished product sales in Arizona and New Mexico, respectively, during 2016, and historically accounted for 90 percent or more of sales throughout the Interior West (Keegan et al. 2001a,b,c; Morgan et al. 2004b). Dimension lumber and studs accounted for $35.7 million (75 percent) of sawmill product sales in 2016, board and shop lumber accounted for $5.3 million (11 percent), timbers accounted for $2.7 million (6 percent), and other sawn products accounted for $1.5 million (3 percent). Finally, other miscellaneous products accounted for nearly $2.5 million (5 percent) of finished product sales from sawmills during 2016.

Log Home Sector

From 1982 to 2002, Colorado's log home industry grew from 6 to 46 facilities (table C9). By 2012, the number of log home and house log manufacturers dropped to 12, and there were just 10 facilities operating in 2016. Only firms that processed timber and manufactured house logs or log homes, not log home distributors, are included in the FIDACS census. In 2016, Colorado's 10 log home manufacturers processed 4.6 MMBF Scribner, produced about 848,000 lineal feet (MLF) of house logs, and generated $7.7 million in product sales.

Other Products Sectors

Following the same trend as the log home sector, Colorado's producers of posts and poles and other primary wood products significantly expanded production from 1982 to 2002, and production subsequently declined from 2002 to 2012. The number of facilities increased from 6 to 37 between 1982 and 2002, and then fell to 15 facilities in 2007, 2012, and 2016 (table C9). In 2016, three of these other products facilities manufactured log furniture, five were post and pole producers, five were biomass/fuel pellets facilities, and two were excelsior plants. Finished products sales by manufacturers of posts and poles exceeded $6 million, and sales by manufacturers of log furniture, fuel pellets/energy, and excelsior exceeded $35.6 million in 2016. Additional detail about this sector is withheld to protect the confidentiality of firm-level information.

Capacity and Utilization

Colorado's annual sawmill production capacity was 223.7 MMBF of lumber in 2016, up from 176.3 MMBF in 2012. Sawmills produced 110 MMBF of lumber in 2016, utilizing 49 percent of their lumber production capacity. This was down from the 2012 capacity utilization rate of 54 percent, when sawmills produced 95.4 MMBF (Sorenson et al. 2016). Timber-processing capacity among Colorado sawmills was 153,319 MBF Scribner, with 76,671 MBF Scribner of timber processed, making utilization of timber-processing capacity among sawmills about 50 percent in 2016. Across all industry sectors in the State, total timber-processing capacity was 183 MMBF Scribner. Accounting for changes in mills' log inventories, a total of 105.5 MMBF Scribner was processed by Colorado firms in 2016, making timber-processing capacity utilization about 57 percent across all sectors. The higher capacity utilization of all sectors compared to sawmills alone indicates that processors other than sawmills were operating above their stated processing capacity and have increased production with more favorable market conditions since 2012.

Mill Residue Volumes, Types, and Uses

Sawmills, the leading timber sector, were also the main residue producers in Colorado. In 2016, sawmills produced 1.0 BDU of residue per MBF of lumber (table C13). Across all sectors, Colorado timber processors produced 129,833 BDU, or approximately 12,464 MCF of mill residue, with 99.7 percent utilized (table C14). Total residue production declined from 22,749 MCF in 1974, but increased from 10,385 MCF in 2012, while the proportion utilized increased from 40 percent in 1974 to 99.1 percent in 2012 (Sorenson et al. 2016). Colorado's decreased residue production over time stemmed from a combination of increased milling efficiencies and decreased timber volumes processed. Increased residue utilization rates between 1974 and 2016 could be attributable to both a decreased supply of residue in the market, and increased demand for residues as inputs for residue-related product manufacturing.

Table C13—Colorado's sawmill residue factors, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016).

Type of residue	2002	2007	2012	2016
	BDU/MBF lumber tally[a]			
Coarse	0.42	0.60	0.56	0.54
Sawdust	0.17	0.21	0.20	0.20
Planer shavings	0.13	0.09	0.09	0.08
Bark	0.29	0.14	0.15	0.18
Total	1.01	1.04	1.00	1.00

[a]Bone-dry unit (BDU = 2,400 lb oven-dry wood) of residue generated for every 1,000 board feet of lumber manufactured.

Table C14—Production and disposition of Colorado mill residues, 2016.

Residue type	Total utilized	Pulp and board	Energy	Mulch/ bedding	Unspecified use	Unused	Total produced
				Bone-dry units[a]			
Coarse	68,532	-	27,651	-	40,881	31	68,563
Fine	36,876	-	7,900	26,751	2,225	22	36,898
Sawdust	*26,805*	-	*7,900*	*16,884*	*2,021*	*12*	*26,817*
Planer shavings	*10,071*	-	-	*9,867*	*204*	*10*	*10,081*
Bark	24,051	-	317	21,582	2,152	321	24,372
Total	129,459	-	35,868	48,333	45,258	374	129,833
				Percentage of residue type			
Coarse	100.0	-	40.3	-	59.6	0.0	52.8
Fine	99.9	-	21.4	72.5	6.0	0.1	28.4
Sawdust	*100.0*	-	*29.5*	*63.0*	*7.5*	*0.0*	*20.7*
Planer shavings	*99.9*	-	-	*97.9*	*2.0*	*0.1*	*7.8*
Bark	98.7	-	1.3	88.6	8.8	1.3	18.8
Total	99.7	-	27.6	37.2	34.9	0.3	100

[a]Bone-dry unit = 2,400 lb oven-dry wood.

Coarse residue was the state's largest residue component at 53 percent (68,563 BDU) of all residues in 2016, with nearly 100 percent utilized. Unspecified uses were reported as using 40,881 BDU of the coarse material, and the remaining volume was used for energy production (table C14). Fine residues comprised the second largest component at slightly over 28 percent (36,898 BDU) of mill residues. About 99.9 percent of fine residue was utilized in 2016, primarily (73 percent) to mulch or animal bedding facilities with a little over 21 percent of fine residues going for energy. Bark accounted for just under 19 percent of all residues and was largely used for mulch and bedding, or listed as burned for energy or for unspecified uses in 2016, with 24,051 BDUs (98 percent) utilized.

Primary Forest Products Sales

Sales from Colorado's primary wood products industry during 2016 totaled nearly $102 million dollars, including finished products and mill residues (table C15). Lumber, timbers, and other sawn products accounted for 46 percent (over $46.7 million) of total sales; other products and mill residues accounted for 32 percent (slightly over $32.6 million); post poles and log furniture made up slightly over 12 percent ($12.4 million) of sales; and house logs and log homes accounted for 10 percent (around $9.7 million). Colorado was the leading market area for log homes, posts, poles, log furniture, and other products with in-state sales accounting for 36 percent of total sales. The South accounted for 15.7 percent of total sales, 19 percent of lumber sales, and 20 percent of other products sales. The other Four Corners States (Arizona, New Mexico, and Utah) accounted for about 13 percent of total sales, the majority of which were posts and poles, lumber and sawn products, and log home products. Other Rocky Mountain States and the North Central United States were major market areas for lumber and other products, including house logs, excelsior and mill residues.

Table C15—Destination and sales value of Colorado's primary wood products and mill residues, 2016.

Product	Colorado	Other Four Corners States	Other Rocky Mtn States[a]	Far West[b]	Northeast[c]	South[d]	North Central[e]	Other[f]	Total
	Thousand 2016 dollars								
Lumber, timbers and other sawn products	15,440	7,623	6,950	247	1,143	9,080	6,262	-	46,745
House logs and log homes	3,901	883	314	314	356	2,035	1,938	-	9,741
Posts, poles, and log furniture	5,954	2,373	1,090	1,038	455	886	598	-	12,394
Other products[g]	11,412	2,266	1,609	2,587	2,217	3,944	6,400	2,224	32,659
Total	36,707	13,145	9,963	4,186	4,171	15,945	15,198	2,224	101,539
	Percentage of product sales by region								
Lumber, timbers, and other sawn products	33.0	16.3	14.9	0.5	2.4	19.4	13.4	-	46.0
House logs and log homes	40.0	9.1	3.2	3.2	3.7	20.9	19.9	-	9.6
Posts, poles, and log furniture	48.0	19.1	8.8	8.4	3.7	7.1	4.8	-	12.2
Other products[g]	34.9	6.9	4.9	7.9	6.8	12.1	19.6	6.8	32.2
Total	36.2	12.9	9.8	4.1	4.1	15.7	15.0	2.2	100

[a]Other Rocky Mountain States include Idaho, Montana, Nevada.
[b]Far West includes Alaska, California, Hawaii, Oregon, and Washington.
[c]Northeast includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[d]South includes Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
[e]North Central includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[f]Other areas consist of products being shipped outside the United States.
[g]Other products include erosion control products, wood pellets, shavings, mulch, firewood, clean chips, and mill residues.

Forest Industry Employment and Labor Income

Employment in Colorado's forestry industry has continued to decline over the last decade, though it remains an important source of jobs in many rural communities around the State. In 2016, there we approximately 6,650 workers employed in the forest industry, representing just a 1 percent decline from 2012 employment estimates (fig. C3) (USDC BEA 2018a). The overall decrease was driven by reductions in forestry support activities (35 percent) and paper manufacturing (5 percent), while employment in forestry and logging as well as wood products manufacturing actually increased between 2012 and 2016. More than 1,930 workers were employed in the "primary" industry—harvesting and processing timber or in private sector land management—during 2016, while the remaining component of the industry can be classified as secondary, employing approximately 4,700 workers in 2016. The small decline in overall forest industry employment between 2012 and 2016 was driven entirely by the 6 percent reduction in primary forest industry employment, while the number of workers within the secondary industry actually increased slightly over the same period.

Colorado's forest industry worker earnings approached $295 million during 2016, down about 2 percent (adjusted for inflation) from 2012, and almost $240 million below 2007 earnings (fig. C4). Labor income includes wages and salaries, some benefits, and earnings of the self-employed. Employees in forestry and logging earned approximately $10.5 million while workers in the wood products manufacturing sector earned more than $170 million in 2016. Wood products manufacturing was the only sector with increasing labor income between 2012 and 2016, with workers earning approximately 17 percent more. Forestry and logging saw the largest decrease in inflation-adjusted earnings (45 percent) while labor income for employees in forestry support activities decreased by approximately 38 percent over the same period.

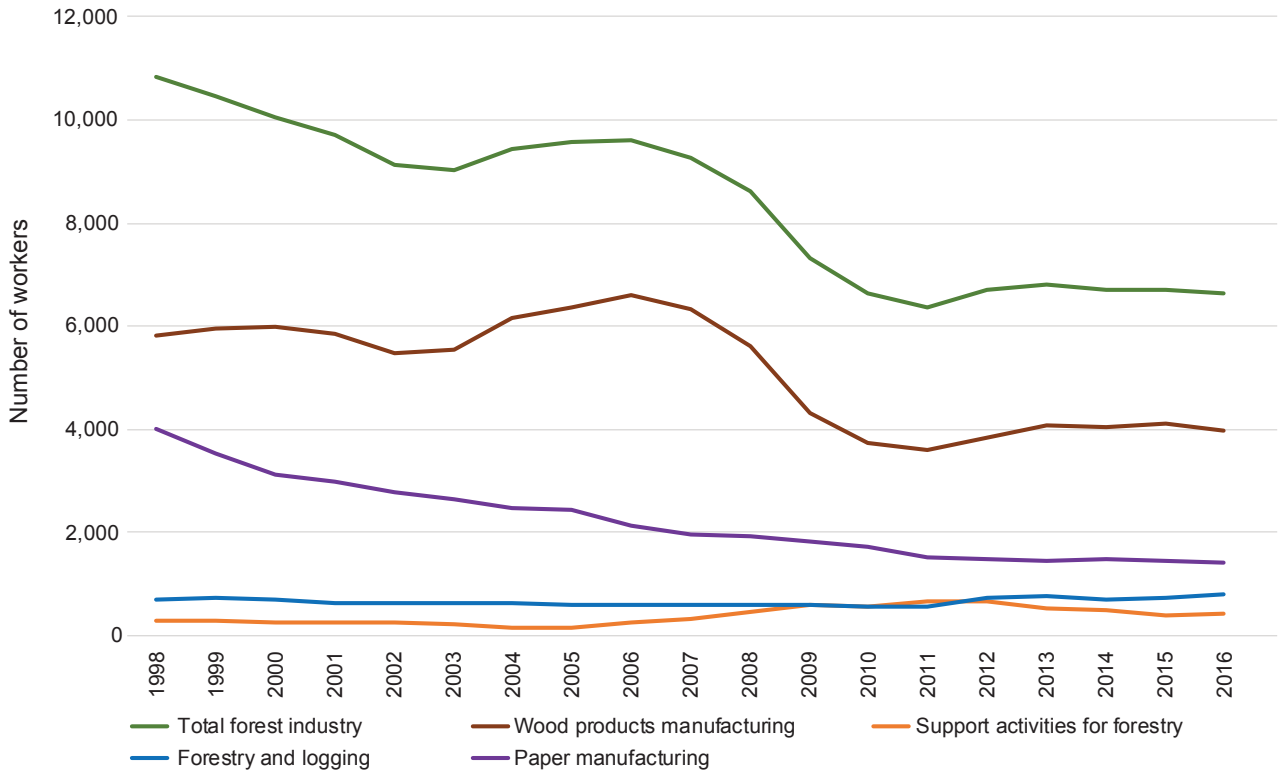


Figure C3—Employment in Colorado's forest industry, 1998–2016.

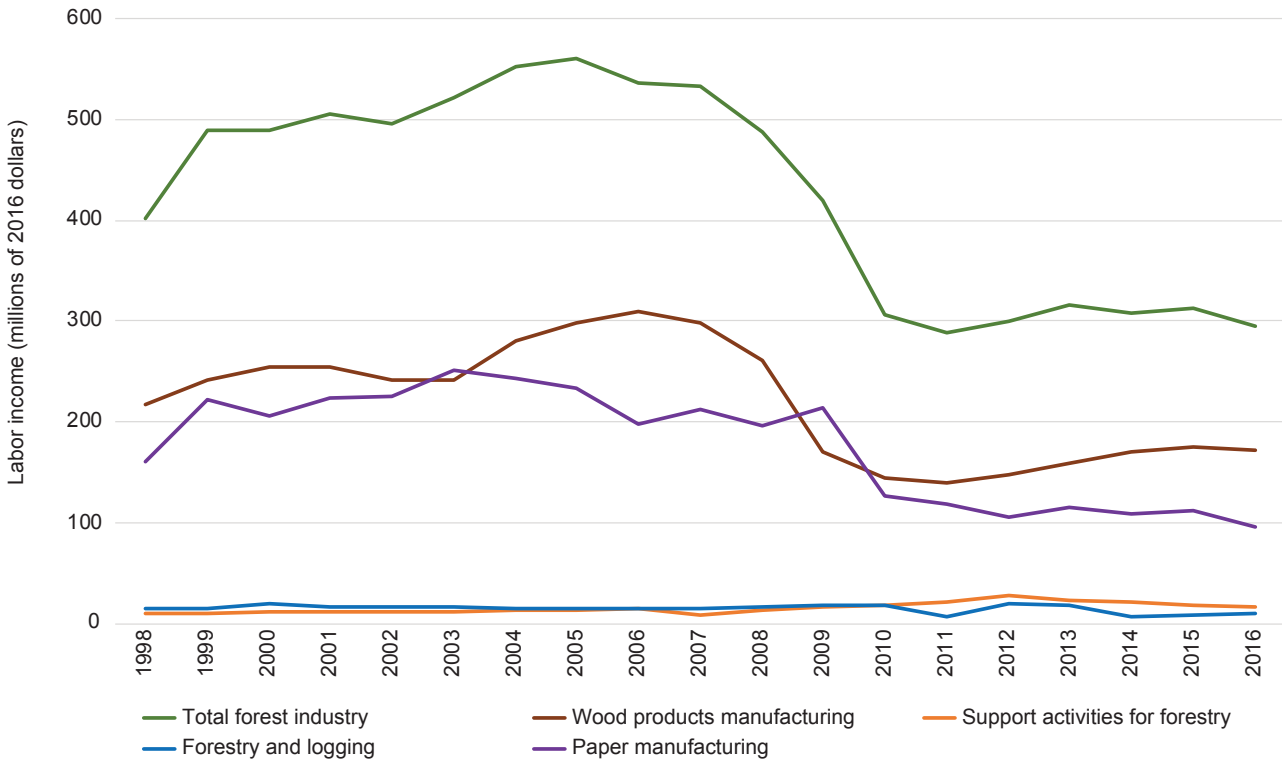


Figure C4—Inflation-adjusted earnings in Colorado's forest products industry, 1998–2016.

Wood products manufacturers, workers engaged in forestry support activities, and those employed in forestry and logging collectively contributed 6,650 jobs and nearly $295 million in labor income directly to the state economy in 2016. The activity associated with this direct employment generates additional economic opportunities by relying upon other industries for raw and intermediate inputs and services. Using regional data and existing linkages with Colorado's economy represented by the BEA's RIMS II multipliers (USDC BEA 2016), BBER estimates that the wood products manufacturing sector alone supported nearly 8,500 full- and part-time jobs and an associated $424 million in labor income during 2016 (table C16). Thus, for every wood products manufacturing job in the State, another 1.13 jobs are supported in related sectors. Additionally, for every $1.00 paid in labor income by wood products manufacturers, another $1.46 is paid in supporting sectors, including forestry and logging, forestry support, trucking, wholesale trade, and management.

Table C16—Average annual employment and labor income contributions from Colorado's forest industry.

Sector	Direct employment	Indirect and induced employment	Total employment contribution[a]	Direct labor income	Indirect and induced labor income	Total labor income contribution[a]
				Thousand 2016 dollars		
Wood products manufacturing[b]	3,993	4,505	8,498	172,279	251,364	423,643
Forestry and logging	805	568	1,373	10,581	8,346	18,927
Forestry support activities	430	163	593	16,875	9,399	26,274
Paper manufacturing	1,424	3,069	4,493	95,189	148,276	243,465
Total forest industry	**6,652**	[a]	[a]	**294,924**	[a]	[a]

[a]Indirect and induced employment and labor income should not be summed for multiple sectors due to some employment and income showing up as both direct contributions to their sector and indirect contributions to other sectors.
[b]Includes employment and labor income for both primary and secondary wood products manufacturing.

Additionally, BBER estimates that the 805 people employed in the forestry and logging sector during 2016 supported an additional 568 full- and part-time jobs along with $8.3 million in supporting sectors, such as equipment sales and repair. It should be noted that we do not aggregate sectors and we avoid providing estimates of the total employment and labor income contribution for the forest industry as a whole to avoid double counting, given that some employment and labor income shows up as both direct contributions to their sector, as well as indirect contributions to other sectors. In other words, some or all of the direct employment and labor income in the forestry and logging sector would be included with the indirect and induced contributions from wood products manufacturing since these manufacturers rely upon forestry and logging business to supply their raw material inputs.

New Mexico

This chapter focuses on New Mexico's timber harvest and forest products industry during 2016 and discusses changes that occurred since the 2012 FIDACS census conducted by Sorenson et al. (2016). Details of timber harvest, flow, and use are followed by descriptions of the primary processing sectors, capacity and utilization statistics, and mill residue characteristics. This chapter concludes with information on sales from New Mexico's primary wood products industry.

Timber Harvest, Flow, and Use

In 2016, New Mexico had approximately 4.2 million acres of nonreserved timberland (USDA FIA 2018), with National Forests accounting for 62 percent, private and tribal owners accounting for 34 percent, and other public agencies accounting for the remaining 4 percent (table N1). All private timberland was classified as NIPF timberland. With the exception of several Native American tribes, New Mexico had no large tracts of timberland owned by entities operating primary wood-processing facilities. Sawtimber volume on nonreserved timberlands was estimated at 5.8 billion cubic feet or approximately 33 billion board feet Scribner in 2016 (USDA FIA 2018).

Table N1—New Mexico nonreserved timberland by ownership class (source: Miles 2018).

Ownership class	Thousand acres	Percentage of nonreserved timberland
National Forest	2,626	62
Private and tribal	1,442	34
Other public	166	4
Total	4,234	100

Timber Harvest

New Mexico's 2016 commercial timber harvest was 26,385 MBF Scribner, about 9 percent less than 2012, 73 percent of the 2007 harvest, 39 percent of the 2002 harvest, and 30 percent of the 1997 harvest (Hayes et al. 2012; Keegan et al. 2001b; Morgan et al. 2006; Sorenson et al. 2016). Of the timber harvested in New Mexico in 2016, 93 percent was live and 7 percent was salvage or standing dead when harvested. As recently as 1989, 210 MMBF Scribner of timber was harvested annually in New Mexico, with 65 percent of that volume coming from the National Forest (Keegan et al. 2001b). While the public share of New Mexico's timber harvest had fallen to just 12 percent by 1997, the public lands portion was slightly higher in 2002 and 2007 and increased to almost 50 percent by 2012 (table N2; Hayes et al. 2012; Morgan et al. 2006; Sorenson et al. 2016). During 2016, National Forests accounted for 60 percent of the state timber harvest. Sawlogs accounted for 75 percent (19.7 MMBF) of the total volume harvested. National Forests provided the majority of sawlogs and house logs harvested in New Mexico in 2016, while the remaining volume was split between private and tribal timberlands (table N3). The largest share (58 percent) of other products, including posts, poles, furniture logs, fiber logs, and fuelwood, was harvested from private timberland.

Table N2—New Mexico timber harvest by ownership class, 1997, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 2001b; Morgan et al. 2006; Sorenson et al. 2016).

	1997	2002	2007	2012	2016	1997	2002	2007	2012	2016
Ownership class	**MBF[a] Scribner**					**Percentage of total**				
Private and tribal timberland	85,903	64,201	33,001	14,496	10,514	88.0	86.3	83.0	50.3	39.8
Private	61,853	36,821	14,971	7,965	5,663	63.4	49.5	37.6	27.6	21.5
Tribal	24,050	27,380	18,030	6,531	4,851	24.6	36.8	45.3	22.6	18.4
Public timberland	11,723	10,160	6,769	14,343	15,871	12.0	13.7	17.0	49.7	60.2
National Forest	11,723	10,160	5,644	14,343	15,871	12.0	13.7	14.2	49.7	60.2
State timberland	-	-	1,125	-	-	-	-	2.8	-	-
All owners	97,626	74,361	39,770	28,839	26,385	100	100	100	100	100

[a]MBF = thousand board feet.

Table N3—New Mexico timber products harvested by ownership class, 2016.

Ownership class	Sawlogs	Vigas	House logs	Other products[a]	All products
			Thousand of board feet, Scribner		
National Forest	13,897	345	161	1,468	15,871
Private timberland	2,387	232	23	3,021	5,663
Tribal timberland	3,377	752	-	722	4,851
State timberland	-	-	-	-	-
All owners	19,661	1,329	184	5,211	26,385
			Percentage of harvested product by ownership		
National Forest	70.7	26.0	87.5	28.2	60.2
Private timberland	12.1	17.5	12.5	58.0	21.5
Tribal timberland	17.2	56.6	-	13.9	18.4
State timberland	-	-	-	-	-
All owners	74.5	5.0	0.7	19.7	100

[a]Other products include posts, poles, furniture logs, fiber logs, and industrial fuelwood.

The 2016, New Mexico harvest was spread across 15 counties, with 6 counties contributing around 75 percent of the harvest (table N4). In 2016, Rio Arriba led New Mexico's timber harvest with slightly more than 17 percent of the total volume; Cibola, Colfax, and Sandoval Counties followed, with 16, 11, and 10 percent, respectively. Historically, Rio Arriba is among the state's top three timber-producing counties, accounting for 15 percent or more of annual harvest volumes until 2007 when it only contributed slightly more than 4 percent. Colfax County, however, was not a significant contributor to New Mexico's annual harvest until recently, only periodically accounting for more than 10 percent of harvest in previous mill censuses (Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Ponderosa pine continued to be the leading species harvested in New Mexico, accounting for 65 percent of the harvest in 2016 (table N5). Douglas-fir and white and subalpine firs together accounted for about 23 percent of the 2016 harvest. Ponderosa pine was the leading species harvested for sawlogs, vigas, and house logs in 2016 (table N6). Douglas-fir and true firs were a substantial component of the sawlog and house log harvest, while Engelmann spruce was a minor component of house logs at 11 percent. Engelmann spruce and Douglas-fir were also small components of the viga harvest. Other species like aspen and juniper were the leading species harvested for other products, while ponderosa pine was also a significant component to the other product category, which includes posts, poles, furniture logs, and firewood logs.

Table N4—New Mexico timber harvest by county, selected years (sources: Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

County	1966	1986	1997	2002	2007	2012	2016	1966	1986	1997	2002	2007	2012	2016
	MBF Scribner							*Percentage*						
Bernalillo	691	-	490	100	-	-	47	0.3	-	0.5	0.1	-	-	-
Catron	25,588	29,494	2,973	250	1,500	3,009	2,573	10.6	17.7	3.0	0.3	3.8	10.4	9.8
Cibola	-	13,857	7,973	15	-	1,523	4,416	-	8.3	8.2	a	-	5.3	16.7
Colfax	32,853	4,000	18,450	3,777	9,423	4,030	3,036	13.6	2.4	18.9	5.1	23.7	14.0	11.5
Eddy	-	548	-	-	-	-	161	-	0.3	-	-	-	-	0.6
Grant	538	663	-	-	279	646		0.2	0.4	-	-	0.7	2.2	-
Lincoln	-	1,450	198	-	1,800	5,495	1,637	-	0.9	0.2	-	4.5	19.1	6.2
Los Alamos	54	-	-	-	-	-	250	a	-	-	-	-	-	0.9
McKinley	36,692	-	2,000	-	-	-		15.1	-	2.0	-	-	-	-
Mora	957	3,830	2,040	10,864	215	224	50	0.4	2.3	2.1	14.6	0.5	0.8	0.2
Otero	17,335	16,982	36,866	30,825	18,835	5,121	2,394	7.2	10.2	37.8	41.5	47.4	17.8	9.1
Rio Arriba	37,156	69,367	17,107	17,869	1,733	4,472	4,605	15.3	41.7	17.5	24.0	4.4	15.5	17.5
San Juan	-	8,159	500	-	-	-		-	4.9	0.5	-	-	-	-
San Miguel	9,140	2,075	2,259	8,100	795	365	1,393	3.8	1.2	2.3	10.9	2.0	1.3	5.3
Sandoval	66,619	5,932	4,360	1,200	2,190	1,849	2,692	27.5	3.6	4.5	1.6	5.5	6.4	10.2
Santa Fe	-	2,865	-	670	1,000	601	129	-	1.7	-	0.9	2.5	2.1	0.5
Sierra	-	-	-	-	-	-	283	-	-	-	-	-	-	1.1
Socorro	2,739	-	1,025	220	-	-	1,649	1.1	-	1.0	0.3	-	-	6.2
Taos	6,767	7,066	1,245	175	2,000	1,506	795	2.8	4.2	1.3	0.2	5.0	5.2	3.0
Torrance	-	-	120	175	-	-	275	-	-	0.1	0.2	-	-	1.0
Valencia	4,548	-	20	120	-	-	-	1.9	-	a	0.2	-	-	-
Total[b]	242,313	166,342	97,626	74,361	39,770	28,839	26,385	100	100	100	100	100	100	100

[a]Less than 0.05 percent.

[b]Percentage detail may not sum to 100 percent due to rounding.

Table N5—New Mexico timber harvest by species, selected years (sources: Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Species	1966	1986	1997	2002	2007	2012	2016
	Percentage of harvest						
Ponderosa pine	49	68	57	50	47	54	65
True firs[b]	5	9	11	16	17	8	12
Douglas-fir	17	16	26	22	25	19	11
Other species[a]	15	4	< 0.5	2	8	15	9
Engelmann spruce	14	3	7	10	3	4	3
All species	100	100	100	100	100	100	100

[a]Other species include aspen, lodgepole pine, and southwestern white pine.

[b]True firs include white and subalpine fir.

Table N6—New Mexico timber harvest by species and product, 2016.

Species	Sawlogs	Vigas	House logs	Other products[a]	All products
	Thousand board feet, Scribner				
Ponderosa pine	14,221	1,175	67	1,747	17,210
White and subalpine fir	2,293	19	97	673	3,082
Douglas-fir	2,258	107	-	648	3,013
Other species[b]	207	-	-	2,076	2,283
Engelmann spruce	661	29	20	67	777
Lodgepole pine	20	-	-	-	20
All species	19,660	1,330	184	5,211	26,385
	Percentage of product by species				
Ponderosa pine	72.3	88.3	36.4	33.5	65.2
White and subalpine fir	11.7	1.4	52.7	12.9	11.7
Douglas-fir	11.5	8.0	-	12.4	11.4
Other species[b]	1.1	-	-	39.8	8.7
Engelmann spruce	3.4	2.2	10.9	1.3	2.9
Lodgepole pine	0.1	-	-	-	0.1
All species	74.5	5.0	0.7	19.7	100

[a]Other products include posts, poles, furniture logs, fiber logs, and industrial fuelwood.
[b]Other species include alligator juniper, Southwestern white pine, and aspen.

Timber Flow

The majority (88 percent) of New Mexico's 2016 timber harvest was processed in-state. Approximately 2 MMBF of New Mexico timber was processed in Colorado, and 1.2 MMBF in Texas, while about the same amount of timber from Colorado and Texas was processed in New Mexico (table N7).

Table N7—Timber product flow into and out of New Mexico, 2016.

Timber product	Log flow into New Mexico	Log flow out of New Mexico	Net inflow (net outflow)
	Thousand board feet, Scribner		
Sawlogs	3,453	1,247	2,206
House logs	0	15	(15)
Other products[a]	476	1,961	(1,485)
All products	3,929	3,223	706

[a]Other products include vigas, furniture logs, fiber logs, and industrial fuelwood.

Timber processors in New Mexico received 27,091 MBF of timber in 2016, including 3,929 MBF that was harvested outside the State. Timber receipts increased 18 percent since 2012, when New Mexico mills received 22,934 MBF of timber. Ownership sources of timber delivered to New Mexico mills has changed substantially since 2007, with the proportion from private and tribal lands decreasing from 79 percent to nearly 33 percent in 2016 (table N8). National Forests supplied 67 percent of timber delivered to New Mexico's mills in 2016, an increase from just 18 percent in 2007. Similar to other States in the region, New Mexico's National Forests provided forest products manufacturers with a large portion of timber products, supplying more than 73 percent of sawlogs, 26 percent of vigas, and 46 percent of other products, mostly post, poles, and firewood logs to the industry in 2016 (table N9).

Table N8—Ownership of timber products received by New Mexico mills, 1997, 2002, 2007, 2012 and 2016 (sources: Keegan et al. 2001b; Morgan et al. 2006; Hayes et al. 2012; Sorenson et al. 2016).

	1997	2002	2007	2012	2016	1997	2002	2007	2012	2016
Ownership class	**MBF[a] Scribner**					**Percentage of total**				
Private and tribal timberland	82,238	58,698	30,023	12,763	8,820	90.6	85.2	79.2	55.7	32.6
Private	*57,788*	*31,318*	*11,993*	*6,531*	*3,969*	*63.6*	*45.5*	*31.6*	*28.5*	*14.7*
Tribal	*24,450*	*27,380*	*18,030*	*6,232*	*4,851*	*26.9*	*39.8*	*47.6*	*27.2*	*17.9*
National Forests	8,562	10,160	6,769	10,103	18,271	9.4	14.8	17.9	44.1	67.4
State lands	-	-	1,125	68	-	-	-	3.0	0.3	-
All owners	90,800	68,858	37,917	22,934	27,091	100	100	100	100	100

[a]MBF = thousand board feet.

Table N9—Timber received by New Mexico forest products industry by ownership class and product, 2016.

Ownership class	Sawlogs	Vigas	Other products[a]	All products
	Thousand board feet, Scribner			
National Forest	16,142	345	1,784	18,271
Tribal timberland	3,376	752	722	4,851
Private timberland	2,348	232	1,389	3,969
State lands	-	-	-	-
All owners	21,866	1,329	3,896	27,091
	Percentage of product by owner			
National Forest	73.8	26.0	45.8	67.4
Tribal timberland	15.4	56.6	18.5	17.9
Private timberland	10.7	17.5	35.7	17.8
State lands	-	-	-	-
All owners	80.7	4.9	14.4	100

[a]Other products include house logs, posts, poles, fiber logs, and industrial fuelwood.

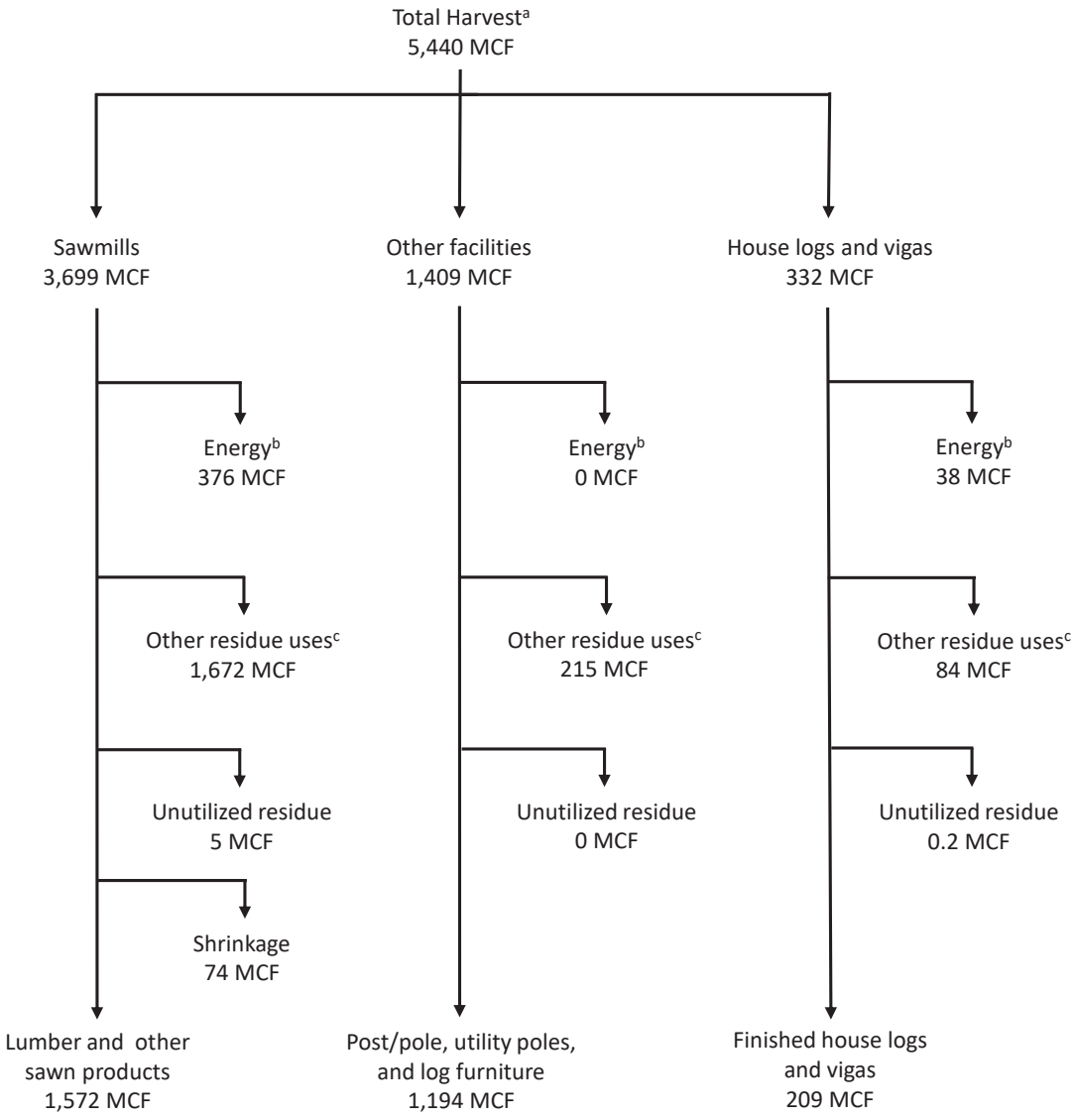
Timber Use

New Mexico's 2016 timber harvest—approximately 5,440 MCF, exclusive of bark (fig. N1)—was used by several manufacturing sectors both within and outside of New Mexico. Of this volume, 3,699 MCF went as logs to sawmills, 332 MCF went to log home and viga manufacturers, and 1,409 MCF went to other plants, including post, pole, log furniture, and excelsior manufacturers. The following conversion factors were used to convert Scribner board foot volume to cubic feet:

- 5.71 board feet per cubic foot for sawlogs;
- 4.54 board feet per cubic foot average for house logs and vigas; and
- 3.13 board feet per cubic foot average for all other products.

Of the 3,699 MCF of timber received by sawmills, 1,572 MCF (43 percent) was manufactured into finished lumber or other sawn products, and about 74 MCF was lost to shrinkage. The remaining 2,053 MCF (56 percent) became mill residue. About 2,048 MCF (99.8 percent) of sawmill residue was utilized, 1,672 MCF of residue was used for other uses, and 376 MCF utilized for internal energy use at the mill, while about 5 MCF remained unused. Of the 332 MCF of timber received by log home

and viga manufacturers, about 209 MCF (63 percent) was used for house logs and vigas, while the remaining 123 MCF became mill residue. Nearly all of the 123 MCF of house log and viga residue was utilized. Of the 1,409 MCF of timber received by other facilities, about 1,194 MCF (85 percent) was utilized in solid wood products such as posts, poles, fuelwood, log furniture, or was used in the production of excelsior. 215 MCF (15 percent) of the residue from these other sectors were utilized for other residue uses, while none went unused.



[a]Harvest volume does not include bark.

[b]Energy includes residue used internally for energy and residue sold for hog fuel, wood pellets, and energy logs.

[c]Other uses include landscape, mulch, and animal bedding.

Figure N1—New Mexico timber harvest and flow, 2016.

Forest Industry Sectors

New Mexico's primary forest products industry in 2016 consisted of 32 active manufacturers in 12 counties (table N10). Facilities tended to be located near the forest resource in north-central New Mexico and in Otero County (fig. N2). The sawmill sector, manufacturing lumber and other sawn products, was the largest sector operating during 2016, with 19 facilities—2 more than were operating in 2012. Four facilities produced vigas and latillas, one fewer than in 2012 and 2007. The number of other products manufacturers operating in 2016 increased to nine, with one post and pole manufacturer, two log home producer, one bark product facility, one fuelwood/pellet facility, two firewood producers, and two wood shaving/excelsior facilities. Primary wood products sales in 2016 were down 24 percent in real (inflation-adjusted) dollars from 2012 (table N11). The decrease in sales was due to the dramatic decrease in other products sales and a slight decrease in the viga and latilla sales. Sales of other wood products were down nearly 35 percent from 2012 to 2016. Since 1986, other products sales had been increasing while lumber and sawn products sales have been declining, both in quantity and as proportions of total sales. In 2016, sales from other product manufacturers accounted for 52 percent of finished products sales, compared to 61 percent in 2012, and 39 percent in 2007.

Table N10—Active New Mexico primary wood products facilities by county and product, 2016 (sources: Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Morgan et al. 2006; Sorenson et al. 2016).

County	Lumber	Vigas and latillas	Other[a]	Total
Bernalillo		1	1	2
Catron	1			1
Cibola	1		1	2
Colfax	1		4	5
Lincoln	1			1
Mora	1			1
Otero	4		3	7
Rio Arriba	2			2
San Miguel	3	1		4
Sandoval	2			2
Santa Fe	2	1		3
Taos	1	1		2
2016 Total	**19**	**4**	**9**	**32**
2012 Total	17	5	6	28
2007 Total	12	5	7	24
2002 Total	21	8	7	36
1997 Total	22	15	7	44
1986 Total	26	5-10	10	41-46

[a] Other products include posts, poles, house logs, firewood, pellets, shavings, erosion control products, and bark products.

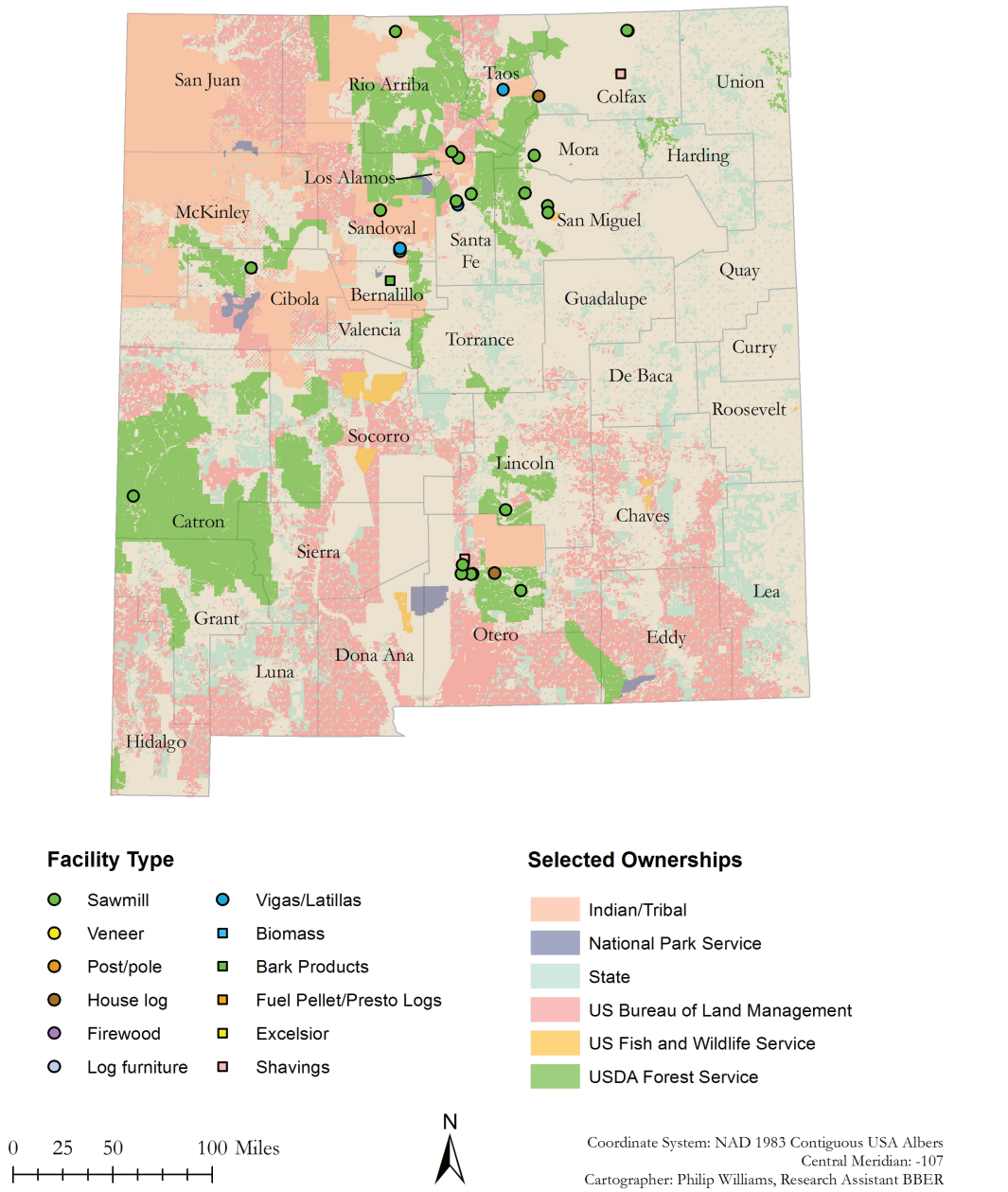


Figure N2—Map of New Mexico primary timber processors.

Table N11—Finished product sales of New Mexico's primary wood products, selected years (sources: Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Miller Freeman, Inc. 1998; Morgan et al. 2006; Sorenson et al. 2016).

Product	1986	1997	2002	2007	2012	2016
	----------*Thousand 2016 dollars*----------					
Lumber and sawn products	131,195	60,666	44,471	14,408	11,201	11,552
Vigas and latillas	5,085	14,338	5,967	3,596	3,883	2,604
Other products[a]	6,356	6,560	10,054	11,537	23,713	15,487
Total[b]	142,637	81,563	60,492	29,540	38,797	29,643

[a]Other products include posts, poles, log homes, log furniture, pellets, and bark products.
[b]All sales are reported f.o.b. the manufacturer's plant.

Sawmill Sector

Total lumber production in New Mexico dropped 70 percent in the past 15 years, from about 81 MMBF in 2002 to fewer than 24 MMBF in 2016. To avoid disclosure of individual firm information, the number of sawmills by production size class cannot be reported (table N12). As a result of the number of smaller mills and the reduction in total production, average annual lumber production fell 61 percent from 3.3 MMBF in 2007 to 1.3 MMBF per mill in 2016 (table N13). In 2016, the state's six largest sawmills produced an average of 3.2 MMBF, accounting for 81 percent of lumber production in New Mexico. The remaining 13 mills had an average annual lumber production of fewer than 353 MBF per mill (table N14).

Table N12—New Mexico sawmills by production size class, selected years (sources: Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Year	Under 10 MMBF[a]	Over 10 MMBF[a]	Total
	----------Number of sawmills----------		
2016	19	c	19
2012	17	c	17
2007	12	c	12
2002	18	3	21
1997	18	4	22
1986	17	9	26
1966	58	6	64
1962	85	c	85
1960	117	c	117
	----------Percentage of lumber output----------		*Volume (MBF[b])*
2016	100	c	23,969
2012	100	c	24,450
2007	100	c	39,823
2002	12	88	81,515
1997	10	90	108,675
1986	12	88	232,000
1966	38	62	262,848
1962	100	c	242,500
1960	100	c	224,400

[a]Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.

[b]MBF = thousand board feet lumber tally.

[c]In 1960, 1962, 2007, 2012 and 2016 all mills were included in < 10 MMBF to avoid disclosing individual operations.

Table N13—Number of New Mexico sawmills and average lumber production, selected years (sources: Hayes et al. 2012; Keegan et al. 2001b; McLain 1989; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Year	Number of sawmills	Average lumber production
		MMBF[a]
2016	19	1.3
2012	17	1.4
2007	12	3.3
2002	21	3.9
1997	22	4.9
1986	25	9.2
1966	64	4.1
1962	85	2.9
1960	117	1.9

[a]MMBF = million board feet lumber tally.

Table N14—New Mexico lumber production by mill size, 2016.

Size class[a]	Number of mills	Volume *(MBFb)*	Percentage of total	Average per mill *(MBF[b])*
Over 1 MMBF	6	19,376	81	3,229
Under 1 MMBF	13	4,593	19	353
Total	19	23,969	100	1,262

[a]Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.

[b]MBF = thousand board feet lumber tally.

On average, New Mexico sawmills produced approximately 1.3 board feet of lumber for every board foot Scribner of timber processed in 2016, or 30 percent overrun. Overrun averaged 25 percent in 2012 (Sorenson et al. 2016). The slight overrun increase from 2012 to 2016 was likely due to the shift in products, with a decrease in board and shop lumber, and an increase in dimension and stud lumber and timbers/cants from 2012. In 2016, lumber produced by New Mexico's sawmills consisted of: 57 percent dimension and studs, 42 percent timbers/cants, and 0.5 percent each board and shop lumber and other sawn products. Timbers/cants accounted for $5.4 million (47 percent) of sawmill product sales in 2016, dimension lumber was about $5.1 million (45 percent), and board and shop and other sawn lumber accounted for just under $1 million (8 percent).

Viga and Latilla Sector

New Mexico's viga and latilla sector was slightly smaller in 2016 than in 2012. One less viga and latilla manufacturer was identified in 2016 than in 2012, with overall sales of $2.6 million dollars – a decrease of 33 percent in real (inflation-adjusted) dollars. In 2016, the four firms operating in the sector processed 1,329 MBF Scribner, versus 1,818 MBF processed in 2012 (Sorenson et al. 2016). Production was

just over 310,000 lineal feet (MLF) of vigas and latillas in 2016, a decline from 2012 when more than 597 MLF were produced. Due to the part-time nature of many viga and latilla operations, the sector could respond quickly with increased production and sales if demand for traditional styles of construction should increase and sufficient timber were available.

Other Products Sector

Additional facilities produced other primary wood products in 2016 as in 2012; three facilities opened or reopened during this 4-year period. Product sales by manufacturers of posts, poles, log homes, firewood, pellets, bark and mulch, and wood shavings and excelsior producers exceeded $15.5 million in 2016; this was a decrease of almost 35 percent over the period. Inflation-adjusted sales from the sector were about $24 million in 2012. Additional detail about the sector is withheld to maintain the confidentiality of individual firms.

Capacity and Utilization

New Mexico's annual lumber production capacity was 46,100 MBF lumber tally in 2016. Sawmills produced 23,969 MBF of lumber and utilized about 52 percent of their production capacity. Across all industry sectors, total timber-processing capacity was 52,805 MBF Scribner. Accounting for changes in log inventories, a total of 29,041 MBF Scribner was processed by New Mexico firms in 2016, with total timber-processing capacity utilization about 55 percent. Sawtimber-processing capacity was 170,000 MBF Scribner in 1997, with 48 percent utilized (Keegan et al. 2001b). By 2002, sawtimber-processing capacity had dropped to 88,162 MBF Scribner, with 65,116 MBF Scribner (74 percent) utilized (Morgan et al. 2006). In 2007, sawtimber-processing capacity was 67,425 MBF Scribner, with 39,823 MBF Scribner (59 percent) utilized (Hayes et al. 2012). In 2012, sawtimber-processing capacity was 63,020 MBF Scribner, with 24,450 MBF Scribner (39 percent) utilized (Sorenson et al. 2016). Decreases in capacity in the sawmill sector have resulted from the permanent closure of large sawmills since 2002, which were operating well below capacity. With the relatively low timber harvest levels of the past 15 to 20 years, many mills were unable to procure enough timber to operate profitably. When capacity utilization levels are below 50 percent, additional mill closures can be expected unless timber harvest levels increase and markets for wood products continue to improve.

Mill Residue Volumes, Types, and Uses

When the Arizona paper mill changed to recycled inputs, and the New Mexico particleboard plant closed between 1997 and 2002, markets for mill residues in the region underwent major changes. Sawmills had to develop new markets for the residues, use more residues in their own operations, and factor residue disposal costs into their business decisions. Despite this major change in outlets for mill residue, subsequent industry censuses have shown that residue utilization rates have remained high.

During 2016, New Mexico mills produced 34,559 BDU of mill residue with 99.6 percent being utilized (table N15). Residue production decreased in 2016 while the proportion utilized increased from 2012, when New Mexico sawmills generated 39,705 BDU, utilizing 96.4 percent (Sorenson et al. 2016). The decrease in total residue volume generated was due primarily to a smaller volume of timber being processed. In 2012, sawmills produced about 1.11 BDU per MBF of lumber; by 2016 that residue factor had decreased to 1.04 BDU per MBF of lumber similar to the 2007 residue factor (table N16).

Table N15—Production and disposition of New Mexico mill residues, 2016.

Residue type	Total utilized	Pulp and board	Energy	Mulch/ bedding	Unspecified use	Unused	Total produced
				Bone-dry units[a]			
Coarse	16,271	-	5,677	-	10,594	-	16,271
Fine	9,252	-	-	4,309	4,943	1	9,253
Sawdust	*5,539*	-	-	*3,231*	*2,308*	-	*5,539*
Planer shavings	*3,713*	-	-	*1,078*	*2,635*	*1*	*3,714*
Bark	8,907	-	1,730	7,042	135	128	9,035
Total	34,430	-	7,407	11,351	15,672	129	34,559
				Percentage of residue type			
Coarse	100.0	-	34.9	-	65.1	-	47.1
Fine	100.0	-	-	46.6	53.4	0.0	26.8
Sawdust	*100.0*	-	-	*58.3*	*41.7*	-	*16.0*
Planer shavings	*100.0*	-	-	*29.0*	*70.9*	*0.0*	*10.7*
Bark	98.6	-	19.1	77.9	1.5	0.4	26.1
Total	99.6	-	21.4	32.8	45.3	0.4	100

[a]Bone-dry unit = 2,400 lb oven-dry wood.

Table N16—New Mexico sawmill residue factors, 1997, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 2001b; Morgan et al. 2006; Sorenson et al. 2016).

Type of residue	1997	2002	2007	2012	2016
			BDU/MBF lumber tally[a]		
Coarse	0.52	0.56	0.58	0.58	0.53
Sawdust	0.29	0.20	0.17	0.20	0.22
Planer shavings	0.18	0.15	0.06	0.09	0.04
Bark	0.23	0.21	0.22	0.24	0.25
Total	1.22	1.12	1.03	1.11	1.04

[a]Bone-dry unit (BDU = 2,400 lb oven- dry wood) of residue generated for every 1,000 board feet of lumber manufactured.

Coarse residue (chips) was the state's largest residue component at 47.1 percent (16,271 BDU) of all residue in 2016, with 100 percent utilized. Energy facilities used about 5,677 BDU of the coarse material, with the remaining utilized volume going to unspecified uses (table N15). Fine residues—sawdust and planer shavings—comprised the second largest component at 26.8 percent (9,253 BDU) of mill residue. All (100 percent) of fine residue was utilized in 2016, primarily as mulch or animal bedding and for unspecified uses. Bark accounted for 26.1 percent of all residue and was largely categorized as used for unspecified uses and then energy and mulch with 8,907 BDU (98.6 percent) utilized in 2016.

Primary Forest Products Sales

Sales from New Mexico's primary wood products industry in 2016 totaled just under $33 million, including finished products and mill residue (table N17). Other products and mill residues accounted for 55 percent ($18.1 million) of total sales. Lumber, timbers, and other sawn products accounted for 37 percent ($12.1 million), while vigas and latillas accounted for 8 percent of sales ($2.6 million). New Mexico was the leading market area for each of the product categories, accounting for 43 percent of lumber sales, 80 percent of vigas and latillas sales, and 69 percent of other products and mill residue sales. Other areas outside the United States (mostly Mexico) accounted for 25 percent of lumber sales. The other Four Corners States (Arizona, Colorado, and Utah) were the second leading market area for vigas and latillas, while other Rocky Mountain States were the second leading destination for the other products category.

Table N17—Destination and sales value of New Mexico's primary wood products and mill residues, 2016.

Product	New Mexico	Other Four Corners States	Other Rocky Mtn States[a]	Far West[b]	Northeast[c]	South[d]	North Central[e]	Other[f]	Total
	Thousand 2016 dollars								
Lumber, timbers, and other sawn products	5,234	1,179	317	173	38	2,083	38	2,990	12,052
Vigas and latillas	2,082	236	190	-	-	96	-	-	2,604
Other products[g]	12,485	1,184	1,977	19	5	1,722	5	729	18,126
Total	19,801	2,599	2,484	192	43	3,901	43	3,719	32,782
	Percentage of product sales by region								
Lumber, timbers, and other sawn products	43.4	9.8	2.6	1.4	0.3	17.3	0.3	24.8	36.8
Vigas and latillas	80.0	9.1	7.3	-	-	3.7	-	-	7.9
Other products[g]	68.9	6.5	10.9	0.1	0.0	9.5	0.0	4.0	55.3
Total	60.4	7.9	7.6	0.6	0.1	11.9	0.1	11.3	100

[a]Other Rocky Mountain States include Idaho, Montana, Nevada.
[b]Far West includes Alaska, California, Hawaii, Oregon, and Washington.
[c]Northeast includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[d]South includes Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
[e]North Central includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[f]Other areas consist of products being shipped outside the United States.
[g]Other products include mulch, shavings, posts, poles, utility poles, log homes, firewood, fuel pellets, and mill residues.

Forest Industry Employment and Labor Income

Based on the four NAICS sectors of the forest industry (113, 321, 1153, and 322), roughly 2,350 workers were directly employed in New Mexico's primary and secondary forest products industry during 2016 (fig. N3) (USDC BEA 2018a). This marked a 1 percent increase over employment levels in the industry during 2012. This increase was driven by increases in forestry support (7 percent) and paper manufacturing employment (6 percent). Unlike Arizona and Colorado, workers engaged in forestry support activities in 2016 represented an increase over 2012 employment levels. Support activities for forestry (NAICS 1153) encompasses a

variety of activities, including wildfire suppression and prevention activities, tree thinning and planting, and pest management. Workers directly engaged in forestry and logging activities reflected very similar employment levels as in 2012, while wood products manufacturing employment saw a slight decrease. Approximately 750 workers were employed in the "primary" industry sector (i.e., harvesting and processing timber or in private sector land management) in 2016, a 9 percent increase (60 jobs) from the 2012 level.

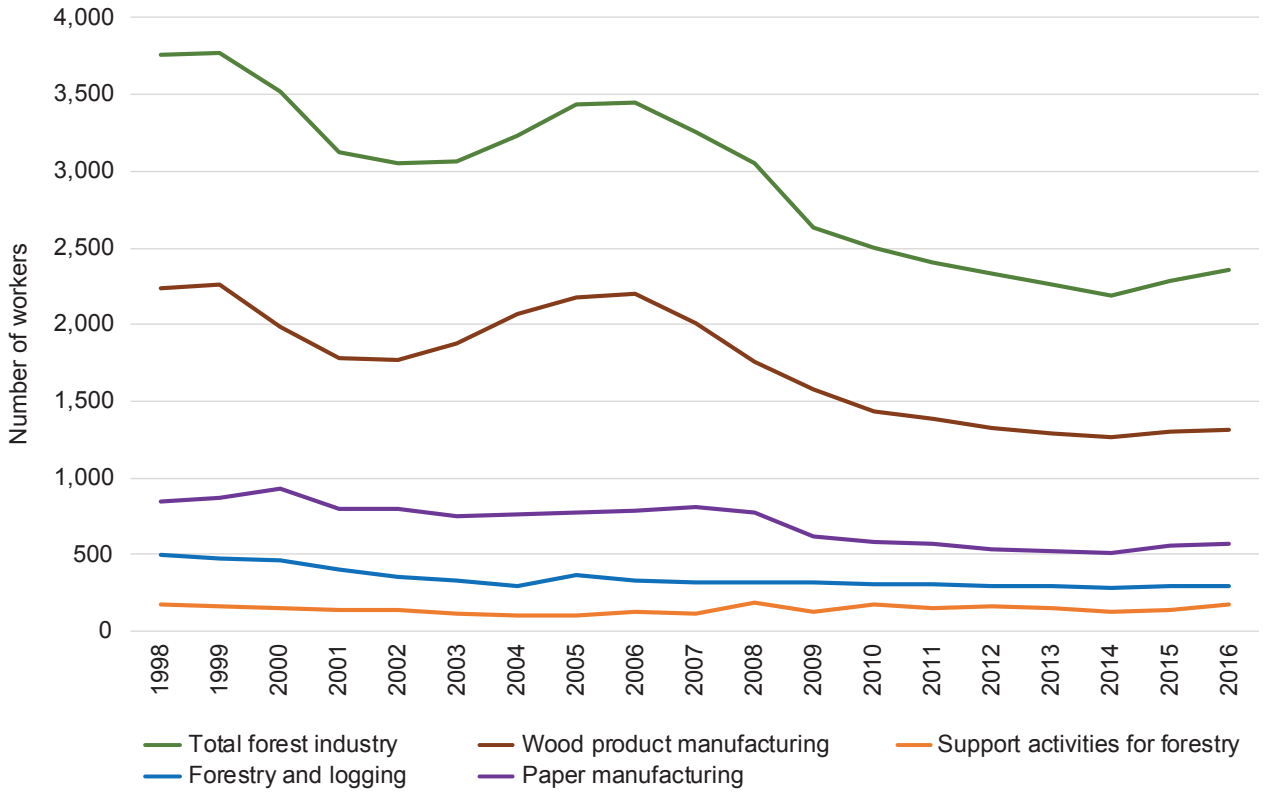


Figure N3—Employment in New Mexico's forest industry, 1998–2016.

New Mexico's forest industry worker earnings approached $96 million during 2016, up about 14 percent (adjusted for inflation) from 2012, but still $61 million below 2007 earnings (fig. N4). Labor income includes wages and salaries, some benefits, and earnings of the self-employed. Despite employment decreases across several sectors of the forest industry, worker earnings have increased (inflation-adjusted 2016 dollars) in all sectors since 2012. Employees in forestry and logging earned over $6.8 million, representing a 16 percent increase from 2012 levels. Employees in support activities for forestry represented the largest proportional increase (88 percent), earning almost $13.9 million. Inflation-adjusted earnings in wood products manufacturing also increased to over $42 million, representing an 11 percent increase over 2012– despite a slight decrease in employment. This

trend of increasing earnings may be a result of several factors, including general wage increases in certain sectors, efforts towards employee retention, as well as the inclusion of both full- and part-time workers in BEA estimates. Employees who were previously working part-time may be adding additional hours or days of work, thus increasing wages without adding employees.

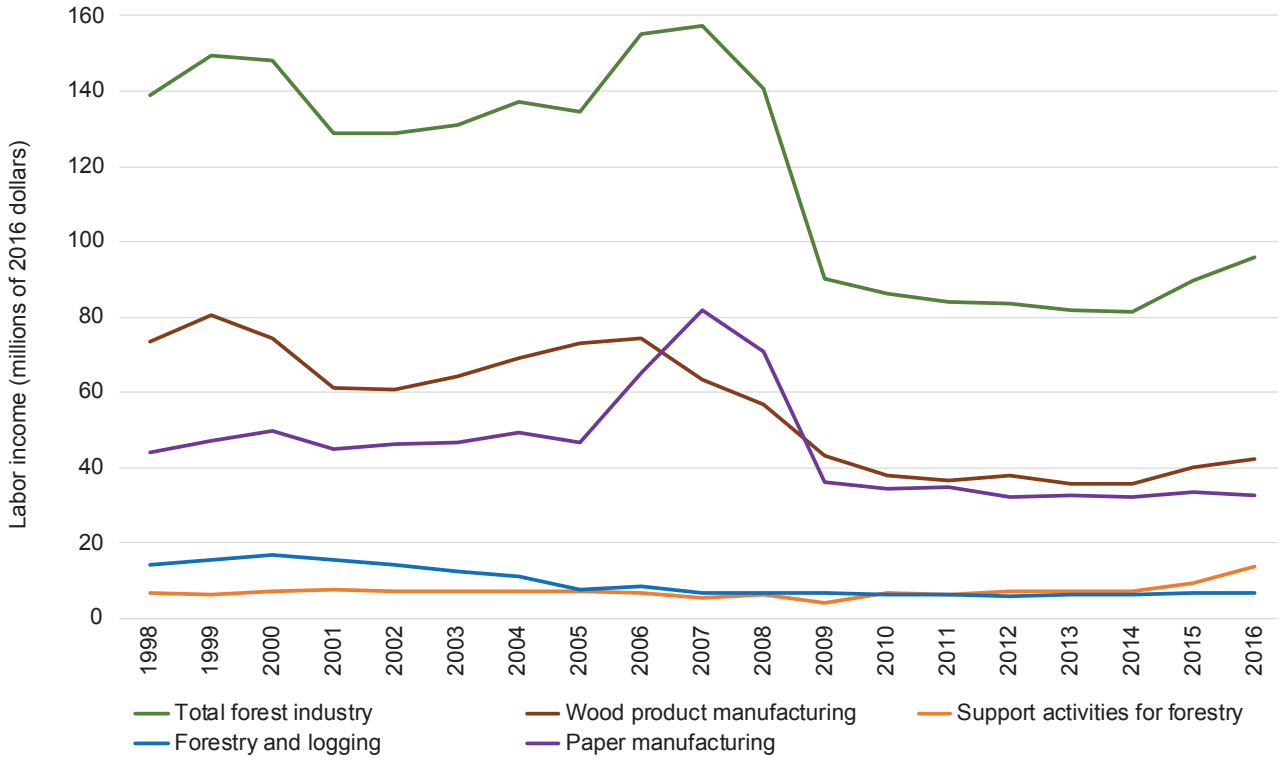


Figure N4—Inflation-adjusted earnings in New Mexico's forest industry, 1998–2016.

New Mexico's forest industry on the whole contributed 2,350 jobs and nearly $96 million in labor income directly to the state economy. Using regional data and existing linkages within the state economy represented by the BEA's RIMS II multipliers (USDC BEA 2016), BBER estimates that the wood products manufacturing sector (primary and secondary) alone supported almost 2,400 jobs and an associated $80 million dollars in labor income during 2016 (table N18). New Mexico's forest industry has the smallest economic multipliers across the Four Corners States, with every wood products manufacturing job in the State supporting fewer than one (0.83) additional job in related sectors. The size of economic multipliers can depend on a variety of factors. Given that New Mexico's forest industry is the smallest in terms of direct employment and labor income in the Four Corners region, the smaller multipliers are a result of differences in the overall size, diversity, geographic extent and proportional role of New Mexico's forest industry within the broader state economy.

Table N18—Average annual employment and labor income contributions from New Mexico's forest industry.

Sector	Direct employment	Indirect and induced employment	Total employment contribution[a]	Direct labor income	Indirect and induced labor income	Total labor income contribution[a]
				----------*Thousand 2016 dollars*--------		
Wood products manufacturing[b]	1,309	1,084	2,393	42,312	37,628	79,940
Forestry and logging	296	206	502	6,870	4,928	11,798
Forestry support activities	176	53	229	13,895	5,398	19,293
Paper manufacturing	570	951	1,521	32,621	34,497	67,118
Total forest industry	**2,351**	[a]	[a]	**95,698**	[a]	[a]

[a]Indirect and induced employment and labor income should not be summed for multiple sectors due to some employment and income showing up as both direct contributions to their sector and indirect contributions to other sectors.
[b]Includes employment and labor income for both primary and secondary wood products manufacturing.

It should be noted that we do not aggregate sectors and we avoid providing estimates of the total employment and labor income contribution for the entire forest industry to avoid double counting, since some employment and labor income shows up as both direct contributions to their sector, as well as indirect contributions to other sectors. In other words, some or all of the direct employment and labor income in the forestry and logging sector would be included with the indirect and induced contributions from wood products manufacturing since these manufacturers rely upon forestry and logging business to supply their raw material inputs.

Utah

This chapter focuses on Utah's timber harvest and forest products industry during 2016. Details of timber harvest, flow, and use are followed by descriptions of the primary processing sectors, capacity and utilization statistics, and mill residue characteristics. The chapter concludes with information on primary wood products industry sales by Utah mills. Comparisons to previous years are provided where possible. Limited historical information is available about timber harvesting and mill production and residues in Utah. The last comprehensive study of the state's industrial roundwood production and mill residues was conducted in 2012 (Sorenson et al. 2016), and data for previous years include 1966 (Setzer and Wilson 1970), 1969 (Setzer 1971c), 1970 (Green and Setzer 1974), 1974 (Setzer and Throssell 1977b), 1992 (Keegan et al. 1995), 2002 (Morgan et al. 2006), and 2007 (Hayes et al. 2012).

Timber Harvest, Flow, and Use

In 2016, Utah had approximately 3.7 million acres of nonreserved timberland (USDA FIA 2018), with National Forests accounting for 75 percent, private and tribal owners accounting for 16 percent, and other public agencies accounting for the remaining 9 percent (table U1). All private timberland was classified as NIPF timberland. Utah had no large tracts of timberland owned by entities operating primary wood-processing facilities. Sawtimber volume on nonreserved timberlands was estimated at 4.2 billion cubic feet (USDA FIA 2018) or approximately 21 billion board feet Scribner in 2016.

Table U1—Utah nonreserved timberland by ownership class (source: Miles 2018).

Ownership class	Thousand acres	Percentage of nonreserved timberland
National Forest	2,765	75
Private and tribal	600	16
Other public	317	9
Total	**3,682**	**100**

Timber Harvest

Utah's 2016 commercial timber harvest was 24.9 MMBF Scribner (table U2), 29 percent higher than the 2012 harvest of approximately 19.4 MMBF (Sorenson et al. 2016). Although harvest was higher in 2016, this volume is 18 percent less than the 2007 harvest of around 30 MMBF Scribner (Hayes et al. 2012), and over 60 percent less than the 1992 harvest of 64 MMBF (Setzer and Throssell 1977b). Of the timber harvested in Utah during 2016, 48 percent was live and 52 percent was salvage or standing dead when harvested. While Utah harvest has increased overall since 2012, all of this increase has occurred on National Forest land, which increased by 96 percent. Harvest levels from private and tribal timberlands, and other public lands, fell over this same period by 43 percent and 50 percent, respectively. As in most of the western States, decreasing federal timber harvests during the 1990s led to greater shares of annual timber harvest coming from other ownerships. National Forests still provided the majority of the state's harvest (80 percent) in 2016, but the volume and share supplied by private and tribal owners continues to be an important component. During 2016, private and tribal landowners accounted for 14 percent (3.6 MMBF) of Utah's timber harvest. The share of harvest from BLM and state lands in Utah was 6 percent of the total in 2016.

Table U2—Utah timber harvest by ownership class, 1992, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Sorenson et al. 2016).

	1982	2002	2007	2012	2016	1982	2002	2007	2012	2016
Ownership class	**MBF[a] Scribner**					**Percentage of total**				
Private and tribal timberland	11,385	16,282	11,669	6,292	3,581	17.6	39.5	38.5	32.5	14.4
Public timberland	53,289	24,987	18,652	13,064	21,297	82.4	60.5	61.5	67.5	85.6
National Forest	49,989	23,776	15,490	10,117	19,848	77.3	57.6	51.1	52.3	79.8
Other public[b]	3,300	1,211	3,162	2,947	1,449	5.1	2.9	10.4	15.2	5.8
All owners	64,674	41,269	30,321	19,356	24,878	100	100	100	100	100

[a]MBF = thousand board feet.

[b]Other public ownership includes BLM and state.

National Forests provided the majority of sawlogs and house logs harvested in Utah with 80 percent and 82 percent, respectively, in 2016 (table U3). National Forests also provided the majority of other products (e.g., furniture logs, post and poles, fiber logs) at over 76 percent. Sawlogs accounted for about 72 percent (17.9 MMBF) of the total volume harvested in 2016, house logs were 12 percent, and other products accounted for about 16 percent.

Table U3—Utah timber products harvested by ownership class, 2016.

Ownership class	Sawlogs	House logs	Other products[a]	All products
	Thousand board feet, Scribner			
National Forests	14,340	2,561	2,947	19,848
Private and tribal timberland	2,881	550	150	3,581
Other public[b]	675	-	774	1,449
All owners	17,896	3,111	3,871	24,878
	Percentage of harvested product by ownership			
National Forests	80.1	82.3	76.1	79.8
Private and tribal timberland	16.1	17.7	3.9	14.4
Other public[b]	3.8	-	20.0	5.8
All owners	71.9	12.5	15.6	100

[a]Other products include industrial fuelwood, furniture logs, fiber logs, posts, and poles.
[b]Other public ownership includes BLM and state.

In 2016, Summit County led Utah's timber harvest with 29 percent (7.3 MMBF) of total volume, followed by Kane and Sanpete Counties with 13 and 7.5 percent, respectively (table U4). In 2012, Summit County led Utah's timber harvest, with 33 percent (6.4 MMBF Scribner) of total volume; Uintah followed with 12 percent (2.3 MMBF); and Emery, Rich, and Sanpete followed, each providing 7.7 percent (1.5 MMBF) (Sorenson et al. 2016).

Spruce was the leading species harvested in Utah, accounting for 31 percent (7.8 MMBF) of the harvest in 2016; ponderosa pine accounted for 25 percent, lodgepole pine 22 percent, and Douglas-fir 15 percent (table U5). While this represents a change from 2012 where the leading species harvested was lodgepole pine, 2016 represents a shift back to recent norms in species harvested, as spruces, including Engelmann and blue spruce, were the leading species harvested in Utah in 2002 and 2007 (Hayes et al. 2012; Morgan et al. 2006). During the 1960s and 1970s, ponderosa pine was the leading species harvested, accounting for 30 to 50 percent of the harvest, while lodgepole pine and spruces each accounted for 15 to 25 percent of the total (Green and Setzer 1974; Setzer 1971c; Setzer and Throssell 1977b; Setzer and Wilson 1970).

Spruce was the leading species harvested for sawlogs in 2016, accounting for 5 MMBF (28 percent) followed by lodgepole and ponderosa pine (27 and 23 percent, respectively) (table U6). Ponderosa pine accounted for slightly more than 2.1 MMBF (55 percent) of the volume harvested for other products. Spruce was the leading species for house logs with 86 percent.

Table U4—Utah timber harvest by county, selected years (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Setzer and Throssell 1977b).

County	1974	1992	2002	2007	2012	2016	1974	1992	2002	2007	2012	2016
	MBF Scribner						*Percentage*					
Beaver	155	2,952	633	468	200	290	0.2	4.6	1.5	1.5	1.0	1.2
Cache	1,389	175	1,180	1,150	-	-	2.2	0.3	2.9	3.8	-	-
Carbon	260	100	1,670	1,564	1,480	213	0.4	0.2	4.0	5.2	7.6	0.9
Daggett	3,193	2,850	375	-	25	103	5.1	4.4	0.9	-	a	0.4
Davis	-	-	135	-	-	-	-	-	0.3	-	-	-
Duchesne	2,539	1,767	3,469	1,793	515	1,301	4.1	2.7	8.4	5.9	2.7	5.2
Emery	250	-	45	284	1,500	1,778	0.4	-	0.1	0.9	7.7	7.1
Garfield	8,502	7,047	3,446	3,141	965	840	13.6	10.9	8.4	10.4	5.0	3.4
Grand	5,000	-	20	1,925	-	5	8.0	-	a	6.3	-	0.0
Iron	-	1,435	773	1,554	200	718	-	2.2	1.9	5.1	1.0	2.9
Juab	-	-	1	-	-	-	-	-	0.0	-	-	-
Kane	6,480	4,117	5,520	60	-	3,192	10.4	6.4	13.4	0.2	-	12.8
Millard	30	-	342	-	-	144	a	-	0.8	-	-	0.6
Morgan	11	25	250	150	100	60	a	a	0.6	0.5	0.5	0.2
Piute	440	620	3,288	500	-	-	0.7	1.0	8.0	1.6	-	-
Rich	2,159	-	3,000	-	1,500	808	3.5	-	7.3	-	7.7	3.2
Salt Lake	-	-	65	59	74	253	-	-	0.2	0.2	0.4	1.0
San Juan	5,000	4,503	1,444	1,865	1,400	1,400	8.0	7.0	3.5	6.2	7.2	5.6
Sanpete	520	3,750	2,468	3,800	1,500	1,875	0.8	5.8	6.0	12.5	7.7	7.5
Sevier	715	3,663	1,703	1,483	155	1,707	1.1	5.7	4.1	4.9	0.8	6.9
Summit	5,589	10,000	4,107	2,700	6,430	7,258	8.9	15.5	10.0	8.9	33.2	29.2
Uintah	14,652	16,624	2,715	1,398	2,300	539	23.5	25.7	6.6	4.6	11.9	2.2
Utah	20	-	323	793	-	546	a	-	0.8	2.6	-	2.2
Wasatch	1,606	2,908	3,750	4,300	1,012	1,333	2.6	4.5	9.1	14.2	5.2	5.4
Washington	-	-	375	1,334	-	224	-	-	0.9	4.4	-	0.9
Wayne	3,905	2,110	110	-		292	6.3	3.3	0.3	-	-	1.2
Weber	50	20	60	-	-	-	0.1	a	0.1	-	-	-
Total	62,465	64,666	41,268	30,321	19,356	24,878	100	100	100	100	100	100

[a]Less than 0.05 percent.

Table U5—Proportion of Utah timber harvest by species, selected years (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Setzer 1971c; Setzer and Throssell 1977b; Setzer and Wilson 1970; Sorenson et al. 2016).

Species	1966	1969	1974	1992	2002	2007	2012	2016
	Percentage of harvest							
Spruces	19	13	22	35	44	42	31	31
Ponderosa pine	50	43	33	5	13	3	4	25
Lodgepole pine	18	18	27	46	23	13	41	22
Douglas-fir	3	11	8	4	8	11	11	15
Aspen and cottonwood	c	c	4	5	10	29	10	6
True firs[a]	4	7	3	5	2	2	2	1
Other species[b]	6	8	3	c	c	c	1	0
All species	100	100	100	100	100	100	100	100

[a]True firs include white, subalpine, and corkbark fir.

[b]Other species include juniper and western white pine.

[c]Less than 0.5 percent.

Table U6—Utah timber harvest by species and product, 2016.

Species	Sawlogs	House log	Other products[c]	All products
	----------Thousand board feet, Scribner----------			
Spruces	5,022	2,678	102	7,803
Ponderosa pine	4,166	5	2,114	6,285
Lodgepole pine	4,831	301	257	5,389
Douglas-fir	3,618	73	84	3,776
Aspen and cottonwood	102	8	1,299	1,409
True firs[a]	151	46	9	207
Other species[b]	6	0	5	11
All species	17,896	3,111	3,871	24,878
	----------Percentage of product by species----------			
Spruces	28.1	86.1	2.6	31.4
Ponderosa pine	23.3	0.2	54.6	25.3
Lodgepole pine	27.0	9.7	6.6	21.7
Douglas-fir	20.2	2.4	2.2	15.2
Aspen and cottonwood	0.6	0.2	33.6	5.7
True firs[a]	0.8	1.5	0.2	0.8
Other species[b]	0.0	d	d	0.0
All species	71.9	12.5	15.6	100

[a]True firs include white, subalpine, and corkbark fir.
[b]Other species include juniper, western white pine, and hardwoods.
[c]Other products include industrial fuelwood, furniture logs, fiber logs, posts, and poles.
[d]Less than 0.1 percent

Timber Flow

More than half (51 percent) of Utah's 2016 timber harvest was processed in-state, and Utah had a net outflow of almost 12.2 MMBF of timber to other States. About 4.6 MMBF was processed in Arizona, 4.5 MMBF in Wyoming, and 1.5 MMBF in both Idaho and Colorado, while there was an inflow of 17 MBF for processing in Utah mills from Idaho (table U7).

Table U7—Timber product flow into and out of Utah, 2016.

Timber product	Log flow into Utah	Log flow out of Utah	Net inflow (net outflow)
	-------Thousand board feet, Scribner-------		
Sawlogs	-	7,841	(7,841)
House logs	-	839	(839)
Other productsa	17	3,484	(3,467)
All products	17	12,164	(12,147)

[a]Other products include industrial fuelwood, furniture logs, fiber logs, posts, and poles.

Timber processors in Utah received 12,731 MBF of timber in 2016, including 17 MBF that was harvested outside the State. Private timberlands provided 3,333 MBF (26 percent) of the timber delivered to Utah mills in 2016 (table U8). National Forests provided 8,542 MBF (67 percent) of timber receipts. Although Utah mills' timber receipts were 11 percent higher in 2016 than in 2012, the 2016 timber receipts is 54 percent lower than in 2007, and 61 percent lower than in 2002. During 2016, National Forests provided Utah timber processors with 79 percent of house logs, 65 percent of sawlogs, and 51 percent of other timber products including furniture logs

(table U9). Private landowners provided 28 percent of sawlogs, 21 percent of house logs, and 4 percent of other timber products. State lands provided 5 percent of the timber received by mills in Utah.

Table U8—Ownership of timber products received by Utah mills, 1992, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Sorenson et al. 2016).

	1992	2002	2007	2012	2016	1992	2002	2007	2012	2016
Ownership class	**MBF Scribner**					**Percentage of total**				
Private timberland	11,341	9,241	11,587	5,177	3,333	19.3	28.4	42.2	45.1	26.2
Public timberland	46,927	23,245	15,732	6,264	9,217	79.9	71.5	57.3	54.5	72.4
National Forest	*46,595*	*21,898*	*15,502*	*6,034*	*8,542*	*79.3*	*67.3*	*56.4*	*52.5*	*67.1*
State lands	*332*	*1,346*	*230*	*230*	*675*	*0.6*	*4.1*	*0.8*	*2.0*	*5.3*
Other owners[a]	485	33	152	47	181	0.8	0.1	0.6	0.4	1.4
All owners	58,753	32,518	27,470	11,488	12,731	100	100	100	100	100

Table U9—Timber received by Utah forest products industry by ownership class and product, 2016.

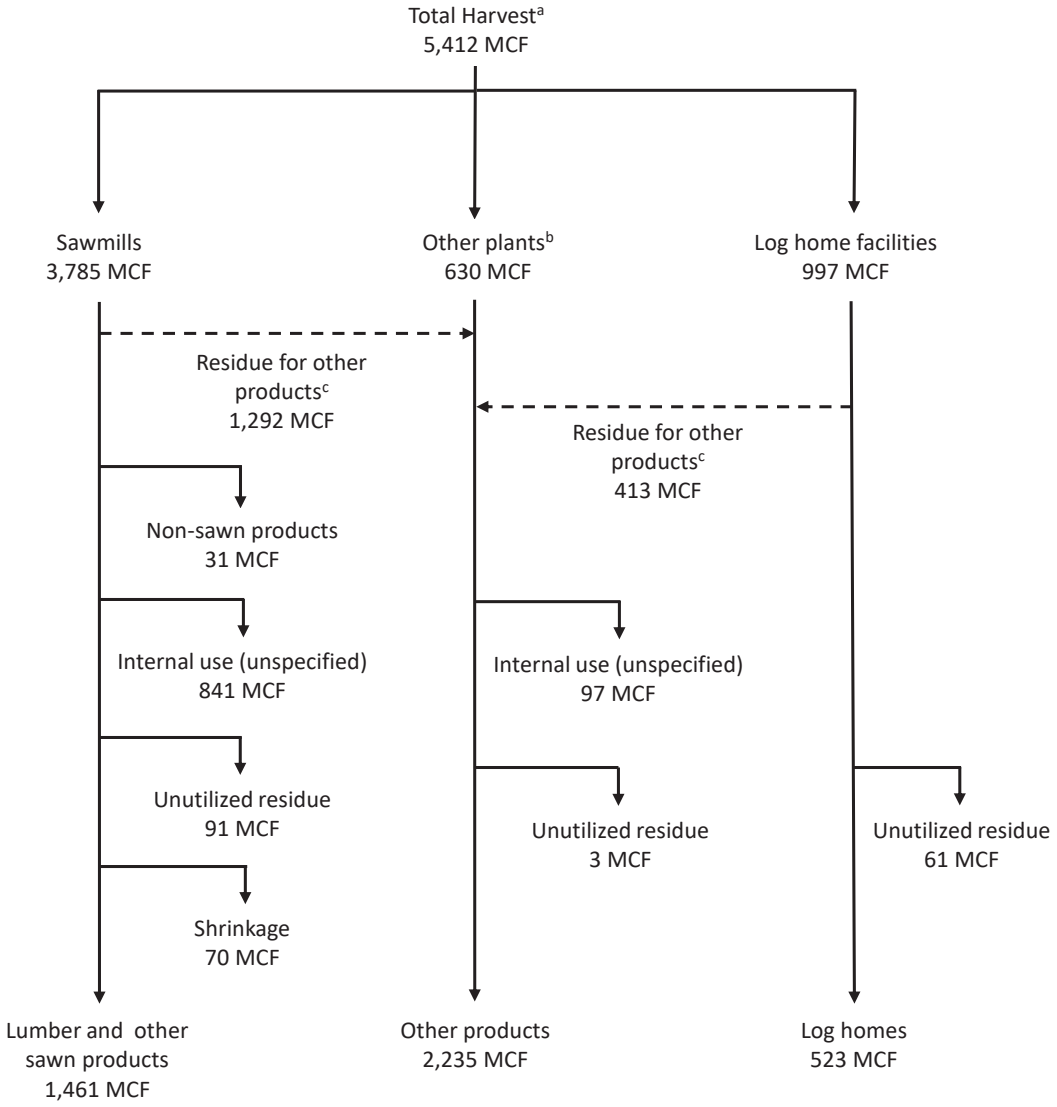
Ownership class	Sawlogs	House logs	Other products[b]	All products
		Thousand board feet, Scribner		
Private timberland	2,841	475	17	3,333
Public timberland	7,214	1,797	206	9,217
National forest	*6,539*	*1,797*	*206*	8,542
State lands	*675*	-	-	675
Other owners[a]	-	-	181	181
All owners	10,055	2,272	404	12,731
		Percentage of product by owner		
Private and tribal timberland	28.3	20.9	4.2	26.2
Public timberland	71.7	79.1	51.0	72.4
National forest	*65.0*	*79.1*	*51.0*	*67.1*
State lands	*6.7*	-	-	*5.3*
Other owners[a]	-	-	44.8	1.4
All owners	79.0	17.8	3.2	100

[a]Other owners include the BLM and Canada.
[b]Other products include furniture logs, fiber logs, posts, and poles.

Timber Use

Utah's 2016 timber harvest—approximately 5,412 MCF, exclusive of bark (fig. U1)—was used by several manufacturing sectors both within and outside of Utah. Of this volume, 3,785 MCF went as logs to sawmills, 997 MCF went to log home manufacturers, and 630 MCF went to other plants, including log furniture, post and pole, and fire/fuelwood facilities. The following conversion factors were used to convert Scribner board foot volume to cubic feet:

- 5.00 board feet per cubic foot for sawlogs;
- 4.60 board feet per cubic foot for house logs; and
- 3.33 board feet per cubic foot average for all other products.



[a]Harvest volume does not include bark.

[b]Other plants include furniture and post and pole manufacturers, as well as residue-utilizing facilities including mulch, animal bedding and excelsior manufacturers

[c]Other products include firewood, landscape, mulch, animal bedding, and unspecified use.

Figure U1—Utah timber harvest and flow, 2016.

Of the 3,785 MCF of timber received by sawmills, 1,461 MCF (39 percent) was milled into finished lumber or other sawn products, and about 70 MCF was lost to shrinkage. The remaining 2,254 MCF (60 percent) was mill residue. About 2,163 MCF (96 percent) of sawmill residue was utilized, and about 91 MCF (4 percent) remained unused. Of the 997 MCF of timber received by log home manufacturers, about 523 MCF (52 percent) was processed into house logs, while the remaining 474 MCF became mill residue. About 413 MCF (87 percent) of house log residue was utilized, and about 61 MCF remained unused. Of the 630 MCF of timber received by the other plants combined with the residues (1,705 MCF) from the other sectors, about 2,235 MCF was utilized as solid wood products such as log furniture, post and poles, and fire/fuelwood. About 3 MCF of residues from these other sectors went unused.

Forest Industry Sectors

Utah's primary forest products industry in 2016 consisted of 18 active manufacturers in 12 counties (table U10). Facilities tended to be located near the forest resource along the mountainous central spine of the State (fig. U2). Changes in Utah's industry structure over the past 30 years were similar to those experienced throughout the West, with the number of sawmills decreasing and the number and diversity of other manufacturers increasing (Hayes et al. 2012; Keegan et al. 1995, 2001a,b; Morgan et al. 2004a,b; Morgan et al. 2006; Sorenson et al. 2016). The sawmill sector (manufacturing lumber and other sawn products) was the largest and included nine mills in 2016; six facilities produced house logs and log homes, and there were three log furniture and other products facilities operating in 2016. For comparison, Sorenson et al. (2016) also identified 18 facilities in 2012, while Hayes et al. (2012) identified 27 facilities operating during 2007, and Morgan et al. (2006) identified 49 primary wood-processing plants in 2002.

Table U10—Active Utah primary wood products facilities by county and product, 2016 (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Sorenson et al. 2016).

County	Lumber	Log homes and house logs	Log furniture and other products [a]	Total
Beaver	1			1
Cache			1	1
Duchesne	2			2
Iron	1			1
Morgan	1			1
Rich	1			1
Salt Lake	1		2	3
Sanpete		1		1
Summit	2			2
Uintah		3		3
Wasatch		1		1
Weber		1		1
2016 Total	**9**	**6**	**3**	**18**
2012 Total	8	7	3	18
2007 Total	12	10	5	27
2002 Total	23	14	12	49
1992 Total	34	13	4	51

[a]Other products include posts, poles, and bark products.

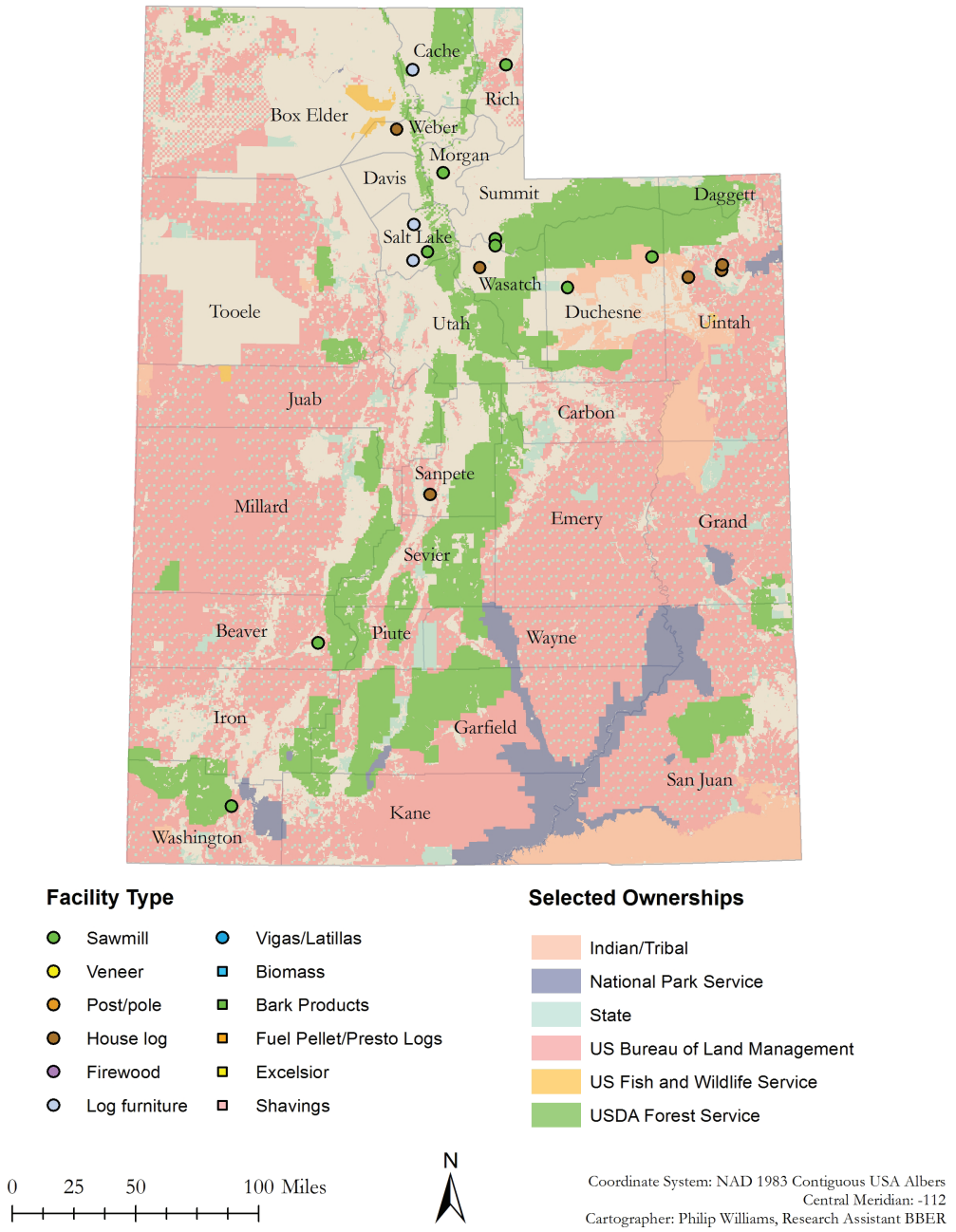


Figure U2—Map of Utah primary timber processors.

While the number of primary wood products producers stayed the same between 2012 and 2016, finished product sales in 2016 ($19.7 million) were about 25 percent higher than 2012 sales ($15.8 million, adjusted for inflation) (table U11). While total sales increased, sales from sawmills dropped by over 16 percent during the FIDACS survey period. Sales from log homes and other sectors grew by the greatest margin with a 37 percent increase ($4.5 million) from 2012. Lumber sales as a percentage of finished product sales continued to decline with 15 percent in 2016, versus nearly 23 percent in 2012, 30 percent in 2007, 40 percent in 2002, and 73 percent in 1992. Log homes and other sector sales accounted for about 85 percent of total sales in 2016.

Table U11—Finished product sales of Utah's primary wood products sectors, 1992, 2002 , 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Sorenson et al. 2016).

	1992	2002	2007	2012	2016
Sector	*----------Thousands of 2016 dollars----------*				
Sawmills	31,266	16,699	9,263	3,600	3,009
Log homes and other sectors[a]	11,633	27,737	21,939	12,222	16,688
Total[b]	42,899	44,435	31,201	15,822	19,697

[a]Other sectors include producers of posts, poles, and log furniture. Mill residues, firewood, mulch, and bark products not included for comparison to previous years.

[b]All sales are reported f.o.b. the manufacturer's plant.

Sawmill Sector

While another sawmill became active in 2016, and lumber production was 20 percent higher than in 2012, production has continued to decline. Lumber production in 2016 was 50 percent lower than in 2007, 57 percent lower than in 2002, 82 percent lower than in 1992 and 84 percent lower than in 1966, while the number of mills declined (table U12). Most of the historic production loss was among the state's larger mills that produced more than 1 MMBF of lumber annually, while the greatest loss of milling facilities has historically been among the small mills. The proportion of lumber production by large versus small mills changed little in 2016 with larger mills contributing 86 percent of the production, versus 87 percent in 2012 (table U13).

Table U12—Utah sawmills by production size class, selected years (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Year	Under 10 MMBF[a]	Over 10 MMBF[a]	Total
	----------Number of sawmills----------		
2016	6	3	9
2012	4	4	8
2007	7	5	12
2002	17	6	23
1992	25	9	34
1966	37	13	50
	----------Percentage of lumber output----------		*Volume (MBF[b])*
2016	14	86	11,431
2012	13	87	9,553
2007	6	94	22,892
2002	13	87	26,524
1992	13	87	63,637
1966	10	90	72,000

[a]Size class is based on reported lumber production. MMBF = million board feet lumber tally.

[b]MBF = thousand board feet lumber tally.

Table U13—Number of Utah sawmills and average lumber production, selected years (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Setzer and Wilson 1970; Sorenson et al. 2016).

Year	Number of sawmills	Average lumber production
		MMBF[a]
2016	9	1.3
2012	8	1.2
2007	12	1.9
2002	23	1.2
1992	34	1.9
1966	50	1.4

[a]MMBF = million board feet lumber tally.

Average annual lumber production among the state's three largest mills was about 3.3 MMBF lumber tally in 2016 (table U14), compared to 2.1 MMBF among four mills in 2012. The remaining six small mills had an average lumber production of 271 MBF in 2016, compared to the 2012 average production of 303 MBF at four small mills (Sorenson et al. 2016).

Table U14—Utah lumber production by mill size, 2016.

Size class[a]	Number of mills	Volume *(MBFb)*	Percentage of total	Average per mill *(MBF[b])*
Over 1 MMBF	3	9,805	86	3,268
Under 1 MMBF	6	1,626	14	271
Total	9	11,431	100	1,270

[a]Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.
[b]MBF = thousand board feet lumber tally.

On average, Utah sawmills produced approximately 1.4 board feet of lumber for every board foot Scribner of timber processed. This average overrun of 40 percent in 2016 is higher than the 2012 overrun of 25 percent (Sorenson et al. 2016). The increase in overrun over the past 4 years indicates a possible shift in products manufactured, a smaller or higher quality logs utilized, or that some sawmills in Utah have invested in new milling technology to help improve their efficiency.

Sales from sawmills accounted for just 15 percent ($3 million) of Utah timber processors' finished products sales in 2016. This proportion of sales from sawmills was the smallest of the Four Corners States. Sales from sawmills accounted for more than 45 percent of sales in Arizona, 39 percent of sales in New Mexico, and 49 percent in Colorado during 2016. Dimension lumber and studs accounted for $2.2 million (74 percent) of sawmill product sales in 2016; timbers and cants accounted for almost $368,000 (12 percent); and board and shop lumber accounted for almost $407,000 (14 percent) of finished product sales from sawmills.

Log Homes and Other Sectors

While the number of facilities that produced log homes and other products continued to decline during the past 4 years, sales from this sector increased during the same period. With respect to log home manufacturers, only firms that processed timber and manufactured house logs or log homes, not log home distributors, were included in the 1992, 2002, 2007, 2012, and 2016 FIDACS censuses. In 2016, Utah's log home and other manufacturers processed nearly 4.3 MMBF of timber and generated $16.7 million in product sales. By sales value, Utah's log home sector is the largest in the Four Corners region, followed by Colorado and New Mexico. Additional detail about the other products sector is withheld to protect the confidentiality of firm-level information.

Capacity and Utilization

Utah's annual sawmill lumber production capacity was 41.1 MMBF in 2016. Sawmills produced 11.4 MMBF (lumber tally) of lumber and utilized 28 percent of their production capacity. This was the lowest level of sawmill production capacity utilization for all the Four Corners States in 2016. Timber-processing capacity among Utah sawmills was 29,399 MBF Scribner, with 10,085 MBF Scribner of timber processed, making utilization of timber-processing capacity among sawmills 34 percent in 2016. Such low levels of capacity utilization often signal the closure of mills or an increased outflow of timber to be processed in other States, and this was no exception for Utah. Across all industry sectors, total timber-processing capacity was 66,047 MBF Scribner. Accounting for changes in mills' log inventories, a total of 12,771 MBF Scribner was processed by Utah firms in 2016, making timber-processing capacity utilization about 19 percent across all sectors.

Mill Residue Volumes, Types, and Uses

Across all sectors, Utah timber processors produced 17,426 BDU (approximately 1,740 MCF) of mill residue, with 93 percent being utilized (table U15), compared to 16,661 BDU and 80 percent utilized in 2012 (Sorenson et al. 2016). Utah's increased residue production was a function of increased timber processing in 2016 compared to 2012. Sawmills, the leading timber processors, were also the main residue producers in Utah, producing 1.08 BDU of residue per MBF of lumber in 2016 (table U16).

Coarse residue was the state's largest residue component at 63 percent (10,920 BDU) of all residues in 2016, with 93 percent utilized (table U15). In-state facilities used 8,608 BDU of the coarse material for unspecified uses, with the remaining utilized volume going to energy. Fine residues—sawdust and planer shavings—comprised 18 percent (3,205 BDU) of mill residues. Nearly 95 percent of fine residue was utilized in 2016, 56 percent of which was used as mulch or animal bedding, and 39 percent of fine residues going to unspecified uses. Bark accounted for 19 percent of all residues, with 2,161 BDU (65 percent) going to unspecified uses, and 856 (26 percent) used as mulch or animal bedding.

Table U15—Production and disposition of Utah mill residues, 2016.

Residue type	Total utilized	Pulp and board	Energy	Mulch/ bedding	Unspecified use	Unused	Total produced
				Bone-dry units[a]			
Coarse	10,131	-	1,524	-	8,608	789	10,920
Fine	3,034	-	-	1,799	1,235	171	3,205
Sawdust	*1,540*	-	-	*915*	*625*	*84*	*1,624*
Planer shavings	*1,494*	-	-	*884*	*610*	*87*	*1,581*
Bark	3,017	-	-	856	2,161	284	3,301
Total	16,182	-	1,524	2,655	12,004	1,244	17,426
				Percentage of residue type			
Coarse	92.8	-	14.0	-	78.8	7.2	62.7
Fine	94.7	-	-	56.1	38.5	5.3	18.4
Sawdust	*94.8*	-	-	*56.3*	*38.5*	*5.2*	*9.3*
Planer shavings	*94.5*	-	-	*55.9*	*38.6*	*5.5*	*9.1*
Bark	91.4	-	-	25.9	65.5	8.6	18.9
Total	92.9	-	8.7	15.2	68.9	7.1	100

[a]Bone-dry unit = 2,400 lb oven-dry wood.

Table U16—Utah sawmill residue factors, 1992, 2002, 2007, 2012, and 2016 (sources: Hayes et al. 2012; Keegan et al. 1995; Morgan et al. 2006; Sorenson et al. 2016).

Type of residue	1992	2002	2007	2012	2016
			BDU/MBF lumber tally[a]		
Coarse	0.56	0.48	0.44	0.64	0.62
Sawdust	0.19	0.19	0.21	0.14	0.14
Planer shavings	0.06	0.10	0.15	0.10	0.11
Bark	0.28	0.21	0.20	0.25	0.21
Total	1.09	0.98	1.00	1.13	1.08

[a]Bone-dry unit (BDU = 2,400 lb oven-dry wood) of residue generated for every 1,000 board feet of lumber manufactured.

Residue utilization in Utah represents a challenge for the state's timber processors. Without buyers/users of mill residue, the residue can present a disposal problem and increase costs for timber processors. In many other western States without the traditional residue users like particle board plants or pulp mills, mill residues are increasingly being used for biomass energy, decorative landscape/mulch, and animal bedding.

Primary Forest Products Sales

Sales from Utah's primary wood products industry during 2016 totaled $21.3 million, including finished products and mill residues (table U17). House logs and log homes accounted for 36 percent ($7.6 million) of total sales (and manufacturers in the house log category had another 3.4 million in sales of other products, primarily lumber); lumber, timbers, and other sawn products accounted for about 32 percent ($6.7 million); while other products and mill residues accounted for nearly 33 percent (nearly $7 million). Utah was the leading market area for lumber, log homes, posts, poles, and log furniture, with in-state sales accounting for almost 32 percent of total

sales. The other Four Corners States (Arizona, Colorado, and New Mexico) accounted for 12 percent of total sales, with house logs and log homes accounting for 54 percent of sales in the region. The North Central region accounted for over 20 percent of total sales, with other products accounting for nearly 48 percent of sales to the region. Following the North Central region, the Northeast, South, and Rocky Mountain regions accounted for the rest of out-of-state sales with 15, 12, and nearly 8 percent of total sales in 2016, respectively. Less than 1 percent of sales from Utah went to the Far West region.

Table U17—Destination and sales value of Utah's primary wood products and mill residues, 2016.

Product	Utah	Other Four Corners States	Other Rocky Mtn States[a]	Far West[b]	Northeast[c]	South[d]	North Central[e]	Total
				Thousand 2016 dollars				
Lumber, timbers, and other sawn products	2,362	907	681	45	687	675	1,353	6,710
House logs and log homes	2,401	1,391	924	99	974	924	924	7,637
Other products[g]	2,029	262	-	-	1,560	1,040	2,080	6,970
Total	6,791	2,560	1,606	144	3,220	2,639	4,357	21,317
				Percentage of product sales by region				
Lumber, timbers, and other sawn products	34.8	35.4	42.4	31.3	21.3	25.6	31.1	31.5
House logs and log homes	35.3	54.3	57.6	68.7	30.2	35.0	21.2	35.8
Other products[g]	29.9	10.2	-	-	48.4	39.4	47.7	32.7
Total	31.9	12.0	7.5	0.7	15.1	12.4	20.4	100

[a]Other Rocky Mountain States include Idaho, Montana, Nevada.
[b]Far West includes Alaska, California, Hawaii, Oregon, and Washington.
[c]Northeast includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[d]South includes Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
[e]North Central includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[f]Other areas consist of products being shipped outside the United States.
[g]Other products include posts, poles, log furniture, and mill residues.

Forest Industry Employment and Labor Income

Of the Four Corners States, Utah saw the second highest increase in forest industry employment between 2012 and 2016. There were over 6,100 jobs in Utah's primary and secondary forest industry during 2016, representing a 9 percent increase from approximately 5,600 jobs in 2012 (fig. U3) (USDC BEA 2018a). This increase was driven by increasing employment in wood products manufacturing (28 percent) and forestry and logging (23 percent), while employment in both forestry support activities and paper manufacturing decreased over the same period. Similar to Arizona and Colorado, Utah experienced a notable decline in workers engaged in forestry support activities (46 percent) from 2012 to 2016. Nearly 450 jobs were in the primary sector of Utah's forest industry, reflecting a decrease of approximately 3 percent from 2012. The remaining 5,650 workers in Utah's forest industry are considered secondary, or jobs that involve further processing of primary sector outputs.

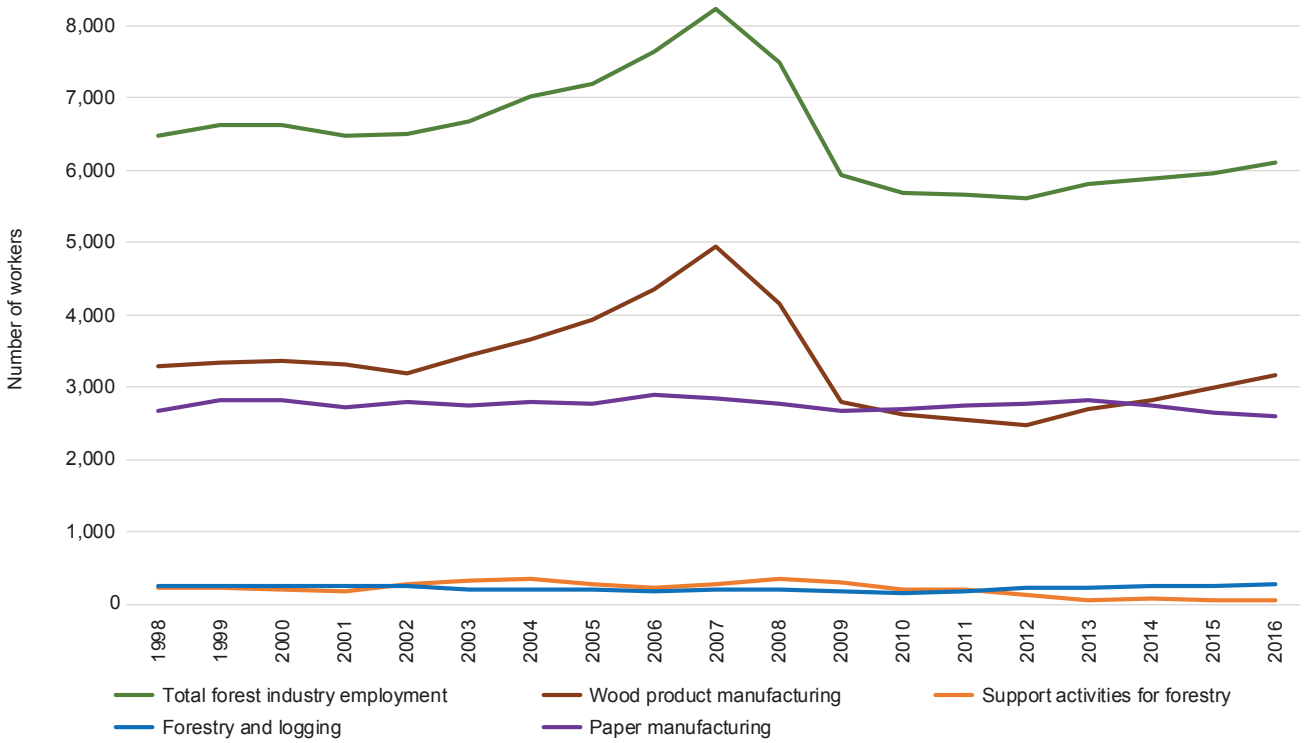


Figure U3—Employment in Utah's forest industry, 1998–2016.

Utah's forest industry worker earnings were just over $300 million during 2016, up about 11 percent (adjusted for inflation) from 2012, but still $80 million below 2007 earnings (fig. U4). The wood products manufacturing sector experienced the greatest increase with the average worker making 51 percent more in 2016 ($119 million) relative to 2012. Forestry and logging earnings have also increased, up 11 percent to $4.2 million in 2016. Both paper manufacturing and support activities for forestry have seen declines in labor income between 2012 and 2016, down 5 percent and 11 percent, respectively.

The various sectors comprising the forest products industry directly contributed over 6,100 jobs and $300 million in labor income to the state economy. Using regional data and existing linkages within Utah's economy represented by the BEA RIMS II multipliers, BBER estimates that wood products manufacturing alone supported over 7,000 full- and part-time jobs and an associated $292 million in labor income (table U18). Thus, for every wood products manufacturing job in the State, another 1.25 jobs were supported in other sectors, while for every $1.00 paid in labor income by wood products manufacturers another $1.45 was paid in supporting sectors, including forestry and logging, forestry support, trucking, wholesale trade and management.

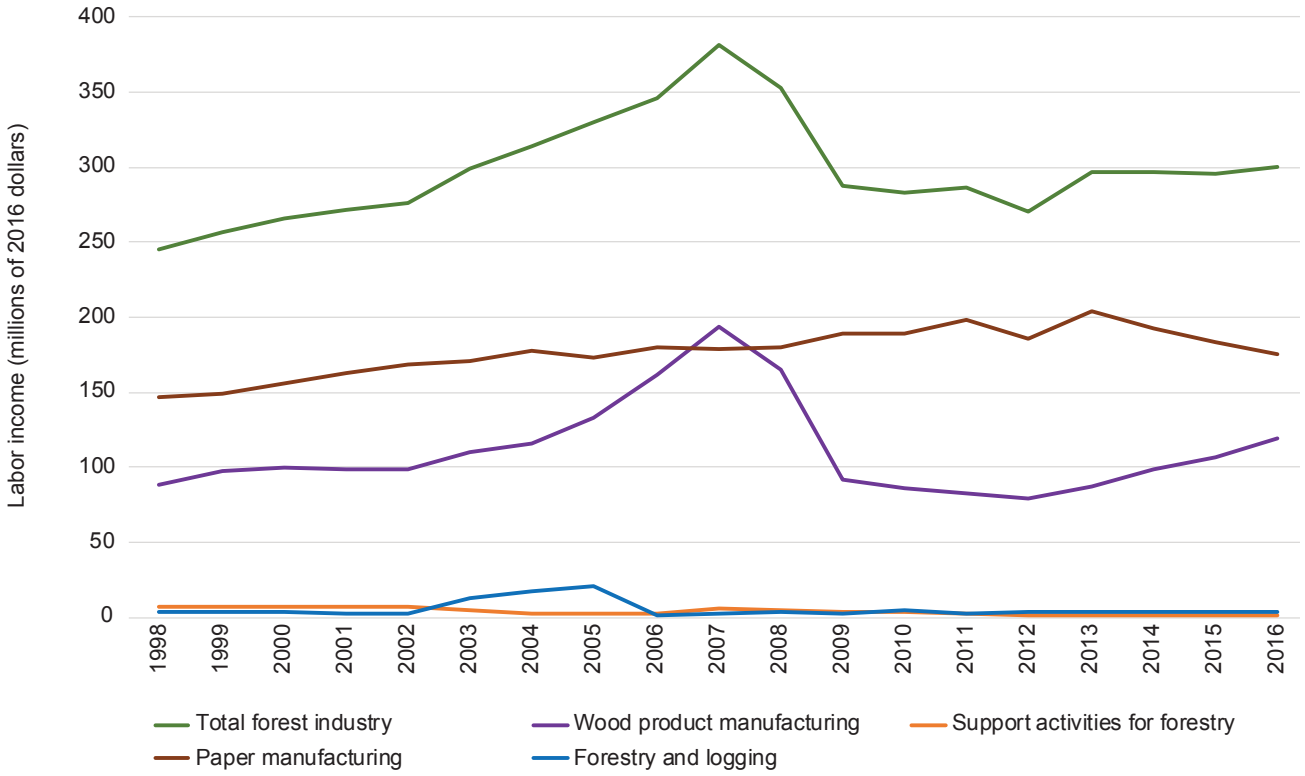


Figure U4—Inflation-adjusted earnings in Utah's forest industry, 1998–2016.

Table U18—Average annual employment and labor income contributions from Utah's forest industry.

Sector	Direct employment	Indirect and induced employment	Total employment contribution[a]	Direct labor income	Indirect and induced labor income	Total labor income contribution[a]
				Thousand 2016 dollars		
Wood products manufacturing[b]	3,162	3,942	7,104	119,008	172,722	291,730
Forestry and logging	282	160	442	4,191	2,921	7,112
Forestry support activities	65	23	88	1,700	917	2,617
Paper manufacturing	2,596	7,702	10,298	175,951	285,850	461,801
Total forest industry	**6,105**	[a]	[a]	**300,850**	[a]	[a]

[a]Indirect and induced employment and labor income should not be summed for multiple sectors due to some employment and income showing up as both direct contributions to their sector and indirect contributions to other sectors.

[b]Includes employment and labor income for both primary and secondary wood products manufacturing.

Likewise, BBER estimates that the 282 people employed in the forestry and logging sector supported an additional 160 jobs along with nearly $3 million in labor income in supporting sectors, such as equipment sales and repair. Leveraging the BEA RIMS II multipliers allows for a broad economic contribution analysis of economic activity generated and cycled through Utah's economy by the different sectors comprising the forest industry. It should be noted that we do not aggregate sectors and we avoid providing estimates of the total employment and labor income contribution for the entire forest industry to avoid double counting, given that some employment and labor income shows up as both direct contributions to their sector and indirect

contributions to other sectors. For example, some or all of the direct employment and labor income in the forestry and logging sector would be included with the indirect and induced contributions form primary wood products manufacturing since these manufacturers rely upon forestry and logging business to supply their raw material inputs.

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