



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Pacific Northwest Research Station | General Technical Report PNW-GTR-1034 | June 2025

California's Forest Products Industry and Timber Harvest, 2021

Samuel G. Scott, Helena F. Murray, Lucas P. Koch, Thale Dillon, Todd A. Morgan, and Glenn A. Christensen



In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint](#) and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

Authors

Samuel G. Scott is a forest economist, **Thale Dillon** is a research economist, and **Todd A. Morgan** is director of the Forest Industry Research Program, University of Montana, College of Business, Bureau of Business and Economic Research, 32 Campus Drive, Missoula, MT 59812; **Helena F. Murray** is Wood and Biomass Utilization Program manager, U.S. Department of Agriculture, Forest Service, Pacific Southwest Region—State, Private, and Tribal Forestry, 1323 Club Drive, Vallejo, CA 94592; **Lucas P. Koch** is a graduate student, University of Montana, Department of Economics, 32 Campus Drive, Missoula, MT 59812; **Glenn A. Christensen** is a forester, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1220 SW 3rd Avenue, Suite 1410, Portland, OR 97204.

Produced through a joint venture agreement with the University of Montana, Bureau of Business and Economic Research and the U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Forest Monitoring and Assessment Program (PNW agreement 21-JV-11261979-053).

Cover photo: A pile of logs tagged for processing at a lumber mill in Willits, California. Spiritofamerica; stock.adobe.com.

Abstract

Scott, Samuel G.; Murray, Helena F.; Koch, Lucas P.; Dillon, Thale; Morgan, Todd A.; Christensen, Glenn A.

2025. California's forest products industry and timber harvest, 2021. Gen. Tech. Rep. PNW-GTR-1034. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 20 p. <https://doi.org/10.2737/pnw-gtr-1034>.

We conducted a census of all facilities in California that purchase roundwood as well as facilities that purchase residuals from roundwood users. We also collected data from facilities in surrounding states that purchase roundwood from California. We asked facilities about their mill characteristics, employment, inputs, outputs, residual production and disposition, and sales values. In total, we identified 72 facilities in California, accounting for more than 1.6 billion board feet (BBF) Scribner of timber harvest, nearly 2.4 BBF Scribner of lumber and 2.1 million bone-dry units of

mill residue. We compare the results of this census to previous surveys that were conducted in 2016, 2012, 2006, and 2000, as well as other sources of related information.

KEYWORDS

California
Forest economics
Forest products
Lumber production
Timber harvest

Report Highlights

- We identified 72 active primary wood products facilities in California in 2021, of which 31 were sawmills.
- A little more than 1.6 billion board feet (BBF) Scribner of timber was harvested in California in 2021, of which 88 percent came from private timberlands, 10 percent came from national forests, and the remaining 2 percent came from other public lands.
- The five most productive timber counties in the state were Butte County (237 million board feet [MMBF] Scribner), Plumas County (225 MMBF Scribner), Siskiyou County (189 MMBF Scribner), Humboldt County (183 MMBF Scribner), and Shasta County (162 MMBF Scribner).
- Almost 35 MMBF Scribner of California timber was processed in other U.S. states, while 53 MMBF Scribner of out-of-state timber was processed within the state.
- Combined, sawmills across the state produced almost 2.4 BBF of lumber, with an average overrun of 1.72 board feet lumber tally per board foot Scribner of log inputs.
- The forest products industry directly employed an estimated 58,373 people, of which 13 percent were in the forestry, forestry support, and logging sectors; 35 percent were in the secondary paper manufacturing sector; and 52 percent were in the wood product manufacturing sector.
- About \$4.7 billion in labor income was generated by the California forest products industry across the forestry, forestry support, wood products manufacturing, biomass power generation, and secondary paper manufacturing sectors.

Contents

1	Introduction
1	California's Timberland and Harvest
1	Timber Resource
2	Timber Harvest by Geographic Source
4	Timber Harvest by Ownership
4	Timber Harvest by Species
4	Timber Harvest by Condition
6	Timber Harvest by Product
6	Timber Flow
7	Forest Products Manufacturing
7	Production Overview
7	Sawmill Sector
10	Residue-Utilizing Sectors
10	Bioenergy Sector
11	Product Flow and Use
13	Economic Effects
13	Private Sector Employment and Income
14	Economic Contributions
16	Future Projections for California
16	Acknowledgments
17	Metric Equivalents
17	Species list
17	References

Introduction

In this report, we discuss the findings from a census of California's primary forest products industry for 2021. Our principal goals for this census were to (1) determine how California's timber harvest was utilized, (2) identify the type and number of primary forest products facilities operating during 2021, and (3) determine their sources for raw material and quantify outputs of finished products.

The University of Montana, College of Business, Bureau of Business and Economic Research (BBER), in cooperation with the Forest Inventory and Analysis (FIA) programs at the U.S. Department of Agriculture, Forest Service's Rocky Mountain and Pacific Northwest Research Stations, has developed a system to collect, compile, and make available state and county information on the operations of the forest products industry. This Forest Industries Data Collection System (FIDACS) has been used to analyze 11 Western States in periodic censuses (e.g., Hayes et al. 2021, Simmons et al. 2021), including four previous efforts in California (Marcille et al. 2020; McIver et al. 2015; Morgan et al. 2004, 2012).

With the 2021 California FIDACS census, we attempted to capture every primary forest products manufacturer in California as well as any out-of-state facilities that receive California timber. We define a primary forest products manufacturer as any business that processes timber into an intermediate or final wood product as well as any facility that processes wood fiber residuals from those timber processors.

Through a combination of mailed surveys, telephone calls, and in-person interviews, we requested the following from every primary wood products manufacturer in California:

- Facility information:
 - Location
 - Production capacity
 - Employment
 - Preferred and accepted log lengths and diameters
- Volume of raw material received:
 - Material type
 - County of origin
 - Ownership

- Species
- Proportion of timber that was standing dead at time of harvest
- Volume and sales value of finished products:
 - Product type
 - Market location
- Residuals information:
 - Production volume by type
 - Industry distribution and utilization by type
 - Sales value

We estimated data for facilities that did not respond using previous census responses, data from annual samples in other years, and other supplementary data sources. We received responses from 65 percent of the facilities we contacted, representing an estimated 72 percent of roundwood mill inputs by volume and 63 percent of non-roundwood mill inputs by volume. This response rate is lower than previous years. Because of lower response rates, we are unable to provide some information that has been included in previous FIDACS reports, such as sales values of finished wood products, intrastate timber flow, and timber processing capacity.

California's Timberland and Harvest

Timber Resource

Inventory estimates compiled by the FIA program show nearly a third—32 million acres—of California's land area is forest land, 40 percent of which is privately owned (USDA FS 2024a) (fig. 1). FIA inventories further show that of the 19 million acres of publicly owned forest land in the state, about 15 million acres are managed by the Forest Service as part of the National Forest System (NFS), and 4 million acres are split among various federal, state, and local agencies. FIA inventories classify about half of all forest land in the state as timberland. Fifty-four percent of that timberland is part of the NFS, with the remaining 6 million acres of NFS land being other forest land or reserved from timber harvest in some manner. The 8.7 million acres of NFS timberland in California produced a little more than 150 million board feet (MMBF) Scribner of timber in 2021. The 7.1 million acres of private timberland produced 1.4 billion board feet (BBF) Scribner in the same period—88 percent of the statewide harvest.

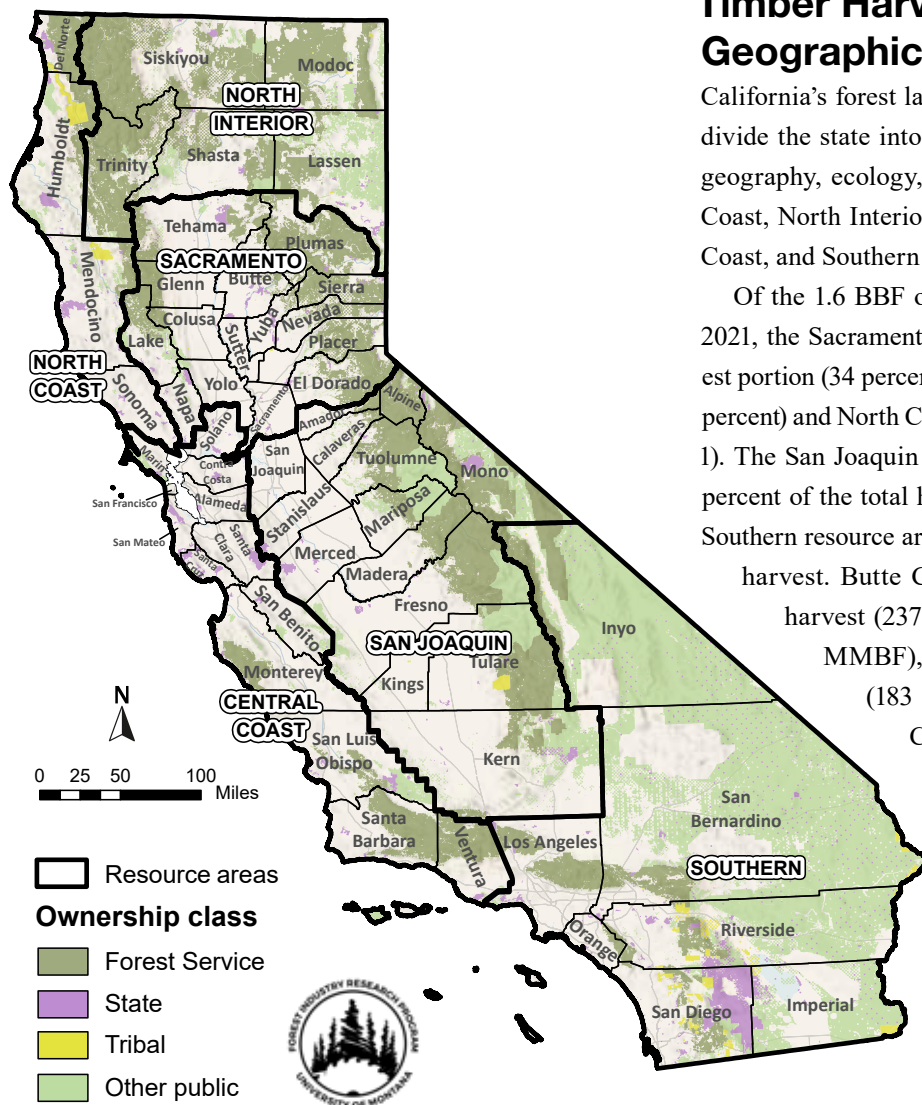
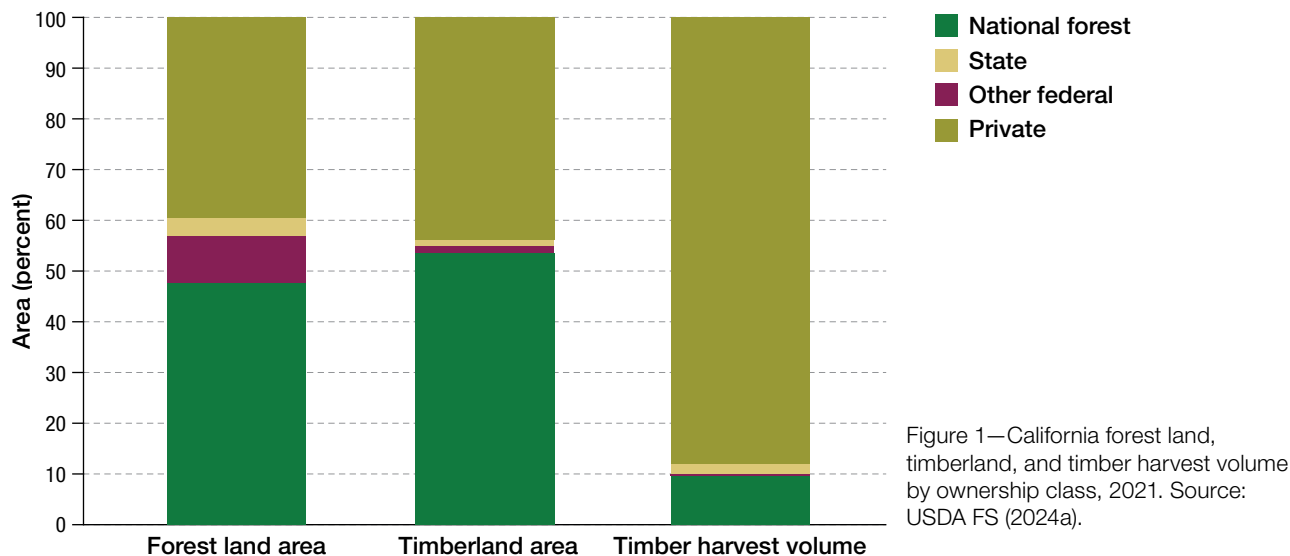


Figure 2—California public land ownership classes and resource areas.

Timber Harvest by Geographic Source

California's forest lands are widespread and diverse. We divide the state into six timber resource areas based on geography, ecology, and industry infrastructure: North Coast, North Interior, Sacramento, San Joaquin, Central Coast, and Southern (fig. 2).

Of the 1.6 BBF of timber harvested in California in 2021, the Sacramento resource area contributed the largest portion (34 percent), followed by the North Interior (32 percent) and North Coast (23 percent) resource areas (table 1). The San Joaquin resource area was responsible for 8 percent of the total harvest, while the Central Coast and Southern resource areas comprised 2 percent of statewide harvest.

Butte County had the largest countywide harvest (237 MMBF), followed by Plumas (225 MMBF), Siskiyou (189 MMBF), Humboldt (183 MMBF), and Shasta (162 MMBF)

Counties. The geographic distribution of the top timber-producing counties in 2021 shows a shift away from the coast and into the interior since the previous census (Marcille et al. 2020: 11). The reason for this shift is difficult to assess using the FIDACS data, but remarks from various mill operators in the data collection process suggest that this may be due to increased wildfire salvage activity in the interior.

Table 1—California timber harvest by resource area, county, and ownership, 2021

Resource area (county)	Private and tribal	National forest	Other public ^a	Total
THOUSAND BOARD FEET SCRIBNER				
Central Coast	23,081	—	—	23,081
(San Mateo)	9,010	—	—	9,010
(Santa Cruz)	14,071	—	—	14,071
North Coast	365,048	—	14,779	379,827
(Del Norte)	27,205	—	—	27,205
(Humboldt)	182,694	—	368	183,062
(Mendocino)	135,086	—	14,411	149,497
(Sonoma)	20,063	—	—	20,063
North Interior	436,155	83,720	1,950	521,825
(Lassen)	81,515	12,110	275	93,900
(Modoc)	15,416	4,626	100	20,142
(Shasta)	151,946	9,150	725	161,821
(Siskiyou)	168,971	19,047	600	188,618
(Trinity)	18,307	38,787	250	57,344
Sacramento	501,652	50,510	6,276	558,439
(Butte)	233,002	3,366	200	236,568
(El Dorado)	41,882	3,872	132	45,886
(Lake)	3,000	—	5,000	8,000
(Nevada)	4,559	1,698	—	6,257
(Placer)	6,638	2,881	125	9,644
(Plumas)	190,807	34,362	325	225,494
(Sierra)	218	2,082	219	2,519
(Tehama)	17,447	2,250	175	19,872
(Yuba)	4,099	—	100	4,199
San Joaquin	99,456	22,019	9,010	130,485
(Amador)	7,927	694	—	8,621
(Calaveras)	13,858	4,100	125	18,083
(Fresno)	33,205	5,912	4,100	43,217
(Madera)	4,200	2,289	—	6,489
(Mariposa)	4,643	—	—	4,643
(Stanislaus)	1,276	—	—	1,276
(Tulare)	2,944	878	4,660	8,482
(Tuolumne)	31,403	8,146	125	39,674
Southern	1,000	—	7,290	8,290
(Riverside)	—	—	7,290	7,290
(San Bernardino)	1,000	—	—	1,000
Total	1,426,392	156,249	39,305	1,621,946

— = no harvest reported

^a Includes county-; municipality-; state-; and U.S. Department of the Interior, Bureau of Land Management-managed timberlands.

Timber Harvest by Ownership

Total timber harvest during 2021 was 3 percent greater than in 2016. Timber harvest on private and tribal timberland was 14 percent greater in 2021 than in 2016 (table 2). The nonindustrial private and tribal land component of that increased 42 percent and the industrial component increased 8.5 percent. Harvest on public timberland was 39 percent less in 2021 than in 2016. The national forest component decreased 41 percent, while the state lands component decreased 34 percent. For more historical timber harvest trends by ownership class, see Marcille et al. (2020: 6).

Table 2—California timber harvest by ownership class, select years

Ownership class	2012	2016	2021
MILLION BOARD FEET SCRIBNER			
Private and tribal timberland	1,193.7	1,250.9	1,426.4
Industrial	1,000.5	1,044.5	1,133.3
Nonindustrial private and tribal	193.2	206.4	293.1
Public timberland	231.7	320.6	195.5
National forest	203.3	265.5	156.2
State lands	27.9	51.4	34.0
Other public ^a	0.5	3.7	5.3
All ownership classes	1,425.4	1,571.5	1,621.9

^a Includes county-; municipality-; state-; and U.S. Department of the Interior, Bureau of Land Management-managed timberlands. Sources: Marcille et al. (2020), McIver et al. (2015).

Timber Harvest by Species

Most of the 2021 timber harvest in California was split among pine (*Pinus* spp.) (28 percent), Douglas-fir (*Pseudotsuga menziesii*) (26 percent), and true fir (*Abies* spp.) (24 percent) (table 3). Historically, these have been the top three species groups harvested across the state in varying proportions (Marcille et al. 2020: 13). Cedars and other species made up the remaining 22 percent of the harvest. Coast redwood (*Sequoia sempervirens*) is an important economic, ecological, and cultural resource to the coastal regions of California. However, publishing

harvest or consumption data for this species individually could disclose private company information; therefore, we have omitted this data.

Table 3—California timber harvest by species, 2021

Species	Volume	Distribution
	THOUSAND BOARD FEET SCRIBNER	PERCENT
Pines ^a	455,075	28
Douglas-fir	421,624	26
True firs ^b	394,904	24
Cedars ^c	56,816	4
Other species ^d	293,526	18
All species	1,621,946	100

^a Includes ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), and western white pine (*Pinus monticola*).

^b Includes white fir (*Abies concolor*), noble fir (*Abies procera*), grand fir (*Abies grandis*), and California red fir (*Abies magnifica*).

^c Includes incense cedar (*Calocedrus decurrens*), Port Orford cedar (*Chamaecyparis lawsoniana*), and western redcedar (*Thuja plicata*).

^d Includes coast redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*), various oaks (*Quercus* spp.), and additional unspecified species.

Timber Harvest by Condition

California has experienced increased wildland fire activity, both in size and distribution, over the past 20 years (Li and Banerjee 2021). Wildland fires affect the California forest products industry by interrupting timber harvesting and planting schedules, redistributing resources—especially labor—from planned green timber sales to salvage timber sales, and degrading wood quality if the salvage timber is not logged in a timely manner (Prestemon and Holmes 2008, Prestemon et al. 2006). In our FIDACS census, we asked mills about the condition of their incoming timber (table 4). Between 2000 and 2016, mills reported receiving an average annual total of 138 MMBF of logs that were dead at the time of harvest, about 8 percent of total wood received. In 2021, mills reported more than 600 MMBF of dead logs (38 percent of total wood received), more than the dead volume reported in 2000, 2006, 2012, and 2016

Table 4—California timber harvest by species and condition, select years

Species	Live volume	Dead volume	Proportion dead
	THOUSAND BOARD FEET SCRIBNER		PERCENT
Pines ^a	185,920	269,155	59
Douglas-fir	325,869	95,755	23
True firs ^b	203,924	190,981	48
Cedars ^c	19,570	37,247	66
Other species ^d	277,146	16,360	6
2021 Total	1,012,429	609,498	38
2016 Total	1,364,100	207,400	13
2012 Total	1,390,400	35,000	2
2006 Total	1,550,300	182,800	11
2000 Total	2,120,600	129,100	6

^a Includes ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), and western white pine (*Pinus monticola*).

^b Includes white fir (*Abies concolor*), noble fir (*Abies procera*), grand fir (*Abies grandis*), and California red fir (*Abies magnifica*).

^c Includes incense cedar (*Calocedrus decurrens*), Port Orford cedar (*Chamaecyparis lawsoniana*), and western redcedar (*Thuja plicata*).

^d Includes coast redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*), various oaks (*Quercus* spp.), and additional unspecified species.

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

Table 5—California timber harvest by product type, select years

Product	2000	2006	2012	2016	2021
	MILLION BOARD FEET SCRIBNER				
Sawlogs ^a	2,020.2	1,526.9	1,180.2	1,291.8	1,384.2
Veneer logs	166.5	138.6	119.7	172.9	151.5
Bioenergy logs	54.0	62.4	116.9	83.3	57.6
Other logs ^b	9.0	5.2	8.6	23.6	28.6
All products	2,249.7	1,733.1	1,425.4	1,571.5	1,621.9

^a Includes export logs.

^b Includes house logs, fiber logs, firewood, furniture logs, and utility pole logs.

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

Table 6—California timber harvest by ownership class and product type, 2021

Ownership class	Sawlogs ^a	Other ^b	All products
	THOUSAND BOARD FEET SCRIBNER		
Private and tribal timberlands	1,217,895	208,497	1,426,392
Industrial	959,042	174,288	1,133,330
NonIndustrial and tribal	258,853	34,209	293,062
Public timberlands	166,317	29,237	195,554
National forest	143,713	12,536	156,249
Other public	22,604	16,701	39,305
All ownership classes	1,384,212	237,734	1,621,946

^a Includes export logs.

^b Includes bioenergy logs, house logs, fiber logs, firewood, furniture logs, and utility pole logs.

Table 7—California timber harvest by species and product type, 2021

Species	Sawlogs ^a	Other ^b	All products
THOUSAND BOARD FEET SCRIBNER			
Pines ^c	393,985	61,090	455,075
Douglas-fir	341,847	79,777	421,624
True firs ^d	325,959	68,945	394,904
Cedars ^e	56,006	810	56,816
Other species ^f	266,415	27,111	293,526
All species	1,384,212	237,734	1,621,946

^a Includes export logs.^b Includes veneer logs, bioenergy logs, house logs, fiber logs, firewood, furniture logs, and utility pole logs.^c Includes ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), and western white pine (*Pinus monticola*).^d Includes white fir (*Abies concolor*), noble fir (*Abies procera*), grand fir (*Abies grandis*), and California red fir (*Abies magnifica*).^e Includes incense cedar (*Calocedrus decurrens*), Port Orford cedar (*Chamaecyparis lawsoniana*), and western redcedar (*Thuja plicata*).^f Includes redwood (*Sequoia sempervirens*), western hemlock (*Tsuga heterophylla*), various oaks (*Quercus* spp.), and additional unspecified species.**Table 8—Timber volume received in California mills by ownership class and product type, 2021**

Ownership class	Sawlogs ^a	Other ^b	All products
THOUSAND BOARD FEET SCRIBNER			
Private timberlands	1,243,178	200,343	1,443,521
Industrial	981,289	174,778	1,156,067
NonIndustrial and tribal	261,889	25,565	287,454
Public timberlands	166,966	30,045	197,011
National forests	144,362	12,536	156,898
Other public	22,604	17,509	40,113
All ownership classes	1,410,144	230,388	1,640,532

^a Includes export logs.^b Includes veneer logs, bioenergy logs, house logs, fiber logs, firewood, furniture logs, and utility pole logs.**Table 9—Domestic and international timber flow into and out of California, 2021**

Timber product	Log flow into California	Log flow out of California	Net inflow (net outflow)
THOUSAND BOARD FEET SCRIBNER			
Sawlogs ^a	51,404	20,488	30,916
Other ^b	1,915	14,245	(12,330)
All products	53,319	34,733	18,586

^a Includes export logs.^b Includes veneer logs, bioenergy logs, house logs, fiber logs, firewood, furniture logs, and utility pole logs.

combined. Between 2020 and 2021, wildfires burned about 6.9 million acres in California (Cal Fire 2024a). These large fires (including the August Complex, Caldor Fire, Dixie Fire, North Complex, and others) contributed to the high salvage harvest in 2021 and will also likely affect timber conditions for several years to come.

Timber Harvest by Product

Different types of primary processors require different types of logs. We present these different timber product types in tables 5, 6, and 7. We have omitted detailed information on nonsawlog products in California to avoid revealing sensitive information about the limited number of mills and mill owners across the state. In 2021, about 85 percent of the timber harvest was sawlogs, an increase from 82 percent in 2016 (table 5) (Marcille et al. 2020: 17).

Timber Flow

Not all timber received by mills in California is harvested in state, nor does all timber harvested in California remain in state. Overall, California mills received 1.6 BBF of timber in 2021 (table 8), about 18.5 MMBF greater than the state's timber harvest. Looking at timber flow into and out of the state, about 53 MMBF of timber received in California came from out of state—about 3 percent of the total received, and 35 MMBF of California timber (about 2 percent of the harvest) was sent out of state for processing. (table 9). In 2016, less than 1 percent of timber processed in California came from out of state, and 3 percent of the state's harvest was shipped out of California (Marcille et al. 2020: 19). For more detailed information about timber flow on the west coast, see Dillon and Morgan (2023).

Forest Products Manufacturing Production Overview

Primary processing facilities in the wood products sector are spread across California (fig. 3). We identified 72 active primary wood products facilities in our 2021 FIDACS census (table 10). We identified fewer facilities in the 2021 census than we did in the four previous censuses. The sector with the most facilities was sawmills with 31. The Sacramento resource area had the most total facilities (20), and the Central Coast resource area had the fewest (1).

Sawmill Sector

Average lumber production per sawmill increased by 22 percent between 2016 and 2021, while the number of sawmills decreased (table 11). This is a trend seen in other Western States and is primarily driven by technological efficiency gains and industrial consolidation (Scott et al. 2025; Simmons et al. 2021, 2024). In 2021, 71 percent of California lumber was produced by sawmills with relatively high output volumes (table 12). Nearly 2.4-BBF lumber tally was produced in California during 2021, an 18-percent increase over 2016 and a 22-percent decrease over 2000 (table 13). Additional historical production data is available from Marcille et al. (2020: 35).

Mill productivity and efficiency is measured using ratios that compare the volume of inputs to the volume of outputs within a sector. For the sawmill sector, lumber overrun is the volume of lumber recovered compared to the lumber volume predicted by the Scribner log scale. While lumber overrun is a common measure in the industry, it can be a misleading metric because it is partly a function of complexities within the Scribner log scale. For example, milling small-diameter logs can arbitrarily increase lumber overrun because Scribner—the denominator—increasingly underestimates the volume of a log as log diameter decreases (Keegan et al. 2010). In 2021, we found a statewide lumber overrun of 1.72 board foot

lumber tally per board foot Scribner, which is a moderate increase from 2016 (table 13).

An alternative measure that uses cubic timber volume rather than Scribner log scale volume as the denominator is lumber recovery factor. Keegan et al. (2010) suggests lumber recovery factor may be a better metric of productivity in some cases, though it requires cubic volume data to calculate. Interestingly, California saw a decrease in lumber recovery factor between 2012 and 2016 **and** between 2016 and 2021. As discussed by Marcille et al. (2020: 44), California sawmill efficiency increased substantially between 1968 and 2012 as a result of technological advances. The recent decrease is relatively small and may represent year-to-year variation that is typical of regional scale industry efficiency metrics.

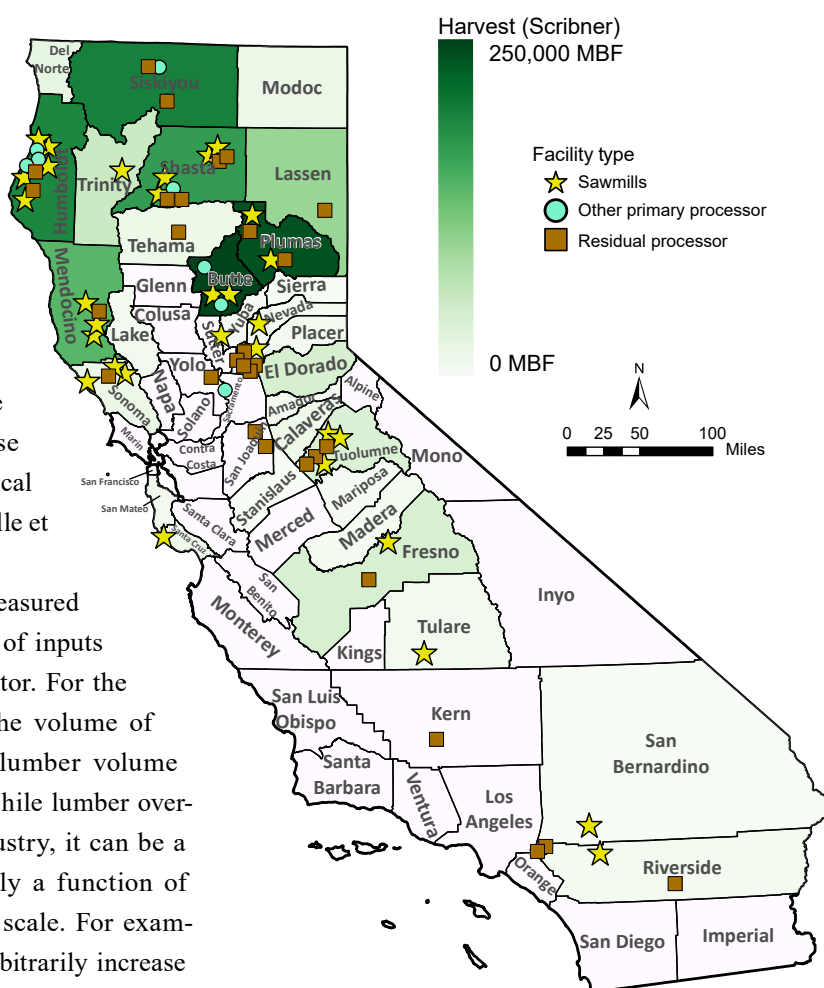


Figure 3—California counties with primary and residual wood products facilities and timber harvest volume by county, 2021. Primary facilities process roundwood (timber), and residual facilities purchase and process wood residuals from primary facilities. MFB = thousand board feet.

Table 10—Active California primary wood products facilities by resource area, county, and mill type, select years

Resource area (county)	Sawmill	Veneer	Bioenergy	Bark products	Other facilities ^a	Total
County						
Central Coast	1	—	—	—	—	1
(Santa Cruz)	1	—	—	—	—	1
North Coast	11	—	2	1	3	17
(Humboldt)	5	—	2	—	3	10
(Mendocino)	2	—	—	—	—	2
(Sonoma)	4	—	—	1	—	5
North Interior	5	2	6	1	1	15
(Lassen)	—	—	1	—	—	1
(Shasta)	4	—	4	—	1	9
(Siskiyou)	—	2	1	1	—	4
(Trinity)	1	—	—	—	—	1
Sacramento	7	—	5	3	5	20
(Butte)	2	—	—	—	2	4
(Glenn)	—	—	—	1	—	1
(Nevada)	1	—	—	—	—	1
(Placer)	1	—	2	1	2	6
(Plumas)	2	—	2	—	—	4
(Sutter)	1	—	—	—	—	1
(Tehama)	—	—	—	1	—	1
(Yolo)	—	—	1	—	1	2
San Joaquin	5	—	3	4	2	14
(Amador)	—	—	—	—	1	1
(Fresno)	1	—	1	—	—	2
(Kern)	—	—	—	1	—	1
(San Joaquin)	—	—	—	2	—	2
(Tulare)	1	—	—	—	—	1
(Tuolumne)	3	—	2	1	1	7
Southern	2	—	1	2	—	5
(Riverside)	1	—	1	1	—	3
(San Bernardino)	1	—	—	1	—	2
2000 Total	47	2	25	10	9	93
2006 Total	33	2	25	10	7	77
2012 Total	30	2	26	11	8	77
2016 Total	32	2	23	12	11	80
2021 Total	31	2	17	11	11	72

^a Includes facilities that produce posts, poles, log homes, fiberboard, chips from roundwood, firewood, log furniture, logs for export, fuel pellets, and animal bedding.

— = no facilities identified.

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

Table 11—Number of California sawmills and average lumber production, select years

Year	Sawmills	Average lumber production
	NUMBER	THOUSAND BOARD FEET LUMBER TALLY
2021	31	77,156
2016	32	63,202
2012	30	63,899
2006	33	74,803
2000	47	64,894

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

Table 12—Lumber produced in California by sawmill production volume, 2021

Mill volume lumber tally ^a	Sawmills	Cumulative lumber tally	Distribution	Average lumber tally per mill
THOUSAND BOARD FEET	NUMBER	THOUSAND BOARD FEET	PERCENT	THOUSAND BOARD FEET
≤10,000	9	14,078	1	1,564
10,001–50,000	7	178,427	7	25,490
50,001–100,000	6	509,688	21	84,948
>100,000	9	1,689,634	71	187,737
Total	31	2,391,827	100	77,156

^a Mill volumes are based on reported lumber production.

Table 13—California sawmill productivity, select years

Year	Lumber production tally	Lumber overrun	Lumber recovery factor
	THOUSAND BOARD FEET	BOARD FOOT LUMBER TALLY PER BOARD FOOT SCRIBNER	BOARD FOOT LUMBER TALLY PER CUBIC FOOT
2021	2,391,827	1.72	8.58
2016	2,022,455	1.64	8.72
2012	1,916,971	1.63	8.87
2006	2,468,489	1.64	8.30
2000	3,050,000	1.53	7.96

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

Residue-Utilizing Sectors

On the census questionnaire, we requested information about the generation and utilization of residuals. Using these data, we estimated the total residuals produced, as well as residual factors based on mill output. We divide mill residuals into three categories:

- Bark: typically removed in the first part of the timber processing chain
- Fine residuals: planer shavings, sawdust, and sander dust
- Coarse residuals: coarse chips and chippable material, such as slabs, log ends, and trim

According to the 2021 census, California mills generated about 2.0 million bone-dry units (BDU) of residuals (table 14). Nearly all—more than 99 percent—of mill residuals produced in California were utilized.

Residual factors describe residuals as a function of mill output. For example, the coarse residual factor of 0.31 observed in 2021 indicates that for every 1 MBF of lumber produced, 0.31 BDU of coarse residuals is generated (table 15). Over time, coarse residual factors have been decreasing in California.

Bioenergy Sector

The bioenergy sector is an important part of the California forest products industry. California does not have an in-state pulp industry, so mill residuals have fewer options for utilization than other regions. Biomass energy production allows California to maintain high utilization levels despite the lack of pulpmills. In the past 20 years, forest-sourced biomass energy production in California has varied significantly (table 16). We captured 25 biomass energy facilities using forest-sourced material in our first census in California in 2000, with a combined capacity of 470 megawatts. In our 2021 census, we found 17 facilities capable of a combined 383 megawatts, a 19-percent decrease. Our 2012 census reported a peak of 26 facilities and a peak capacity that was 44 percent higher than in 2021 (551 megawatts).

California's bioenergy facilities currently fall into two categories: cogeneration of heat and power at sawmills and stand-alone biomass power plants. Most stand-alone biomass power plants in California were built in the late 1980s when state energy policy favored biomass power (Morris 2000); these power plants were reaching the end

Table 14—California production and disposition of wood products residuals, 2021

Type of residue	Total utilized	Pulp and board	Energy	Other products ^a	Unutilized	Total produced
BONE-DRY UNITS						
Coarse	830,346	174,864	536,987	118,495	61	830,407
Fine	674,458	37,921	373,232	263,305	258	674,716
Sawdust	360,827	28,558	257,806	74,463	258	361,085
Shavings	313,631	9,363	115,426	188,842	—	313,631
Bark	543,052	789	261,216	281,046	—	543,052
Total	2,047,856	213,574	1,171,435	662,847	319	2,048,175

^a Includes landscape products, mulch, soil additives, and animal bedding.

Table 15—California sawmill residual factors, select years

Type of residue	2000	2006	2012	2016	2021
BONE-DRY UNITS PER MBF LUMBER TALLY					
Coarse	0.41	0.37	0.33	0.33	0.31
Sawdust	0.15	0.15	0.14	0.14	0.15
Shavings	0.13	0.11	0.08	0.10	0.13
Bark	0.23	0.21	0.22	0.21	0.20
Total	0.92	0.84	0.77	0.78	0.79

BDU = bone-dry unit, MBF = thousand board feet.

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

Table 16—California biomass energy capacity and production, select years

Year	Facilities ^a	Total capacity	Average capacity	Total production	Average production
	NUMBER	MEGAWATTS		MEGAWATT HOURS	
2021	17	383	22.6	2,628,546	154,620
2016	23	510	22.2	3,152,501	137,065
2012	26	551	21.2	3,790,696	145,796
2006	25	485	19.4	3,641,335	145,653
2000	25	470	18.8	3,100,000	124,000

^a Includes biomass energy and co-generation plants that produce electricity, at least partially, from forest-sourced woody biomass.

Sources: Marcille et al. (2020); McIver et al. (2015); Morgan et al. (2004, 2012).

of their life in the mid-2010s. In 2016, to combat the tree mortality crisis, the state mandated that the California Public Utilities Commission require utilities to procure power from facilities that obtained 60 to 80 percent of their feedstock from forest sources through the BioRAM program (CPUC 2016). In 2021, eight stand-alone facilities had these special contracts (CPUC 2024, IHI Power Services Corp. 2017: 10). Some older facilities that did not have state support and relied mostly on agricultural or urban biomass have closed since 2016 because of aging equipment and technology, lack of investment, and competition with other renewable energy sources. Bioenergy remains the primary market for mill residuals in California.

Product Flow and Use

California's 2021 total timber harvest was about 373.1 million cubic feet. Of the total harvest, 74 percent went directly to sawmills, 7 percent went to veneer manufacturers, 15 percent went directly to biomass energy facilities, and the remaining 4 percent went to a variety of other primary producers. By converting the raw timber, intermediate products, and final products into thousand cubic feet (MCF), we can track and illustrate the flow of wood fiber through the primary processing sector (fig. 4). Using data collected through the 2021 census, we developed the following timber conversion factors from log size specifications as well as product and residual recovery information:

- 4.98 board feet Scribner per cubic foot for saw logs and export logs
- 5.89 board feet Scribner per cubic foot for veneer logs
- 3.18 board feet Scribner per cubic foot as a weighted average for other products
- 4.35 board feet Scribner per cubic foot as an overall statewide weighted average

Bark is not included in figure 4 but is an important part of the California forest products industry. We break down the source and flow of bark from harvested roundwood through the primary processing sector in figure 5. About 51 percent of bark from timber harvested in California is used for biomass energy and cogeneration, while the remaining 49 percent is used for specialty bark products, including landscaping products.

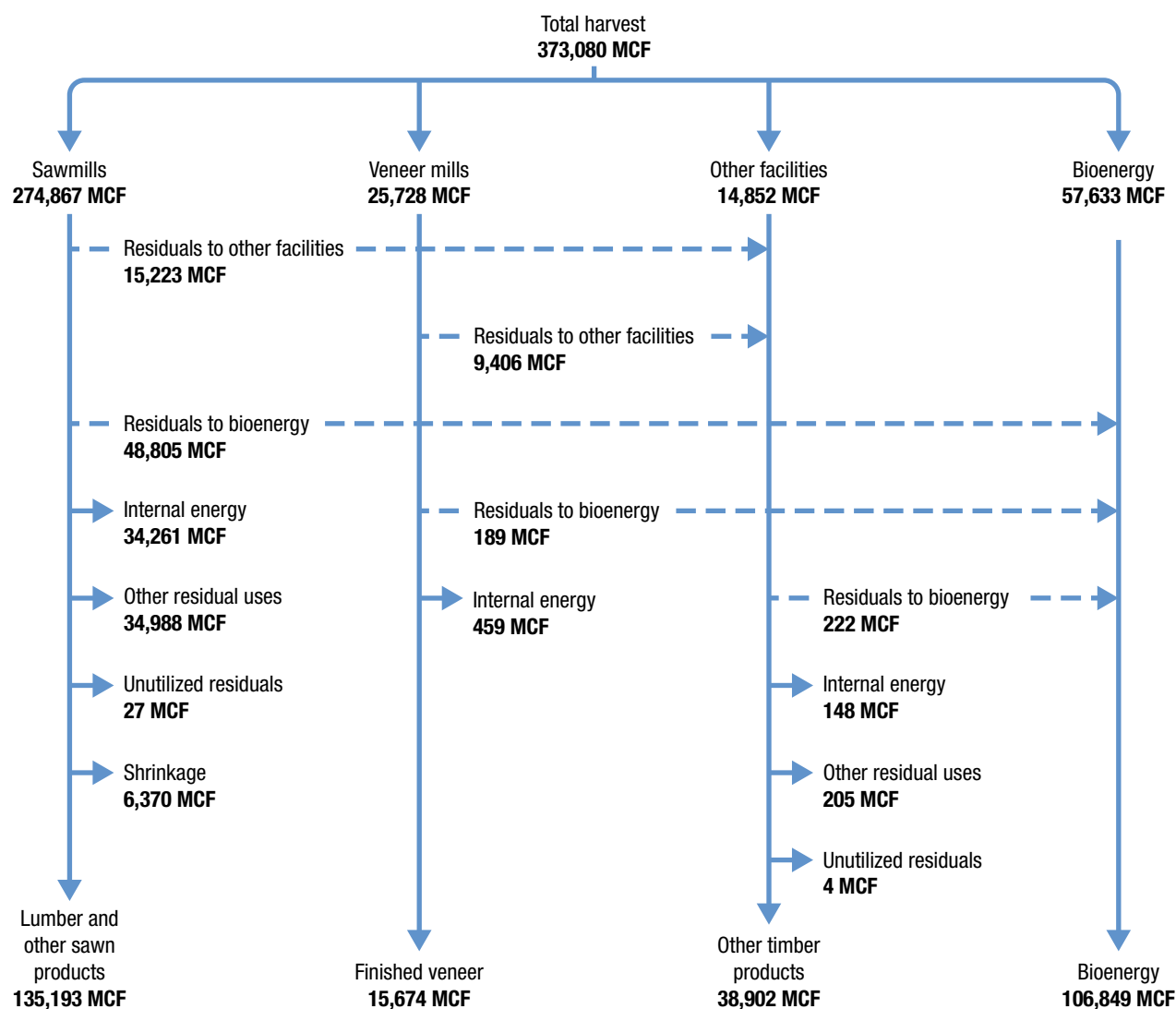


Figure 4—Flow of California wood fiber through primary and residual processing sectors. Harvest volume does not include bark. Other facilities include producers of log furniture, utility poles, clean chips, firewood, export logs, pulp and paper, and fiber board. Other residual uses include mulch, pellets, landscaping products, and animal bedding. MCF = thousand cubic feet.

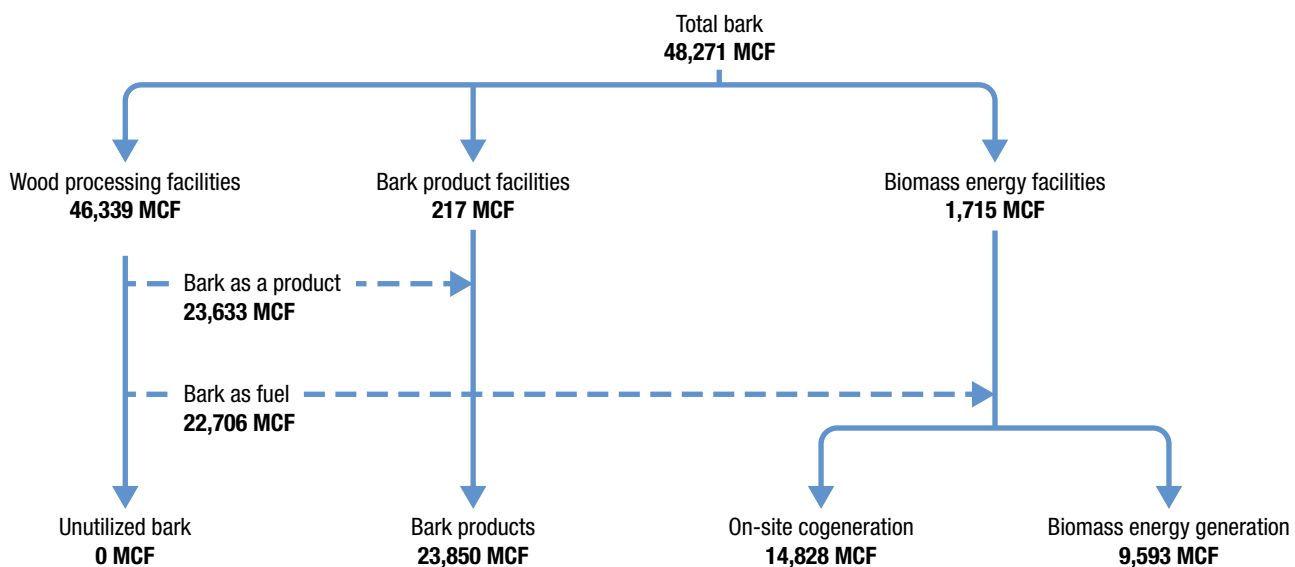


Figure 5—Flow of California bark from harvest timber through primary and residual processing sectors. MCF = thousand cubic feet.

Economic Effects

Private Sector Employment and Income

Beyond primary manufacturing, the forest products industry contributes to the California economy throughout its supply chain. The North American Industrial Classification System (NAICS) is used to define the various sectors within the industry: forestry and logging (NAICS 113), forestry support activities (NAICS 1153), wood products manufacturing (NAICS 321), and paper manufacturing (NAICS 322). We further disaggregate NAICS 321 and NAICS 322 into primary and secondary activity. For example, a paper converting facility that purchases raw paper and produces tissue paper would be a secondary paper manufacturing facility within NAICS 322. In California, all paper manufacturing activity is secondary. The definitions of these types of primary and secondary manufacturing are slightly different than in the rest of this report because of the limitations of federal economic data. In this context, primary processing includes making pulp from wood fiber in addition to making paper from either pulp made onsite or purchased from a pulp mill.

Public employment is a significant portion of the forest products industry, especially in relation to managing public lands, but it is not included in this report. Because industry sector is defined at the establishment level in the federal datasets used here, public employees that specifically work in the forest industry cannot be separated from other public employees that work in other sectors.

These NAICS sectors represent a conservative estimate of the effect of the wood products industry. Key elements of the supply chain are not always included in these estimates, and they are difficult to account for using the methods presented here. Important absences include log hauling companies, road construction companies, lumber wholesalers, and services carried out by government agencies and nonprofit organizations.

Our employment and labor income estimates combine results from the 2021 California FIDACS census with data from the U.S. Department of Labor, Bureau of Labor Statistics' Quarterly Census of Employment and Wages (USDOL BLS 2021); U.S. Department of Commerce, Bureau of Economic Analysis' (BEA's) Regional Economic Accounts (USDC BEA 2023); and U.S. Department of Commerce, Census

Bureau's County Business Patterns (USDC CB 2021). For example, forestry support activities (NAICS 1153) data are not reported by the BEA, so we apply the proportion of NAICS 1153 workers within the broader agriculture and forestry support activities (NAICS 115) sector from the Quarterly Census of Employment and Wages to the total NAICS 115 value reported by BEA to make an estimate.

In 2021, an estimated 58,373 full- and part-time private-sector workers were directly employed by the forest products industry in California (table 17). Importantly, 78 percent of those workers were in the secondary wood products manufacturing (25,531 workers) and secondary paper manufacturing sectors (20,274 workers). Secondary forest products jobs are an important part of the economy, but California's relatively large secondary sector can make comparisons with other states misleading. For example, in 2020, Washington had an estimated 28,154 workers and a timber harvest of 2.9 BBF, or 104 MBF of timber per worker. California, using the same methods for 2021, had about half the timber harvest (1.6 BBF) and almost double the employment, equating to just 28 MBF of timber per worker (Scott et al. 2025).

Since the Great Recession (2007 to 2009), employment in all forest products industry sectors in California has risen, but not by much (fig. 6). Employment is increasing in the forestry support sector across the West because wildland fire suppression and mitigation efforts have increased, and possibly because some workers were reclassified into the sector as roles expanded (Hayes et al. 2021, Scott et al. 2025, Simmons et al. 2021).

Labor income measures the total income reported by workers within a given industrial sector. It includes wages and salaries, benefits, intersector income, and government transfers. Over the past 30 years, labor income across the sector has been volatile compared to employment, especially in the forestry, logging, and wood products manufacturing sectors. Employers frequently add or reduce workers' hours before hiring or firing workers, so this is to be expected.

Inflation-adjusted direct labor income rose 7 percent between 2020 and 2021, with the largest gains found in the primary wood products manufacturing sector (fig. 7). A 14 percent decrease was seen in the forestry and logging sector over the same period. Between 2019 and 2020, the

Table 17—Private sector employment and labor income contributions from California's forest products industry, 2021

Sector	Direct employment	NUMBER OF WORKERS ^B		THOUSAND 2021 DOLLARS		
		Indirect and induced employment ^a	Total employment contribution ^a	Direct labor income	Indirect and induced labor income ^a	Total income contribution ^a
Forestry and logging	4,774	5,770	10,544	\$424,370	\$377,350	\$801,720
Forestry support activities	2,683	840	3,523	\$84,886	\$41,518	\$126,404
Wood product manufacturing	30,261	37,911	68,172	\$1,962,010	\$2,677,555	\$4,639,565
Primary wood product mfg	4,730	7,816	12,546	\$364,693	\$603,420	\$968,113
Secondary wood product mfg	25,531	25,843	51,374	\$1,597,317	\$2,035,941	\$3,633,258
Biomass power generation	381	1,178	1,559	\$257,318	\$312,178	\$569,496
Pulp and paper manufacturing ^c	20,274	28,347	48,621	\$1,933,690	\$2,763,243	\$4,696,933
Secondary paper manufacturing	20,274	28,347	48,621	\$1,933,690	\$2,763,243	\$4,696,933
Total forest industry	58,373	—	—	\$4,662,274	—	—

^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 full- and part-time workers.

^c All paper manufacturing in California is secondary, and very little California-sourced wood fiber is used in the paper that the secondary manufacturers purchase. We include it here to insure our economic analysis methods are similar between states and years.

Sources: USDC BEA (2021a, 2021b, 2023); USDC CB (2021); USDL BLS (2021).

forestry and logging sector saw an increase of nearly 46 percent. Although the effect is less pronounced in California, an increase in labor income between 2019 and 2020 is common throughout the West and is primarily tied to the early days of the COVID-19 pandemic: increased hours per worker, increased pay and bonuses, and increased government transfers (Scott et al. 2025).

Economic Contributions

The forest products industry also supports industries beyond those directly involved in harvesting and manufacturing processes. For example, manufacturing facilities purchase machinery and hire accounting firms, while the wages paid to industry workers are used at the local grocery store and doctor's office. One way to account for these indirect contributions (money spent by forest products companies on products and services in other industries) and induced contributions (money spent by forest products workers) to the economy is with the use of an economic input-output model. We used type I and type II multipliers from the U.S. Bureau of Economic Analysis' RIMS II input-output model to estimate these contributions (table 17).

Wood products manufacturing had the largest employment contribution among the forest industry sectors with more than 68,000 estimated workers (table 17). In 2016, we estimated just 66,000 workers in the same sector. Most of the sector's contributions were in the secondary processing sector (51,374 workers). The second largest sector was the pulp and paper industry at 48,621 workers, but all the jobs were from the from the secondary (paper converting) sector. Note that the wood products manufacturing and pulp and paper industry contributions cannot be added together because they encompass many of the same workers and income. For example, the work of a single logger will be captured as an indirect effect on both the sawmill that a log goes to first and the bioenergy facility that purchases that log's residuals from the sawmill.

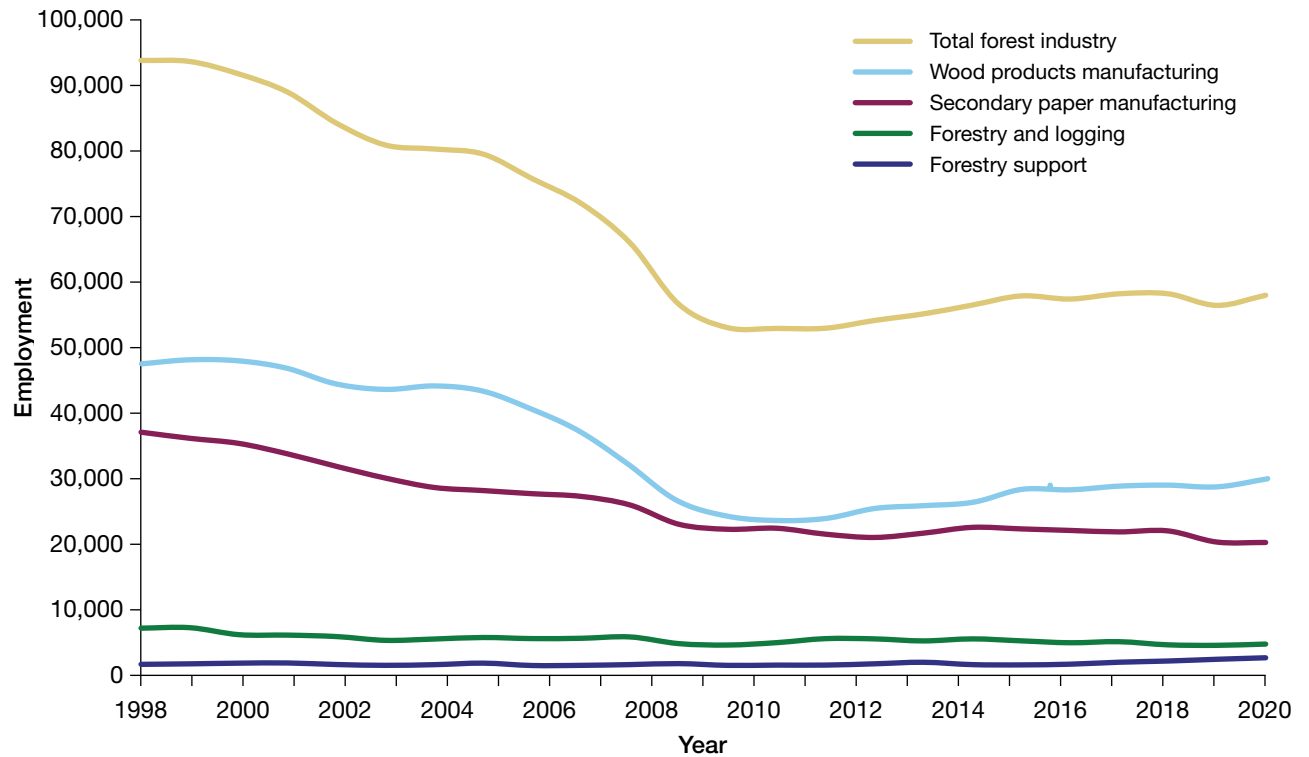


Figure 6—Employment (number of full- and part-time workers) in California's private wood products industry by sector, 1998–2021.

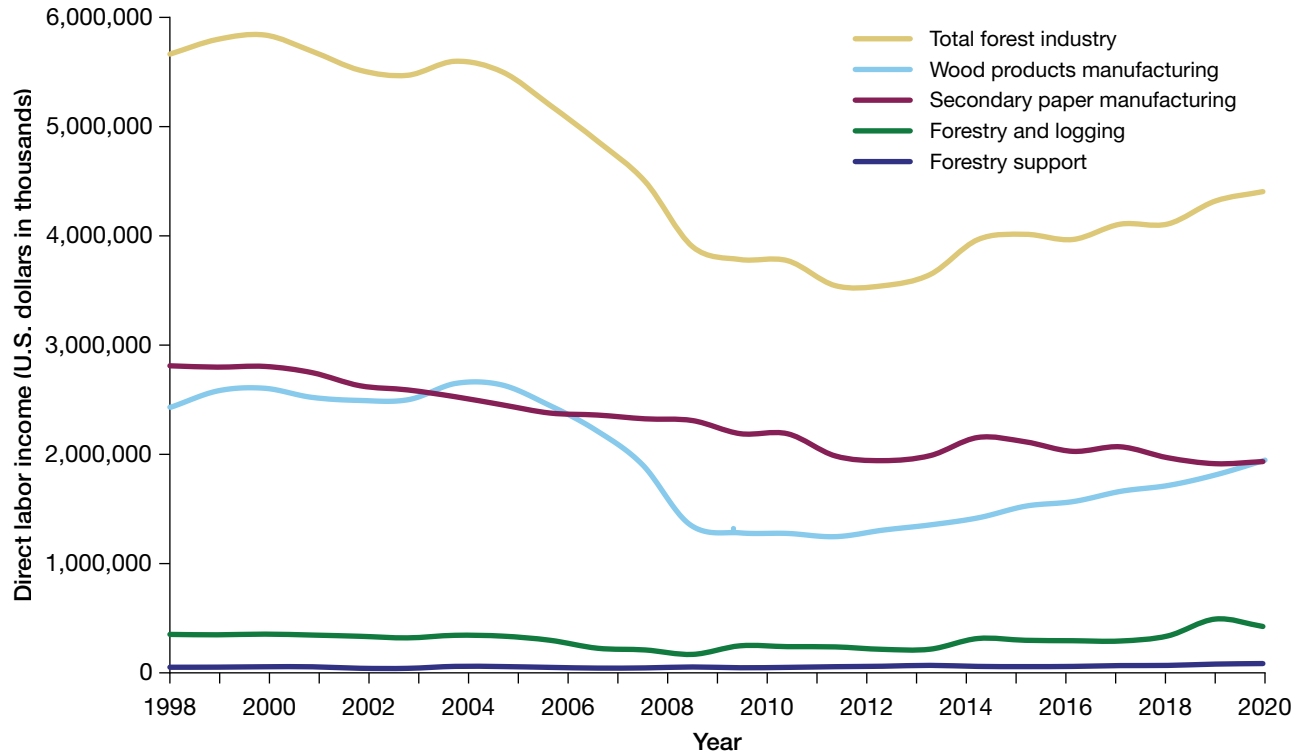


Figure 7—California wood products industry direct labor income by sector, 1998–2021.

Future Projections for California

Large wildfires, state and federal forest policy, and emerging technologies and markets will likely continue to be the primary factors driving change in California's wood products industry, as they did in the early 2020s. Catastrophic wildfire has changed the landscape of forest management in California. From 2018 to 2021, more than 21 million acres of productive forest land burned in California from fires ranging in size from 10,000 to more than 1 million acres; this includes more than 1.5 million acres of high-severity fire (Mason, Bruce and Girard, Inc. 2023). These fires have substantial effects on current and future timber harvest, including short-term increases in harvest from fire recovery and salvage activities as well as long-term decreases in green sawtimber volume on private and public land (Mason, Bruce and Girard, Inc. 2023). This wood-supply uncertainty can increase uncertainty in timber availability and risk for sawmills and other wood products manufacturing facilities, potentially affecting business viability into the future.

State and federal governments have increased efforts to increase forest management and reduce fuels on public and private land in California. In 2020, the state of California and the Forest Service signed a memorandum of understanding to treat 1 million acres of forest statewide each year for wildfire risk reduction and forest resilience (USDA FS 2021). The California Department of Forestry and Fire Protection's grant programs, funded with revenue from the state's compliance carbon market, has invested more than \$100 million annually since 2016 in forest health and fuels reduction projects (Cal Fire 2024b, 2024c). The U.S. Department of Agriculture has also invested hundreds of millions of dollars in forest management on priority landscapes in California through the 10-Year Strategy to Confront the Wildfire Crisis, with some of the funding authorized by the 2021 Bipartisan Infrastructure Law and the 2022 Inflation Reduction Act (Freeman 2023, USDA FS 2022). These activities are expected to produce a significant volume of nonsawlog biomass in addition to sawtimber (Porter and Longcor 2020).

Wildfire and economic conditions threaten the viability of existing wood processing infrastructure. Markets for sawmill residuals have been in jeopardy for decades.

The state's last pulp mill closed in 2008, the last composite board facility closed in 2021 after a facility fire, and many bioenergy facilities are facing policy and investment issues that may result in closures by the early 2030s. However, state and federal policy and investment, along with an increased interest in forest management from nontraditional sectors such as technology and finance, are working to create conditions for new wood-utilizing businesses to succeed.

Technological advancements in biomass-based products, policies such as California's Low-Carbon Fuel Standard, and the projected increase in low-value forest biomass availability throughout the state could be associated with business proposals to build facilities that produce low-carbon biofuels. This could include aviation fuel, hydrogen, and high-value-added carbon materials (HVCMs), with the potential for providing a market for sawmill residuals and forest biomass into the future (Baker et al. 2020, Cabiyo et al. 2021).

In addition, multiple businesses began developing small industrial sawmills between 2021 and 2024 in coordination with various state and federal support programs, ranging in size from 3 to 20 MMBF Scribner of annual log processing (Cal Fire 2024d, CDOC 2023, USDA FS 2024b). These smaller mills can support and boost local forest management and processing capacity in areas with lower capacity. As new businesses develop and forest conditions change, we may see an increase in wood processing infrastructure in the future focused on smaller sawmill facilities and new energy products.

Acknowledgments

The authors gratefully acknowledge the financial support of the U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Forest Inventory and Analysis program in Portland, Oregon. We thank all the participating wood products facility owners, managers, and other staff who took the time to provide detailed information about their operations. In addition, we are grateful to our cooperators and multiple reviewers of the tables and manuscript for this report, including Y.G. Gentry of the California Forestry Association, and Nadia Tase and Sam Evans of the California Department of Forestry and Fire Protection.

Metric Equivalents

When you know:	Multiply by:	To find:
Acres	0.405	Hectares
Cubic feet	0.028	Cubic meters
Tons	907	Kilograms

Species List

Common name	Scientific name	Authority
White fir	<i>Abies concolor</i>	(Gord. & Glend.) Lind. ex Hildebr.
California red fir	<i>Abies magnifica</i>	A. Murray bis
Noble fir	<i>Abies procera</i>	Rehder
Incense cedar	<i>Calocedrus decurrens</i>	(Torr.) Florin
Port Orford cedar	<i>Chamaecyparis lawsoniana</i>	(A. Murray bis) Parl.
Lodgepole pine	<i>Pinus contorta</i>	Douglas ex Loudon
Jeffrey pine	<i>Pinus jeffreyi</i>	Balf.
Sugar pine	<i>Pinus lambertiana</i>	Douglas
Western white pine	<i>Pinus monticola</i>	Douglas ex D. Don
Ponderosa pine	<i>Pinus ponderosa</i>	Lawson & C. Lawson
Douglas-fir	<i>Pseudotsuga menziesii</i>	(Mirb.) Franco
Various oaks	<i>Quercus</i> spp.	Linnaeus
Coast redwood	<i>Sequoia sempervirens</i>	(Lamb. ex D. Don) Endl.
Western redcedar	<i>Thuja plicata</i>	Donn ex D. Don
Western hemlock	<i>Tsuga heterophylla</i>	(Raf.) Sarg.

Source: USDA (n.d.).

References

- Baker, S.E.; Stolaroff, J.K.; Peridas, G. [et al.]. 2020.** Getting to neutral: options for negative carbon emissions in California. Tech. Rep. LLNL-TR-796100. Livermore, CA: Lawrence Livermore National Laboratory. 178 p.
- Brodie, L.C.; Palmer, M. 2020.** California's forest resources, 2006–2015: 10-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-983. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 68 p. <https://doi.org/10.2737/pnw-gtr-983>.
- Cabiyo, B.; Fried, J.S.; Collins, B.M. [et al.]. 2021.** Innovative wood use can enable carbon-beneficial forest management in California. *Proceedings of the National Academy of Sciences*. 118(49). <https://doi.org/10.1073/pnas.2019073118>.
- California Department of Conservation [CDOC]. 2023.** Forest Biomass to Carbon-Negative Biofuels Pilot Program. <https://www.conservation.ca.gov/cgs/fbp>. (May 30, 2024).
- California Department of Forestry and Fire Protection [Cal Fire]. 2024a.** 2021 Incident archive. <https://www.fire.ca.gov/incidents/2021>. (September 1, 2024).
- California Department of Forestry and Fire Protection [Cal Fire]. 2024b.** Forest health grants. <https://www.fire.ca.gov/what-we-do/grants/forest-health>. (May 30, 2024).

- California Department of Forestry and Fire Protection [Cal Fire]. 2024c.** Wildfire protection grants. <https://www.fire.ca.gov/what-we-do/grants/wildfire-prevention-grants>. (May 30, 2024).
- California Department of Forestry and Fire Protection [Cal Fire]. 2024d.** Annual report, 2023 calendar year. Sacramento, CA: Wood Products and Bioenergy Team, Climate and Energy Program. 13 p.
- California Public Utilities Commission [CPUC]. 2016.** Commission motion authorizing procurement from forest fuelstock bioenergy facility supplied from high hazard zones for wildfires and falling trees pursuant to the governor's emergency proclamation. Resolution E-4770. Sacramento, CA: California Public Utilities Commission, Energy Division. 19 p.
- California Public Utilities Commission [CPUC]. 2024.** Bioenergy Renewable Auction Mechanism (BioRAM) Program. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/rps/rps-procurement-programs/rps-bioram>. (May 30, 2024).
- Dillon, T.; Morgan, T.A. 2023.** Pacific coast temperate forest regional timber product flow analysis. Gen. Tech. Rep. PNW-GTR-1017. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 47 p. <https://doi.org/10.2737/PNW-GTR-1017>.
- Freeman, A. 2023.** USDA Forest Service launches new efforts in California to address the wildfire crisis. Press release. Vallejo, CA: U.S. Department of Agriculture, Forest Service.
- Hayes, S.W.; Bingaman, C.A.; Morgan, T.A. [et al.]. 2021.** The Four Corners timber harvest and forest products industry, 2016. Resour. Bull. RMRS-RB-34. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p. <https://doi.org/10.2737/RMRS-RB-34>.
- IHI Power Services Corp. 2017.** California biomass: biomass energy, cleaning the air, reducing greenhouse gas, minimizing waste. 2017 Western Statewide Wood Energy Team Forum. <https://ucanr.edu/sites/swet/files/274504.pdf>. (May 30, 2024).
- Keegan, C.E., III; Morgan, T.A.; Blatner, K.A.; Daniels, J.M. 2010.** Trends in lumber processing in the Western United States. Part II: overrun and lumber recovery factors. Forest Products Journal. 60(2): 140–143. <https://doi.org/10.13073/0015-7473-60.2.140>.
- Li, S.; Banerjee, T. 2021.** Spatial and temporal pattern of wildfires in California from 2000 to 2019. Scientific Reports. 11: 8779. <https://doi.org/10.1038/s41598-021-88131-9>.
- Marcille, K.C.; Morgan, T.A.; McIver C.P.; Christensen, G.A. 2020.** California's forest products industry and timber harvest, 2016. Gen. Tech. Rep. PNW-GTR-994. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 58 p.
- Mason, Bruce and Girard, Inc. 2023.** Long-term economic impacts of large fires in California from 2018–2021: losses and opportunities. Portland, OR. 68 p.
- McIver, C.P.; Meek, J.P.; Scudder, M.G. [et al.]. 2015.** California's forest products industry and timber harvest, 2012. Gen. Tech. Rep. PNW-GTR-908. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 49 p. <https://doi.org/10.2737/PNW-GTR-908>.
- Morgan, T.A.; Brandt, J.P.; Songster, K.E. [et al.]. 2012.** California's forest products industry and timber harvest, 2006. Gen. Tech. Rep. PNW-GTR-866. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p. <https://doi.org/10.2737/PNW-GTR-866>.

- Morgan, T.A.; Keegan, C.E., III; Dillon, T. [et al.]. 2004.** California's forest products industry: a descriptive analysis. Gen. Tech. Rep. PNW-GTR-615. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55 p. <https://doi.org/10.2737/PNW-GTR-615>.
- Morris, G. 2000.** Biomass energy production in California: the case for a biomass policy initiative. Sub. Rep. NREL/SR-570-28805. Golden, CO: U.S. Department of Energy, National Renewable Energy Laboratory. 99 p.
- Porter, D.; Longcor, R. 2020.** Accelerating forest restoration: stimulating a forest-restoration economy and rebuilding resilience in California's fire-adapted forests. The Nature Conservancy and Bain & Company. 24 p. https://www.scienceforconservation.org/assets/downloads/tnc_AFR_v9.pdf. (March 7, 2025).
- Prestemon, J.P.; Holmes, T.P. 2008.** Timber salvage economics. In: Holmes, T.P.; Prestemon, J.P.; Abt, K.L., eds. The economics of forest disturbances, wildfires, storms, and invasive species. New York: Springer Science + Business Media B.V: 167–190. Chapter 9. https://doi.org/10.1007/978-1-4020-4370-3_9.
- Prestemon, J.P.; Wear, D.N.; Stewart, F.J.; Holmes, T.P. 2006.** Wildfire, timber salvage, and the economics of expediency. *Forest Policy and Economics*. 8(3): 312–322. <https://doi.org/10.1016/j.forpol.2004.07.003>.
- Scott, S.G.; Koch, L.P.; Simmons, E.A. [et al.]. 2025.** Washington's forest products industry and timber harvest, 2020. Gen. Tech. Rep. PNW-GTR-1032. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 21 p. <https://doi.org/10.2737/pnw-gtr-1032>.
- Simmons, E.A.; Marcille, K.C.; Lettman, G.J. [et al.]. 2021.** Oregon's forest products industry and timber harvest 2017 with trends through 2018. Gen. Tech. Rep. PNW-GTR-997. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 63 p.
- Simmons, E.A.; Scott, S.G.; Morgan, T.A. [et al.]. 2024.** Timber basket of the Interior West: Idaho's forest products industry and timber harvest, 2019, with trends through 2021. Resour. Bull. RMRS-RB-38. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 51 p. <https://doi.org/10.2737/RMRS-RB-38>.
- U.S. Department of Agriculture [USDA]. [N.d.].** PLANTS database. <https://plants.usda.gov/home>. (March 10, 2025).
- U.S. Department of Agriculture, Forest Service [USDA FS]. 2021.** Memorandum of understanding for the purpose of increasing the use of fire to meet ecological and other management objectives including the protection of public health and community safety. Forest agreement 21-MU-11052012-162. Washington, DC. 19 p.
- U.S. Department of Agriculture, Forest Service [USDA FS]. 2022.** Confronting the wildfire crisis: a strategy for protecting communities and improving resilience in America's forests. Report FS-1187a. Washington, DC. 25 p.
- U.S. Department of Agriculture, Forest Service [USDA FS]. 2024a.** EVALIDator Version 2.1.2. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. <https://apps.fs.usda.gov/fiadb-api/evalidator>. (April 7, 2025).
- U.S. Department of Agriculture, Forest Service [USDA FS]. 2024b.** 2022 wood innovations grant recipients. <https://www.fs.usda.gov/science-technology/energy-forest-products/wood-innovation-2022-grant-recipients>. (April 7, 2025).
- U.S. Department of Commerce, Bureau of Economic Analysis [USDC BEA]. 2021a.** Total full-time and part-time employment by industry (REA). <https://www.bea.gov/data/economic-accounts/regional>. (October 1, 2023).
- U.S. Department of Commerce, Bureau of Economic Analysis [USDC BEA]. 2021b.** Personal income by major component and earning by industry (REA). <https://www.bea.gov/data/economic-accounts/regional>. (October 1, 2023).

U.S. Department of Commerce, Bureau of Economic Analysis [USDC BEA]. 2023. Regional Input-Output Modeling System (RIMS II). <https://apps.bea.gov/regional/rims/rimsii>. (October 1, 2023).

U.S. Department of Commerce, Census Bureau [USDC CB]. 2021. County business patterns data. <https://www.census.gov/programs-surveys/cbp/data.html>. (October 1, 2023).

U.S. Department of Labor, Bureau of Labor Statistics [USD L BLS]. 2021. Quarterly census of employment and wages. <https://www.bls.gov/cew/>. (October 1, 2023).

Pacific Northwest Research Station

Website	https://research.fs.usda.gov/pnw
Telephone	(503) 808-2100
Publication requests	(503) 808-2138
FAX	(503) 808-2130
E-mail	sm.fs.pnw_pnwpubs@usda.gov
Mailing address	Publications Distribution Pacific Northwest Research Station USDA Forest Service 1220 SW 3rd Avenue Portland, OR 97204



Federal Recycling Program
Printed on Recycled Paper

Pacific Northwest Research Station
USDA Forest Service
1220 SW 3rd Ave., Suite 1400
Portland, OR 97204

Official Business
Penalty for Private Use, \$300

