

Arizona's Forest Products Industry: A Descriptive Analysis 1998

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Introduction

This monograph presents results of a census of Arizona's primary forest products industry for calendar year 1998 with discussion of changes over time. Arizona's primary forest product manufacturers include firms that process timber into manufactured wood products (i.e., lumber, house logs, and pulp and paper) and facilities that utilize the wood fiber residue directly from the timber processors.

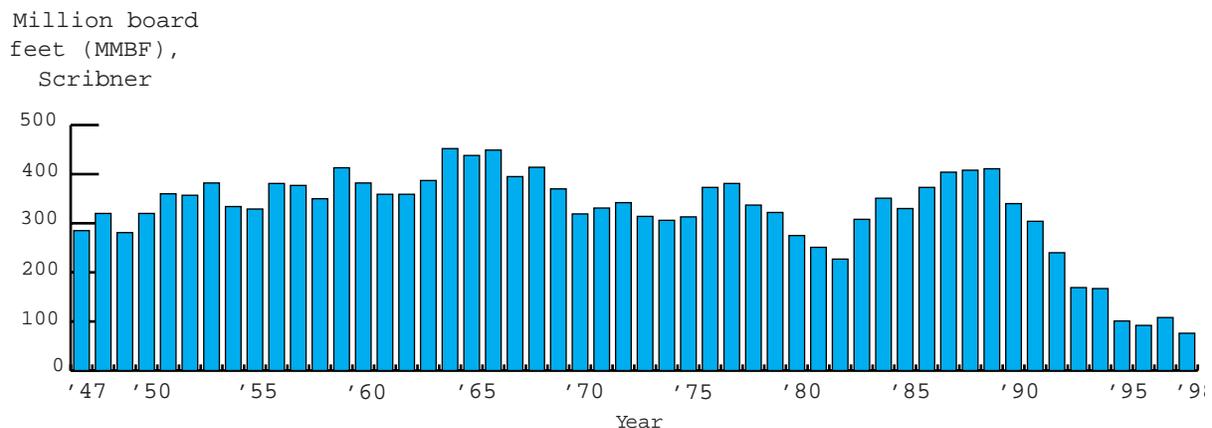
The University of Montana-Missoula Bureau of Business and Economic Research (BBER), in cooperation with the U.S. Forest Service's Inventory Monitoring and Evaluation Program at the Rocky Mountain Research Station in Ogden, Utah, developed a system to collect, compile, and make available state- and county-level information on forest products industry operations. The Forest Industries Data Collection System (FIDACS) focuses on the source and volume of timber used and the products manufactured from that timber.

FIDACS is based on a census of primary forest products manufacturers located in a given state. Through a written questionnaire or phone interview, manufacturers provide the following detailed information for each plant:

- production employment,
- plant production capacity,
- volume of raw material received, by county and ownership,
- species of timber received,
- finished product volumes, types, sales value, and market locations,
- utilization and marketing of manufacturing residue, and
- beginning and ending inventory levels for raw materials and finished products.

Arizona manufacturers were identified through several sources including national forest timber sale bidder lists, the *1998 Directory of the Wood Products Industry* (Miller Freeman, 1998), telephone directories, and information provided by industry personnel.

Figure 1
Arizona Timber Harvest, 1947-1998 [excluding fuelwood]



Source: Derived by the Bureau of Business and Economic Research based on McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*. Western Wood Products Association, *Statistical Yearbook of the Western Lumber Industry*.

This effort to collect 1998 data is the first full application of FIDACS in Arizona. Similar censuses have been conducted by the BBER in Montana for 1976, 1981, 1988, 1993, and 1998; in Idaho for 1979, 1985, 1990, and 1995; in Utah for 1992; and in Wyoming for 1976. The Intermountain Research Station collected similar but more limited data in Arizona for 1984 and in other Rocky Mountain States for other years. Prior to the 1998 analysis, the BBER performed a modified census of Arizona's forest products industry to develop data for 1990. Results from 1990 are also included in this report.

Firms cooperating in the 1998 Arizona census processed virtually all of the state's non-fuelwood timber harvest. Published sources and data from various land management agencies were used to make estimates of any non-respondent firms. Firms in other states—identified through various directories, records of land management agencies, and industry personnel—were contacted to track timber that left Arizona for processing.

Information collected through FIDACS is stored at The University of Montana's Bureau of Business and Economic Research. Additional information is available by request. Individual firm-level data are confidential and will not be released.

Recent Harvest Trends and Impacts on Arizona's Forest Products Industry

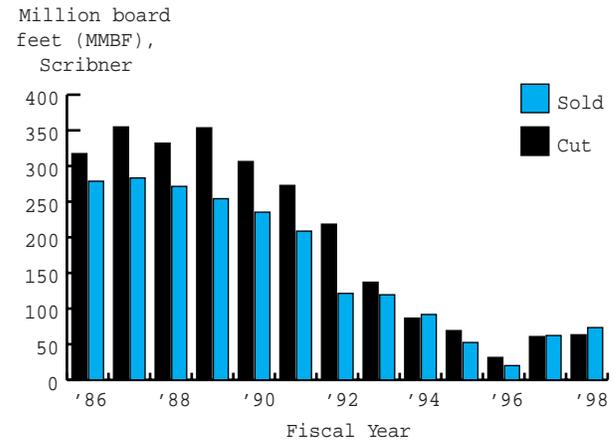
Arizona's timber harvest has declined dramatically in recent years. Large decreases in harvests from national forest lands and, to a lesser degree, from tribal lands brought on this decline. Statewide harvest volumes dropped from about 400 million board feet Scribner (MMBF) annually in the late 1980s to under 100 MMBF in recent years (Figure 1), with national forest harvest volumes decreasing from 350 MMBF to about 50 MMBF (Figure 2), and tribal lands dropping from about 100 MMBF to 50 MMBF. As recently as 1990, more than 300 million board feet of timber, including fuelwood, was harvested annually from national forest lands in Arizona. In fiscal year 1998—October 1997 through September 1998—less than 65 MMBF of timber was harvested from Arizona's national forests, and about 37 MMBF of that was fuelwood, leaving about 28 MMBF of industrial timber products harvested from the state's national forests.

The decline in Arizona's national forest timber harvest followed a pattern similar to that of many western states during the 1990s. The harvest from national forest lands throughout the West began to decline in the early 1990s, brought on by a combination of pressures related to threatened and endangered species, appeals and litigation directed at federal timber sales, and federal budget levels (Keegan *et al.* 1995 and 1997, Warren 1998). In Arizona, the listing of the Mexican spotted owl as an endangered species had major impacts on timber harvest levels.

In March of 1993, the U.S. Fish and Wildlife Service listed the Mexican spotted owl as threatened. In August of 1995, a federal judge ordered a halt of logging new sales on national forests in Arizona and New Mexico until a recovery plan for the owl could be developed. This injunction was in place until December of 1996. The fiscal year 1996 harvest from Arizona national forests fell to about 28 MMBF as a result, and most of that was fuelwood harvest, not industrial timber harvest. The lifting of the injunction resulted in increases in national forest timber offerings in 1997 and 1998. The cut from Arizona national forests increased to about 61 MMBF in 1997 and 63 MMBF in 1998 (Figure 2).

The harvest decline of the 1990s left many mills without enough timber to sustain operations. As a result, several Arizona mills closed, and many others curtailed operations. In addition to the relatively long-term harvest declines, the Asian financial crisis and global economic problems of late-1997 and 1998 weakened what had been very strong market conditions for wood products. These weaker markets caused a drop in prices and further reduction in total sales, leaving an industry that was only a fraction of what had operated in Arizona just a few years prior.

Figure 2
Arizona's National Forest Timber Harvest, 1986-1998 (including fuelwood)



Source: USDA Forest Service Region Three, Cut and Sold Reports, Albuquerque, NM.

Overview

Structure and Distribution

The 1998 Arizona census identified 13 active timber processing plants in the state (Table 1). These include six sawmills manufacturing lumber and other sawn products; four house log and log home plants; one pulp and paper mill producing recycled newsprint and Kraft linerboard; one log furniture manufacturer, and one mesquite briquette plant. The number of plants has declined from 1990 when there were an estimated 19 active timber processing facilities in Arizona. The decline from 1990 to 1998 was mostly in the sawmill sector, where an estimated eight mills closed due primarily to national forest harvest declines.

As of 1984, Arizona had 20 active sawmills, one papermill, and two post and pole yards (McLain 1988). In 1966, Arizona had 23 active sawmills. In 1960, the state had 38 mills (Setzer and Wilson 1970).

During 1998, timber processing facilities operated in four of Arizona's fourteen counties, and timber was harvested in seven counties. Facilities tend to locate near the forest resource along the north side of the Mogollon Plateau, with concentrations in southern Apache and Navajo counties (Figure 3).

Figure 3
Location of Arizona's Timber Processing Facilities, 1998

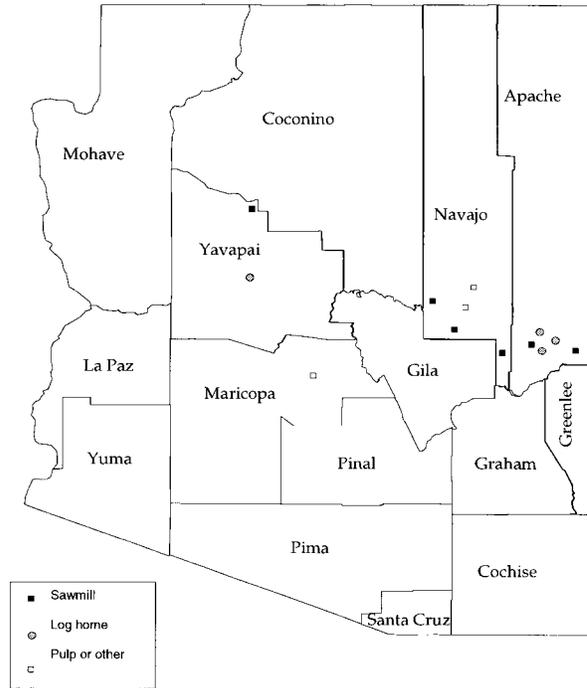


Table 1
Number of Active Arizona Primary Wood Products Facilities by County, 1998

County	Log Homes and Other Products*				Total
	Lumber	House Logs	Other Products*	Pulp and Paper Mill	
Apache	2	3	--	--	5
Coconino	--	--	--	--	--
Maricopa	--	--	1	--	1
Navajo	3	--	1	1	5
Yavapai	1	1	--	--	2
1998 Total	6	4	2	1	13
1990 Total	14	3	1	1	19
1984 Total	20	--	2	1	23

*Other products include a mesquite briquette manufacturer and a log furniture producer.

Sources: McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana, Bureau of Business and Economic Research, Missoula, MT.

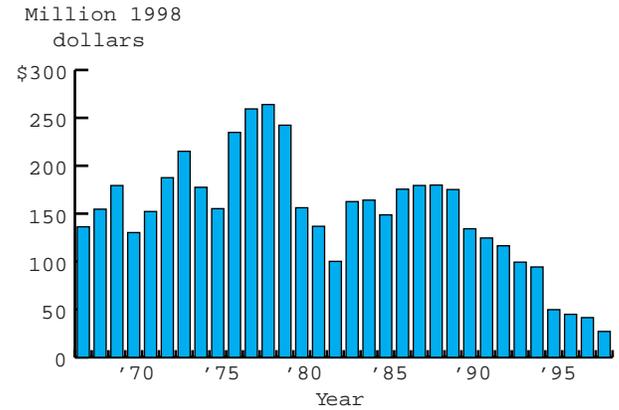
Table 2
Sales Value of Arizona's Primary Wood Products^a: 1984, 1990, and 1998

Product	—Thousand 1998 Dollars—		
	1984	1990	1998
Lumber and sawn products ¹	164,000	134,200	27,000
House logs and other products ^{b 2}	230	528	2,218
Total^a	164,230	134,728	29,218

^a Does not include sales of pulp and paper products. All sales are reported F.O.B. the manufacturer's plant.
^b Other products include log homes, mesquite briquettes, and log furniture.

Sources: ¹ Western Wood Products Association, *Statistical Yearbook of the Western Lumber Industry*;
² FIDACS 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Figure 4
Arizona Lumber Sales, 1967-1998



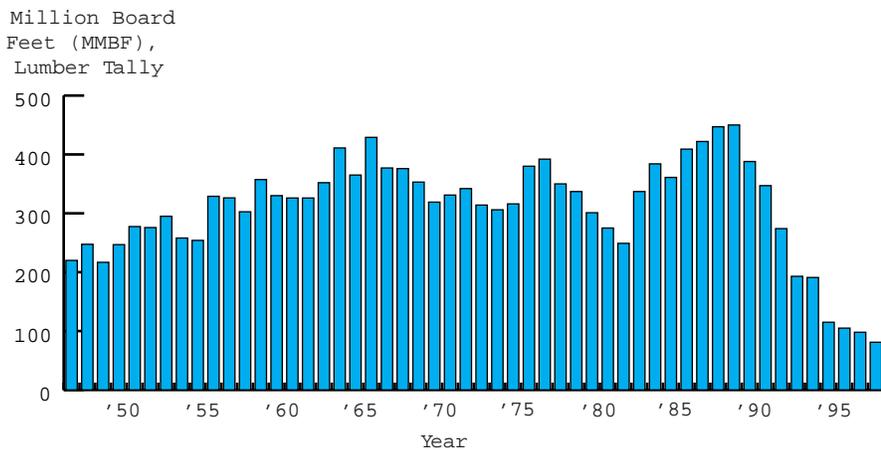
Source: Western Wood Products Association, *Statistical Yearbook of the Western Lumber Industry*.

Sales Value of Primary Wood Products

The 1998 estimated sales of Arizona's primary forest products industry was about \$29.2 million F.O.B. the producing mill—not including the sales of the pulp and paper mill (Table 2). Lumber sales comprised almost 95 percent of these sales, with all other products including log homes, mesquite briquettes and log furniture contributing \$2.2 million. With timber supply driven

declines in the sawmill industry, Arizona lumber sales in 1998 were the lowest inflation-adjusted lumber sales in at least 30 years (Figure 4). Based on lumber production (Figure 5), Arizona's inflation-adjusted 1998 lumber sales were likely lower than any level since World War II. Arizona lumber sales peaked in 1978 at \$264 million (1998 dollars).

Figure 5
Arizona Lumber Production, 1947-1998



Source: Western Wood Products Association, *Statistical Yearbook of the Western Lumber Industry*.

Processing Sectors

Sawmill

As shown in Figure 5, Arizona's six sawmills produced about 81 MMBF of lumber and other sawn products in 1998, the lowest production level since World War II and more than a 70 percent decline in lumber production from just six years prior. The highest lumber production for Arizona's industry in the last 50 years was in 1988 and 1989 when the state's sawmills produced about 450 MMBF annually.

On average, Arizona sawmills produced approximately 1.46 board feet of lumber for every board foot Scribner of timber processed for an average overrun of 46 percent in 1998. Lumber recovery varied among mill types, with higher overrun in sawmills producing primarily random length dimension and stud lumber and lower overrun in mills producing primarily board lumber. In 1998, about 64 percent of the lumber produced by Arizona's sawmills was dimension and studs, 35 percent was board and shop lumber, and less than 1 percent was timbers. Sales of lumber, mine timbers, and associated products totaled about \$28.4 million in 1998. Board and shop lumber accounted for \$12.1 million (43 percent), dimension lumber \$16.1 million (56 percent), and mine timbers and associated products \$228,000.

In addition to the reduced statewide lumber production and sales values discussed earlier, the 1990s saw the end of a nearly 40-year trend of increasing output per mill (Table 3). Arizona sawmills produced an average of 13.5 MMBF each in 1998, with output ranging from less than 1 MMBF to more than 42 MMBF. This compares to 1990 when average sawmill production was 105 percent greater, averaging 27.7 MMBF per mill. Studies conducted in 1960 and 1962 found average production per sawmill lower than in 1998, but there were a greater number of mills during the 1960s (Table 3). As recently as 1990, nine sawmills reported sawing more than 10 MMBF (Table 4). In 1998, only four sawmills produced more than 10 MMBF annually, accounting for 99 percent of Arizona's lumber production. These larger mills produced an average of 20 MMBF each in 1998.

Pulp and Paper

Arizona has one pulp and paper manufacturer that processes wood and recycled fiber to produce recycled-content newsprint and Kraft linerboard. Estimated annual sales of Arizona's pulp and paper products in the mid-1990s were well in excess of \$100 million (Miller Freeman, 1994). Production and sales declined substantially in recent years due to declining fiber availability and soft markets.

Table 3
Number of Sawmills and Average Production per Mill, 1960, 1962, 1966, 1984, 1990, and 1998

Year	Number of Sawmills	Average Production per mill
1960	38	8.7 MMBF
1962	28	11.6 MMBF
1966	23	19.0 MMBF
1984	20	19.2 MMBF
1990	14	27.7 MMBF
1998	6	13.5 MMBF

Sources: Setzer, T.S. and A.K. Wilson, *Timber Products in the Rocky Mountain States, 1966*; McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 4
Number of Arizona Sawmills by Production Size and Percentage of Lumber Produced by Size Class, 1966, 1990, and 1998

Year	Number of Sawmills		
	Under 10 MMBF	Over 10 MMBF	Total
1966	13	10	23
1990	5	9	14
1998	2	4	6

Year	Percent of Lumber Output		
	Under 10 MMBF	Over 10 MMBF	Lumber Output
1966	11%	89%	437,000 MBF
1990	4%	96%	388,000 MBF
1998	1%	99%	80,970 MBF

Note: Size class is based on reported lumber production. MMBF denotes million board feet lumber tally.

Sources: Setzer, T.S. and A.K. Wilson, *Timber Products in the Rocky Mountain States, 1966*; Western Wood Products Association, *Statistical Yearbook of the Western Lumber Industry*; Miller Freeman, Inc., *1992-93 Directory of the Forest Products Industry*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

House Log/Log Home

The 1998 census identified four house log and log home manufacturers operating in Arizona. The census included only firms that process timber—not distributors of log home and house logs manufactured in other states. These firms produced about 103,300 lineal feet of house logs, processing approximately 400 thousand board feet (MBF) of timber in 1998, generating sales just over \$2 million.

Based on discussions with industry representatives, Arizona's commercial log home industry commenced operation in 1983, with a single plant located in Prescott. Three more firms were established near

Springville—two later in the decade and the third in the mid-1990s. Manufacturing methods included hand-hewn, sawn, and laminated logs. Shells, house logs, and turn-key homes were the principal outputs, and the majority of sales were in Arizona and the southern Rocky Mountain region.

Other Products

Two other timber processors operating in 1998 include a manufacturer of packaged mesquite briquettes for home smokers and a log furniture producer. Statistics for these firms are not reported to protect the privacy wishes of the owners.

Timber Source, Use, and Movement

This section examines Arizona's timber harvest and the industry's use of timber during 1998. It focuses on ownership and geographic sources of timber, types of timber products harvested and processed, species composition and movement of timber products. Timber harvested from Arizona timberland and manufactured into wood products came from three land ownership categories: national forests, tribal lands, and private lands. All private timberland was classified as non-industrial private forestland. Arizona has no large tracts of industrial timberland owned by individuals or companies operating primary wood processing plants.

Harvest by Ownership

In 1998, 76.3 MMBF (Scribner) of industrial timber was harvested from Arizona's timberlands and sent to mills for processing. This harvest level is less than 25 percent of the average annual harvest for the past 50 years, with the decline due largely to reductions in national forests with some declines in tribal harvests since the late 1980s. The national forest harvest reductions have led to a distinct shift in ownerships supplying timber to Arizona's industry, with tribal lands now supplying the majority.

Most (60 percent) of the 76.3 MMBF of timber harvested from Arizona timberlands in 1998 came from tribal timberlands (Table 5 and Figure 6). National

forests accounted for 37 percent, and non-industrial private timberlands the remaining 3 percent—a dramatic shift from past industry censuses in which national forests provided the bulk of the harvest (Figure 7). In 1984, 1974, 1970, and 1966, national forests supplied over two-thirds of Arizona's timber harvest (Setzer and Wilson 1970, Setzer 1971, Green and Setzer 1974, Setzer and Throssell 1977, McLain 1988).

Harvest by Product Type

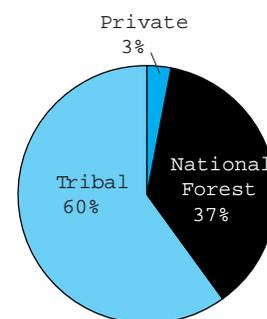
In both 1984 and 1998, two product types—sawlogs and pulpwood—accounted for 99 percent of the harvest for commercial products. In 1998, sawlogs were the primary timber product harvested in Arizona, accounting for 80 percent (61.2 MMBF) of the total harvest (Figure 8). Pulpwood accounted for about 19 percent (14.7 MMBF), and house logs and other products together comprised less than 1 percent of the 1998 harvest (Table 6). In 1984, the product mix was slightly different. Sawlogs comprised 89 percent of Arizona's industrial timber harvest, and pulpwood made up 10 percent (McLain 1988). Prior to 1984, statistics indicate sawlogs and pulpwood accounted for about 85 percent of the timber harvest (Figure 8). However, harvest data for 1969 and 1974 included fuelwood among "other" products, whereas 1984 and 1998 data did not include fuelwood. Consequently, sawlogs and pulpwood likely

Table 5
Arizona's 1998 Timber Harvest by Ownership Source

Origin	Board Feet Scribner	Percent of Total
Private and Tribal Timberland	48,102,000	63.0%
Private	2,138,000	2.8%
Tribal	45,964,000	60.2%
Public Timberland	28,210,000	37.0%
National Forest	28,210,000	37.0%
All Sources	76,312,000	100.0%

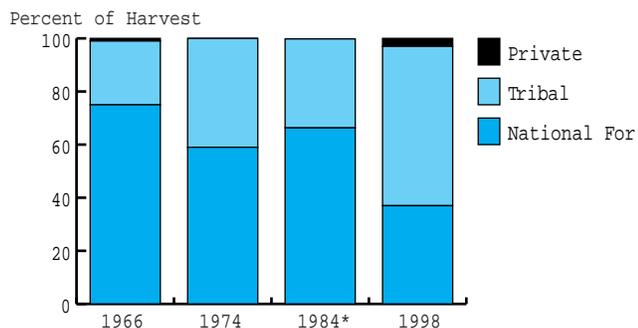
Source: FIDACS 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Figure 6
Arizona's 1998 Timber Harvest by Ownership Source



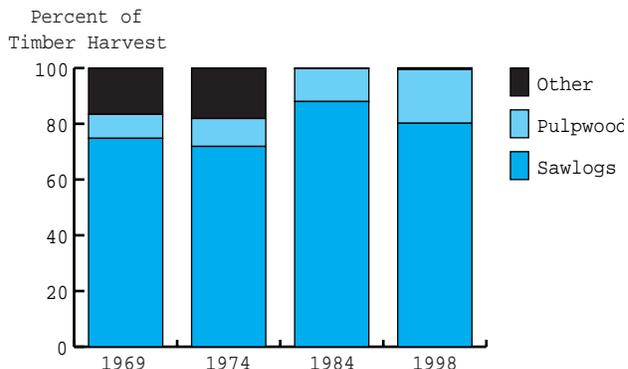
Source: FIDACS 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Figure 7
Arizona's Timber Harvest by Ownership,
1966, 1974, 1984, and 1998



* Harvest report for 1984 did not list tribal ownership separately from private.

Figure 8
Arizona's Timber Harvest by Product Type,
1969, 1974, 1984, and 1998



Sources: Setzer, T.S., *Estimates of Timber Products Output and Plant Residues, Arizona, 1969*; Setzer, T.S. and T.S. Throssell, *Arizona Timber Production and Mill Residues, 1974*; McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 6
Arizona's 1998 Timber Products Harvested by Ownership Source

Ownership Source	Thousand Board Feet, Scribner				All Products
	Sawlogs	Pulpwood	House Logs	Other Products	
Tribal Timberland	41,584	4,230	150	--	45,964
National Forest	19,150	9,060	--	--	28,210
Private Timberland	425	1,410	250	53	2,138
Total	61,159	14,700	400	53	76,312

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

accounted for greater proportions of the industrial timber harvests in 1969 and 1974 than indicated by Figure 8.

Ownership Source by Product Type

As shown in Table 6, tribal timberlands supplied 68 percent (41.6 MMBF) of Arizona's 1998 sawlog harvest, while national forests made up 31 percent (19.2 MMBF), and private timberlands supplied the remaining 1 percent (425 MBF). National forests were the primary source of Arizona's pulpwood harvest, providing 62 percent (9.1 MMBF) in 1998; tribal timberlands supplied 28 percent (4.2 MMBF), and private lands supplied the remaining 10 percent (1.4 MMBF). Of the timber supplied for house logs and other products, 69 percent (303 MBF) was harvested from private timberlands with the remaining 31 percent (150 MBF) coming from tribal lands.

Harvest by Geographic Source

Historically, 80 percent or more of Arizona's timber has come from three counties: Apache, Coconino and Navajo. The recent decline in national forest timber harvest, and subsequent proportionate shift to tribal lands, has led to some changes in the geographic sources of timber—from counties with more national forest land to those counties with more tribal timberland. Navajo County led the state's 1998 timber harvest with 50 percent of the total harvest, followed by Apache County with 21 percent and Coconino County with 20 percent (Table 7). In 1984, Apache County produced 45 percent of Arizona's timber harvest, while Coconino and Navajo counties produced 39 and 14 percent, respectively (McLain 1988). In 1974, Coconino County led the state with almost 38 percent of the harvest, followed by Navajo with 34 percent, and Apache with 19 percent (Setzer and Throssell 1977). Similarly, Coconino County was the largest timber producer in 1969, contributing 32 percent of the harvest, followed by Apache and Navajo with 25 and 23 percent, respectively (Setzer 1971).

Harvest by Species

Ponderosa pine (*Pinus ponderosa*) represented the greatest portion of Arizona's timber harvest in 1998, accounting for 66.8 MMBF, or 88 percent of the total, followed by Douglas-fir (*Pseudotsuga menziesii*) with 5.3 MMBF, or 7 percent of the total (Table 8 and Figure 9). The remaining harvest comprised three species groups: Engelmann and blue spruces (*Picea spp.*), 2.3 MMBF (3.1 percent); white and subalpine firs (*Abies spp.*), 961 MBF (1.3 percent); and other species, including pinyon pine (*Pinus monophylla* or *P. edulis*), 943 MBF (1.2 percent).

Table 7
Arizona's 1984 and 1998 Timber Products Harvest by County

County	MBF, Scribner		Percent of Harvest	
	1984	1998	1984	1998
Navajo	52,745	38,384	13.8%	50.3%
Apache	171,128	15,641	44.8%	20.5%
Coconino	150,727	15,314	39.4%	20.1%
Gila	931	5,405	a	7.1%
Greenlee	4,623	1,515	1.2%	2.0%
Yavapai	2,220	20	0.6%	a
Pima	--	33	--	a
Graham	300	--	a	--
Total Arizona	382,674	76,312	100.0%	100.0%

Note: a=less than 0.5 percent. Percentage detail may not add to 100 due to rounding.

Sources: McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 8
Arizona's 1984 and 1998 Timber Harvest by Species

Species ^a	MBF, Scribner ^b		Percent of Harvest ^c	
	1984	1998	1984	1998
Ponderosa Pine	346,851	66,804	90.6%	87.5%
Douglas Fir	17,217	5,264	4.5%	6.9%
Spruce	8,667	2,340	2.3%	3.1%
True Firs	9,214	961	2.4%	1.3%
Other Species	722	943	0.2%	1.2%
All Species	382,674	76,312	100.0%	100.0%

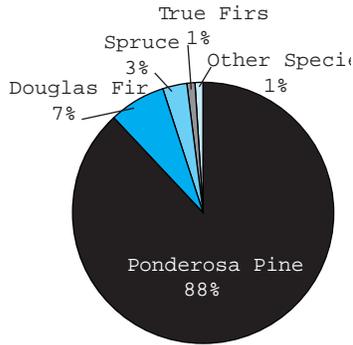
^a Spruce includes Engelmann and blue spruce; True Firs include white and subalpine fir.

^b Percentage detail may not add to 100 due to rounding.

^c Data may not sum to totals due to rounding.

Sources: McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Figure 9
Arizona's 1998 Timber Harvest by Species



Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

As shown in Table 9 and Figure 10, ponderosa pine has historically been the dominant component of Arizona's timber harvest, comprising 74 percent in 1969 and 70 percent in 1974 (Setzer 1971, Setzer and Throssell 1977), 90 percent in 1984 (McLain 1988), and 88 percent in 1998. The relatively large proportions of "other" species and consequently lower proportions of ponderosa pine harvested in 1969 and 1974 were heavily influenced by fuelwood (pinyon pine) cutting, which was included in harvest data for these years (Setzer and Throssell 1977).

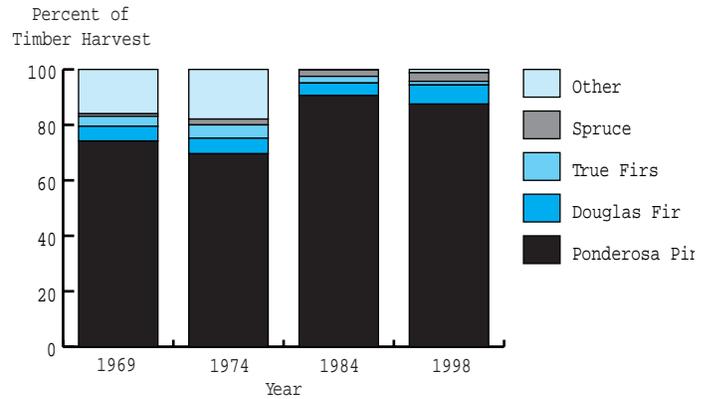
Product Type by Species

Ponderosa pine was the predominant species harvested for lumber production in 1998, accounting for 54.8 MMBF (90 percent) of the sawlog harvest. Douglas-fir was next with 3.8 MMBF (6 percent), followed by true firs at 2 percent, and all other species at about 1 percent (Table 10).

In 1998, three species were harvested for pulpwood. Again, ponderosa pine was the predominant pulpwood species, accounting for 11.8 MMBF or 79 percent of the pulpwood harvest. Spruce and Douglas-fir each made up 10 percent of the pulpwood harvest, and all other species together made up about 1 percent.

Ponderosa pine comprised 55 percent of the harvest of house logs from Arizona timberlands in 1998, and spruce made up the remaining 45 percent.

Figure 10
Arizona's Timber Harvest by Species, 1969, 1974, 1984, and 1998



Note: Harvest data for 1969 and 1974 include fuelwood cutting; 1984 and 1998 do not include fuelwood. "Other" includes juniper; limber, pinyon, and whitebark pines; aspen, cottonwood, and other hardwoods.

Sources: Setzer, T.S., *Estimates of Timber Products Output and Plant Residues, Arizona, 1969*; Setzer, T.S. and T.S. Throssell, *Arizona Timber Production and Mill Residues, 1974*; McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 9
Arizona's Timber Harvest by Species, 1969, 1974, 1984 and 1998

Species ^a	Percent of Harvest			
	1969	1974	1984	1998
Ponderosa Pine	74.2%	69.6%	90.6%	87.5%
Douglas Fir	5.3%	5.6%	4.5%	6.9%
Spruce	0.9%	2.1%	2.3%	3.1%
True Firs	3.6%	4.8%	2.4%	1.3%
Pinyon Pine, Juniper, Limber Pine, Aspen	16.0%*	17.9%*	0.2%	1.2%
All Species	100.0	100.0	100.0%	100.0%

^a Spruce includes Engelmann and blue spruce; True Firs include white and subalpine fir.
* Harvest data for 1969 and 1974 include fuelwood; 1984 and 1998 do not include fuelwood.

Sources: Setzer, T.S., *Estimates of Timber Products Output and Plant Residues, Arizona, 1969*; Setzer, T.S. and T.S. Throssell, *Arizona Timber Production and Mill Residues, 1974*; McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*; FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 10
Arizona's 1998 Timber Harvest by Species
and Product Type

Species ^a	Board Feet, Scribner			All Products
	Sawlogs	Pulpwood	Other Products	
Ponderosa Pine	54,792	11,775	237	66,804
Douglas Fir	3,802	1,459	3	5,264
Spruce	729	1,430	180	2,339
True Firs	943	18	0	961
Other Species	892	18	34	944
Total	61,158	14,700	454	76,312

^a Spruce includes Engelmann and blue spruce; True Firs include white and subalpine fir.

Sources: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Timber Flow

Although Arizona's intrastate and interstate timber flows were examined, discussion is limited to avoid disclosing firm-level information on the state's relatively few mills. Arizona timber processing mills received 67.6 MMBF of timber for processing in 1998. Since Arizona's timber harvest was just over 76.3 MMBF, Arizona was a net exporter of timber, with 8.7 MMBF being exported as sawlogs to Idaho, Montana, and Utah (Table 11). No Arizona mills reported importing timber from other states in 1998. However, this has not always been the case. In 1997, for example, several million board feet of timber flowed into Arizona from New Mexico (FIDACS 1997), and in 1995 tribal ownerships in adjacent states reported sending 10 to 15 MMBF to Arizona mills (FIDACS 1995).

Table 11
Arizona's 1998 Timber Product Imports
and Exports to Other States

Timber Product	—Thousand Board Feet, Scribner—		
	Imports	Exports	Net Imports (Net Exports)
Sawlogs	--	8,700	(8,700)
Pulpwood	--	--	--
House Logs	--	--	--
All Other Products	--	--	--
All Products	--	8,700	(8,700)

Note: All Other Products include pulp and paper, house logs, mesquite briquettes, and log furniture.

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Only 11.4 percent of Arizona's 1998 timber harvest left the state for processing in other states, and harvested timber generally did not move long distances within the state. Thirty-two percent of Arizona's 1998 timber harvest that remained in state was processed in the same county where the timber was harvested; another 65 percent was processed in adjacent Arizona counties.

Timber Use by Ownership

Figures for Arizona's total timber harvested and its timber processed are different because of timber flows into and out of the state. As discussed, 8.7 MMBF was processed outside the state. This section examines characteristics of timber processed by Arizona's mills.

As shown in Table 12, private and tribal timberlands contributed 71 percent (48.1 MMBF) of the timber received by Arizona mills in 1998. Tribal lands supplied about 68 percent of 1998 receipts, while private timberlands contributed 3 percent. National forests supplied 29 percent of the timber received by Arizona's industry in 1998.

Table 12
Source of Timber Products Received by Arizona Mills, 1998

<u>Ownership Source</u>	<u>Board Feet Scribner</u>	<u>Percent of Total</u>
Private and Tribal Timberland	48,102,000	71%
Private	2,138,000	3%
Tribal	45,964,000	68%
Public Timberland	19,510,000	29%
National Forest	19,510,000	29%
All Sources	67,612,000	100%

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 13
Ownership Source of Timber Products Delivered to Arizona's Forest Products Industry Sectors, 1998

<u>Ownership Source</u>	<u>Board Feet, Scribner</u>			<u>All Products</u>
	<u>Sawlogs</u>	<u>Pulpwood</u>	<u>Other Products</u>	
Private and Tribal Timberland	42,009,000	5,640,000	453,000	48,102,000
Private	425,000	1,410,000	303,000	2,138,000
Tribal	41,584,000	4,230,000	150,000	45,964,000
Public Timberland	10,450,000	9,060,000	--	19,510,000
National Forest	10,450,000	9,060,000	--	19,510,000
Total	52,459,000	14,700,000	453,000	67,612,000

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

To a degree, different industry sectors rely on different land ownerships for their timber (Table 13). For instance, Arizona’s sawmills received 52.5 MMBF of sawlogs in 1998. Seventy-eight percent of that volume came from tribal lands, 21 percent from national forests, and 1 percent from private lands. Pulpwood receipts totaled 14.7 MMBF in 1998. National forest lands provided 60 percent of those receipts, followed by tribal lands with 30 percent, and private lands with 10 percent. Arizona manufacturers of house logs and log homes received 400 MBF of timber in 1998. Private lands provided 68 percent of those receipts, and tribal timberlands provided the remaining 32 percent.

Log Utilization

Arizona’s timber harvest flows through various manufacturing sectors. Since mill residue products and timber products are displayed, volumes are presented in cubic feet rather than board feet Scribner. The following conversion factors were used to convert Scribner volume to cubic foot volume:

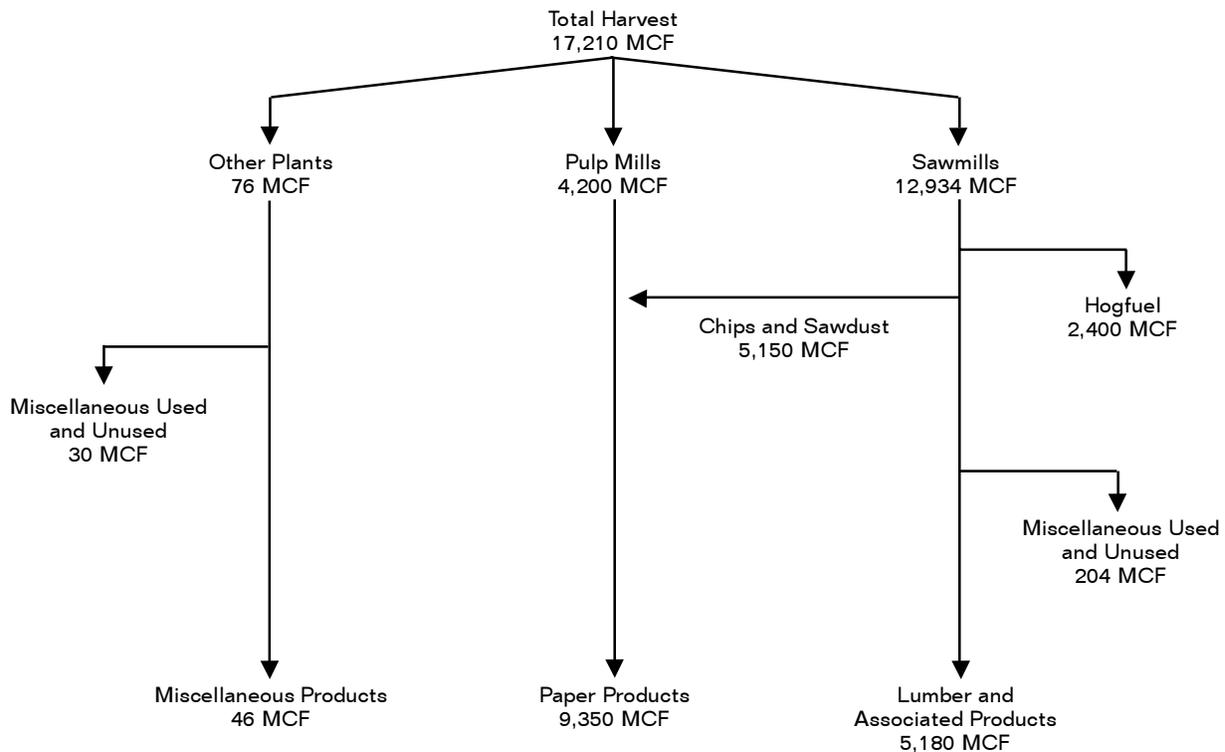
- 4.73 board feet per cubic foot for sawlogs;
- 4.50 board feet per cubic foot for house logs;
- 3.50 board feet per cubic foot for pulpwood; and
- 1.00 board foot per cubic foot for other plants.

Arizona’s 1998 timber harvest was approximately 17,210 thousand cubic feet (MCF), exclusive of bark (Figure 11). Of this volume, 12,934 MCF went as logs to sawmills, 4,200 MCF went to pulp mills, 76 MCF went to other manufacturers. The following figures refer to Arizona’s timber harvest and include timber shipped to out of state mills.

Of the 12,934 MCF received by sawmills for manufacturing, 5,180 MCF (40 percent) actually became finished lumber or other sawn products. The remaining 7,754 MCF (60 percent) became mill residue. About 5,150 MCF of sawmill residue was used by the pulp and paper industry, 2,400 MCF was burned as hogfuel, and 204 MCF was used for other purposes such as livestock bedding and firewood or remained unused in 1998.

Pulp and paper manufacturers consumed 4,200 MCF of Arizona’s 1998 timber harvest in the form of roundwood pulpwood, and another 5,150 MCF of residues from sawmills to manufacture pulp and paper products. Other product manufacturers received 76 MCF of wood fiber from Arizona’s timberlands in 1998. About 46 MCF ended up as finished products, mostly house logs, and 30 MCF as residue.

**Figure 11
Utilization of Arizona’s 1998 Timber Harvest - Excluding Bark**



Mill Residue Quantity, Type, and Use

A substantial portion of the wood fiber processed by primary forest products plants ends up as mill residue, which can be used to produce additional products and generate revenue. Arizona mills have developed outlets that make beneficial use of residues, which would otherwise be a waste problem. The pulp and paper industry in 1998 was the largest consumer of residues generated in the state. Following is a discussion of the volume and use of mill residues during 1998.

Sawmills are the main residue producers in Arizona, generating three types of wood fiber residue:

- coarse or chippable residue consisting of slabs, edging, trim, and log ends from lumber manufacturing,
- fine residue consisting of planer shavings and sawdust, and
- bark.

The 1998 census gathered information on volumes and uses of mill residue. Actual residue volumes were obtained from large sawmills that sold all or most of their residues. For the small sawmills, residue volume factors—which express mill residue generated per unit of lumber produced—were used to estimate total residue volumes. These residue factors were derived in part from numbers reported by large firms and from product recovery and log descriptions obtained from the mills. All mills reported, on a percentage basis, how their residues were used. The sawmill residue factors are shown in Table 14, and represent statewide averages.

In 1998, Arizona sawmills generated 8,687 MCF of mill residue, utilizing 99.9 percent (Table 15). The volume of residue in 1998 was a substantial decrease from the 1984 volume of 49,914 MCF (McLain 1988). The lower supply of residue was due to lower lumber production in 1998 and was primarily responsible for the increase in percent residue used from 96 percent in 1984 (McLain 1988). However, there has been a long-term trend of increased (percent) residue utilization by Arizona mills (Figure 12), with only about 54 percent utilized in 1969 and 86 percent in 1974 (Setzer and Throssell 1977). The increases from 1969 to 1984 were due primarily to increased use of residue both as a raw material for pulp and paper manufacture and as a fuel to dry lumber.

Coarse residue was the state's largest residue component (44.6 percent of all residues) in 1998. Arizona sawmills produced 3,874 MCF of coarse residue, 100 percent of which was utilized for some purpose in 1998. Slabs (the exterior portions of logs removed by the saw,

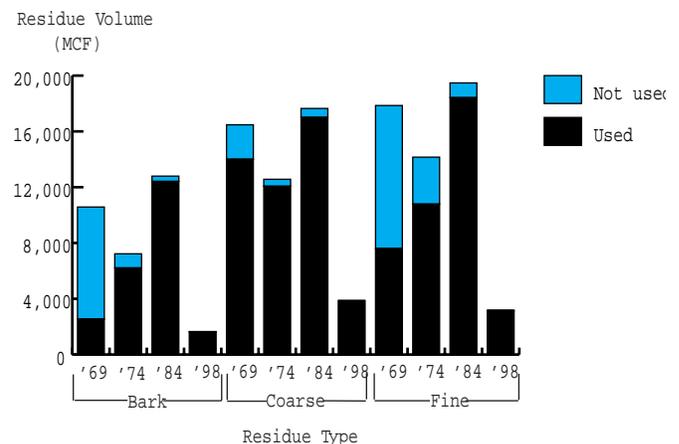
Table 14
Arizona's 1998 Sawmill Residue Factors

Type of Residue	Cubic Feet per Thousand Board Feet Lumber Tally ¹
Coarse	48
Sawdust	21
Planer Shavings	18
Bark	20
Total	107

¹ Cubic feet of the various residue types generated for every 1,000 board feet of lumber manufactured.

Source: FIDACS 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Figure 12
Arizona Mill Residue Utilization by Type, 1969, 1974, 1984, and 1998



Sources: Setzer, T.S. and T.S. Throssell, *Arizona Timber Production and Mill Residues, 1974*; McLain, W.H., *Arizona's Timber Production and Mill Residue, 1984*.

**Table 15
Arizona's 1998 Estimated Volume of Wood
Residue Generated by Sawmills and
Utilization of Residue**

Residue Type	Thousand Cubic Feet			Percent of Total		
	Utilized	Unutilized	Total	Utilized	Unutilized	Total
Coarse	3,874	0.0	3,874	100.0%	0.0%	44.6%
Fine	3,161	4.0	3,165	99.9%	0.1%	36.4%
Bark	1,640	8.0	1,648	99.5%	0.5%	19.0%
Total	8,675	12.0	8,687	99.9%	0.1%	100.0%

Note: Fine Residue includes sawdust and planer shavings.

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

having one flat side and one curved surface), log ends, and pieces of unsuitable lumber are a major component of the coarse material produced by sawmills. All but 14 MCF of this material was chipped and used by the pulp and paper industry and the rest was sold for firewood or fencing material (Table 16). In 1984, 96 percent (17,007 MCF) of coarse residues were utilized (McLain 1988).

Fine residues—sawdust and planer shavings—made up the second largest component (36.4 percent) of sawmill residues, 3,165 MCF in 1998. All but a few thousand cubic feet of these residues were utilized in some fashion, primarily as hogfuel or animal bedding in 1998. In 1984, fine residues were the leading residue component, with 19,476 MCF (39 percent of all 1984 residues) and over 1,000 MCF unused (McLain 1988).

Bark from the logs processed by Arizona sawmills was generally burned as hogfuel or remained unused in 1998. Arizona sawmills generated 1,648 MCF of bark in 1998—all but 8 MCF of that was used by the industry as hogfuel. Most of the 8 MCF remained unused, but small volumes were used as firewood and fencing (that which remained on the slabs), garden mulch, and livestock bedding (Table 16). Utilization of bark residue in 1998 substantially increased over previous years (Figure 12). In 1969, 8 MMCF was unused; in 1974, 1 MMCF was unused; and in 1984, 377 MCF of bark residue went unused (McLain 1988, Setzer and Throssell 1977).

**Table 16
Arizona's 1998 Estimated Volume of Wood
Residue Generated by Sawmills and
Utilization of Residue**

Residue Type	Thousand Cubic Feet					Total
	Total Utilized	Pulp and Paper Mill	Hogfuel	Other Uses	Unused	
Coarse	3,874	3,860	--	14	--	3,874
Fine						
Planer Shavings	1,446	--	1,398	48	--	1,446
Sawdust	1,715	784	816	115	4	1,719
Bark	1,640	--	1,532	108	8	1,648
Total	8,675	4,644	3,746	285	12	8,687

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Plant Capacity

This section focuses on production capacity and capacity utilization in Arizona's sawtimber processing plants—sawmills and house log plants. Sawtimber is timber of “sufficient size and quality to be suitable for conversion into lumber” (Random Lengths, 1993). Respondent mills were asked to specify their annual product output capacity (production capacity), assuming sufficient supplies of raw materials and a firm market demand for their products.

Sawmills reported their capacity in thousand board feet, lumber tally; house log manufacturers reported capacity in lineal feet of house logs. Product recovery

ratios were calculated for each firm using timber input and product output. An input capacity was calculated for each firm using product recovery ratios and product output capacity.

This estimate is expressed in units of timber input (board feet, Scribner of timber) and called “capacity to process timber” or “processing capacity.” Arizona's total estimated capacity to process sawtimber in 1998 was 141.5 MMBF Scribner (Table 18). Overall, 38 percent of this capacity was utilized in 1998, to process 53.5 MMBF of sawtimber.

Table 17
Arizona's 1998 Estimated Sawtimber Processing Capacity and Capacity Utilized

Plant Type	Volumes in Board Feet, Scribner			
	Capacity to Process Sawtimber	Actual Volume Processed	Percent Capacity Utilized	Unutilized Capacity
Sawmills and House Log Plants	141,480,000	53,458,000	38%	88,022,000

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Table 18
Destination and Value of Arizona's 1998 Primary Wood Products Sales^a

Product	Other Rocky Mountain States						Total
	Arizona	Far West	North Central	South	Northeast		
Thousand 1998 Dollars							
Lumber, Mine Timbers and Associated Products	\$4,068	\$7,923	\$7,117	\$3,650	\$4,972	\$670	\$28,400
House Logs and Other Products	\$468	\$1,400	\$350	--	--	--	\$2,218
All Products	\$4,536	\$9,323	\$7,467	\$3,650	\$4,972	\$670	\$30,618

^a Does not include sales of pulp and paper products. No lumber or house log sales were reported sold to foreign markets in 1998.

Source: FIDACS, 1999, The University of Montana Bureau of Business and Economic Research, Missoula, MT.

Product Markets

Respondent mills summarized their 1998 shipments of finished wood products, providing information on volume, sales value, and geographic destination. Mills usually distributed their products in two ways: 1) through their own distribution channels, or 2) through independent wholesalers and selling agents. Because of subsequent wholesaling transactions, the geographic destination reported here may not precisely reflect final delivery points of shipments. Figure 13 shows the regions where Arizona's manufactured wood products were distributed in 1998.

Arizona's lumber and sawn products and house logs and log homes sales in 1998 were \$30.5 million.

Sales of lumber and sawn products accounted for more than 93 percent of these sales, with house logs and log homes making up \$2.1 million in sales. The Rocky Mountain States, including Arizona, were major markets for Arizona's lumber in 1998, accounting for 42 percent (\$11.9 million) of total lumber sales (Table 18). Arizona itself accounted for \$4.1 million of those sales, while the other Rocky Mountain States accounted for \$7.9 million. The Far West, mostly California, accounted for \$7.1 million of Arizona lumber sales in 1998, followed by the South with \$4.9 million, North Central with \$3.6 million, and Northeast with \$0.7 million.

Figure 13
Market Areas for Arizona's Primary Forest Products



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