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Oregon's Forest Products Industry and Timber Harvest, 2003

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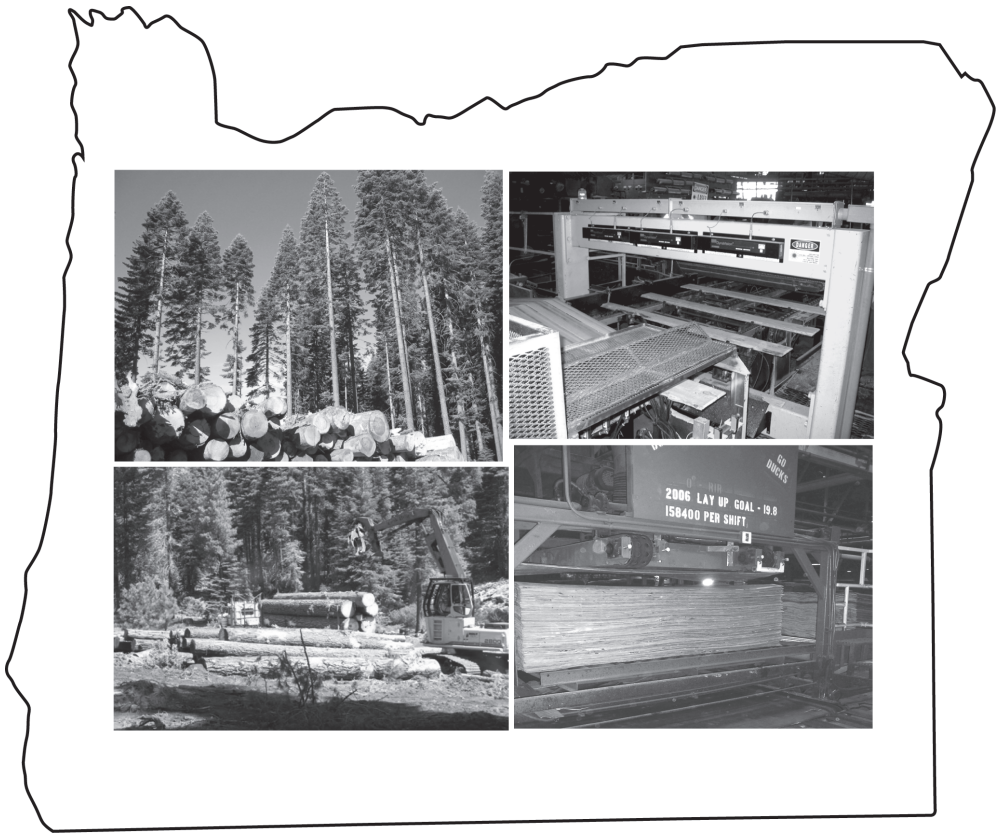

The **Forest Service** of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the national forests and national grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

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Abstract

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This report traces the flow of Oregon's 2003 timber harvest through the primary timber-processing industry and describes its structure, operations, and condition. Pulp and board, lumber, and plywood and veneer sectors accounted for 96 percent of total industry sales of $6.7 billion. Oregon's 2003 timber harvest of just over 4 billion board feet was 95 percent softwood species; 65 percent of the total was Douglas-fir. As a result of improved technology, lumber overrun increased 32 percent since 1988 to 2.07 board feet lumber tally per board foot Scribner of timber input. Despite decreases in amount of timber harvested, the industry has remained important to Oregon's workforce: average earnings for a worker in Oregon forest products industry was about $50,200; Oregon's average for all industries was $32,400.

Keywords: Employment, lumber overrun, mill residue, timber-processing capacity, wood products.

Report Highlights

- A total of 249 facilities were identified as operating in Oregon during 2003:
  - 126 lumber facilities
  - 33 plywood and veneer plants
  - 25 house log manufacturers
  - 23 pulp and board facilities
  - 18 chipping, bark products, fuel pellets, and energy plants
  - 12 log furniture, cedar products, export, and engineered wood products manufacturers
  - 12 post, pole, piling, and utility pole manufacturers
- Total sales value for Oregon's primary forest products was about $6.7 billion in 2003, with pulp and reconstituted board products accounting for 37 percent and lumber accounting for 33 percent of sales. The Far Western States received the largest proportion (41 percent) of the products, and 30 percent were sold within Oregon.
- Three sectors accounted for 96 percent of industry sales: pulp and board, lumber, and plywood and veneer.
- The state's timber-processing capacity decreased more than 40 percent between 1986 and 2003. However, since 1996, capacity increased nearly 15 percent. Approximately 23 percent of Oregon's timber-processing capacity (excluding pulpwood and industrial fuelwood) can utilize trees less than 10 inches diameter at breast height.
- Oregon's timber harvest during 2003 was just over 4 billion board feet and increased to just under 4.5 billion board feet during 2004 (Andrews and Kutara 2005). In 2003, softwood species made up 95 percent of the volume harvested, while hardwoods made up the remaining 5 percent. Douglas-fir was the primary species harvested, making up 65 percent of the total harvest.
- Oregon's forests supplied approximately 84 percent of the timber utilized by Oregon mills in 2003.
- Oregon is the leading producer of softwood lumber and structural panels in the United States.
- Oregon sawmills recovered 2.07 board feet lumber tally per board foot of Scribner input, which is a 32-percent increase since 1988. The increase in overrun can be attributed to greater use of small-diameter timber and increased milling efficiencies.
- During 2003, Oregon's average worker earnings across all industries was $32,400, while for the forest products industry the figure was close to $50,200.

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Introduction

This report describes the composition, operation, and condition of Oregon's primary forest products industry during 2003, and discusses timber harvest with brief comparisons to inventory and growth. The report also discusses long-term historical trends and trends since 1968 and 2000. Products directly manufactured from timber, also referred to as "primary products," include lumber, plywood, veneer, posts and poles, pilings and timbers, and cedar shakes and shingles. Products made from chipping or grinding timber, as well as from the residues (e.g., bark, sawdust, and planer shavings) generated in the production of primary products, also are included. These "reconstituted" primary products include pulp and paper, particleboard, medium-density fiberboard, and energy. Derivative, or "secondary" products (goods made from primary products) such as window frames, doors, trusses, and furniture are not included in this report.

The foremost source of data for this report is a statewide census of Oregon's primary forest products industry and out-of-state mills that received timber from Oregon during calendar year 2003. Firms were identified through telephone directories, directories of the forest products industries (Paperloop 2004, Random Lengths 2002-2005), and with the assistance of the Oregon Department of Forestry (ODF) and the Oregon Forest Industry Council. Firms cooperating in the 2003 Oregon census, including exporters and out-of-state mills, processed virtually all of Oregon's commercial timber harvest. Inventory data, including standing volumes and growth, were provided by the USDA Forest Service, Pacific Northwest (PNW) Research Station's Forest Inventory and Analysis (FIA) Program. Other data sources were used to provide historical and 2004 information.

This census of Oregon timber processors represents a cooperative effort between University of Montana's Bureau of Business and Economic Research (BBER) and the PNW-FIA Program. The BBER, in cooperation with the FIA programs in the Rocky Mountain and PNW Research Stations, developed the Forest Industries Data Collection System (FIDACS) to collect, compile, and make available state- and county-level information on the operations of the forest products industry. The FIDACS is based on a census of primary forest product manufacturers located in a given state. Through a written questionnaire or phone interview, manufacturers provide the following information for each of their plants for a given calendar year:

- Plant production, capacity, equipment, and employment
- Volume of raw material received, by county and ownership
- Species of timber received and live/dead proportions
- Finished product volumes, types, sales value, and market locations
- Utilization and marketing of manufacturing residue

This effort is the first complete application of FIDACS in Oregon. The BBER and the Forest Service research stations have been conducting censuses in the Rocky Mountain and Pacific Coast States periodically for almost 30 years. The state of Washington, in cooperation with the PNW Research Station, reports on periodic surveys of that state's industry.

Information collected through FIDACS is 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.

Historical Overview of Oregon's Forest Products Industry

Since 1827, when the first known sawmill west of the Mississippi River was built near Fort Vancouver, Oregon's forest products industry has been producing lumber and other wood products (Andrews and Kutara 2005). By the mid 1800s, coincident with a shift from log cabins to homes built of sawn lumber, the industry began to grow rapidly. By 1900, the wood products industry had assumed a major role in the state's economy. During the late 1920s and early 1930s, timber harvests plummeted when the Great Depression severely curtailed demand for Oregon's lumber (fig. 1) (Andrews and Kutara 2005). By 1938, however, the lumber markets had recovered enough for Oregon to become the leading producer of logs in the United States. Fueled by the onset of World War II, demand remained strong until the war ended in 1945.

Operating Environment: 1945-1989

Following World War II, timber harvests continued to increase in response to demand for lumber needed for large increases in U.S. home building. By 1961, more than "one-fifth of the nation's sawtimber supply was in Oregon forests, [supplying] about one-fourth of the softwood lumber, half of the plywood and more than one-fourth of the hardboard produced in the United States" (Miller 1982). Along with increasing harvests came a concern about sustaining the state's timber supply. To address these concerns the Oregon

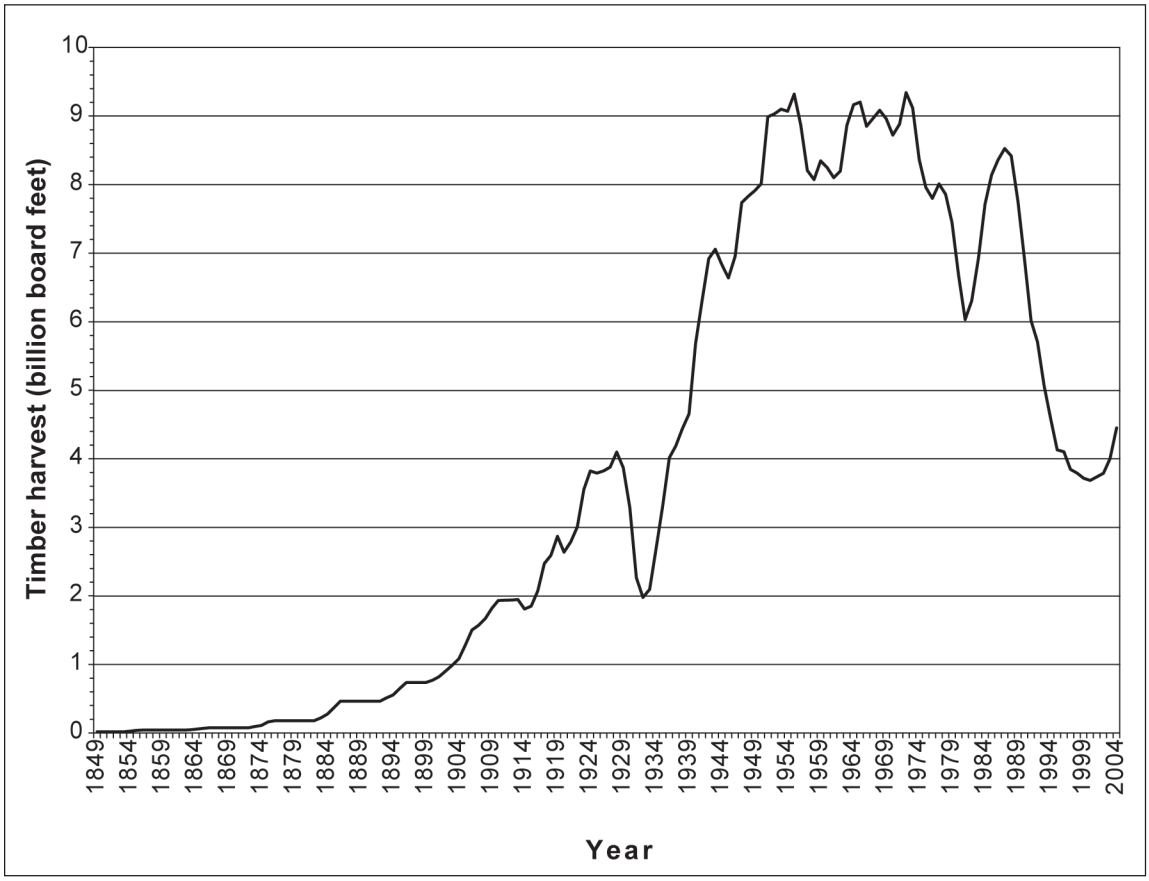

Figure 1—Oregon timber harvest 1849-2004 (3-year rolling average). Source: Andrews and Kutara 2005.

Forest Conservation Act was passed in 1941, and a much stronger Oregon Forest Practices Act was implemented in 1972. Much of the second- and third-growth timber being harvested today was reforested under the auspices of these laws. Oregon's wood products industries diversified with rapid growth in the pulp and board and plywood industries, and from 1945 through 1972, annual softwood plywood production in Oregon increased from 323 million square feet (MMSF) to 8,635 MMSF.[1]

Timber harvesting and wood product manufacturing remained at high levels through the early 1970s, driven by robust markets, large inventories of older stands on forest industry lands, and strong timber sales from federal forests managed by the USDA Forest Service (USFS) and Bureau of Land Management (BLM). By the late 1970s, falling inventories of mature timber on

[1] Adair, Craig. 2005. Personal Communication. Market Research Director, The Engineered Wood Association (APA). P.O. Box 11700, Tacoma, WA 98411.

forest industry lands and declining sale volumes from federal lands began to constrain harvest. During this period, log exporters competed strongly with mills for Oregon timber as exports from Oregon's custom districts climbed from 147 million board feet (MMBF) in 1962 to 944 MMBF by 1976 (Ruderman 1978).

Stalwart appetites for Oregon's lumber and other wood products collapsed in late 1979. Very high oil prices and federal economic policies to combat inflation resulted in high interest rates, a deep recession, and weak commercial construction and housing demand. By 1981, timber harvests had fallen to 5.7 billion board feet from a 1970s high of 9.7 billion board feet in 1972. By 1983, U.S. commercial construction and housing markets improved and timber harvesting and wood products manufacturing strengthened. By the mid 1980s, timber harvest levels had increased to 8.5 billion board feet, approaching average levels of the previous three decades. With strengthening log prices in the late 1980s (fig. 2) and substantial uncut volumes under contract on federal land as a result of weak markets of the early 1980s, timber harvests and forest products production remained strong. Oregon log exports continued to strengthen, increasing to 1.4 billion board feet in 1988. Major shifts in the industry were beginning to occur during this period as pressure grew to limit log exports, market share for substitute products (i.e., oriented strand board [OSB]) increased, and environmental issues began to gain traction.

Operating Environment: 1990 and Beyond

In the late 1980s and 1990s, forest health, aesthetics, recreation, biodiversity, old-growth preservation, livability, and other values became increasingly important drivers of forest management in Oregon. This shift in values was implemented in a way that severely constrained timber harvesting from public forests. Listing of the northern spotted owl (*Strix occidentalis*) as a threatened species in 1990, the listing of the marbled murrelet (*Brachyramphus marmoratus*) in 1992, and the listings of various salmon (*Oncorhynchus* spp.), trout (*Salvelinus confluentus*), and steelhead (*Oncorhynchus mykiss*) all resulted in removals of forest land from the timber base and in additional harvest restrictions on much of the remaining lands open to timber harvesting. Administrative appeals, litigation, and restrictions on operating in roadless areas further decreased harvest levels.

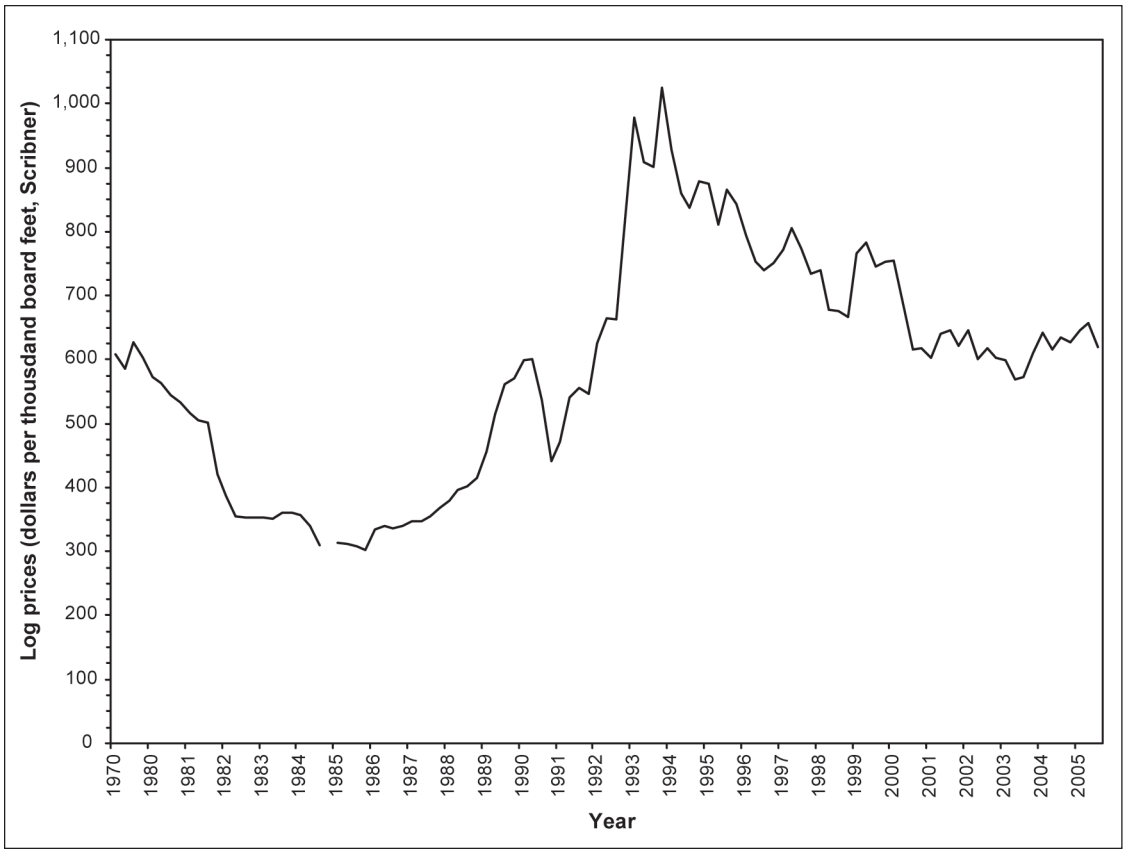

Figure 2—Quarterly adjusted softwood log prices in 2005 dollars 1979-2005. Source: Oregon Department of Forestry 2005.

By the early 2000s, federal timber sales had fallen to extremely low levels, and large volumes were no longer under contract. Timber harvests from federal land fell to less than 10 percent of historical levels. With harvests from industrial lands limited by an inventory dominated by young but well-stocked stands, nonindustrial private forest land (NIPF) owners increased harvests to take advantage of strong timber prices, and log exports fell. In little more than a decade, the federal share of Oregon's timber harvest fell from more than 50 percent of the harvest to 5 percent (fig. 3).

In little more than a decade, the federal share of Oregon's timber harvest fell from more than 50 percent of the harvest to 5 percent.

In 1999, product markets improved considerably owing to the U.S. economy's continued strong performance and some improvement in the global economy. However, this produced a short-lived spike in log prices, and—with a U.S. recession in 2001 and falling log exports and plywood production—timber harvesting levels remained at historically low levels. Lumber production, however, continued at relatively high levels, driven by surprisingly strong U.S. home building and decreased log exports allowing a greater proportion of the harvest to go to sawmills.

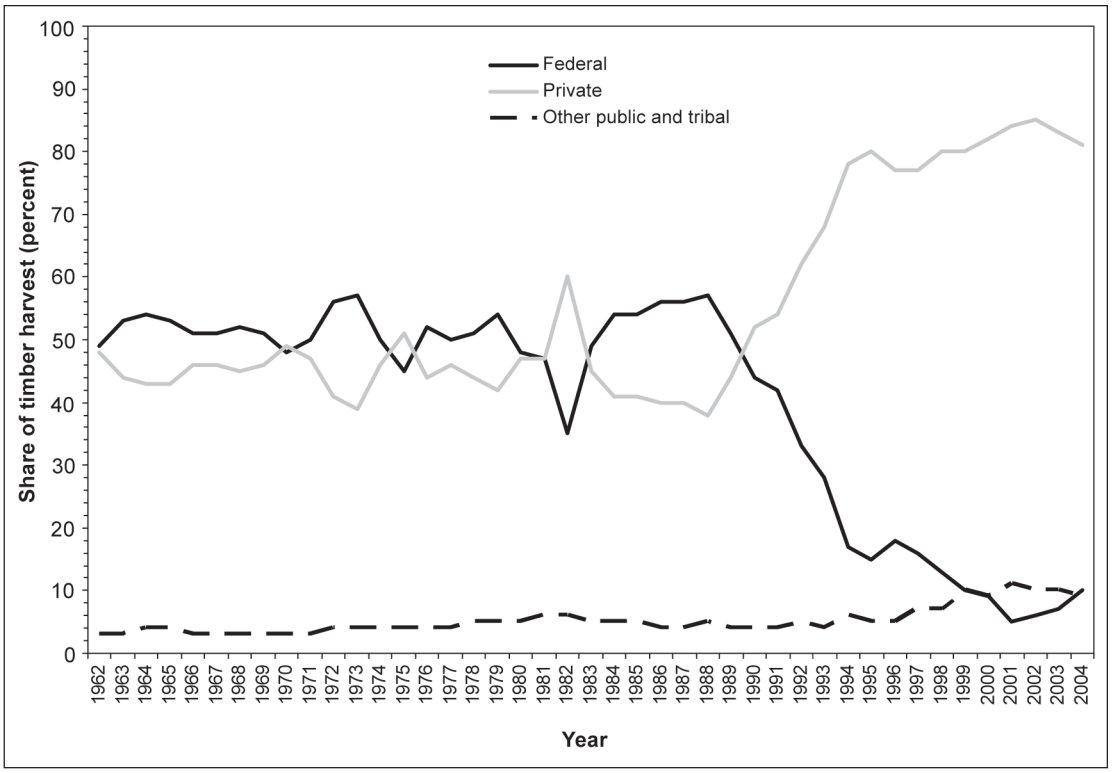

Figure 3—Changing shares of Oregon timber harvest 1962-2004. Source: Andrews and Kutara 2005.

With low interest rates and high demand for housing in the United States, there has been resurgence in Oregon's forest products industry. Lumber production continues at historically high levels, and—supported by increasing federal and NIPF harvesting—Oregon's total timber harvest has increased from the low of 2001. Despite harvests below historical levels on federal land, Oregon still remains the leader in lumber production in the United States (WWPA 2005).

Oregon's Timber Harvest, Products, and Flow

Similar timber harvest characterizations are available from several sources, including ODF (2003) and the PNW Research Station (Howard 1984; Howard and Hiserote 1978; Howard and Ward 1988, 1991; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000), and these sources were used for historical comparisons. Small differences may exist between the numbers published here and those published by other sources. These differences are often due to varying reporting units and conversion factors, rounding error, and scaling discrepancies among timber sellers and between sellers and buyers, as well as other reporting variations.

Standing volume and growth were calculated by PNW-FIA for all nonreserved timberland. Total aboveground stem volume and growth, net of cull and mortality, was calculated on a cubic-foot basis for all trees larger than 1 inch diameter at breast height (d.b.h.). Scribner board-foot volume, net of mortality, was calculated for all trees larger than 10 inches d.b.h. Growth-to-harvest ratios reported here were calculated on a board-foot basis.

Oregon Timberlands

Oregon has approximately 61.4 million acres of land area, of which 30.2 million acres are classified as forest land (Campbell et al. 2004). Of the approximately 30.2 million acres in Oregon classified as forest land, about 23.0 million acres (76 percent) are classified as timberland, 2.6 million acres are reserved from timber harvesting, and another 4.6 million acres are "available" other forest land (Campbell et al. 2004). Of nonreserved timberland in Oregon, the forest industry owns nearly 5.8 million acres (21 percent), NIPF landowners hold almost 3.0 million acres (13 percent), and public lands account for 14.2 million acres (62 percent) (fig. 4). Approximately 14.4 million acres of forest land in Oregon are managed by the USDA Forest Service in national forests, and about 75 percent (10.9 million acres) of that forest land is nonreserved timberland.

Ownership distribution of standing (live) timber volume differs slightly from land ownership. Total standing volume on Oregon's nonreserved timberland is approximately 77.8 billion cubic feet, with trees greater than 10 inches d.b.h. accounting for approximately 70.8 billion cubic feet (319.1 billion board feet, Scribner) or 91 percent (Campbell et al. 2004). The majority (52 percent) of the volume of trees greater than 10 inches d.b.h. is in national forests, whereas 10 percent is on NIPF and tribal lands, 19 percent is located on industrial land, and 19 percent is on other public lands (Campbell et al. 2004).

Harvest by Ownership

During 2003, slightly more than 4 billion board feet of timber was harvested from forests in Oregon and sent to mills for processing. Most (84.5 percent) of the timber harvested from Oregon timberlands in 2003 came from industrial, NIPF, and tribal timberlands (table 1). State forests accounted for 7.2 percent of the harvest, national forests accounted for 5 percent, and BLM and other public sources combined made up the remaining 3.2 percent.

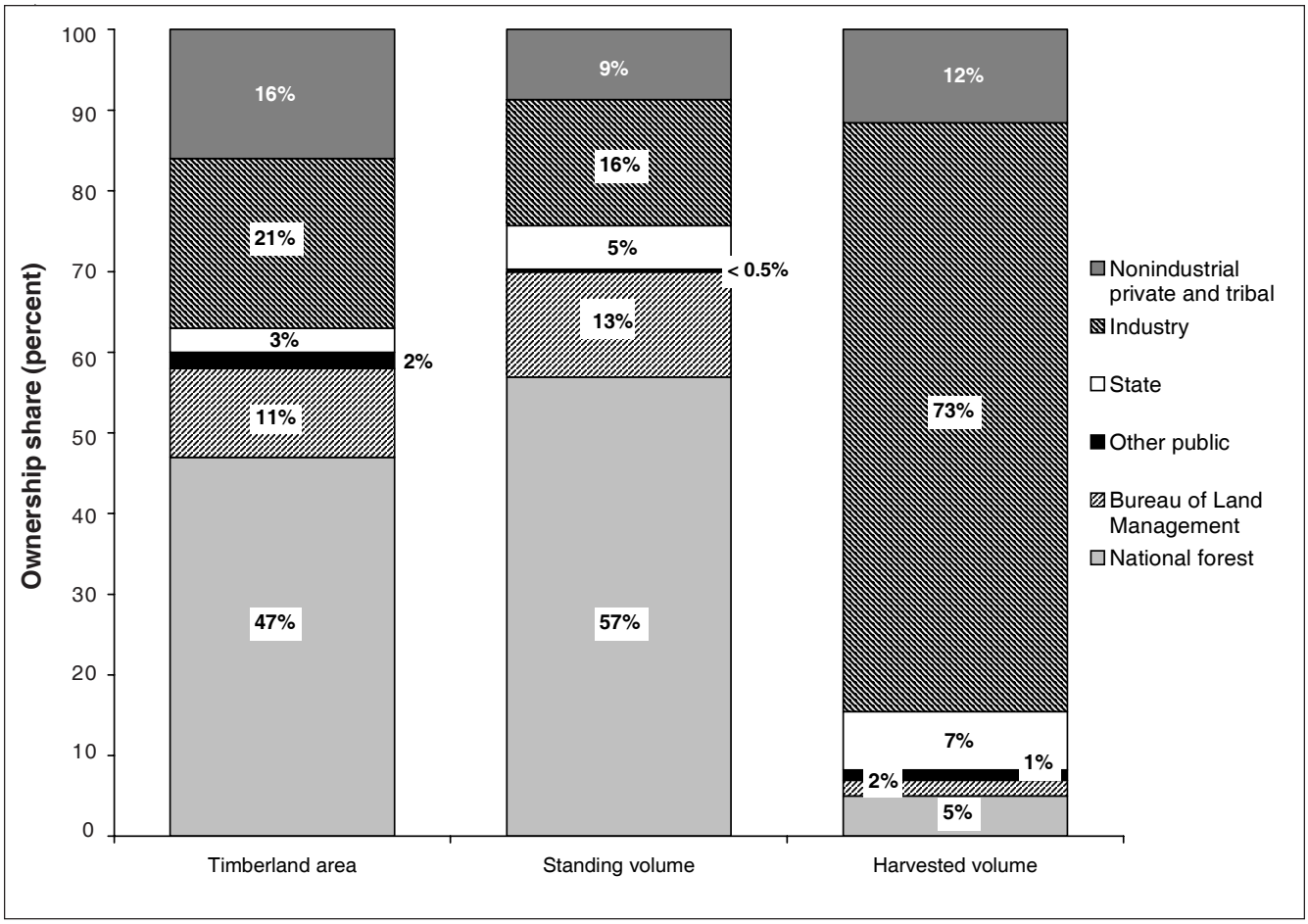

Figure 4—Characteristics of Oregon's nonreserved timberland by ownership class, 2003.

Table 1—Oregon timber harvest, standing volume, growth, and growth:harvest ratio by ownership, 2003

	Harvest		Standing		Growth		
Ownership	**Volume**	**Percentage of total**	**Volume**	**Percentage of total**	**Volume**	**Percentage of total**	**Growth: harvest**
	MMBF[a]	*Percent*	*MMBF*[a]	*Percent*	*MMBF*[a]	*Percent*	
Industry	2,960.7	73.0	52,321	15.6	2,360	28.4	0.8
Nonindustrial private and tribal	468.1	11.5	29,249	8.7	939	11.3	2.0
State	292.8	7.2	18,261	5.4	646	7.8	2.2
National forest	202.8	5.0	191,417	56.9	3,262	39.3	16.1
Bureau of Land Management	78.4	1.9	43,657	13.0	1,069	12.9	13.6
Other public	52.3	1.3	1,220	.4	34	.4	.7
Total	4,055.2	100	336,125	100	8,310	100	2.0

[a] Volume in million board feet Scribner log rule.

Oregon's 2003 timber harvest was roughly 99 percent of the average annual harvest for the previous 10 years, but only 57 percent of the 40-year average (fig. 5). Reductions in national forest harvests taking place since the late 1980s led to the decline in Oregon's overall timber harvest and caused a distinct shift in the proportion of timber harvested from public versus private sources in Oregon. From 1993 to 2003, timber harvests from national forests in Oregon averaged 405 MMBF annually, less than 10 percent of the state's total annual harvest; whereas between 1962 and 1992, national forest timber harvests in Oregon averaged 3,045 MMBF annually, 38 percent of the state's total annual harvest. The shift away from national forests as a nearly equal provider of timber means that today more than 80 percent of timber harvested in Oregon is coming from less than 40 percent of the state's nonreserved timberlands.

The 4 billion board foot harvest during 2003 represents 1.2 percent of the approximately 336 billion board feet of standing volume greater than 10 inches d.b.h. At the state level, growth exceeded harvest, with a 2:1 growth-to-harvest ratio across all ownerships (table 1). Growth exceeded harvest for each ownership class (i.e., NIPF and tribal, state, national forest, and BLM) except for industry and other public, which had 0.8:1 and 0.7:1 growth-to-harvest ratios, respectively. Growth-to-harvest ratios for federal lands were substantially higher than other ownerships, at 14:1 for the BLM, and 16:1 for national forests. Growth-to-harvest ratios are an approximate measure of sustainable production (Smith et al. 2001). Growth-to-harvest ratios of less than 1 indicate that harvest is exceeding growth, which, if continued in the long run, would lead to a reduction in standing volume, and could be considered overcutting. Growth-to-harvest ratios greatly in excess of 1 indicate that growth is rapidly outpacing harvest, and could create higher potential for insects, disease, wildfire, and increased mortality in the long run (O'Laughlin and Cook 2003).

Growth exceeded harvest for each ownership class except for industry and other public. Growth-to-harvest ratios for federal lands were substantially higher than other ownerships, at 14:1 for the BLM, and 16:1 for national forests.

During 2004, 4,451 MMBF Scribner log scale of timber was harvested in Oregon (Andrews and Kutara 2005). The majority of the harvest (84 percent) in 2004 came from private lands, whereas 10 percent came from federal lands, and the remaining 9 percent was from other public and tribal lands (Andrews and Kutara 2005).

Harvest by Species

Softwoods accounted for 3,846 MMBF, or nearly 95 percent of Oregon's timber harvest in 2003 while hardwoods made up the remaining 5 percent (table 2). Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) was the leading

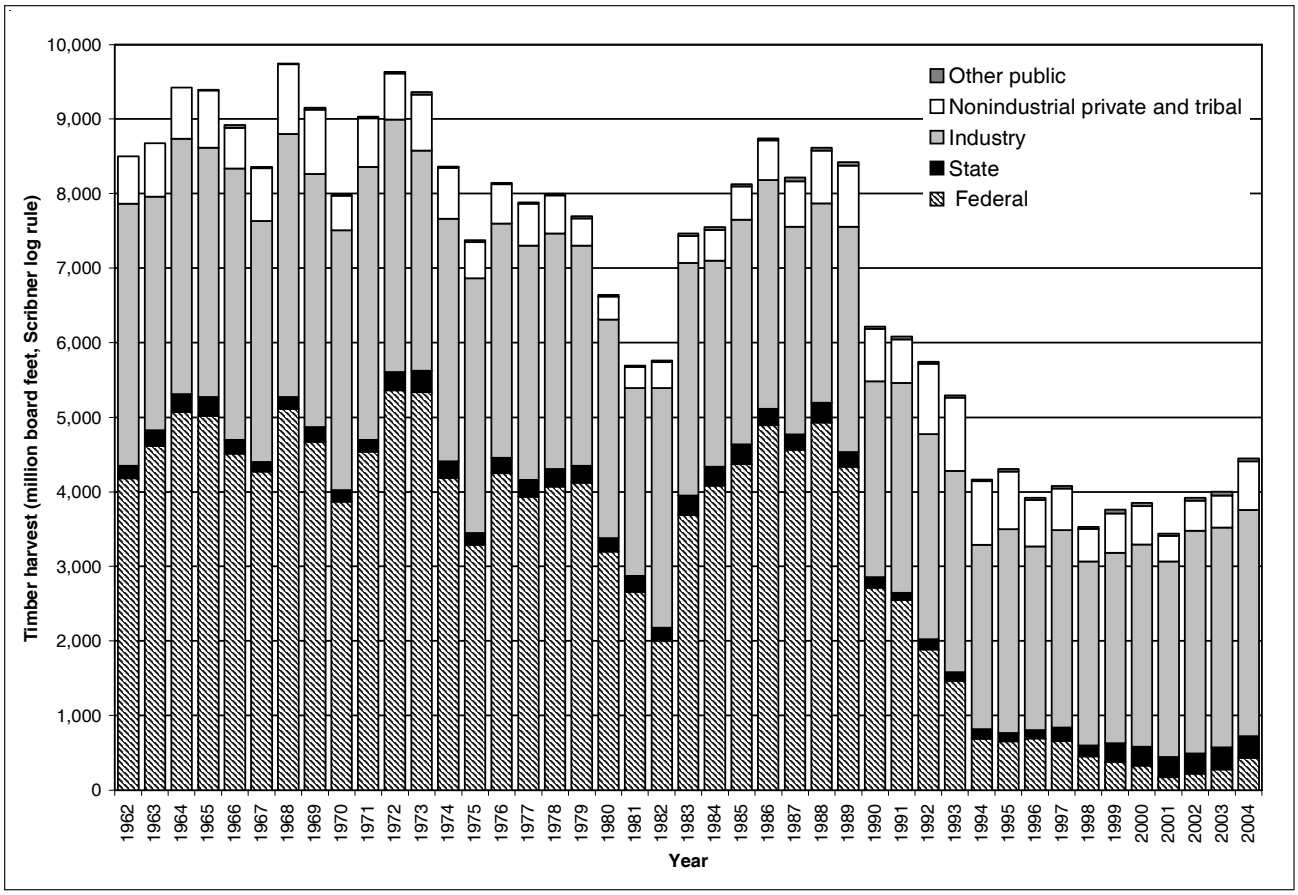

Figure 5—Oregon's timber harvest by ownership, 1962-2003. Source: Andrews and Kutara 2005, Oregon Department of Forestry 2003.

Table 2—Oregon timber harvest, standing volume, growth, and growth:harvest ratio by species, 2003

Species	Harvest		Standing		Growth		
	Volume	Percentage of total	Volume	Percentage of total	Volume	Percentage of total	Growth: harvest
	MMBF[a]	*Percent*	*MMBF*[a]	*Percent*	*MMBF*[a]	*Percent*	
Douglas-fir	2,660.2	65.6	193,908	57.7	4,502	54.2	1.7
True firs	359.8	8.9	34,051	10.1	848	10.2	2.4
Hemlock	358.0	8.8	29,503	8.8	870	10.5	2.4
Pines	266.8	6.6	41,277	12.3	927	11.2	3.5
Spruce	87.2	2.2	6,761	2.0	197	2.4	2.3
Cedar	82.4	2.0	9,615	2.9	189	2.3	2.3
Other softwoods	31.8	.8	2,854	.8	45	.5	1.4
All softwoods	3,846.3	94.8	317,969	94.6	7,578	91.2	2.0
Red alder	152.9	3.8	9,876	2.9	488	5.9	3.2
Other hardwoods	56.0	1.4	8,280	2.5	246	3.0	4.4
All hardwoods	208.9	5.2	18,156	5.4	734	8.8	3.5
All species	4,055.2	100	336,125	100	8,312	100	2.0

[a] Volume in million board feet Scribner log rule.

species harvested for timber in Oregon during 2003. Douglas-fir accounted for 2,660 MMBF, or nearly 66 percent of the total; followed by true firs (*Abies* spp.) and western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), each accounting for nearly 9 percent. Pines (*Pinus* spp.) accounted for about 6 percent, and red alder (*Alnus rubra* (Bong.) for nearly 4 percent. Spruces (*Picea sitchensis* (Bong.) Carr.); *Picea engelmannii* (Parry) ex Engelm.), cedars (*Thuja plicata* (Donn) ex D. Don, *Libocedrus decurrens* (Torr.), *Chamaecyparis lawsoniana* (A. Murr.) Parl.), other softwoods and other hardwoods together accounted for the remaining 6 percent of harvest.

The growth-to-harvest ratio for all hardwoods was nearly twice that for all softwoods. Growth-to-harvest ratios by species for softwoods ranged from 1.7:1 for Douglas-fir to 3.5:1 for pines, and for hardwoods ranged from 3.2:1 for red alder to 4.4:1 for other hardwoods (table 2), indicating that net growth outpaced harvest for each species harvested in Oregon during 2003.

Industrial landowners harvested the greatest volumes of each of the species (table 3), leading other landowners by significant margins. Nonindustrial private forest land and tribal owners were the second largest harvesters of most species, with the exception of hemlock and pine, where the state and USFS most closely followed industrial landowners.

Industrial landowners harvested the greatest volumes of each of the species, leading other landowners by significant margins.

Table 3—Oregon timber harvest by species and ownership, 2003

Species	Industry	Nonindustrial private and tribal	State	National forest	Bureau of Land Management	Other public	Total
			Million board feet, Scribner				
Softwoods:							
Douglas-fir	1,967.0	295.1	219.1	90.6	52.8	35.7	2,660.2
True firs	264.5	41.0	4.9	29.6	10.8	9.0	359.8
Hemlock	235.9	43.1	59.7	12.6	4.4	2.2	358.0
Pines	174.7	32.9	1.3	52.8	4.0	1.2	266.8
Spruce	77.1	1.7	3.1	3.3	1.6	.5	87.2
Cedar	73.5	5.6	.5	1.1	1.6	.1	82.4
Other softwoods	15.3	5.9	—	10.4	.3	—	31.8
All softwoods	2,808.0	425.2	288.5	200.4	75.5	48.7	3,846.3
Hardwoods:							
Red alder	117.5	26.0	3.7	1.8	.3	3.6	152.9
Other hardwoods	35.3	16.9	.6	.5	2.6	—	56.0
All hardwoods	152.8	42.9	4.3	2.4	2.9	3.6	208.9
All species	2,960.7	468.1	292.8	202.8	78.4	52.3	4,055.2

Harvest by Product Type

Four general categories of timber products are referred to throughout this report: saw logs—timber sawn to produce lumber; veneer logs—timber sliced or peeled to make veneer for plywood or laminated veneer lumber; chipped logs—timber chipped or ground to use in reconstituted products or as fuel; and other timber products—timber used to manufacture cedar shakes and shingles, posts, small poles, utility poles, pilings, log homes, firewood, and log furniture.

During 2003, saw logs accounted for about 73 percent (2,955 MMBF) of Oregon's timber harvest, and veneer logs accounted for 21 percent (table 4). Chipped logs accounted for about 4 percent (178 MMBF) and other timber products accounted for the remaining 1 percent (61 MMBF).

Timber harvest by ownership and product type combined (table 5) followed the same general trend as harvest by ownership source or product type alone. Private and tribal timberland provided the majority of the volume for each product type, and saw logs were the leading product harvested from each ownership class with veneer logs coming in at a distant second. Private and tribal timberlands provided 84 percent (3,202 MMBF) of Oregon's 2003 saw and veneer log harvests, whereas public forest land provided 16 percent (615 MMBF). Industrial timberland led the private timberlands making up 2,748 MMBF of the private saw and veneer log harvest, while the state timberlands

Table 4—Oregon timber harvest by product type, 2003

Product	Volume	Percentage of total
	Million board feet, Scribner	*Percent*
Saw logs	2,954.5	72.9
Plywood/veneer	861.7	21.3
Chipped logs[a]	177.9	4.4
Other timber products[b]	61.0	1.5
Total	4,055.2	100

[a] Chipped logs are primarily roundwood pulpwood but also include industrial fuelwood.

[b] Other timber products include cedar products, posts, small poles, pilings, utility poles, log homes, firewood, and log furniture.

Table 5—Oregon timber harvest by ownership class and product type, 2003

Ownership class	Sawlogs	Veneer logs	Chipped logs[a]	Other timber products[b]	All products
			Million board feet, Scribner		
Industrial	2,096.9	651.5	159.3	53.0	2,960.7
Nonindustrial and tribal	398.5	54.9	7.9	6.9	468.1
State	243.6	48.6	.3	.2	292.8
National forest	145.8	53.1	3.1	.7	202.8
BLM	41.3	34.1	3.1	—	78.4
Other public	28.4	19.6	4.1	.1	52.3
All owners	2,954.5	861.7	177.9	61.0	4,055.2

[a] Chipped logs are primarily roundwood pulpwood but also include industrial fuelwood.

[b] Other timber products include logs for cedar products, posts, small poles, pilings, utility poles, log homes, and log furniture.

led the public timberlands with 292 MMBF of saw and veneer log harvest. Industry-owned timberland was also the major source of timber for chipped logs and other timber products, accounting for 90 and 87 percent of the timber harvested in-state for these sectors, respectively. Public lands accounted for a very small portion of chipped logs and other timber products, making up 6 and 2 percent of the harvest for these sectors, respectively.

During 2003, all of Oregon's commercially harvested tree species were used to produce lumber (table 6). Douglas-fir was the species most harvested for both saw and veneer logs, accounting for 67 percent (2,568 MMBF) of the combined saw and veneer log harvest in 2003. Hemlock accounted for 9 percent (354 MMBF) of the saw and veneer log harvest followed closely by the true firs and pines with 9 percent (342 MMBF) and 7 percent (264 MMBF), respectively. Chipped logs and other timber products consisted mainly of Douglas-fir (93 MMBF), cedar (52 MMBF), and red alder (51 MMBF). All other species combined for chipped logs and other timber products harvest

Table 6—Oregon timber harvest by species and product type, 2003

Species	Sawlogs	Veneer logs	Chipped logs[a]	Other timber products[b]	All products
			Million board feet, Scribner		
Softwoods:					
Douglas-fir	2,023.3	544.3	85.3	7.3	2,660.2
True firs	193.6	148.5	17.6	—	359.8
Hemlock	298.7	54.9	4.4	—	358.0
Pines	222.8	40.9	.9	2.2	266.8
Spruce	28.6	58.2	—	0.4	87.2
Cedar	29.9	1.1	.6	50.8	82.4
Other softwoods	16.6	13.7	1.2	.3	31.8
All softwoods	2,813.7	861.7	110.1	60.9	3,846.3
Hardwoods:					
Red alder	101.6	—	51.3	—	152.9
Other hardwoods	39.3	.1	16.5	.2	56.0
All hardwoods	140.9	.1	67.8	.2	208.9
All species	2,954.5	861.7	177.9	61.0	4,055.2

[a] Chipped logs are primarily roundwood pulpwood but also include industrial fuelwood.

[b] Other timber products include logs for cedar products, posts, small poles, pilings, utility poles, log homes, and log furniture.

totaled only 44 MMBF or 18 percent of this category. Cedar accounted for 83 percent (50.8 MMBF) of the other timber products category largely owing to the cedar processing facilities in this category; this was the only instance where Douglas-fir was not the leading harvested species. Red alder composed 73 percent (153 MMBF) of the hardwoods harvested with 66 percent (102 MMBF) of this volume as saw logs and the remaining volume as chipped logs.

Harvest by Geographic Source

Oregon has historically been divided into two major wood-producing regions, Western and Eastern, with the Western Region defined as counties lying west of the crest of the Cascade Range (fig. 6), and the Eastern Region consisting of all the remaining counties (Manock et al. 1970). The Western Region has historically consisted of three resource areas, the Northwest Resource Area, the West-Central Resource Area, and the Southwest Resource area. For this report the West-Central Resource Area has been split between the Northwest and Southwest Resource Areas, with Lincoln, Benton, and Linn Counties in the Northwest Resource Area and Lane County in the Southwest Resource Area. The Eastern Region consists of two resource areas, the Central Resource Area and the Blue Mountain Resource Area.

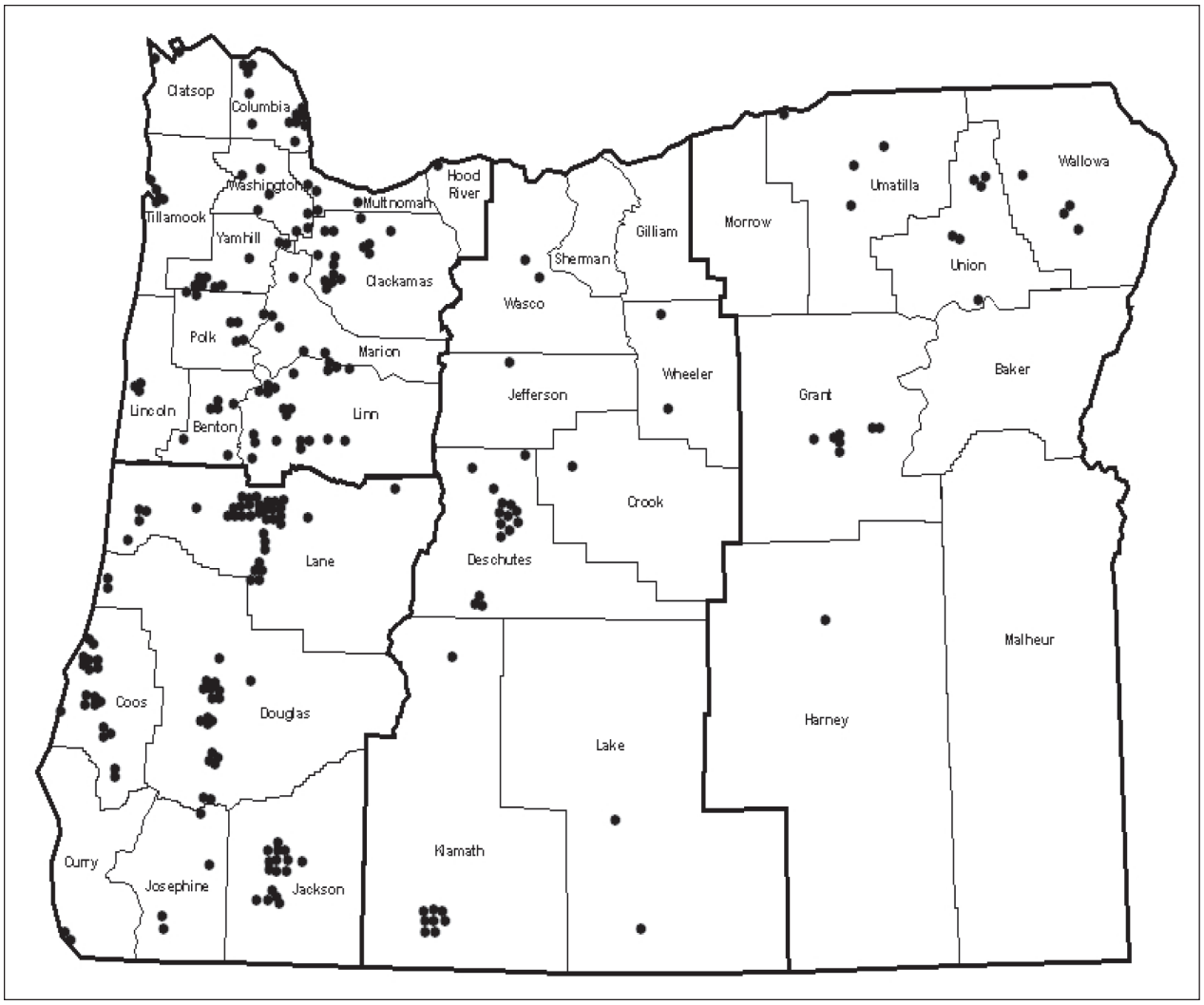

Figure 6—Oregon resource areas and active primary forest products manufacturers, 2003.

The Western Region supplied 86 percent of Oregon's 2003 total timber harvest.

The Western Region supplied 86 percent (3,472 MMBF) of Oregon's 2003 total timber harvest (table 7), and the Eastern Region supplied the remaining 14 percent (583 MMBF). The Northwest Resource area timber harvest totaled 1,935 MMBF or 48 percent of the total, and the Southwest Resource Area accounted for 38 percent (1,537 MMBF) of Oregon's timber harvest. Lane and Douglas Counties in the Southwest Resource Area were the top two timber harvesting counties with Lane County leading the state harvesting 483 MMBF (12 percent) of timber and Douglas County at 468 MMBF (12 percent). Historically these two counties have had the largest proportion of the state's timber harvest, and the Western Region as a whole has accounted for more than 70 percent of the state's total timber harvest since 1962 (fig. 7).

Table 7—Oregon timber harvest by resource area and county, 2003

Resource area	Harvest volume	Percentage of total
	MMBF[a]	*Percent*
Northwest:		
Benton[b]	131.1	3.2
Clackamas	134.8	3.3
Clatsop	336.7	8.3
Columbia	180.7	4.5
Hood River	26.1	.6
Lincoln[b]	178.9	4.4
Linn[b]	261.4	6.4
Marion	84.8	2.1
Multnomah	6.7	.2
Polk	147.4	3.6
Tillamook	171.5	4.2
Washington	162.4	4.0
Yamhill	112.9	2.8
Total Northwest	1,935.4	47.7
Southwest:		
Coos	342.6	8.4
Curry	79.2	2.0
Douglas	467.9	11.5
Jackson	117.2	2.9
Josephine	46.5	1.1
Lane[b]	483.2	11.9
Total Southwest	1,536.6	37.9
Central:		
Crook	1.6	<.1
Deschutes	26.5	.7
Gilliam	0	0
Jefferson	21.5	.5
Klamath	200.1	4.9
Lake	75.2	1.9
Sherman	0	0
Wasco	37.2	.9
Wheeler	17.5	.4
Total Central	379.6	9.4
Blue Mountains:		
Baker	16.6	.4
Grant	37.3	.9
Harney	3.4	.1
Malheur	.8	<.1
Morrow	14.3	.4
Umatilla	16.0	.4
Union	47.6	1.2
Wallowa	67.7	1.7
Total Blue Mountains	203.6	5.0
State total	4,055.2	100

[a] Volume in million board feet Scribner log rule.

[b] Previous Oregon forest products industry reports listed these counties in the West-Central Resource Area.

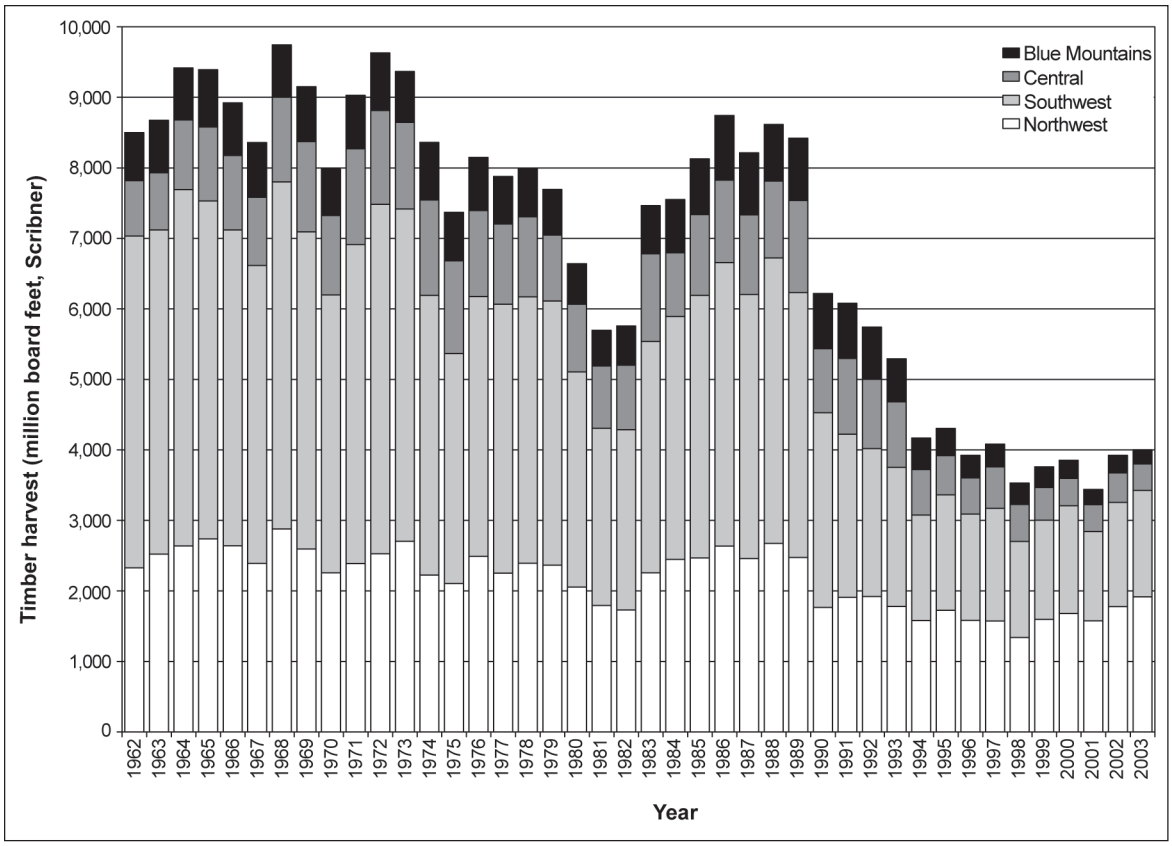

Figure 7—Oregon's timber harvest by resource area for various years. Source: Oregon Department of Forestry 2003.

Timber harvest by resource area has been fairly consistent over time, with the Central Resource Area providing slightly more timber than the Blue Mountain Resource Area. The big change over the last decade has been that the Northwest Resource Area has surpassed the Southwest Resource Area in proportion of timber harvested. The total percentage of harvest from the Western Region, however, has held relatively steady (fig. 7). This switch coincides with the declines in harvest from federal lands, which are predominantly in the Southwest Resource Area.

In each of Oregon's resource areas, growth (in trees 10 inches d.b.h. or greater) exceeded harvest with the growth-to-harvest ratios ranging from 1.6:1 for the Northwest Resource Area to 3.6:1 for the Blue Mountain Resource Area (table 8). The Northwest Resource Area contributed to almost half (48 percent) of the timber harvest, and the Blue Mountain Resource Area only contributed 5 percent of Oregon's timber harvest. Gilliam, Sherman, and Malheur Counties were the only counties in Oregon that had no timber harvest during 2003.

Table 8—Oregon timber harvest, standing volume, growth, and growth:harvest ratio by resource area, 2003

Resource area	Harvest	Standing volume (>10 inches d.b.h.)	Growth (>10 inches d.b.h.)	Growth: harvest
		Million board feet, Scribner		
Northwest	1,935.4	102,605	3,155	1.6
Southwest	1,536.6	161,458	3,527	2.3
Central	379.6	40,214	899	2.4
Blue Mountains	203.6	31,848	730	3.6
State total	4,055.2	336,125	8,311	2.0

Note: d.b.h. = diameter at breast height

Oregon timber processors received more than 4,299 MMBF of timber for processing during 2003.

Timber Flow and End Uses of Oregon's 2003 Timber Harvest

Oregon timber processors received more than 4,299 MMBF of timber for processing during 2003 (table 9). Timber processed in Oregon from sources outside of the state totaled 395 MMBF (9.2 percent of timber processed in Oregon), and 151 MMBF (3.7 percent of Oregon's timber harvest) was exported to Washington and California for processing in those states. Thus Oregon was a net importer of 244 MMBF of timber in 2003 (table 10). Not surprisingly, practically all (99.9 percent) the timber imported into Oregon was saw and veneer logs. Log flow out of Oregon to Washington and California was a bit more diversified with only 59 percent of the volume going out as saw and veneer logs, while the remaining 41 percent was sent out as chipped logs or other timber products. These timber flow volumes do not include timber received by Oregon export facilities for subsequent export to other countries. An estimated 385 MMBF of logs were exported from Oregon's customs districts during 2003, and 383 MMBF of that volume went to Japan (WWPA 2004).

The flow of timber harvested in the state and delivered to mills within the state shows that the majority of Oregon timber was harvested and processed in the same resource area (table 9). Approximately 76 percent (1,378 MMBF) of the Oregon timber used in the Northwest Resource Area was harvested in that resource area, whereas 23 percent (412 MMBF) was harvested in the Southwest Resource Area and the remaining timber was harvested in the Central and Blue Mountain Resource Areas. About 96 percent (1,460 MMBF) of the Oregon timber used in the Southwest Resource Area was harvested in that resource area, and the remaining Oregon timber originated in the Northwest and Central Resource Areas. The Central Resource Area received 51 percent (185 MMBF) of its Oregon timber from the Central Resource Area,

Table 9—Oregon timber flow by resource area, 2003

Destination (resource area[a])	Geographic source of timber					Total timber received in Oregon
	Northwest	Southwest	Central	Blue Mountains	Out-of-state timber[b]	
	Million board feet, Scribner					
Northwest	1,377.9	58.0	—	—	230.6	1,666.5
Southwest	411.9	1,459.9	158.1	0.3	59.6	2,089.7
Central	.1	10.0	185.1	.1	40.5	235.8
Blue Mountains	32.8	—	16.3	194.2	63.9	307.2
California	—	8.7	20.0	—	394.6	4,299.3
Washington	112.7	—	—	9.1		
Total Oregon timber harvest by resource area	1,935.4	1,536.6	379.6	203.6	4,055.2	

[a] See table 7 for counties in each resource area.

[b] Imports from California, Idaho, Montana, Washington, and international sources were combined to avoid disclosure.

Table 10—Oregon interstate timber flow, 2003

Timber products	Log flow into Oregon	Log flow out of Oregon[a]	Net in (net out)
	Million board feet, Scribner		
Saw logs	311.5	(55.2)	256.3
Veneer logs	82.7	(33.7)	49.0
Chipped logs[b]	—	(24.2)	(24.2)
Other timber products[c]	.5	(37.5)	(37.0)
All products	394.7	(150.6)	244.1

[a] Does not include logs received by Oregon export facilities for subsequent export to other countries.

[b] Chipped logs are primarily roundwood pulpwood but also include industrial fuelwood.

[c] Other timber products include logs for cedar products, posts, small poles, pilings, utility poles, log homes, and log furniture.

and 48 percent (158 MMBF) was harvested in the Southwest Resource Area. Of the Oregon timber received by the Blue Mountain Resource Area, 99.8 percent (194 MMBF) was harvested in that resource area.

The Northwest Resource Area received 59 percent (231 MMBF) of the out-of-state timber processed in Oregon during 2003. The Southwest Resource Area received 15 percent (60 MMBF) of the out-of-state timber, the Central Resource Area received 10 percent (41 MMBF), and the Blue Mountain Resource Area received 16 percent (64 MMBF) of the out-of-state timber processed in Oregon during 2003.

This section traces Oregon's timber harvest through the various primary processing sectors. As both timber products and mill residues from manufacturing facilities are presented, volumes are expressed in cubic feet rather than in board feet Scribner. Residue volumes were reported in bone dry units (a BDU is 2,400 pounds of oven dry wood) and were converted to cubic feet by using a conversion of 96 cubic feet per BDU. Timber product volumes were generally reported in board feet Scribner west-side log rule. Differences between timber product conversion factors were due to size and quality differences of the logs that mills received. The following factors were used to convert board-foot Scribner log volumes to cubic-foot volume:

- 4.19 board feet per cubic foot for saw logs
- 4.28 board feet per cubic foot for veneer logs
- 2.41 board feet per cubic foot for chipped logs
- 3.71 board feet per cubic foot for other timber products

The following figures refer to Oregon's timber harvest and include timber products shipped to out-of-state mills; the figures do not include timber that was harvested in other states and processed in Oregon. Other manufacturers include cedar products manufacturers, log furniture manufacturers, log home manufacturers, and house log and log home manufacturers that were combined to avoid disclosing information on individual firms.

During 2003, Oregon's timber harvest was approximately 997 million cubic feet (MMCF). Of this volume, 706 MMCF (71 percent) went as saw logs to sawmills; 201 MMCF (20 percent) were veneer logs that went to veneer and plywood plants; 73 MMCF (7 percent) was chipped for pulp mills and board plants; and 17 MMCF (2 percent) went as other timber products to various types of facilities (fig. 8).

Of the 706 MMCF of timber delivered to sawmills, 354 MMCF (50 percent) of bole volume actually became finished lumber or another sawn product, 343 MMCF (49 percent) became mill residue, and 9 MMCF (1 percent) was lost from shrinkage of green lumber. About 331 MMCF of sawmill residue was sold as raw material to manufacturers of pulp and paper, particleboard, medium-density fiberboard, and hardboard in Oregon and other states. About 6 MMCF of sawmill residue was used for energy; 30 percent of that residue was used by the sawmill producing it, whereas the remaining 70 percent was sold to other facilities generating electricity or other forms of energy. Residues used for miscellaneous other purposes such as livestock bedding accounted for 5 MMCF, and slightly less than 1 MMCF of sawmill residue went unused.

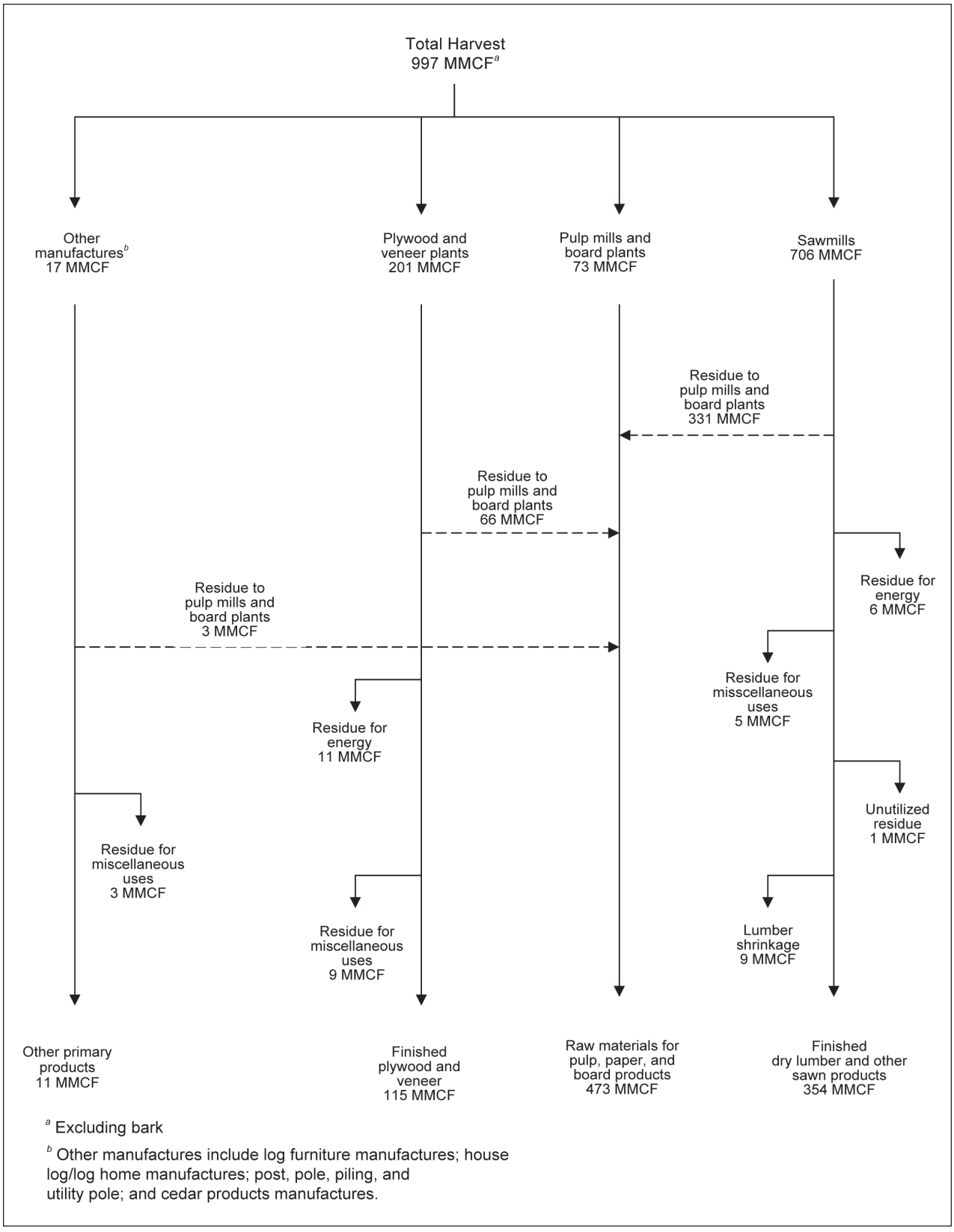

Figure 8—Oregon's timber harvest and flow, 2003.

Of the 201 MMCF of Oregon's timber harvest received by veneer plants in Oregon and other states, 57 percent (115 MMCF) of bole volume became veneer, and 43 percent (86 MMCF) became residue. Of the 86 MMCF that became residue, 66 MMCF was sold as raw material to pulp and paper and board manufacturers. About 11 MMCF was used as fuel, with 72 percent being used internally, and the remaining 28 percent being sold to other facilities. Approximately 9 MMCF of veneer mill residue was used for miscellaneous other purposes such as livestock bedding.

About 73 MMCF of Oregon's timber harvest was in the form of pulpwood that was chipped and used to manufacture pulp and paper. Pulp, paper, and reconstituted board facilities received an additional 400 MMCF of mill residues from sawmills and plywood plants for use as raw material.

Other manufacturers, which include cedar products manufacturers, log furniture manufacturers, log home manufacturers, and house log and log home manufacturers received 17 MMCF of Oregon's timber harvest. About 11 MMCF of this material became finished products, 3 MMCF of residue was used for miscellaneous other purposes such as livestock bedding, and the remaining 3 MMCF of the residue was sold as raw material to pulp, paper, and board manufacturers.

In total, 997 MMCF of wood fiber, excluding bark, was harvested from Oregon timberlands during 2003. About 473 MMCF was used as raw material to produce pulp, paper, or reconstituted board products such as particleboard or medium-density fiberboard; 354 MMCF became finished lumber; 115 MMCF became veneer or plywood; 17 MMCF was used to generate energy usually in the form of steam or electricity; 17 MMCF went to other uses such as animal bedding; 11 MMCF was used to produce other primary products; 9 MMCF was lost in shrinkage from green to dry lumber; and nearly 1 MMCF of mill residue went unutilized.

The FIDACS census identified 249 primary forest products plants operating in Oregon during 2003.

Oregon's Forest Products Industry

The FIDACS census identified 249 primary forest products plants operating in Oregon during 2003 (table 11). These plants produce an array of products including lumber and other sawn products, veneer and plywood, medium-density fiberboard, particleboard, hardboard, log homes, log furniture, engineered wood products (EWP), bioenergy, pulp and paper, shakes and shingles and other cedar products, decorative bark and mulch, fuel pellets and fire logs, and posts, poles, pilings, and utility poles. The number of active timber processors was higher in 2003 than the numbers found in the 1994 and 1998

Table 11—Active Oregon primary forest products facilities by sector

Year	Lumber	Veneer and plywood	Pulp and board	Cedar products	Exports	Posts, poles, pilings, and utility poles	Chipping	Log homes	Log furniture	Other facilities[a]	All sectors
2003	126	33	23	2	2	12	9	25	6	11	249
1998	93	43	29	7	—	8	20	—	—	—	200[b]
1994	106	34	31	10	10	10	—	—	—	—	201[b]
1992	115	64	30	16	13	15	—	—	—	—	253[b]
1988	165	87	33	24	33	18	—	—	—	—	360
1985	173	89	35	26	35	7	—	—	—	—	365
1982	161	101	36	34	32	8	—	—	—	—	372
1976	243	132	40	46	28	9	—	—	—	—	498
1972	262	133	40	43	38	10	—	—	—	—	526
1968	300	168	37	48	—	—	—	—	—	—	553

Note: — = not included in specific year.

[a] Other facilities include biomass/energy, bark products, engineered wood products (EWP), and fuel pellets/fire logs.

[b] All the mills did not participate in the specified survey years.

Sources: Howard 1984; Howard and Hiserote 1978; Howard and Ward 1991, 1988; Manock et al. 1970; Schuldt and Howard 1974; Ward 1997, 1995; Ward et al. 2000.

surveys (Ward 1997, Ward et al. 2000) primarily because of two factors: greater participation by sawmills and inclusion of other sectors in the 2003 census. The log export, EWP, biomass/energy, bark products, fuel pellets/fire logs, log home and log furniture sectors accounted for 51 facilities in 2003, but were not reported in 1998, 1994, and 1992.

The Northwest and Southwest Resource Areas contained 192 (77 percent) of Oregon's active forest products facilities during 2003 (table 12). Together, the Central and Blue Mountain Resource Areas contained the remaining 57 (23 percent) active facilities. The Northwest Resource Area contained 96 active forest products facilities and had the largest proportion of lumber producers (43 percent), pulp and board plants (57 percent), chipping operations (78 percent), and other facilities (64 percent) in the state. The Southwest Resource area was represented by 96 active forest products facilities and had the greatest proportion of plywood and veneer operations (73 percent), and post, pole, piling, and utility pole producers (33 percent) in the state. The Central Resource Area contained only 32 active forest products facilities but had the highest proportion of house log manufacturers (64 percent), and the Blue Mountain Resource Area had a total of 25 active forest products facilities operating in 2003.

Lane County in the Southwest Resource Area had the largest number of active forest products facilities in the state, with a total of 36 facilities operating during 2003. Historically, Lane County has had the most active forest

Table 12—Active Oregon primary forest products manufacturing facilities by resource area, county, and product produced, 2003

Resource area/ county	Lumber	Veneer and plywood	Pulp and board	Cedar products	Export	Posts, poles, pilings, and utility poles	Chipping	Log homes	Log furniture	Other facilities[a]	All industries
Northwest:											
Benton	5	—	1	—	—	—	—	—	—	—	6
Clackamas	11	—	2	—	—	—	—	2	—	1	16
Clatsop	2	—	—	—	—	—	—	—	—	—	2
Columbia	4	1	3	—	—	1	1	—	—	2	12
Hood River	—	—	—	—	—	—	—	—	—	1	1
Lincoln	1	—	1	—	—	—	1	—	—	—	3
Linn	9	4	4	1	—	—	1	1	—	2	22
Marion	3	—	—	—	—	1	1	—	—	—	5
Multnomah	2	—	—	—	—	—	—	1	—	—	3
Polk	5	1	—	—	—	—	—	—	—	—	6
Tillamook	4	—	—	—	—	—	—	—	—	—	4
Washington	3	—	1	—	—	—	1	—	1	1	7
Yamhill	5	1	1	—	—	—	2	—	—	—	9
Northwest total	54	7	13	1	0	2	7	4	1	7	96
Southwest:											
Coos	14	1	1	—	1	—	1	—	—	—	18
Curry	1	—	—	—	—	—	—	—	—	—	1
Douglas	12	6	1	1	—	1	—	—	—	—	21
Jackson	3	7	2	—	—	—	—	1	—	2	15
Josephine	2	2	—	—	—	—	—	—	1	—	5
Lane	19	8	3	—	1	3	—	1	—	1	36
Southwest total	51	24	7	1	2	4	1	2	1	3	96

Table 12—Active Oregon primary forest products manufacturing facilities by resource area, county, and product produced, 2003 (continued)

Resource area/ county	Lumber	Veneer and plywood	Pulp and board	Cedar products	Export	Posts, poles, pilings, and utility poles	Chipping	Log homes	Log furniture	Other facilities[a]	All industries
Central:											
Crook	—	—	—	—	—	—	—	1	—	—	1
Deschutes	—	—	—	—	—	2	—	12	1	—	15
Gilliam	—	—	—	—	—	—	—	—	—	—	0
Jefferson	1	—	—	—	—	—	—	—	—	—	1
Klamath	5	1	2	—	—	1	—	—	—	—	9
Lake	2	—	—	—	—	—	—	—	—	—	2
Sherman	—	—	—	—	—	—	—	—	—	—	0
Wasco	—	—	—	—	—	—	—	2	—	—	2
Wheeler	—	—	—	—	—	—	—	1	1	—	2
Central total	8	1	2	0	0	3	0	16	2	0	32
Blue Mountains:											
Baker	—	—	—	—	—	—	1	1	—	—	2
Grant	5	—	—	—	—	2	—	—	—	1	8
Harney	—	—	—	—	—	—	—	—	1	—	1
Malheur	—	—	—	—	—	—	—	—	—	—	0
Morrow	—	—	—	—	—	—	—	—	—	—	0
Umatilla	3	—	—	—	—	1	—	—	—	—	4
Union	3	1	1	—	—	—	—	1	—	—	6
Wallowa	2	0	0	—	—	—	—	1	1	—	4
Blue Mountain total	13	1	1	0	0	3	1	3	2	1	25
2003 total	126	33	23	2	2	12	9	25	6	11	249

[a] Other facilities include biomass/energy, bark products, engineered wood products (EWP), and fuel pellets/fire logs.

products facilities in the state (Howard 1984; Howard and Hiserote 1978; Howard and Ward 1988, 1991; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000). During 2003, Lane County was home to 15 percent of Oregon's sawmills, 24 percent of the plywood and veneer operations, 50 percent of export operations, and 25 percent of the post, pole, piling, and utility pole producers.

During 2003, Oregon's primary wood products sectors had product sales of $6.7 billion dollars.

During 2003, Oregon's primary wood products sectors had product sales of $6.7 billion dollars (table 13). Sawmill and pulp and board sectors each accounted for about $2.3 billion (34 percent) of the total. The plywood and veneer sector had a total sales value of almost $1.8 billion (26 percent), while the remaining sectors accounted for only 6 percent ($0.4 billion).

Timber Consumption by Oregon Mills

During 2003, 91 percent of Oregon's mill receipts (timber received at Oregon mills) were composed of Oregon timber. Since 1968, Oregon timber-processing facilities have received 93 percent of their timber supply from within the state (table 14) (Howard 1984; Howard and Hiserote 1978; Howard and Ward 1988, 1991; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000). Washington provided 6 percent (261 MMBF) of Oregon mill receipts in 2003, and it has supplied an average of 4 percent of Oregon mill receipts since 1968. About 3 percent (134 MMBF) of Oregon's mill receipts during 2003 came from California, Idaho, and other out-of-state timber suppliers, maintaining their historical percentage of Oregon mill receipts.

Oregon mill receipts (table 15) were dominated by industry lands, which accounted for 73 percent of all mill receipts during 2003. Between 1968 and 1992, industry lands accounted for an average of 40 percent of mill receipts in Oregon (Howard 1984, Manock et al. 1970, Schuldt and Howard 1974, Ward 1995). Historically, national forests and the BLM have provided 33 percent and 11 percent on average, respectively. However, in 2003 national forests and the BLM only provided 5 percent and 2 percent, respectively. This shift began during the late 1980s and early 1990s and is consistent with the declining harvest on federal lands throughout the U.S. West. Nonindustrial private forest lands and tribal lands provided 11 percent of the mill receipts in 2003, slightly above the average of 9 percent between 1968 and 1992. State lands accounted for 8 percent of mill receipts in Oregon, which is double their historical average of 4 percent.

Table 13—Product sales value of Oregon primary wood product sectors, 2003

Sector	2003 product sales
	Thousand U.S. dollars
Sawmills	2,284,985
Pulp and board facilities	2,271,143
Plywood and veneer plants	1,773,487
Other sectors[a]	344,800
Chipping facilities	23,627
Log home plants	13,153
Posts, pole, pilings, and utility pole plants	11,403
Log furniture plants	888
Total	6,723,486

[a] Other sectors includes bark products, cedar products, energy/biomass, engineered wood products (EWP), export, and fuel pellet/fire log manufacturers.

Table 14—Log flows to timber processors in Oregon by state of origin

State of origin	1968	1972	1976	1982	1985	1988	1992	1994	1998	2003
	Million board feet, Scribner log rule									
Oregon	9,169	9,892	8,923	5,703	7,756	8,201	3,674	3,203	3,752	3,905
Washington	268	458	284	130	224	272	183	289	515	261
California	152	82	131	127	281	308	155	203	151	67
Idaho	[a]	1	1	0	11	16	17	47	18	58
Other[b]	5	0	1	0	0	1	4	33	64	8
Total	9,595	10,434	9,339	5,961	8,272	8,798	4,033	3,775	4,500	4,299

[a] For 1968, Idaho is combined with Other.

[b] Other contains log flows from states and countries not listed.

Sources: Howard 1984; Howard and Hiserote 1978; Howard and Ward 1991, 1988; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000.

Table 15—Proportion of Oregon mill receipts by ownership

Ownership	1968[a]	1972[a]	1982[a]	1992[a]	2003[b]
	Percentage of consumption				
Industry	34.7	34.5	45.3	37.0	72.8
Nonindustrial private and tribal	8.1	5.3	8.3	21.4	10.9
State	2.5	3.4	2.6	7.4	8.3
National forest	39.8	40.4	33.7	24.2	5.0
Bureau of Land Management	14.6	14.6	8.3	7.6	1.7
Other public	.3	1.8	1.8	2.4	1.3
Total	100	100	100	100	100

[a] Tribal not reported for specified years.

[b] Unidentified out-of-state ownerships included in Other.

Sources: Howard 1984; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995.

Mill receipts by species for 2003 followed the historical mill receipts since 1968, with Douglas-fir accounting for the majority (66 percent) of mill receipts (table 16). Hemlock, true firs, and pine made up 9 percent, 9 percent, and 8 percent, respectively, and the remaining softwoods made up 4 percent of Oregon mill receipts in 2003. Hardwoods accounted for 4 percent of Oregon's mill receipts during 2003, with red alder accounting for 3 percent and other hardwoods the remaining 1 percent.

During 2003, private lands provided 84 percent (2,697 MMBF) of the saw logs delivered to mills and 81 percent (736 MMBF) of the veneer logs (table 17). In contrast, national forests provided 5 and 6 percent (151 and 59 MMBF) of the saw logs and veneer logs, respectively, delivered to Oregon mills. Timber from state lands accounted for 9 percent (292 MMBF) of the saw logs and 7 percent (65 MMBF) of the veneer logs delivered to Oregon mills. Chipped logs and other timber products delivered to Oregon mills were also mainly provided from private land: 93 percent (143 MMBF) and 94 percent (23 MMBF) respectively.

Past studies of Oregon's wood products industry (Howard 1984; Howard and Hiserote 1978; Howard and Ward 1988, 1991; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000) indicate that saw logs have consistently been the leading timber product used by Oregon mills, accounting for an average of 63 percent of annual receipts (table 18). From the late 1960s until the early 1980s, veneer logs made up about 35 percent of the volume used by Oregon mills. However, since the 1980s, veneer logs have accounted for about 25 percent of Oregon's annual timber use. Timber products other than saw and veneer logs have typically represented 8 percent of Oregon's mill receipts. Because of the pulp and board sector's extensive use of mill residues, timber for that sector has typically represented less than 1 percent of Oregon's timber use. The use of other timber products has varied through the years but averaged less than 5 percent of annual use.

During 2003, each species group except for spruce had the majority of its volume (average of 69 percent) delivered as saw logs, (table 19). Spruce, on the other hand, had only 29 percent (30 MMBF) delivered as saw logs, and 70 percent (72 MMBF) was delivered as veneer logs. Douglas-fir was the primary species delivered in the chipped log product class, accounting for 52 percent (80 MMBF) of that volume. The other product class was made up primarily of cedars, which accounted for 60 percent (13 MMBF) of the volume.

Table 16—Proportion of Oregon mill receipts by species

Species	1968	1972	1982	1992	2003
	Percentage of consumption				
Douglas-fir	65.1	61.1	59.2	61.2	66.0
Hemlock	10.6	13.4	11.5	9.9	9.4
True firs	5.9	5.1	5.2	8.9	8.5
Spruce	1.1	1.2	1.3	1.8	2.4
Pine	13.6	14.5	17.7	14.0	7.6
Cedar	2.2	2.0	2.1	1.5	1.1
Other softwoods	.7	2.0	2.2	1.3	.9
Red alder	.7	—	0.6	.7	3.0
Other hardwoods	.1	.7	.2	.8	1.2
Total	100	100	100	100	100

Note: — = species not listed for given year.

Sources: Howard 1984, Manock et al. 1970, Schuldt and Howard 1974, Ward 1995.

Table 17—Timber products received by Oregon timber processors by ownership class, 2003

Ownership class	Sawlogs	Veneer logs	Chipped logs[a]	Other timber products[b]	All products
	Million board feet, Scribner				
Industrial	2,295.6	684.5	135.2	15.5	3,130.8
Nonindustrial private and tribal	401.5	51.5	7.9	6.9	467.8
State	292.1	64.5	.3	.2	356.6
National forest	151.1	58.5	3.1	.7	212.7
Bureau of Land Management	41.3	29.9	3.1	—	74.2
Other[c]	29.3	21.9	4.1	.5	55.3
All owners	3,211	911	154	24	4,299

[a] Chipped logs are primarily roundwood pulpwood but also include industrial fuelwood.

[b] Other timber products include logs for cedar products, posts, small poles, pilings, utility poles, log homes, and log furniture.

[c] Includes other public ownerships and unidentified out-of-state ownerships.

Table 18—Proportion of Oregon mill receipts by timber product

Product	1968[a]	1972[ab]	1982[ab]	1992[ab]	2003[c]
			Percentage of consumption		
Sawlogs	61.1	58.9	57.2	67.3	74.7
Veneer	37.3	35.0	34.1	24.7	21.2
Chipped logs	—	—	—	—	3.6
Other timber products[d]	1.6	6.2	8.6	8.0	.6
All products	100	100	100	100	100

[a] Pulp and board included in Other for specified years.

[b] Log export included in Other for specified years.

[c] Log homes, firewood, and log furniture included in Other for 2003.

[d] Other includes cedar products, post, pole, piling, and utility poles.

Sources: Howard 1984, Manock et al. 1970, Schuldt and Howard 1974, Ward 1995.

Table 19—Timber products received by Oregon timber processors by species, 2003

Species	Sawlogs	Veneer logs	Chipped logs[a]	Other timber products[b]	All products
			Million board feet, Scribner		
Softwoods:					
Douglas-fir	2,183.1	566.1	80.3	7.5	2,837.0
True firs	204.1	151.4	10.8	—	366.3
Hemlock	341.3	57.7	2.9	—	401.9
Pines	279.3	42.7	—	2.5	324.4
Spruce	30.1	71.5	—	.4	101.9
Cedar	32.4	1.2	.4	13.3	47.2
Other softwoods	17.8	20.2	.6	.3	38.8
All softwoods	3,088.0	910.7	95.0	23.8	4,117.6
Hardwoods:					
Red alder	85.9	—	43.7	—	129.6
Other hardwoods	37.0	.1	14.9	.2	52.1
All hardwoods	122.8	.1	58.7	.2	181.7
All species	3,211	911	154	24	4,299

[a] Chipped logs are primarily roundwood pulpwood but also include industrial fuelwood.

[b] Other timber products include logs for cedar products, posts, small poles, pilings, utility poles, log homes, and log furniture.

Sawmill Sector

Softwoods have historically made up well over 95 percent of Oregon's lumber production. Between 1954 and 1979, Oregon lumber production was maintained at fairly consistent levels with some minor troughs and peaks reflecting the commodity market (fig. 9). During the recession of the early 1980s, lumber production dropped substantially, with Oregon's lumber production just under 4,700 MMBF in 1982. Following the recession, lumber production climbed consistently throughout the 1980s until dropping off in the first half of the 1990s. The decline in the early 1990s was mainly due to changes in federal land management that reduced timber availability. The mid 1990s through 2003 saw a gradual increase in lumber production to 6,574 MMBF in 2003. During 2004, Oregon's lumber production increased just over 8 percent to 7,130 MMBF lumber tally (WWPA 2005).

Since 1958, the number of sawmills in Oregon has been declining, but since the early 1990s this decline has leveled off (table 20). During 2003, there were 126 sawmills operating in Oregon with 57 in the largest capacity class, 11 in the two middle capacity classes, and 58 in the smallest capacity class. The number of sawmills operating during 1998 totaled only 85, with 51 in the largest capacity class, 21 in the two middle capacity classes, and only 13 in the smallest capacity class. By way of comparison, in 1958 Oregon had a total of 485 sawmills with 70 in the largest capacity class, 247 in the two middle classes, and 168 in the smallest capacity class. The two middle capacity classes have seen the greatest decline since 1958, whereas the largest capacity class has maintained a fairly consistent number of sawmills operating in Oregon. This stability in the largest mills and increased efficiencies in processing timber have allowed fewer sawmills operating with less timber to maintain Oregon's status as the largest lumber-producing state in the United States.

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Capacity to produce lumber differs widely among Oregon's 126 sawmills, and the utilization of that capacity is generally correlated with mill size (table 21). Total lumber production during 2003 was 6,574 MMBF, whereas production capacity was 7,764 MMBF lumber tally. Thus, approximately 85 percent of Oregon's total lumber-producing capacity was utilized. A majority, 6,129 MMBF (79 percent) of lumber-producing capacity, was aggregated among the 33 mills with capacity greater than 100 MMBF of lumber output. These largest mills accounted for 79 percent (5,196 MMBF) of lumber production and utilized on average 85 percent of their lumber-producing capacity. Mills with capacities of 50 to 100 MMBF accounted for 830 MMBF (11 percent) of total

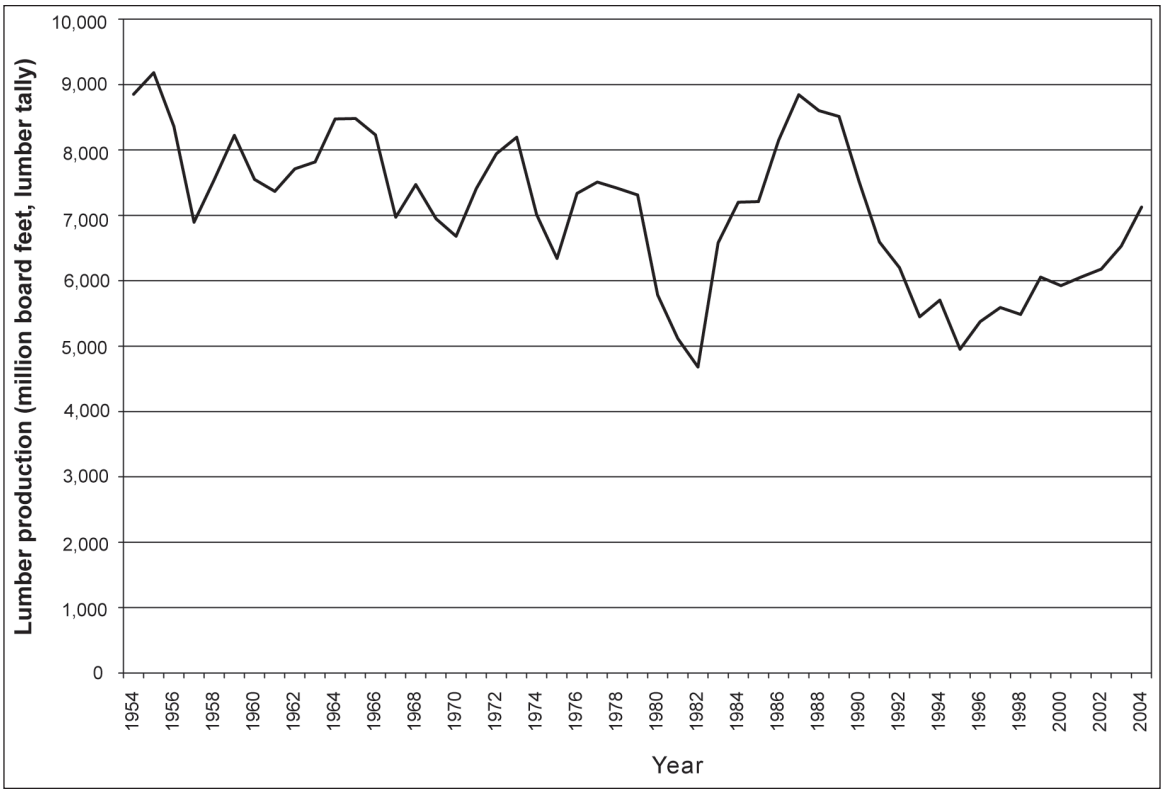

Figure 9—Oregon's lumber production 1954-2004. Source: Bodie et al. 1978, WWPA 1964-2005.

Table 20—Active Oregon sawmills by shift capacity, selected years 1958-2003

Year	120 mbf or greater	80 mbf to 119.9 mbf	40 mbf to 79.9 mbf	Less than 40 mbf	All
			Capacity per 8-hour shift		
2003	57	8	3	58	126
1998	51	15	6	13	85[a]
1994	60	9	5	15	89[a]
1992	56	9	8	13	86[a]
1988	98	30	11	26	165
1985	88	35	19	31	173
1982	71	41	26	23	161
1976	88	59	45	51	243
1972	87	60	57	58	262
1968	59	69	70	102	300
1958	70	90	157	168	485

Note: mbf = thousand board feet.

[a] Includes only mills that participated in the specified survey years.

Sources: Howard 1984; Howard and Hiserote 1978; Howard and Ward 1991, 1988; Manock et al. 1970; Schuldt and Howard 1974; Ward et al. 2000; Ward 1995, 1997.

Table 21—Active Oregon sawmills, production capacity, and capacity utilization by size class, 2003

Production capacity	Number of mills	Annual capacity			Annual production			Capacity utilization
		Capacity	Percentage of total capacity	Average capacity per mill	Production	Percentage of total production	Average production per mill	
		MMBF	*Percent*	*MMBF*	*MMBF*	*Percent*	*MMBF*	*Percent*
Over 100 MMBF annual capacity	33	6,129	78.9	186	5,196	79.0	157	84.8
Over 50 to 100 MMBF annual capacity	11	830	10.7	75	605	9.2	55	72.9
Over 10 to 50 MMBF annual capacity	22	724	9.3	33	729	11.1	33	100.6
10 MMBF or less annual capacity	60	81	1.0	1	45	.7	1	55.2
Total	126	7,764	100	74	6,574	100	62	84.7
120 MBF or greater shift capacity	57	7,357	94.8	129.1	6,222	94.6	109.2	84.6
40 MBF to 119.9 MBF shift capacity[a]	11	346	4.5	31.4	315	4.8	47.3	91.2
Less than 40 MBF shift capacity	58	61	.8	1.1	37	.6	.6	59.9
Total	126	7,764	100	54	6,574	100	52	84.7

Note: MBF = thousand board feet, MMBF = million board feet, lumber tally

[a] 40 MBF to 79.9 MBF shift capacity class combined with 80 MBF to 119.9 MBF to avoid disclosure.

capacity and produced 605 MMBF (9 percent) of the state's lumber. Mills with capacities of 10 to 50 MMBF accounted for 724 MMBF (9 percent) of total capacity and produced 729 MMBF (11 percent) of the state's lumber; mills with capacities of 10 MMBF or less accounted for 81 MMBF (1 percent) of total capacity and produced 45 MMBF (1 percent) of the state's lumber.

Product recovery ratios, or the volume of output per unit of input, are reported for Oregon's sawmills as lumber recovery factors (LRF) and overrun. The LRF is the lumber output (in thousand board feet lumber tally) divided by the timber input (thousand cubic feet). The volume of sawtimber used by Oregon's sawmills in 2003 was approximately 760 MMCF, and lumber production was about 6,574 MMBF lumber tally. Thus the statewide LRF for Oregon sawmills in 2003 was approximately 8.6 board feet of lumber per cubic foot of log input.

Between 1968 and 1988, there was a 24-percent increase in overrun, the board-foot volume of lumber produced per board foot Scribner of timber input. In 1988, Oregon sawmills produced around 8,538 MMBF lumber tally by processing about 5,448 MMBF Scribner of logs (Howard and Ward 1991) for an overrun of 1.57. This compares with overruns of 1.27 in 1968, 1.34 in 1972, 1.37 in 1976, 1.35 in 1982, and 1.50 in 1985 (Howard 1984, Manock et al. 1970, Howard and Hiserote 1978, Howard and Ward 1988, Schuldt and Howard 1974). Between 1988 and 2003, overrun increased 32 percent. The volume-weighted statewide average overrun in 2003 was 2.07 board feet of lumber per board foot Scribner of timber.

The volume-weighted statewide average overrun in 2003 was 2.07 board feet of lumber per board foot Scribner of timber.

Increases in overrun are attributable primarily to improvements in technology and smaller log sizes. Technological improvements have made Oregon mills more efficient in numerous ways. Log size (diameter and length) sensing capabilities linked to computers determine the best sawing pattern for logs to recover either the greatest volume or greatest value from each log. Improved sawing accuracies have reduced the amount of size variation in sawn lumber increasing solid wood recovery. Thinner kerf saws reduce the proportion of the log that becomes sawdust.

Additionally, the average log diameter processed by Oregon mills has likely decreased over the past 50 years. As log diameters decrease, the Scribner log rule, which is used in Oregon, underestimates by an increasing amount the volume of lumber that can be recovered from a log, thus increasing overrun. Approximately 15 percent of timber processed in Oregon during 2003 (excluding roundwood pulpwood and industrial fuelwood) came from trees <10 inches d.b.h., and statewide capability to process trees <10 inches

d.b.h. accounted for about 23 percent of timber-processing capacity (Keegan et al. 2006). Nearly 60 percent of Oregon sawmills, representing about 90 percent of lumber-production capacity, indicated the capability to process logs with small-end diameters ≥32 inches. However, 80 percent of the sawmills stated a preference for logs with a large-end diameter of <32 inches and a minimum small-end log diameter between 4 and 16 inches. Approximately 90 percent of the logs processed in Oregon during 2003 came from logs with a small-end diameter of <24 inches.

Plywood and Veneer Sector

Oregon plywood facilities use veneer from in-state and out-of-state sources for production, and veneer is also used for the production of laminated veneer lumber (LVL) in Oregon. Oregon's plywood and veneer sector produced 4,106 million square feet, 3/8-inch basis (MMSF-3/8-inch) of plywood and 2,094 MMSF-3/8-inch of veneer in 2003, making Oregon the leading producer of plywood in the United States. Of the 2,094 MMSF-3/8-inch of veneer, about 1.1 MMSF-3/8-inch went to plywood facilities in Oregon, roughly 800 MMSF 3/8-inch went to LVL facilities in Oregon, and 120 MMSF-3/8-inch was exported out of Oregon. We estimate that about 170 MMSF-3/8-inch of veneer was imported for plywood production and roughly 200 MMSF-3/8-inch of veneer was imported for LVL production.

Oregon's plywood industry grew rapidly between 1954 and 1965 (fig. 10), fluctuating somewhat until the recession in the early 1980s, when production dropped to 5,113 MMSF-3/8-inch in 1982 (Brodie et al. 1978, Warren 1988). Following the recession, plywood production ramped up quickly to 8,381 MMSF-3/8-inch in 1987 (see footnote 1). After 1987, plywood production began to fall rapidly so that by 2002, production had decreased to a new low of 3,058 MMSF-3/8-inch (see footnote 1). One of the factors causing the decrease in plywood production over time is the introduction and acceptance of OSB in the 1980s, which is a substitute for plywood in many structural panel applications. There are currently no OSB facilities operating in the Western United States (see footnote 1).

During 2003, there were 33 plywood and veneer plants operating in Oregon; 11 of these were plants that produced veneer only, 13 were veneer and plywood lay-up operations, and 9 plants operated only as plywood lay-up facilities (table 22). The number of plywood and veneer facilities has decreased substantially since 1968. In 1968, there were 138 plywood and

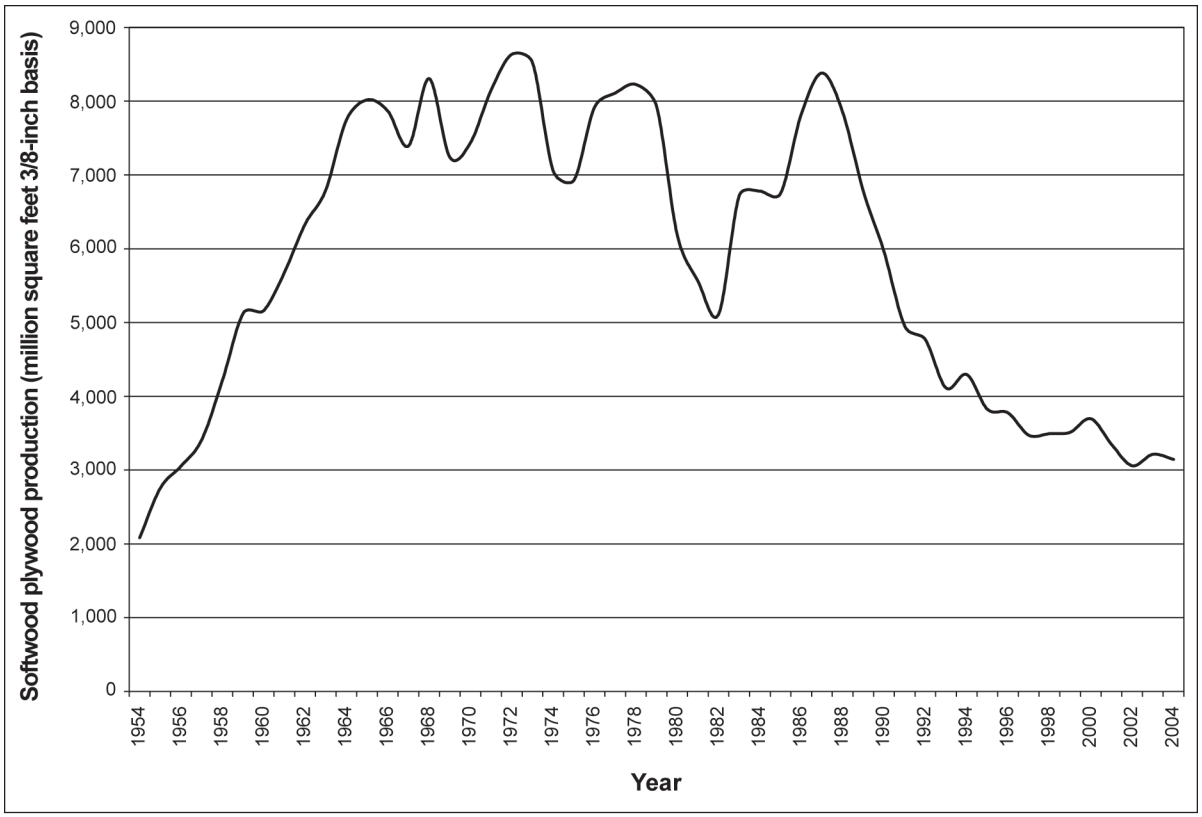

Figure 10—Oregon's softwood plywood production 1954-2004. Sources: Adair 2005 (see footnote 1), Brodie et al 1978, Warren 1988.

Table 22—Number of Oregon plywood and veneer mills, selected years 1968-2003

Year	Veneer only	Veneer and layup	Layup only	All
2003	11	13	9	33
1998	15	14	13	42
1994[a]	—	—	—	26
1992	16	13	11	40
1988	33	33	21	87
1985	36	32	21	89
1982	45	37	19	101
1976	52	52	28	132
1972	46	58	29	133
1968	59	58	21	138

[a] For 1994, plywood and veneer mills not separated.

Sources: Howard 1984; Howard and Hiserote 1978; Howard and Ward 1991, 1988; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000.

veneer plants operating in Oregon: 59 veneer-only, 58 veneer and plywood lay-up, and 21 plywood lay-up only (Manock et al. 1970). In 1994, there were just 26 plywood and veneer facilities operating in Oregon (Ward 1997).

Product recovery ratios, or the volume of output per unit of input, are reported for Oregon's veneer and plywood facilities as a plywood and veneer recovery factor. The plywood and veneer recovery factor is the plywood/veneer output (in thousand square feet 3/8-inch basis) divided by the timber input (thousand board feet Scribner). The statewide plywood and veneer recovery factor for Oregon during 2003 was approximately 4.0 square feet 3/8-inch basis per board foot Scribner of log input.

The plywood production volume calculated from the 2003 FIDACS census is substantially higher than plywood production published by the Engineered Wood Association (APA) (see footnote 1). The two main reasons for discrepancies in the production numbers are (1) inclusion of both softwood and hardwood plywood production in the FIDACS estimate, whereas APA includes just softwood plywood production and (2) inclusion of specialty veneer panel products produced by a few Oregon facilities in the FIDACS estimate that APA does not include in its plywood production.

Pulp and Board Sector

In 2003, 23 pulp and board facilities operated in Oregon. The 11 board facilities operating in the state produced particleboard, hardboard, and medium-density fiberboard (MDF), and there were 12 pulp and paper facilities operating. Oregon's pulp and board sector is the major consumer of mill residues in the state, processing over 70 percent of the residue generated from sawmills and plywood and veneer facilities in the state. Oregon's pulp and paper sector produced more than 4.4 million dry tons of pulp and paper in 2003, with a sales value close to $1.9 billion.

Over 70 percent of the board mills and all the pulp and paper mills in Oregon operate in the Western Resource Areas. Pulp and paper mills tend to be more concentrated in the Northwest Resource Area, which contained 80 percent of the pulp and paper plants. The board plants were most heavily concentrated in the Southwest Resource Area, which had five facilities, whereas the Northwest Resource Area contained three board plants. There were three board facilities in the Central and Blue Mountain Resource Areas combined. In 2003, board facilities in Oregon produced a total of 1,676 MMSF of products including particleboard, MDF, and hardboard with a total sales value of close to $422 million.

Remaining Sectors

Other forest product sectors operating in Oregon during 2003 included both timber- and residue-utilizing manufacturers. The timber-utilizing manufacturers included cedar product facilities; export operations; log furniture manufacturers; log home manufacturers; post, small pole, piling, and utility pole facilities; and roundwood pulp-chip conversion operations. The residue-utilizing sectors included bark product plants, biomass/energy production facilities, and fire-log and wood pellet manufacturers.

Just two cedar products facilities and two export facilities were identified in the FIDACS census, so to ensure protection of firm-level information, no detailed information can be released. The log furniture sector had six facilities operating in Oregon during 2003, producing 1,750 pieces of log furniture with a sales value of just under $1 million. The log home industry in Oregon had 25 plants operating in 2003. These log home facilities produced 988 thousand lineal feet (MLF) with a total sales value of just over $13 million. There were 12 post, small pole, piling, and utility pole plants operating in Oregon during 2003, producing more than 1 million pieces of product with a sales value of $11.4 million. In 2003, there were nine roundwood pulp-chip conversion facilities operating, producing 260,274 BDU of product with a sales value of $23.6 million.

The residue-utilizing sectors had only one biomass/energy operation and only three fire-log and wood pellet manufacturers operating during 2003, so to ensure protection of firm-level information, no further information can be released. However, five bark product facilities operated in Oregon producing 89,243 BDU of product with a sales value of $9.4 million.

Plant Capacity

Timber-processing capacity for 2003 was developed directly from the FIDACS census of Oregon's forest products industry. Timber-processing capacity for previous years was estimated based on changes from the 2003 estimate that used reported mill closures[2] (Spelter and McKeever 2002) and previous industry censuses, which provide information on production capacity in units of output (Howard and Ward 1991, Ward 1995, Ward et al. 2000).

[2] Ehinger, P.F. 2004. Personal communication. Consulting forester, Paul F. Ehinger & Associates, 2300 Oakmont Way, No. 212, Eugene, OR 97401.

Through the FIDACS census, Oregon mills were asked for their 8-hour shift and annual production capacities given sufficient supplies of raw materials and firm market demand for their products. Most mills estimated annual capacity equal to two 8- or 9-hour shifts daily for 220 to 260 days per year. Some of the larger mills expressed capacity comparable to three 8-hour shifts or 120 hours per week. Smaller mills generally reported annual capacity at only one shift per day, for not more than 240 days per year.

Sawmill production capacity was reported in thousand board feet (MBF), lumber tally. Veneer production capacity was reported in thousands of square feet (MSF) on a 3/8-inch basis. Cedar product facilities reported production capacity in squares (hundred square feet) and MBF; log home manufacturers reported capacity in MLF; log furniture, post, small pole, pilings, and utility poles reported their capacity in pieces; and utility pole capacity was reported in MLF. To combine the various production capacity figures for the state's timber users and to estimate the industry's total timber-processing capacity, timber-processing capacity was developed in units of raw material input (million board feet of timber Scribner log rule). Sawmill production capacity figures were converted to timber-processing capacity by dividing production capacity in lumber tally by each mill's overrun. Veneer capacity figures were converted by dividing production capacity in square feet of 3/8-inch veneer by each mill's veneer recovery. Capacities for utility pole plants were converted by multiplying capacity in lineal feet by an average Scribner board-foot volume per piece or per lineal foot.

Oregon's timber-processing capacity (excluding pulpwood and industrial fuelwood) during 2003 was 5,077 million board feet (MMBF) Scribner, of which 84 percent was utilized with mills processing just over 4,261 MMBF (table 23). Annual timber-processing capacity in Oregon was 10 billion board feet Scribner in 1986, when the state's timber users processed over 7 billion board feet (Keegan et al. 2006). Because of declining federal timber offerings, capacity dropped consistently through 1996, even in years with lumber prices (Random Lengths 1976-2004) at or near record high levels. However, between 1996 and 2003, capacity increased by approximately 15 percent. During 2003, sawmills processed 3,179 MMBF Scribner of timber, utilizing 84 percent of the 3,763 MMBF Scribner of available timber-processing capacity. The plywood and veneer sector used 91 percent of the sector's

Oregon's timber-processing capacity (excluding pulpwood and industrial fuelwood) during 2003 was 5,077 million board feet Scribner, of which 84 percent was utilized with mills processing just over 4,261 MMBF.

Table 23—Oregon timber-processing capacity and use, 2003

Facility type	Timber processed	Timber-processing capacity	Capacity used
	– – – Million board feet, Scribner – – –		*Percentage*
Sawmills	3,178.8	3,763.3	84
Plywood and veneer	935.8	1,031.0	91
Chipping	125.2	237.9	53
Other facilities[a]	21.3	45.3	47
All facilities	4,261.2	5,077.4	84

[a] Other includes cedar products, log furniture, log homes, posts, small poles, pilings, and utility poles.

timber-processing capacity of 1,031 MMBF Scribner by processing 936 MMBF Scribner. Facilities that brought in timber to chip processed 125 MMBF Scribner, representing only 53 percent of the sector's available timber-processing capacity of 238 MMBF Scribner. Other facilities utilized 47 percent of available capacity (45 MMBF Scribner) by processing 21 MMBF Scribner.

Mill Residue Production and Use

Mill residue from primary wood products manufacturers can present difficult and expensive disposal problems, or it can be used to produce additional products and generate revenue. The 2003 FIDACS census gathered information on volumes and uses of mill residue. Residue volumes were obtained from facilities that sold all or most of their residues. Mills reported, on a percentage basis, how their residues were used. Residue volume factors, which express mill residue generated per unit of lumber produced, were calculated from production and residue output volumes provided by each mill.

Oregon sawmills and plywood and veneer facilities had substantially smaller residue factors during 2003 than had been reported in previous years (Howard 1984; Howard and Hiserote 1978; Howard and Ward 1988, 1991; Manock et al. 1970; Schuldt and Howard 1974; Ward 1995, 1997; Ward et al. 2000). The sawmill sector had a coarse residue factor of 0.37 BDU per MBF lumber tally and a bark factor of 0.17 BDU per MBF lumber tally (table 24). The factors for sawdust and planer shavings were 0.13 and 0.08, respectively. The plywood and veneer sectors had a coarse residue factor of 0.21 BDU per MSF 3/8-inch, whereas bark and fines were 0.07 and 0.01 BDU per MSF 3/8-inch respectively (table 25).

Oregon's substantial pulp and paper industry was the largest consumer of residues, whereas sawmills were the largest residue producers. Sawmills

Table 24—Oregon sawmill residue factors, 2003

Type of residue	BDU per thousand board feet lumber tally[a]
Coarse	0.37
Sawdust	.13
Planer shavings	.08
Bark	.17
Total	.75

[a] Bone dry units (BDU) (2,400 lbs. of oven dry wood) of various residue types generated for every 1,000 board feet of lumber manufactured.

Table 25—Oregon plywood and veneer plant residue factors, 2003[a]

Type of residue	BDU per thousand square feet of plywood and veneer[b]
Coarse[c]	0.21
Fines	.01
Bark	.07
Total	.29

[a] Plywood and veneer plants are facilities that produce both plywood and veneer and receive timber inputs.

[b] Bone dry units (BDU) (2,400 lbs. of oven dry wood) of various residue types generated for every 1,000 square feet (3/8-inch) of plywood and veneer manufactured.

[c] Peeler cores are included with coarse.

Oregon timber processors generated a total of about 6.3 million BDU of residue during 2003.

accounted for 78 percent of all mill residues generated in Oregon during 2003. During 2003, Oregon sawmills generated 4.9 million BDU of residue; 99.8 percent of which was utilized. Other facilities produced about 1.4 million BDU of residues, meaning Oregon timber processors generated a total of about 6.3 million BDU of residue during 2003 (table 26).

Three types of wood residue are typically created by the primary wood products industry: coarse or chippable residue consisting of slabs, edging, trim, log ends, and pieces of veneer; fine residue consisting primarily of planer shavings and sawdust; and bark. Coarse residue was the state's largest wood products residue component, making up 54 percent of all residues (table 26). Oregon's primary wood products facilities produced almost 3.4 million BDU of coarse residue, of which only 10 BDU (less than 0.01 percent) was not utilized for some purpose. About 93 percent of coarse residues was chipped and used by the pulp and paper industry and reconstituted board plants, 4 percent was used as fuel, and about 3 percent was sold for use in other

Table 26—Production and disposition of wood residues from Oregon sawmills and plywood/veneer plants, 2003

Type of residue	Total utilized	Pulp and board	Fuel	Other uses[a]	Unutilized	Total
			Bone dry units[b]			
Coarse[c]	3,366,703	3,138,714	120,971	107,018	10	3,366,713
Sawdust	889,961	782,752	64,623	42,586	5,875	895,836
Planer shavings	563,914	531,101	9,851	22,962	1,590	565,504
Bark	1,416,435	51,179	1,087,684	277,572	6,085	1,422,520
All residues	6,237,013	4,503,746	1,283,129	450,138	13,560	6,250,573

[a] Other uses primarily include animal bedding and landscape material.

[b] Bone dry unit (BDU) = 2,400 pounds of oven dry wood.

[c] Peeler cores are included in coarse residue.

products. Fines—sawdust and planer shavings—made up the second largest component (23 percent) of residues, at nearly 1.5 million BDU in 2003. Sawdust composed 14 percent and planer shavings 9 percent of all residues. All but 7,465 BDU (0.5 percent) of fine residues were utilized, primarily by the pulp, paper, and reconstituted board plants (1.3 million BDU); fuel for energy production (74,474 BDU); or for other uses (65,548 BDU). Oregon facilities generated 1.4 million BDU of bark while processing timber, 80 percent of which was used as fuel, with nearly all the remaining 20 percent used for decorative bark or soil additives.

Economic Aspects of Oregon's Forest Products Industry

Product Markets and Sales Value

The FIDACS census collected market information by geographic destination and product type. Mills summarized their calendar year 2003 shipments of finished products and residues, 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 precisely reflect the final delivery points of shipments.

Sales of primary wood products and mill residues from Oregon totaled nearly $7 billion in 2003 (table 27). Sales from pulp and reconstituted board sectors accounted for 37 percent of total sales at slightly over $2.6 billion. The lumber sector was a close second accounting for almost $2.3 billion or

Table 27—Destination and sales value of Oregon primary wood products and mill residues, 2003

Product	Oregon	Far West[a]	Rockies[b]	North Central[c]	Northeast[d]	South[e]	Canada	Pacific Rim	Other[f]	Total
					Thousands of 2003 dollars					
Pulp and board[g]	497,725	1,425,202	346,456	158,217	30,005	55,221	57,927	17,654	14,344	2,602,752
Lumber	676,515	1,006,645	216,396	120,473	157,672	86,171	4,978	12,124	3,763	2,284,737
Plywood and veneer	662,786	393,769	138,018	226,215	243,615	95,566	13,517	0	0	1,773,487
Other primary wood products[h]	22,545	8,080	5,343	631	641	1,252	0	24,020	0	62,511
Total primary product	1,859,571	2,833,697	706,213	505,536	431,933	238,210	76,422	53,798	18,107	6,723,486
Residues[i]	222,599	10,834								233,433
Total sales value	2,082,170	2,844,531	706,213	505,536	431,933	238,210	76,422	53,798	18,107	6,956,920

[a] Far West includes Alaska, California, Hawaii, and Washington.

[b] Rockies includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

[c] North Central includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

[d] Northeast includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

[e] South includes Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

[f] Other includes Europe and Mexico.

[g] Pulp and board includes pulp, paper, reconstituted board, bark, wood pellets, and other energy products.

[h] Other primary wood products include cedar products, export logs, log furniture, house logs, posts, small poles, pilings, and utility poles.

[i] Mill residues in Far West include all out-of-state mill residue sales.

33 percent of the total. Plywood and veneer sectors made up 25 percent of the sales value with slightly less than $1.8 billion in total sales. Other primary wood products sectors made up the remaining 1 percent of sales at $63 million. The pulp, board, and lumber sectors all had their largest sales values in the Far Western States, while the plywood, veneer, and other primary products sectors had their largest sale value in Oregon.

The Far West States (excluding Oregon) made up the largest market for Oregon's primary wood and paper products, accounting for slightly over $2.8 billion or 42 percent of the total sales value. Of the states in the Far West, California was the main consumer of Oregon's primary wood and paper products accounting for over 60 percent of 2003 sales. Slightly over $1.4 billion (55 percent) of the pulp and board sector went to the Far West, while 44 percent ($1 billion) of lumber sector sales went there. The plywood and veneer sector delivered 22 percent ($394 million) of their products to the Far West, while 13 percent ($8 million) of the other primary product sectors went there.

Oregon, with almost $1.9 billion and 28 percent of total sales, was the second largest market for primary wood and paper products produced in Oregon. The lumber sector was the largest component of sales within the state, making up almost $677 million and 30 percent of total lumber sector sales. The plywood and veneer sector followed closely with almost $663 million in sales within Oregon and 37 percent of the total plywood and veneer sector. The pulp and board sector had nearly $498 million of sales value that stayed in Oregon making up 19 percent of that sector, while the other primary products sector had almost $23 million of sales in Oregon, making up 36 percent of the sector. Sales of residues were dominated by in-state sales, which accounted for 95 percent ($222.6 million) of the residue sales, and the remaining 5 percent of residue sales were to facilities outside of Oregon, largely to neighboring Far West states.

The sales value to states in the Rockies made up 11 percent of Oregon's total sales value and was primarily made up of the pulp and board sector with slightly over $346 million. Lumber shipped to the Rockies accounted for slightly over $216 million, plywood and veneer was just over $138 million, and other primary wood products accounted for just over $5 million. The North Central area made up 8 percent of Oregon's total sales value with almost 45 percent of it being in plywood and veneer. The Northeast area accounted for 6 percent and had almost 57 percent of it in plywood and

veneer. The Southern States accounted for 4 percent of the total sales value. Canada and the Pacific Rim countries each accounted for only 1 percent of the total sales value, and other areas, which include Europe and Mexico, accounted for less than 1 percent.

Employment and Worker Earnings

Employment data developed as part of the FIDACS census was used in conjunction with employment and earnings data from the U.S. Department of Commerce, Regional Economic Information System (REIS) to identify employment and labor income for Oregon's primary and secondary forest products industry. The primary forest products industry, includes logging, processing logs into lumber and other wood products, processing wood residues from timber-processing plants into outputs such as paper or electricity, and private sector forest management services. The secondary industry includes firms processing outputs from the primary industry, although the outputs may be from mills in Oregon or elsewhere. Secondary products include prefabricated buildings, molding, millwork and cut stock, doors, windows, and laminated veneer lumber (LVL).

Most of the primary and secondary industry has traditionally been reported in three standard industrial classifications (SIC) as defined by the U.S. Office of Management and Budget (1987): SIC 08—forestry services; SIC 24—lumber and wood products; and SIC 26—pulp, paper, and allied products. Starting in 2001, the North American Industry Classification System (NAICS) replaced the SIC system, causing some problems with data continuity. The forest products industry can now be found in four categories (OMB 1998): NAICS 113—forestry and logging; NAICS 1153—forestry support activities; NAICS 321—wood product manufacturing; and NAICS 322—paper manufacturing. The total numbers for the industry are comparable between the two systems, albeit in a slightly different combination.

Based on the four NAICS sectors (113, 1153, 321 and 322), almost 65,700 workers, earning a total of $3.3 billion annually, were directly employed in the primary and secondary wood and paper products industry in Oregon during 2003. Approximately 43,300 of these were employed in the harvesting and processing of timber or in private sector land management, earning nearly $2.3 billion in labor income. The remaining component of the industry can be classified as secondary and employed 22,400 workers during 2003, with worker earnings of approximately $1 billion.

Total employment and inflation-adjusted labor income in Oregon's forest products industry have both decreased since 1969 (figs. 11 and 12). In 1969, forest products industry employment was close to 85,600, with a payroll near $3.5 billion (in 2003 dollars). At its peak in 1979, the industry employed more than 100,700 workers and paid approximately $5.3 billion in labor income. A trough occurred during the recession of the early 1980s: employment dipped to 73,600 in 1982, with workers being paid slightly over $3.4 billion. After this dip, a fairly steady period ensued, peaking at close to 90,000 workers being paid close to $4.2 billion in 1988, before sliding to 72,300 employees in 1996, with a payroll of $3.1 billion. Since 1996, employment in the forest products industry has continued to decline, reaching 70,050 in 2000, and 65,700 in 2003. Labor income, however, has exhibited a slightly different trend, increasing to $3.3 billion in 1999 (while employment continued to fall), and maintaining this level through 2003.

The major reason for the decline in overall forest products industry employment in Oregon over the past 30 years is the substantial decline in timber harvest, particularly from federal lands, that took place in the 1990s. The impact of this nearly 50-percent decline in timber harvest was partly offset by an increase in the number of workers employed per MMBF of timber (fig. 13). Much of the increase in employment per unit volume harvested is due to the expansion of the secondary industry, and an increase in private sector workers in land management activities.

The majority of the volatility in employment and labor income in the wood and paper products industry is due primarily to shifts in SIC 24—lumber and wood products. While SIC 26—paper and allied products—has remained stable throughout the past three decades, SIC 24 has fluctuated widely, showing several peaks and troughs with more extreme variation. This suggests that SIC 24 is more sensitive than SIC 26 to recessionary periods such as those experienced in the early 1980s when declines in home construction reduced the demand for lumber and wood products (McWilliams and Goldman 1994). Also, the secondary industry is more flexible in terms of raw material sources: whereas the primary industry mainly processes timber from within the state and thus relies heavily on local harvest levels, the secondary industry gets its raw materials from suppliers within and outside of Oregon. Labor income has also fluctuated more than employment over the past 30 years, generally because firms tend to reduce workers' hours rather than lay employees off during drops in business.

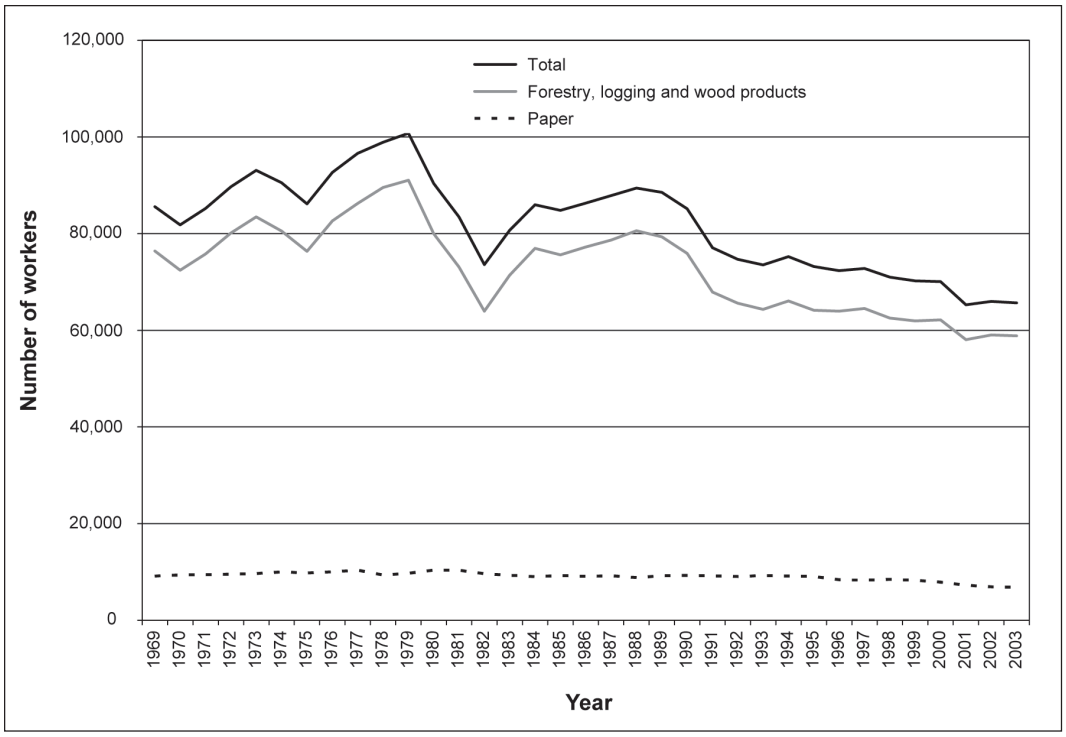

Figure 11—Employment in Oregon's forest products industry, 1969-2003. Source: U.S. Department of Commerce 2005.

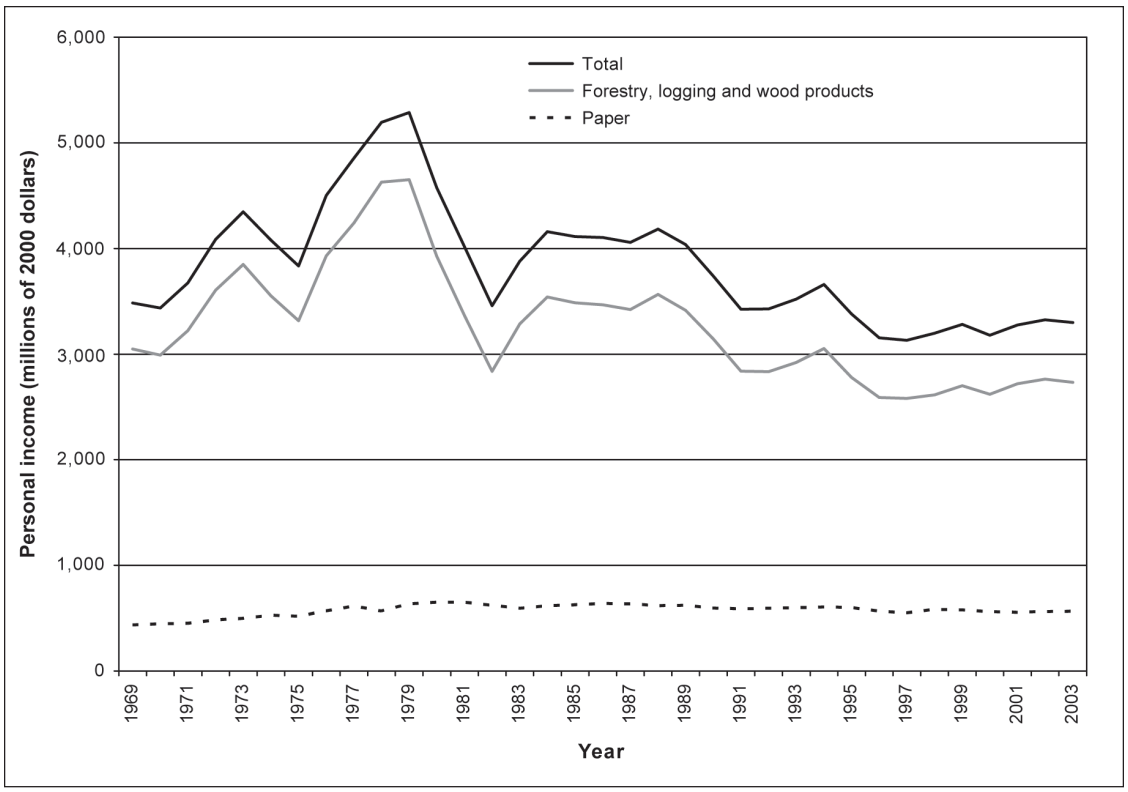

Figure 12–Personal income in Oregon's forest products industry, 1969-2003. Source: U.S. Department of Commerce 2005.

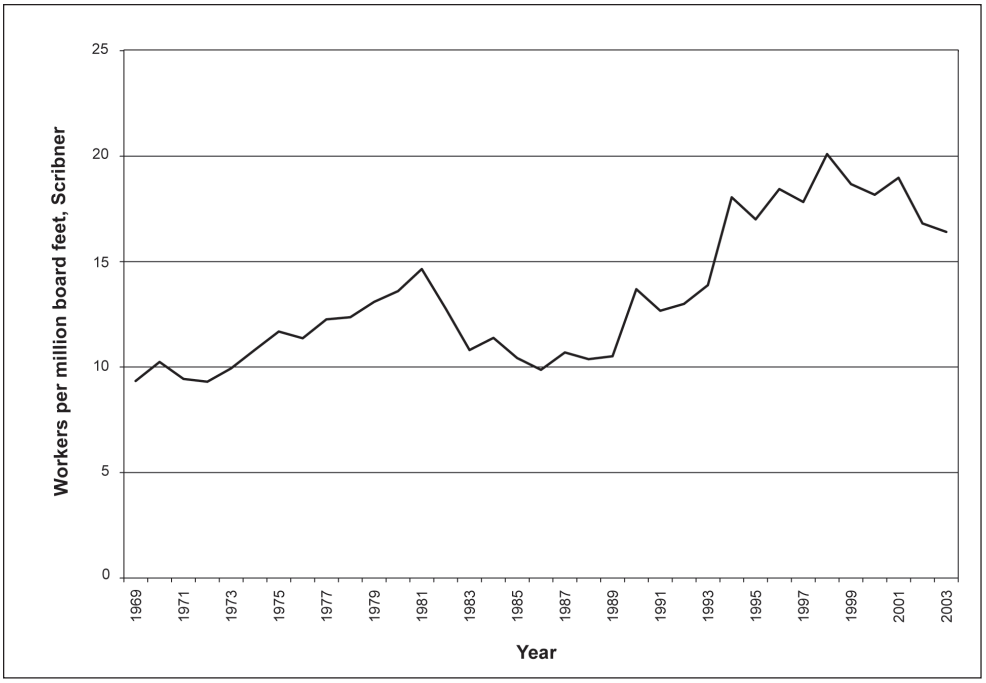

Figure 13–Employment per unit volume of timber harvested in Oregon 1969-2003. Sources: Andrew and Kutara 2005, U.S. Department of Commerce 2005

Sector SIC 26 has seen a total drop of less than 1,300 workers from 1969 to 2000, while SIC 24 has dropped more than 21,600. However, total job loss for the period is only 15,500 owing to a gain of close to 7,400 workers in SIC 08. This sector includes services related to timber production, wood technology, forestry economics, and marketing, as well as forestry services such as cruising timber, firefighting, and reforestation. Employment growth in this sector has been impressive, but has happened gradually over the course of three decades, thus illustrating the general trend of increased forest management. In 2000, SIC 08 accounted for 13 percent of total forest products industry employment (up from 2 percent in 1969), and 11 percent of labor income. In 2003, the NAICS sector including these forestry management services (NAICS 113) accounted for 20 percent of forest products industry employment but just 10 percent of labor income, reflecting the seasonality of much of the work in this sector.

Oregon's forest products industry has consistently been responsible for a higher portion of labor income than employment, indicating that the industry provides above-average wages and benefits.

Oregon's forest products industry has consistently been responsible for a higher portion of labor income than employment, indicating that the industry provides above-average wages and benefits. For example, during 2000, Oregon's average worker earnings across all industries was $31,500, but for the forest products industry, the figure was close to $45,400, 44 percent

higher. In 2003, under the new NAICS, those numbers were $32,400 and $50,200, respectively. Additionally, some forestry subsectors have posted stronger wage gains than the statewide average wage (E.D. Hovee & Company 2004).

During the late 1960s and the early 1970s, Oregon was extremely dependent on the forest products industry. During this period, the industry employed approximately 9 percent of Oregon's workers, and directly provided about 13 percent of total labor income in the state. When considering federal and state land management activities as well, the industry directly and indirectly contributed close to 25 percent of the state's labor income. These proportions have been in steady decline ever since, with employment hovering around 3 percent in 2000 and 2003. Although it fluctuated more than employment through its decline, labor income was 5 percent in 2000 and 2003. Although not as significant as the contribution to income three decades ago, this still represents a substantial direct and indirect contribution to Oregon's economy, certainly close to 10 percent. Only Maine, at 5.6 percent of labor income, shows a higher relative dependency on its forest products industry than Oregon.

Regional Dependence on the Forest Products Industry

The Northwest and the Southwest Resource Areas are similar in industry size and the Central and the Blue Mountain areas share common characteristics. However, a different pattern emerges when considering resource area dependency on the forest industry, as measured by percentage of labor income. The Northwest Resource Area has been and continues to be large in terms of the size of its forest products industry. In fact, in 2000, it was the largest of the four areas. However, it has always been the least dependent on the forest products industry. At its peak in 1969, 7.6 percent of labor income was from forest industry, and currently it is less than 3 percent, despite labor income being remarkably similar in the two years—$1.31 billion in 1969 vs. $1.32 billion in 2000 (2003 dollars), an increase of less than 0.5 percent. This is obvious testament to the economic growth and diversification of the area's economy. Of all the counties in the Northwest Resource Area, only Columbia County shows a significant dependency on the forest products industry. With a low population base but a large number of forest products firms, in addition to its location immediately across the Columbia River from busy timber counties in Washington state, Columbia County's labor income from the forest products industry was at 21 percent of total labor income during 2000.

The forest products industry in the Southwest Resource Area, has seen a greater decline in labor income—$1.59 billion in 1969 vs. $1.16 billion in 2000 (2003 dollars), a decrease of 27 percent)—and is now smaller than that of the Northwest. However, in terms of industry dependency, the area has always been the most dependent of the four, at 30 percent of labor income in 1969 and at approximately 10 percent in 2000. This is due in large part to the presence of Roseburg Forest Products in Douglas County.

The Central Resource Area has seen healthy population growth in the past three decades despite three counties experiencing negative population growth during the period. For example, Wheeler County's population dropped from 1,800 in 1969 to 1,500 in 2000, and forest industry labor income dropped from 48 percent to 1 percent of total labor income over the same period. Although the forest products industry in this area is much smaller, in terms of dependency, the Central and Southwest Resource Areas are about equal and have been since the early 1980s, with about 10 percent of labor income from forest industry in both areas during 2000. The Blue Mountains Resource Area has low population numbers, low growth rates, and the smallest forest products industry of the four resource areas. Its dependency is slightly higher than that of the Northwest, and actually increased in the early 1980s to early 1990s. Labor income from forest industry went from 11 percent in 1969, through a peak of 12 percent in 1989, to 6 percent in 2000. No county in this area depends on the forest industry for more than 15 percent of its labor income.

Metric Equivalents

When you know:	Multiply by:	To find:
Inches	2.54	Centimeters
Feet	.305	Meters
Square feet	.093	Square meters
Cubic feet	.028	Cubic meters
Acres	.405	Hectares
Pounds	.454	Kilograms
Boardfeet	see p. 20	

Literature Cited

Andrews, A.; Kutara K., 2005. Oregon's timber harvests: 1849-2004. Salem, OR: Oregon Department of Forestry. 152 p.

Brodie, D.J.; McMahon, R.O.; Gavelis, W.H. 1978. Oregon's forest resources: their contributions in the state's economy. Res. Bull. 23. Corvallis, OR: Forest Research Laboratory, Oregon State University. 80 p.

Campbell, S.; Dunham, P.; Azuma, D. 2004. Timber resource statistics for Oregon. Resour. Bull. PNW-RB-242. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 67 p.

E.D. Hovee & Company/FP Marketing Solutions. 2004. Oregon forest sector contributions & potential. Vancouver, WA. 61 p.

Howard, J.O. 1984. Oregon's forest products industry: 1982. Resour. Bull. PNW-RB-118. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 79 p.

Howard, J.O.; Hiserote, B.A. 1978. Oregon's forest products industry: 1976. Resour. Bull. PNW-RB-79. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 102 p.

Howard, J.O.; Ward, F.R. 1988. Oregon's forest products industry: 1985. Resour. Bull. PNW-RB-149. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 90 p.

Howard, J.O.; Ward, F.R. 1991. Oregon's forest products industry: 1988. Resour. Bull. PNW-RB-183. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 91 p.

Keegan, C.E.; Morgan, T.A.; Gebert, K.M.; Brandt, J.P.; Blatner, K.A.; Spoelma, T.P. 2006. Timber-processing capacity and capabilities in the Western United States. Journal of Forestry. 104(5): 262-268.

Manock, E.R.; Choate, G.A.; Gedney, D.R. 1970. Oregon timber industries: wood consumption and mill characteristics, 1968. Salem, OR: Oregon Department of Forestry. 122 p.

McWilliams, B.; Goldman, G. 1994. The forest products industries in California: their impact on the state economy. Publ. CNR002. Berkeley, CA: University of California, College of Natural Resources. 30 p.

Miller, H.M. 1982. Forest, people and Oregon: a history of forestry in Oregon. Salem, OR: Oregon State University, Forestry Department. 52 p.

Office of Management and Budget [OMB]. 1987. Standard industrial classification manual. Springfield, VA: Executive Office of the President. 703 p.

Office of Management and Budget [OMB]. 1998. North American industrial classification system. Lanham, MD: Executive Office of the President. 1247 p.

O'Laughlin, J.; Cook, P.S. 2003. Inventory-based forest health indicators: implications for national forest management. Journal of Forestry. 101(2): 11-17.

Oregon Department of Forestry [ODF]. 2003. Complete harvest data 1962-present. www.odf.state.or.us (August 2004).

Oregon Department of Forestry [ODF]. 2005. Quarterly adjusted softwood log price index. http://egov.oregon.gov/ODF/STATE_FORESTS/FRP/Charts.shtml. (August 2005).

Paperloop. 2004. 2004 Lockwood-Post's directory of the pulp, and paper mills. San Francisco, CA. 245 p.

Random Lengths. 1976-2004. Forest product market prices and statistics yearbook. Eugene, OR. [Pages unknown].

Random Lengths. 2002-2005. Big book: the buyers and sellers directory of the forest products industry. Eugene, OR. 1008 p.

Ruderman, F.K. 1978. Production, prices, employment, and trade in Northwest forest industries, first quarter 1977. U.S. Department of Agriculture, Pacific Northwest Forest and Range Experiment Station. Portland, OR. 58 p.

Schuldt, J.P.; Howard, J.O. 1974. Oregon forest industries: wood consumption and mill characteristics, 1972. Spec. Rep. 427. Corvallis, OR: Oregon State University. 113 p.

Smith, W.B.; Vissage, J.S.; Darr, D.R.; Sheffield, R.M. 2001. Forest resources of the United States, 1997. GTR-NC-219. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 198 p.

Spelter, H.; Mckeever, T. 2002. Profile 2001: softwood sawmills in the United States and Canada. Res. Pap. FPL-RP-594. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 73 p.

U.S. Department of Commerce, Bureau of Economic Analysis. 2005. Regional accounts data. www.bea.gov/bea/regional/data.htm. (May 2005).

Ward, F.R. 1995. Oregon's forest products industry: 1992. Resour. Bull. PNW-RB-207. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 89 p.

Ward, F.R. 1997. Oregon's forest products industry: 1994. Resour. Bull. PNW-RB-216. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 70 p.

Ward, F.R.; Lettman, G.J.; Hiserote, B.A. 2000. Oregon's forest products industry: 1998. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station; Oregon Department of Forestry. 82 p.

Warren, D.D. 1988. Production, prices, employment, and trade in Northwest forest industries, third quarter 1987. Resour. Bull. PNW-RB-152. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 74 p.

Western Wood Products Association [WWPA]. 1964-2005. Statistical yearbook of the Western lumber industry. Portland, OR.

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