Montana's Forest Products Industry:

A descriptive analysis 1969-1988

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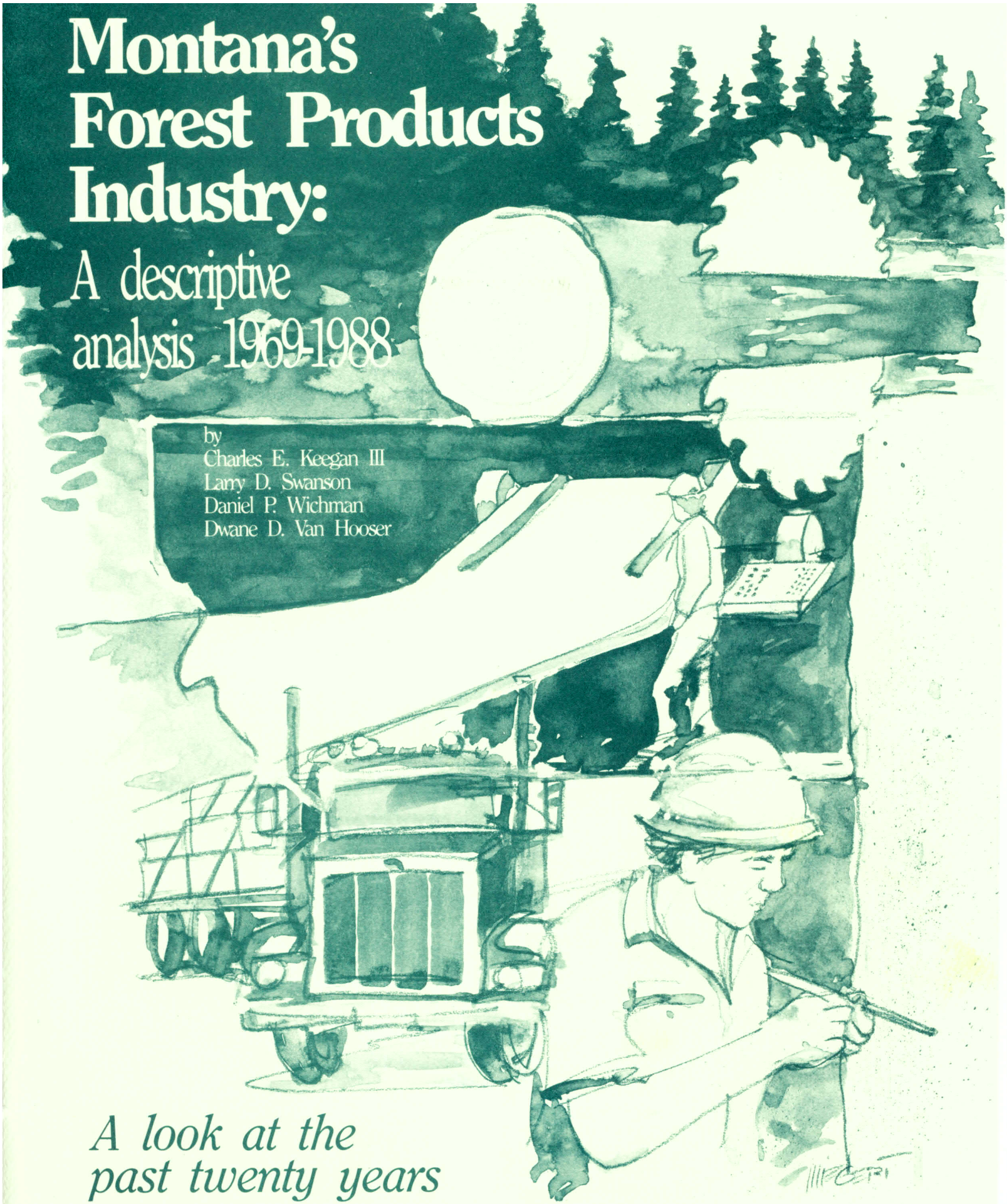


A look at the past twenty years

TABLE OF CONTENTS

List of Tables iii

List of Figures. v

Background 1

Highlights of Report 4

Section 1: The Structure of Montana's Forest Products Industry 8
- Structure and Location. 8
- Sales Value of Primary Wood and Paper Products. 8
- The Sawmill Sector. 11
  - Lumber Overrun 11
  - Sales Value. 12
  - Geographic Source of the Lumber Shipments. 13
  - Number and Size of Mills 13
- Plywood and Veneer Sector 14
  - Plywood Recovery 14
- Residue-Utilizing Sector. 14
- Other Primary Manufacturers 15
  - Log Home Industry. 15
  - Cedar Products Industry. 15
- Roundwood Products 15

Section 2: Montana's Timber Harvest and Utilization. 16
- Sources of Montana's Timber Harvest 16
  - Public and Private Timberlands. 16
- Geographic Source of the Harvest. 17
- Types of Timber Products Harvested. 18
- End Uses of Montana's Timber. 19
- Land Ownership and Type of Product Harvested. 21
- Species Composition of the Harvest. 22
- Species Composition by Type of Product. 22
- Movement of Timber Products 23
  - Across State Lines 23
  - Across County Lines, Western Montana 24
  - Major Processing Centers 24
  - Across County Lines, Southwestern and Central Montana 26

Section 3: Public and Private Timberlands as Sources of Raw Material for Various Sectors of Montana's Forest Products Industry 27
Ownership Sources by Industry Sector. 27
Sources of Timber by County 29
Sources of Sawtimber by Size of Mill. 30

Section 4: Plant Utilization by Primary Wood Products Manufacturers in Montana. 32
A Definition of Production Capacity 32
Capacity in Units of Raw Material for the Sawtimber Processing Sector 32
The Industry's Capacity to Process Sawtimber, 1976-1988 33
Capacity by Sector. 33
Sawtimber Processing Capacity by County or County Group. 34
Capacity by Size of Mill. 34
Capacity Related to Units of Production 34
Post and Small Pole and Cedar Products Capacities. 35
Capacity in the Residue Utilizing Sector. 36

Section 5: Markets for Finished Wood Products. 37
Market Areas by Finished Product Type 37

Section 6: Wood Residue from Primary Wood Products Manufacturers in Montana. 40
The Supply and Use of Mill Residue. 41
Revenue from the Sale of Manufacturing Residue. 42

Section 7: The Forest Products Industry and the Montana Economy 43
Recent Trends in the Montana Economy 43
Labor Income and Employment in the Forest Products Industry 44
Industry's Share of Montana's Economic Base 46
Areas Most Dependent Upon the Forest Products Industry 46

LIST OF TABLES

Table 1 Number of Active Forest Products Plants, Space by County and Product Produced, Montana, 1988. 9

Table 2 Number of Active Forest Products Facilities by Plant Type, 1976, 1981 and 1988 10

Table 3 Sales Value of Manufactured Forest Products, Montana, 1969, 1976, 1981, and 1988. 11

Table 4 Number of Sawmills, by Size of Production, Montana, Selected Years, 1956-1988 12

Table 5 Lumber Output, by Size of Mill, Montana, Selected Years, 1956-1988 12

Table 6 Lumber Production, by Size of Mill, Montana 1988. 14

Table 7 Timber Products Harvested, by County, Montana, 1976, 1981, and 1988 17

Table 8 Timber Products Harvested, by Ownership Source, Montana, 1988 21

Table 9 Timber Products Harvested, by Species, Montana, 1969, 1976, 1981, and 1988 22

Table 10 Timber Products Harvested, by Species and Product, Montana, 1988. 23

Table 11 Movement of Timber Products, by Counties of Origin and Receipt, Montana, 1988 25

Table 12 Exports and Imports of Timber Products, Montana, 1988 26

Table 13 Source of Timber Products Received by Mills, Montana, 1976, 1981, and 1988. 27

Table 14 Ownership Source of Timber Products Delivered to Various Sectors of the Industry, Montana, 1988 28

Table 15 Source of Timber Products Received by Mills, by County of Plant Location, Montana, 1988. 29

Table 16 Source of Sawtimber Received by Mills, by Size of Mill, Montana, 1988. 31

Table 17 Capacity to Process Sawtimber, Montana, 1976-1988. 32

Table 18 Percentage of Sawtimber Processing Capacity Utilized, Montana, 1976-1988 33

Table 19 Sawtimber Utilized and Estimated Capacity of Sawmills, Plywood Plants, Utility Pole Plants, and House Log Plants, Montana 1976, 1981 and 1988 35

Table 20 Sawtimber Utilized and Estimated Capacity of Sawmills, Plywood Plants, Utility Pole Plants, and House Log Plants, by Size of Plant, Montana, 1988. 36

Table 21 Destination of Wood and Paper Products Shipments by Value of Shipment, Montana, 1988. 39

Table 22 Estimated Volume of Wood Residue Generated by Sawmills and Plywood Plants, Montana, 1969, 1976, 1981, and 1988 40

Table 23 Production and Disposition of Mill Residues by Sawmills and Plywood Plants, by Type of Residue Use, Montana, 1988 41

Table 24 Mill Residue from Lumber and Plywood Plants, Montana, 1988. 42

Table 25 Sawmill Residue Factors, Montana, 1988 42

Table 26 Softwood Plywood Residue Factors, Montana, 1988. 42

LIST OF FIGURES

Figure 1	Location of Active Primary Forest Products Plants, Montana, 1988	8
Figure 2	Sales Value of Montana's Wood and Paper Products, 1969-1988	10
Figure 3	Lumber Production by Montana Mills, Montana, 1960-1988	12
Figure 4	Plywood Production by Montana Mills, Montana, 1960-1988	15
Figure 5	Montana Harvest by Ownership, Montana, 1969-1988	16
Figure 6	Timber Products Harvested, Montana, 1969, 1976, 1981 and 1988	19
Figure 7	Utilization of Montana's Timber Harvest, 1988	20
Figure 8	Montana Mill Capacity and Timber Processed	34
Figure 9	Shipment Destination of Wood Products, 1988	38
Figure 10	Composition of Montana's Economic Base	43
Figures 11, 12	Industry Employment and Worker Earnings	44
Figure 13	Changing Share of Montana's Economic Base	45
Figures 14, 15	Current Make-up of Montana's Economic Base, 1985 to 1989	45
Figure 16	Counties Most Economically Dependent Upon the Forest Products Industry	47
Figure 17	Economic Base of the Principal Forest Product Producing Counties in Montana, 1988	47

BACKGROUND

This monograph presents the results of a census of Montana's primary forest products industry done to collect information for calendar year 1988. Primary forest products manufacturers include firms processing timber into manufactured wood products as well as firms using, as raw material, wood fiber residue from those manufacturers. The census is a cooperative effort involving the Bureau of Business and Economic Research at the University of Montana and the U.S. Forest Service, Intermountain Research Station, Forest Survey Unit in Ogden, Utah. The census is the major source of data for an ongoing system designed to provide reliable and consistent information on the operations of the forest products industry for individual states in the Rocky Mountain Region. This system, the Forest Industries Data Collection System (FIDACS), focuses on the source and volume of timber used and the products produced from that timber.

"The 1970s and 1980s have been decades of extreme contrast for Montana's forest products industry."

The primary forest products manufacturers provide the following detailed information through written questionnaires and oral communication for each plant for a given calendar year:

- Production employment
- Plant production capacity
- Volume of raw material received, by county and ownership
- Species of timber received
- Volume, type, sales value, and location of markets for finished products
- Utilization and marketing of manufacturing residue
- Plant production equipment
- Beginning and ending inventory levels for raw materials and finished products

Montana manufacturers were identified through a Directory of Montana's Forest Products Industry published by the Department of State Lands, National Forest bidders lists, and information provided by industry personnel.

FIDACS collects data every five to seven years, with censuses being conducted in Wyoming for 1976, in Idaho for 1979 and 1985, and in Montana for 1976, 1981, and 1988. The Forest Survey Research Work Unit has collected more limited data in other states and for some years prior to 1976 in Montana, including 1969.

Firms cooperating in the census processed virtually all of Montana's timber harvest. By using published sources and data from various land management agencies, estimates were made for the very few non-respondent firms to attempt to include all of the activity in Montana's forest products industry for 1988. Firms in other states, identified through various directories and the records of land management agencies, were contacted to determine the volume and type of timber they received from Montana.

"Another factor influencing the industry in the 1970s was the extremely good -- perhaps best ever -- wood products markets."

Information collected through FIDACS is stored at the University of Montana's Bureau of Business and Economic Research. Besides this report, additional information is available by request. Individual firm level data are confidential and will not be released.

The results of the 1988 Montana census and changes especially since 1969 are discussed in this report.

Montana's Forest Products Industry in the 1970s and 1980s

The 1970s and 1980s have been decades of extreme contrast for Montana's forest products industry. The 1970s saw diversification and tremendous markets, which led to increases in sales value, employment, and labor income. Full- and part-time employment increased from 9,757 workers in 1970 to 13,494 workers in 1979 (Bureau of Economic Analysis, 1990).

Structural changes during the 1970s involved increased substitution of the more labor-intensive plywood industry for a portion of the sawmill industry and expansion of sectors using waste wood from sawmills and plywood plants.

Another factor influencing the industry in the 1970s was the extremely good -- perhaps best ever -- wood products markets. These very strong markets came to an abrupt halt in late 1979 and the industry entered a six-year period (late-1979 through 1985) that was, without a doubt, the most difficult extended operating period for the forest products industry since the Great Depression.

"After record production and sales in 1987, Montana's forest products industry had lower production, sales, and employment in 1988 due to labor strikes. . ."

That six-year period began with a sharp drop in U.S. housing and construction industries that actually started in the last quarter of 1979. Those recession-like conditions in the construction industry ended in the last quarter of 1982. The years 1983 through 1985 were an unusual period with record levels of wood products consumption in the United States in 1984 and 1985, but very low prices, due in large part to the very high value of the U.S. dollar (Richards, 1987).

Markets improved in 1986 and 1987 with continued high consumption and a lower valued U.S. dollar. The industry responded with record sales and production. Employment in Montana's wood products industry, on the other hand, dropped from the peak 1979 level of 13,494 workers to 11,130 workers in 1988 and 11,690 workers in 1989 Bureau of Economic Analysis, 1990).

The lower employment was due primarily to:

- Increased mechanization and other cost cutting efforts in response to very competitive markets in the 1980s.

- Structural changes to less labor intensive products, related especially to the shift to facilities to process small diameter timber; in particular, this involved a decline in the size of the large log segment of the sawmill industry.

After record production and sales in 1987, Montana's forest products industry had lower production, sales, and employment in 1988 due to labor strikes which affected about 20 percent of the state's sawmill industry and more than half of the state's plywood industry for about three months.

HIGHLIGHTS OF THE REPORT

The Forest Products Industry in Montana in 1988

.... A total of 179 primary forest products plants operated in Montana in 1988, down forty-six from the previous census in 1981. These included eighty-seven sawmills, four plywood plants, a medium density fiberboard plant, a particleboard plant, a pulp and paper mill, thirty-five house log plants, thirty-seven post and pole plants, three cedar products plants, two utility pole plants, four wood pellet plants, two planing mills, one facility generating electricity, and a roundwood dipping plant.

.... Montana mills had total sales of $898 million in 1988, down from the record $944 million (1988 dollars) in 1987. Although strikes during the summer of 1988 slowed production, for the twenty years 1969-1988, 1988 ranked as the third highest annual sales value figure in constant dollars.

.... Over 95 percent of sales were from three sectors: sawmills (43 percent), plywood plants (12 percent), and the residue utilizing sector which includes the kraft pulp and paper mill, the particleboard plant, the medium density fiberboard plant, wood fuel pellet producers, and the plant generating electricity (41 percent).

.... The proportion of sales contributed by the two largest sectors has changed dramatically over the last twenty years with the sawmill sector's share dropping from 61 percent in 1969 to 43 percent in 1988. During the same period, the residue utilizing sector's share increased from 25 percent of the industry's sales in 1976 to 41 percent in 1988.

.... In 1988, the sawmill sector had sales of $385 million from the production of lumber and other sawn products.

.... Sales in the mill residue sector were $367 million in 1988. The large increases in this mill residue utilizing sector accounted largely for the record and near-record sales from Montana's forest products industry in the late 1980s.

.... The third major sector, the plywood industry, was most affected by the 1988 strikes, with more than half of the state's plywood capacity closed for approximately three months in 1988. Sales were $106 million in 1988, substantially lower than the $130 million (1988 dollars) in 1987 and 1989 when the plywood industry was operating at near full capacity.

.... Sales from all other primary manufacturer's increased over earlier years due primarily to increased sales in the log home industry.

.... Montana sawmills produced 1,558 million board feet (MMBF) lumber tally. This represents 4 percent of the U.S. output of softwood lumber.

.... Despite strikes, closing 20 percent of the state's sawmill capacity for about three months in 1988, the 1,558 MMBF was Montana's third highest lumber output on record through 1988.

.... Sales value in constant dollars was lower in 1988 than in the 1970s due to lower real prices for lumber and to lower grades of products.

.... Lumber production has become more concentrated in larger mills and average output per sawmill is 17.9 MMBF, compared to 7.5 MMBF in 1981 and 12 in 1976.

.... The strike had its largest impact on the plywood industry, closing about half the state's capacity for three months in 1988. Production in 1988 was 612 million square feet (MMSF) on a 3/8-inch basis, down from the record levels of 717 MMSF in 1987 and 725 MMSF in 1989.

.... The major markets for Montana's wood products were in the north central states, the far western states, and the Rocky Mountain states.

.... There has been a small decrease in the industry's capacity to process sawtimber since the late 1970s with Montana's capacity declining from about 1,578 million board feet (MMBF) Scribner in the late 1970s to 1,561 MMBF Scribner in 1988.

.... Montana mills utilized more of their capacity to process sawtimber in the late 1980s than in previous years. Even with the strikes, Montana mills used 79 percent of their capacity to process sawtimber in 1988. This compares to 75 percent in 1976 and 66 percent in 1981.

.... Ninety-one percent of the wood fiber residue from Montana's sawmills and plywood plants was utilized in 1988, a decrease from 95 percent in 1981, and an increase from 1969 (63 percent) and 1976 (86 percent). The percentage utilization in 1981 was high primarily because of low lumber production and resultant low residue production in that year.

Timber Harvest and Utilization, 1988

.... Montana's timber harvest in 1988 was 1,236 MMBF Scribner. Lincoln County had the highest harvest level with 324 MMBF, followed by Flathead County (255 MMBF), Missoula (141 MMBF), and Sanders (89 MMBF). These four counties accounted for 65 percent of Montana's timber harvest in 1988.

.... Eighty-one percent of the harvest went to sawmills in 1988. Plywood plants utilized 17 percent of the harvest, and the pulp and paper industry received less than 1 percent. The remaining 2 percent went to utility pole plants, house log plants, post and pole plants, and cedar products manufacturers.

.... Private lands supplied 56 percent of the 1988 harvest. Public ownerships, mostly national forest lands, provided the remaining 44 percent of the harvest.

.... In 1988, lodgepole pine was the predominant species harvested, accounting for 28 percent of the total volume. Douglas-fir comprised 27 percent of the harvest, with the remainder of the harvest composed primarily of ponderosa pine, western larch, Engelmann spruce, and the true firs.

.... Montana mills used 50 MMBF of timber harvested in adjacent states, primarily Idaho, while out-of-state firms processed about 83 MMBF of Montana timber.

.... More than 80 percent of the timber delivered to Montana mills was received by processors in the seven western counties: Flathead, Lake, Lincoln, Mineral, Missoula, Ravalli, and Sanders.

.... Flathead County has displaced Missoula County as the major timber processing center. Lincoln County is second followed by Missoula.

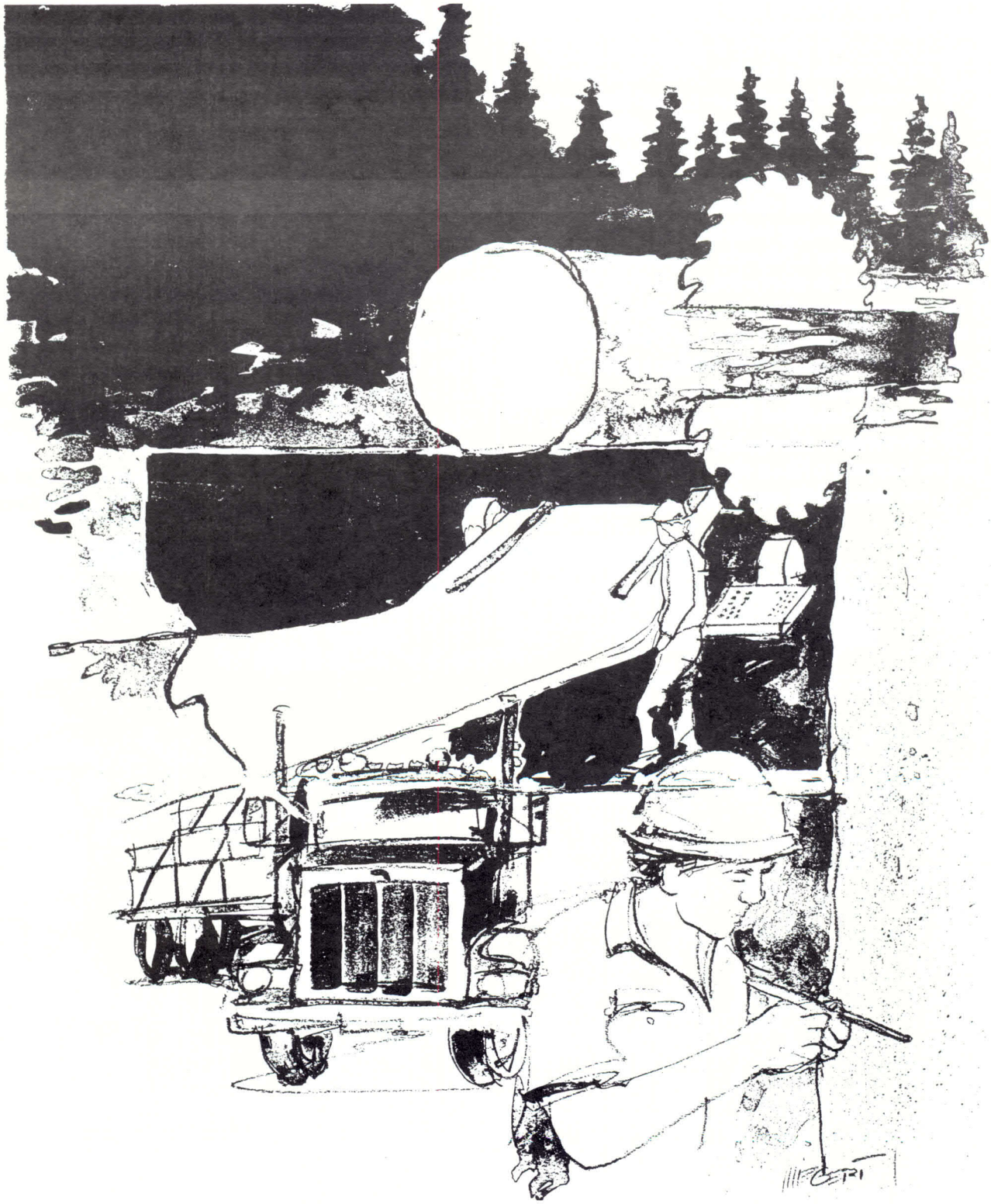
Forest Products and the Montana Economy

.... Total employment in Montana's forest products industry stood at 11,690 workers in 1988. This employment is down from a peak of 13,494 workers in 1978 and 12,250 workers in 1984, shortly after the nationwide recession. It is up from the 9,757 workers in the industry in 1970.

.... Earnings by these workers (or labor income) totaled $271 million in 1988. This is about $100 million less than in the late 1970s when industrywide labor earnings peaked (as measured in constant 1988 dollars).

.... Measured in terms of labor income, the forest products industry is the third largest basic industry sector in Montana, exceeded only by the federal government (which also is considered basic to the state) and agriculture. The industry accounts for 15 percent of the state's economic base as measured by labor income and 11 percent of the state's economic base as measured by employment.

.... At least 5 percent of the economic base of 17 of Montana's 56 counties is accounted for by the forest products industry. However, most of the industry is concentrated in western Montana where seven contiguous counties (including Missoula, Flathead, Lincoln, Ravalli, Lake, Sanders, and Mineral) account for 85 percent of the industry's labor income. In this seven-county area, the industry represents 43 percent of the local economic base.



Section 1

Structure of the Industry

The Structure of Montana's Forest Products Industry

STRUCTURE AND LOCATION

The forest products industry in Montana in 1988 included plants producing lumber and other sawn products, plywood, pulp and paper, particleboard, medium density fiberboard, house logs, utility poles, posts, small poles, tree props, cedar products, wood pellets, and some byproducts of the pulp and paper industry such as tall oils and turpentine.

While timber processing facilities operated in thirty-three of Montana's fifty-six counties and timber was harvested in thirty-four counties, the industry was concentrated in western and southwestern Montana (figure 1). Table 1 shows the number of plants manufacturing various primary wood products in Montana counties.

The 1988 census identified 179 active forest products plants, a decrease of forty-six since the 1981 census but an increase of four since 1976 (table 2). Most of the loss since 1981 occurred in the sawmill and cedar products sectors of the industry. There were fifty-five fewer sawmills and five fewer cedar products facilities. However, there was an increase of eight facilities in the house log sector.

SALES VALUE OF PRIMARY WOOD AND PAPER PRODUCTS

This section discusses the sales value (F.O.B. the producing mill) of products produced by the primary wood and paper products industry. Detailed breakdowns by sector are displayed for the years in which a complete census of the forest products industry was done (table 3). Sales value for 1976, 1981, and 1988 was obtained directly from the individual mills. For other years, sales value was obtained or derived from various sources as indicated in figure 2 and table 3.

The estimated total sales of primary wood and paper products manufacturers in Montana were

FIGURE 1

Location of Active Forest Products Plants Montana, 1988

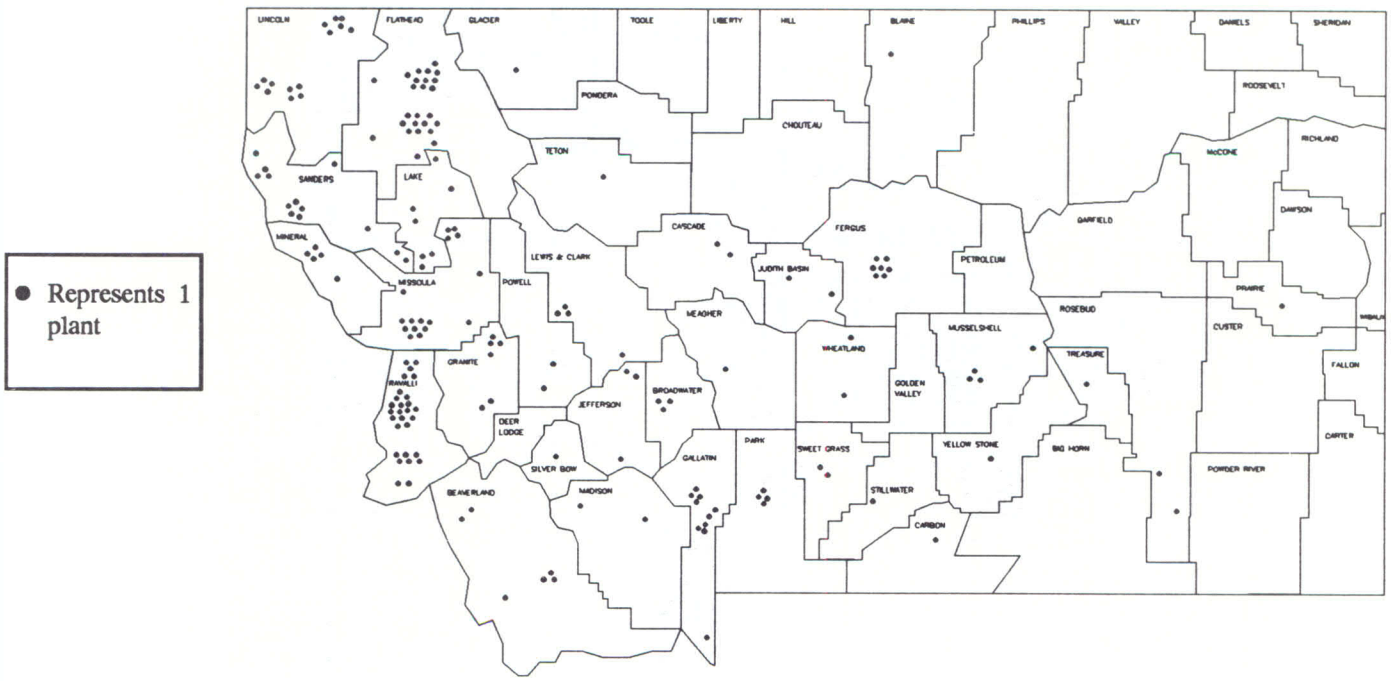


TABLE 1

Number of Active Primary Forest Products Plants, by County and Product Produced Montana, 1988

	Type of Wood Product Plant									
	Lumber	Plywood	Particleboard and Fiberboard	Pulp and Paper	Posts and Poles	House Logs	Cedar Products	Utility Poles	Other* Facilities	Total
Beaverhead	3	--	--	--	1	2	--	--	--	6
Blaine	1	--	--	--	--	--	--	--	--	1
Broadwater	2	--	--	--	1	--	--	--	--	3
Carbon	1	--	--	--	--	--	--	--	--	1
Cascade	1	--	--	--	--	1	--	--	--	2
Fergus	5	--	--	--	2	--	--	--	--	7
Flathead	13	2	1	--	5	3	--	1	--	25
Gallatin	2	--	--	--	2	5	--	1	--	10
Glacier	--	--	--	--	1	--	--	--	--	1
Granite	4	--	--	--	2	--	--	--	--	6
Jefferson	1	--	--	--	2	--	--	--	--	3
Judith Basin	1	--	--	--	1	--	--	--	--	2
Lake	5	--	--	--	--	1	--	--	1	7
Lewis and Clark	2	--	--	--	1	1	--	--	--	4
Lincoln	6	1	--	--	--	2	2	--	3	14
Madison	1	--	--	--	--	1	--	--	--	2
Meagher	--	--	--	--	1	--	--	--	--	1
Mineral	2	--	--	--	1	1	--	--	1	5
Missoula	6	1	1	1	3	2	1	--	1	16
Musselshell	3	--	--	--	1	--	--	--	--	4
Park	3	--	--	--	1	--	--	--	--	4
Powell	1	--	--	--	1	--	--	--	--	2
Prairie	1	--	--	--	--	--	--	--	--	1
Ravalli	9	--	--	--	5	13	--	--	2	29
Rosebud	2	--	--	--	--	--	--	--	--	2
Sanders	7	--	--	--	3	2	--	--	--	12
Silver Bow	1	--	--	--	--	--	--	--	--	1
Stillwater	1	--	--	--	--	--	--	--	--	1
Sweet Grass	1	--	--	--	1	--	--	--	--	2
Teton	--	--	--	--	1	--	--	--	--	1
Treasure	1	--	--	--	--	--	--	--	--	1
Wheatland	1	--	--	--	1	--	--	--	--	2
Yellowstone	--	--	--	--	--	1	--	--	--	1
Total	87	4	2	1	37	35	3	2	8	179
Montana, 1981	142	4	2	1	35	27	8	3	3	225

Source: Page 51.

*Includes wood pellet plants, decorative bark plants, planing mills, and plants generating electricity.

$898 million in 1988, down from the record $944 million (1988 dollars) in 1987. Although strikes during the summer of 1988 slowed production, for the twenty years examined, 1988 ranked as the third highest annual sales value figure on record in constant dollars (figure 2).

More than 95 percent of sales over the last twenty years have been in three sectors of the industry: sawmills, plywood plants, and the residue utilizing sector consisting primarily of a pulp and paper mill, a particleboard plant, and a medium density fiberboard plant. Also included in the residue sector are sales of mill residue out of state, electricity generated from wood, and pelletized fuel producers.

The proportion of sales contributed by the individual sectors has changed and the distribution of sales shown in table 3 illustrates two major developments in Montana's forest products industry over the last twenty years. These have been:

1) Increasing lumber and plywood production but decreasing sales value due to lower real lumber prices and a higher proportion of lower grade lumber produced.

2) An increase in the size of the components of the industry based on processing mill residue (wood fiber residue from sawmills and plywood plants).

In 1988, the sawmill sector had sales of $385 million from the production of lumber and other sawn products. While this sector remains the largest manufacturing component of Montana's forest products industry, its proportionate contribution to total sales has decreased substantially over the last

TABLE 2

Number of Active Forest Products Facilities by Plant Type 1976, 1981, and 1988

Plant Type	1988	1981	1976
Lumber	87	142	98
Plywood	4	4	5
Particleboard and fiberboard	2	2	2
Pulp and paper	1	1	1
Posts and poles	37	35	37
House logs	35	27	19
Cedar products	3	8	9
Utility poles	2	3	3
Other Facilities[a]	8	3	1
Total	179	225	175

Source: Page 51.

[a]Includes wood pellet plants, decorative bark plants, planing mills, and plants generating electricity.

twenty years -- from about 61 percent in 1969 to 43 percent in 1988 (table 3).

Sales in the mill residue sector more than doubled in constant 1988 dollars from an estimated $153 million in 1969, or 20 percent of the total, to $367 million, or 41 percent of total sales in 1988 (table 3). The large increases in this mill residue utilizing sector account largely for the record sales from Montana's forest products industry in the late 1980s.

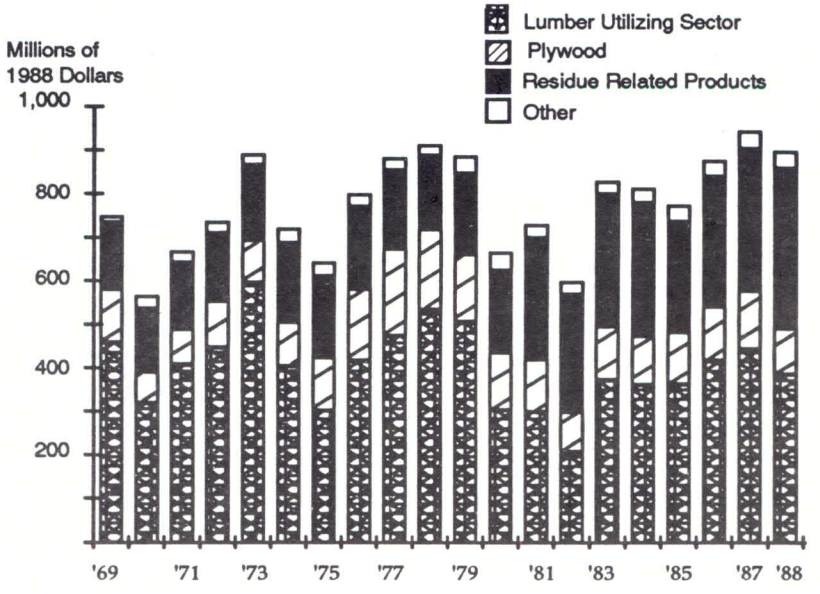
The third major sector, the plywood industry, was affected more than the sawmill or residue sector by the 1988 strikes, with more than half of the state's plywood capacity closed for approximately three months in 1988. Sales were $106 million in 1988, substantially lower than in 1987 and 1989. Based on an annual Bureau of Business and Economic Research survey of major producers, sales were about $130 million (1988 dollars) in 1987 and 1989 when the plywood industry was operating at near full capacity.

Other primary manufacturers (house logs, utility poles, cedar products, posts, and small poles) had sales of $40 million in 1988, about 4 percent of the total -- an increase over the earlier years shown in the survey. The increase was due primarily to increased sales in the log home industry with the utility pole and cedar products sales declining.

The specific developments in the various sectors are discussed in more detail in the next few pages.

FIGURE 2

Sales Value of Montana's Wood and Paper Products, 1969 - 1988



Source: Page 49.

THE SAWMILL SECTOR

In 1988, Montana sawmills produced 1,558 MMBF lumber tally of lumber and shipped 1,545 MMBF, generating $385 million in sales. This represented 4 percent of the total U.S. production of softwood lumber and about 3.2 percent of U.S. consumption (Western Wood Products Association, 1990).

In spite of the strikes, the 1988 production level represents the third highest for Montana's sawmills during the 1969 to 1988 period (Western Wood Products Association, 1971 1980, 1989). The mills achieved higher production in 1986 and 1987 at 1,563 and 1,640 MMBF lumber tally, respectively (figure 3).

A number of factors have affected Montana's lumber production over the last twenty years. These include: 1) changes in size of the plywood industry relative to the sawmill industry; 2) increased recovery of lumber per unit volume of log input; and, 3) greatly varying markets for lumber and wood products.

Based on the volume and proportion of timber processed, the plywood industry expanded during the 1970s relative to the sawmill industry. The plywood industry contracted slightly, measured by timber processed, relative to the sawmill industry from the late 1970s to the late 1980s.

Montana's declining lumber production from 1969 to 1979, shown in figure 3 was due in large part to the expansion of the plywood capacity and substitution of the plywood industry for a portion of the sawmill industry. Plywood mills in Montana use timber that sawmills can also process into lumber.

In 1969, sawmills processed 86 percent of the timber harvested in Montana and plywood plants processed 12 percent. In 1976 and 1981 sawmills processed 74 percent and 71 percent respectively of Montana's timber while plywood plants processed 23 percent and 22 percent, respectively. In 1988, sawmills processed 81 percent of Montana's timber harvest and the state's plywood industry used 17 percent. Utilization of Montana's timber harvest is discussed further in Section 2 (see figure 6).

Increases in lumber production from the late 1970s to the late 1980s are due both to increased lumber recovery per board foot (Scribner rule) of timber processed and to increased volumes of timber processed by the sawmill sector. Lumber production in 1988 was 1,558 MMBF lumber tally, 33 percent greater than in 1976 when lumber production was 1,170 MMBF. The volume of timber measured in board feet Scribner used to produce that lumber was 10 percent greater in 1988 than in 1976. The remaining increase in lumber production in comparing the two years was due to increased lumber recovery per board foot Scribner of timber processed.

Lumber Overrun

In 1988, Montana sawmills produced approximately 1.58 board feet of lumber for every board foot Scribner of timber processed. This compares to

TABLE 3

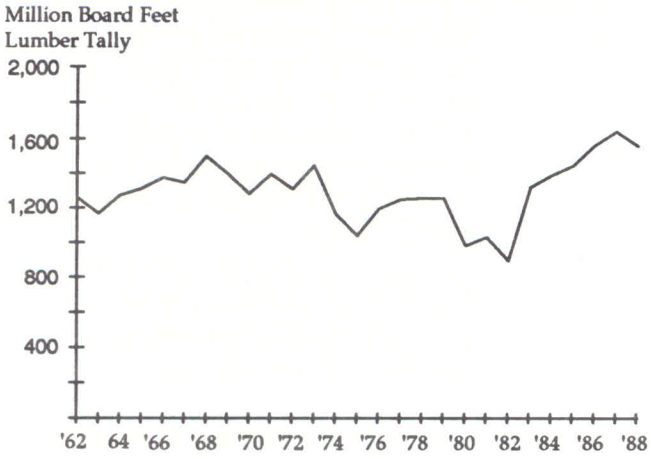
Sales Value of Manufactured Forest Products Montana, 1969, 1976, 1981 and 1988 (In Millions of 1988 Dollars)

	1969	1976	1981	1988
Lumber, structural timbers, and railroad ties	$459.0	$417.0	$299.0	$385.0
Plywood	122.0	164.0	121.5	105.7
Residue related products	153.0	189.0	276.0	367.3
House logs	*	13.4	13.5	29.5
Posts and poles and utility poles	15.0	13.0	13.0	9.7
Cedar products	*	3.9	5.1	1.2
Total	$749.0	$800.3	$728.1	$898.4
	------ Percentage of Total ------			
Lumber, structural timbers, and railroad ties	*61%*	*52%*	*41%*	*43%*
Plywood	*16%*	*20%*	*17%*	*12%*
Residue related products	*20%*	*24%*	*38%*	*41%*
House logs	*	*2%*	*2%*	*3%*
Posts and poles and utility poles	*2%*	*2%*	*2%*	*1%*
Cedar products	*	*	*1%*	*
Total	*100%*	*100%*	*100%*	*100%*

Source: Page 51.
Notes: For 1969, sales of house logs, post and poles, utility poles, and cedar were combined.
*Less than 0.5%.
Percentages may not add to 100 due to rounding..

FIGURE 3

Lumber Production by Montana Mills Montana, 1960 - 1988



Source: Page: 49.

1.45 BF in 1981, and 1.31 BF in 1976. The increase in overrun has been due to a number of factors. Certainly, there have been improvements in technology and efficiency in Montana's mills, resulting in increased lumber recovery. An additional factor which may have contributed to a higher overrun is decreasing log size. As log diameter decreases the Scribner Decimal C log rule, which is used in Montana, underestimates by an increasing amount the lumber that can be recovered. The increasing proportion of lodgepole pine processed by sawmills would indicate that average log diameter has decreased. From the census data it was impossible to differentiate between increases in overrun caused by productivity improvements as opposed to quirks in the Scribner scaling system.

Sales Value

The 1988 lumber sales value of $385 million is higher than the lumber sales value figures for the early 1980s, but in constant 1988 dollars it is down from sales figures for the strong lumber markets in the late 1960s and the 1970s (figure 2).

During the first three years of the 1980s, Montana mills had very low sales levels due to low lumber production and low prices, which were caused by two national recessions and low levels of building throughout the United States (Richards, 1986). Lumber production by Montana mills during these years was 983 MMBF, 1,032 MMBF, and 895 MMBF respectively with sales value averaging $270 million (1988 dollars).

In contrast, the late 1960s and the 1970s saw very strong lumber markets and these are reflected in the sales figures from Montana sawmills (figure 2). For example, lumber sales by Montana mills peaked in 1973 at $595 million (1988 dollars) from production of 1,445 MMBF lumber tally. Other peak sales years were 1978 with sales value in 1988 dollars at $533 million, 1979 with sales of $506 million, 1977 with

TABLE 4

Number of Sawmills, by Size of Production, Montana Selected Years 1956-1988

	Annual Production			
Year	Under 10 MMBF	10 MMBF to 50 MMBF	Over 50 MMBF	Total Mills
1956	304	26	—[a]	330
1966	111	37	—[a]	148
1973	86	22	7	115
1976	68	24	6	98
1981	114	23	5	142
1988	58	16	13	87

Source: Page 51.

[a]Mills with lumber production in excess of 50 MMBF have been included in the 10 to 50 MMBF category for these years.

TABLE 5

Lumber Output, by Size of Mill, Montana Selected Years 1956-1988

	Percentage of Total Lumber Output		
Year	Mills with Annual Production below 10 MMBF	Mills with Annual Production 10 MMBF and Above	Total Lumber Output (MMBF)
1956	33	67	979
1962	13	87	1,259
1966	10	90	1,375
1976	4	96	1,176
1981	8	92	1,071
1988	4	96	1,558

Source: Page 51.

sales of $474 million, and 1969 with sales of $459 million in constant 1988 dollars.

During the late 1980s, sales value of lumber was lower in constant dollars than in the 1970s and late 1960s despite increased production. Lower real prices for lumber, and the fact that Montana's average lumber output was certainly in lower grades in the late 1980s than in earlier years were the reasons for the lower sales value. The price of virtually every common grade and species produced in Montana in 1988, as indicated by *Random Lengths*, was lower in constant dollars than in the late 1970s (Richards 1985, 1988, 1989). Additionally in 1988, approximately 46 percent of the lumber produced by Montana sawmills came from mills sawing primarily stud-type lumber, compared to 1976 and 1981 when studmills produced only about 22 and 37 percent of the lumber output, respectively.

Geographic Source of the Lumber Shipments

In 1988, Montana had total lumber shipments of 1,545 MMBF lumber tally. Flathead County mills had lumber shipments of 345 MMBF, or 22 percent of the total, leading the state in lumber shipments. Lincoln County was second with shipments of 331 MMBF (21 percent), followed by Missoula County with 142 MMBF (9 percent). Mills in Ravalli and Granite Counties reported lumber shipments of 120 MMBF, 8 percent of 1988 shipments. Mills in Lake, Mineral, and Sanders Counties shipped 231 MMBF (15 percent) in 1988. Eight central and south central counties -- Beaverhead, Broadwater, Gallatin, Jefferson, Lewis and Clark, Madison, Park, and Powell -- accounted for about 314 MMBF or 20 percent of Montana's lumber shipments. The remaining counties in the state had shipments of 60 MMBF or 4 percent of the states lumber shipments in 1988.

Number and Size of Mills

Over the past thirty years, sawmills have changed dramatically. The heavy demand for housing after World War II resulted in an increase in the number of sawmills operating in Montana. At the peak of this boom, in 1956, there were about 330 sawmills, but only twenty-six sawmills produced more than 10 MMBF annually (table 4).

In 1976, the census identified ninety-eight active sawmills in Montana. The loss was among smaller sawmills, those producing less than 10 MMBF of lumber annually. Although 304 smaller mills operated in 1956, only sixty-eight remained by 1976, and the number of larger mills actually increased over the period.

The trend temporarily reversed itself with an increase in the number of active sawmills, from ninety-eight in 1976 to 142 in 1981. An increase in the number of small sawmills accounted for the change with the number of mills producing under 10 MMBF, increasing from 68 in 1976 to 114 in 1981.

The results of the 1988 census indicate a return to the general trend toward fewer but larger sawmills. The census identified eighty¬seven active sawmills in 1988 compared to 142 in 1981.

The concentration of lumber production has followed a similar pattern. In 1956, nearly one-third of the state's total lumber output came from mills producing annually less than 10 MMBF each (table 5). By 1976, the thirty largest mills in the state accounted for 96 percent of the state's total lumber output, while the sixty-eight mills producing less than 10 MMBF contributed only 4 percent.

In 1981, figures showed the proportionate contribution of lumber from mills producing less than 10 MMBF increasing from 4 percent to 8 percent. Two factors were primarily responsible for the increased proportion of total lumber output from mills producing less than 10 MMBF in 1981. First, there was an increase in the number of small sawmills in Montana in the late 1970s and early 1980s, probably due to the very strong lumber markets in the late 1970s, the expected strong lumber markets in the 1980s, and the development of easy-to-operate portable sawmills. The second factor was that the early 1980s turned out to be a period of very weak lumber markets. A number of mills, which in good market years produced more than 10 MMBF annually, fell below this level in 1981.

As indicated in table 5, after the difficult lumber market years of the early 1980s and with increased output in the late 1980s, lumber production has become even more concentrated in the largest mills. In 1988, only 4 percent of the state's output was in mills producing less than 10 MMBF for the year.

As indicated in table 6, mills producing more than 50 MMBF of lumber in 1988 accounted for 68 percent of the state's production,compared to 1976 and 1981 when mills producing more than 50 MMBF of lumber accounted for 44 and 42 percent of the production respectively.

PLYWOOD AND VENEER SECTOR

In 1988, Montana had four plants that produced plywood and veneer. These plants shipped 620.5 million square feet (MMSF, 3/8-inch basis) of plywood and veneer, for total sales of $105.7 million. Production was 612 MMSF, and accounted for 2 percent of the structural panel production in the United States (American Plywood Association, 1990).

Production was lower in 1988 than in 1987 or 1989, with strikes affecting more than half of Montana's plywood production capacity for three months in 1988. The state's plywood plants produced 714 MMSF and 725 MMSF in 1987 and 1989, respectively. The 1987 and 1989 levels were both new records for the plywood industry in Montana (American Plywood Association, 1990).

TABLE 6

Lumber Production, by Size of Mill Montana, 1988

Size Class	Production: Number of Mills	Production: Volume (MMBF)	Production: *Percentage of Total*	Production: Average per Mill (MMBF)
A -- over 50 MMBF	13	1,062	*68.1%*	81.7
B -- over 25 MMBF to 50 MMBF	8	290	*18.6%*	36.3
C -- over 10 MMBF to 25 MMBF	8	141	*9.1%*	17.6
D -- over 1 MMBF to 10 MMBF	14	57	*3.6%*	4.1
E -- under 1 MMBF	44	8	*0.5%*	0.2
Total	87	1,558	*100%*	17.9

Source: Page 51.

Notes: MMBF denotes millions of board feet, lumber tally. The percentage detail may not add to 100 because of rounding.

Plywood Recovery

The record levels of plywood production in the late 1980s were due to increased recovery per unit volume of timber processed rather than an increase in the volume of timber processed by the plywood industry. In 1976, Montana's plywood industry processed 267 MMBF Scribner of timber to produce 642 MMSF of plywood for a recovery of 2.40 square feet 3/8-inch basis per board foot Scribner of timber input. In 1988, the state's plywood industry processed 218 MMBF Scribner and produced 612 MMSF for a recovery of 2.81 square feet per board foot Scribner of timber processed. To produce the record volume of 725 MMSF in 1989, Montana's plywood industry processed 253 MMBF Scribner, less timber than it processed in 1976 (CURFOR, 1990).

Residue-Utilizing Sector

The residue utilizing sector of Montana's primary forest products industry has experienced substantial growth since the 1969 survey. The 1988 census identified one kraft pulp and paper mill, one particleboard plant, one medium-density fiberboard plant, four active wood pellet producers, and one facility generating electricity for sale. Also included in this sector are mill residue sales to out-of-state users. The total sales from this sector were $367.3 million in 1988 (table 3).

This sector accounted for approximately 41 percent of the sales of primary forest products by Montana manufacturers in 1988, up from 38 percent in 1981, 24 percent in 1976, and 20 percent in 1969.

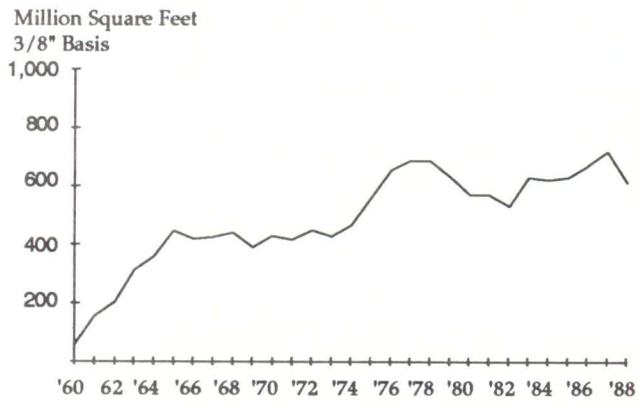
Because of the limited number of plants processing mill residue, much of the information in this section was developed from published sources. In 1969, this sector consisted of a kraft pulp and paper mill, a mill selling electricity generated from wood fiber, and mills selling residue to out-of-state users. Since then, the pulp and paper mill has increased in capacity by more than 60 percent. The particleboard and fiberboard plants were built in the 1970s with some expansion since then.

More specifically, in the early 1970s the pulp and paper mill was capable of producing 1,000 tons of linerboard per day and 150 tons of bleached kraft pulp per day. By 1988, this capacity had increased to 1,910 tons per day of kraft paper (Berg, et al., 1974 and Miller Freeman, 1989a).

The particleboard and medium density fiberboard plants were both built in the first half of the 1970s. In 1976, the particleboard plant had an annual capacity of 100 million square feet on a

FIGURE 4

Plywood Production by Montana Mills Montana, 1960 - 1988



Source: Page 49.

3/4-inch basis and the medium density fiberboard plant had an annual production capacity of 70 million square feet on a 3/4-inch basis. The capacity of these three facilities in 1988 was about 150 MMSF for the particleboard plant and 80 MMSF for the fiberboard plant (Miller Freeman, 1989b).

The 1988 census identified four wood fuel pellet producers in operation, producing 5,500 tons of fuel pellets for sales of $440,000. Since then, there has been substantial expansion of the industry with the addition of two facilities, bringing the total production capacity to about 67,000 tons. The expected 1990 production is about 30,000 tons, with a sales value of about $3 million (Hearst,1990).

The residue utilizing sector is also a significant source of revenue for the lumber and plywood producers. In 1988, the residue sectors in both Montana and surrounding states paid $25 million for chips, sawdust, planer shavings, and bark from Montana sawmills and plywood plants.

OTHER PRIMARY MANUFACTURERS

Montana also contains many other primary wood products firms that produce a variety of products. The 1988 census identified seventy-seven of these facilities manufacturing log homes, utility poles, posts, tree props, and cedar products. In 1981, there were seventy-three and in 1976 there were sixty-eight (table 2). There have been major changes among these smaller manufacturers, mostly involving the log home industry and cedar products producers.

Log Home Industry

In 1988, log home manufacturers produced about 5.5 million lineal feet of house logs, with total sales of $29.5 million. This compares to sales of $13.5 million (1988 dollars) and production of approximately 4 million lineal feet in 1981, and sales of $13.4 million (1988 dollars) with 3 million lineal feet produced in 1976. Most of these house logs were sold in the form of custom log homes or kits. The 1988 census identified thirty-five log home manufacturers, up from the twenty-seven in 1981 and nineteen in 1976.

Cedar Products Industry

In contrast to the log home industry, Montana's cedar products industry has declined substantially from the previous two censuses. In 1988, there were three active cedar products manufacturers identified in the census, compared to eight in 1981 and nine in 1976. Cedar products manufacturers processed about 2 MMBF Scribner of cedar products logs into cedar shakes, shingles, and split rail fencing in 1988, with a sales value of $1.2 million. In 1981, cedar products manufacturers processed more than 7 MMBF for sales of $5.1 million (1988 dollars). In 1976, this sector processed 10.2 MMBF Scribner, for sales of $3.9 million (1988 dollars).

Roundwood Products

In 1988, there were thirty-nine plants producing various types of roundwood products such as posts, corral poles, tree stakes, and utility poles. These manufacturers had sales of $9.7 million in 1988, producing about 4.7 million pieces. This was down from 1981 when sales were $13 million (1988 dollars) and production was 3.8 million pieces and down from 1976 when sales were $13 million (1988 dollars) and production was 2.2 million pieces.

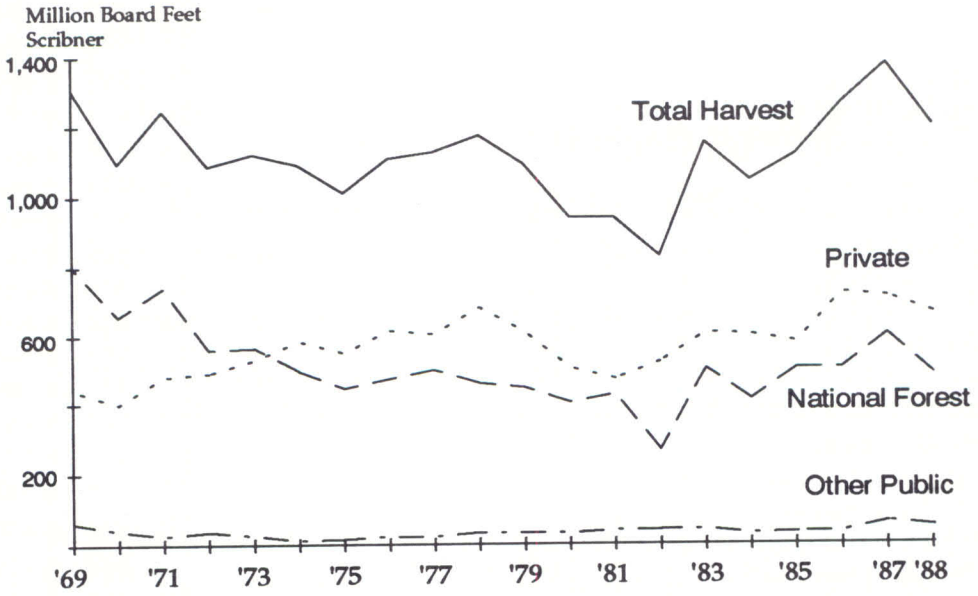
The lower sales by these producers in 1988 -- in spite of increased numbers of pieces produced -- is due to: 1) a decline in the sales value in constant dollars of virtually all of the roundwood products of a given size, and 2) a proportionate increase in the production of smaller and generally lower priced roundwood products. In particular, from 1976 to 1988, there was increased production of lower value per piece small tree props and decreased production of the highest value roundwood products -- utility poles.

Section 2
Harvest & Utilization

Montana's Timber Harvest and Utilization

FIGURE 5

Montana Harvest By Ownership, Montana, 1969 - 1988
A 20-Year Trend



Source: Page 49.

Note: Other public lands are those managed by the Montana Department of State Lands and the USDI Bureau of Land Management. Harvest from tribal lands is included in the private harvest.

SOURCES OF MONTANA'S TIMBER HARVEST

Public and Private Timberlands

This section examines Montana's timber harvest from public and private timberlands from 1969-1988. It focuses on geographic sources of timber, types of products harvested, species composition, movement of products, and end uses of timber.

Timber harvest from private timberlands, national forests, and other public timberlands for the period 1969-1988 is shown in figure 5. In looking at the twenty years from 1969-1988, peak harvests occurred in the first three years and last three years of that period. The average harvest for the twenty-year period was 1,114 MMBF Scribner. The 1969-1971 average annual harvest was 1,213 and the 1986-1988 average annual harvest was 1,279.

The percentage of Montana's timber harvest supplied by private timberlands and the national forests changed significantly from 1969 to the mid 1970s, but has changed very little since then. There was a major shift in the early 1970s away from national forest timber and an increase in harvesting timber from private timberlands. In 1969, about 34 percent of the total harvest in Montana came from private timberlands (including tribal lands) and 61 percent from national forests. In 1975, about 55 percent came from private timberlands and about 44 percent from national forests. Since 1975, the contribution of national forest timberlands has averaged 42 percent and private timberlands' contribution has averaged 55 percent.

GEOGRAPHIC SOURCE OF THE HARVEST

The commercial timber harvest by county for the three most recent surveys (1976, 1981, and 1988) is shown in table 7. Lincoln County continued to lead the state in timber harvest with 324 MMBF harvested in 1988, 26 percent of Montana's harvest. Other leading timber-production counties in 1988 were Flathead, 255 MMBF; Missoula, 141 MMBF; and Sanders, 89 MMBF. These four counties accounted for 65 percent of Montana's timber harvest.

The most dramatic changes in county level harvest since 1976 have occurred in Sanders and Powell Counties and a number of counties in southeastern Montana. The annual harvest in Sanders County declined (42 percent) from 153 MMBF, 13 percent of total harvest in 1976, to 89 MMBF or 7 percent of total harvest in 1988. There was a major increase (55 percent) in the harvest level in Powell County from 36 MMBF in 1976 to 56 MMBF in 1988. There was also a substantial increase in harvest from several counties in southeastern Montana particularly Big Horn, Powder River and Rosebud Counties -- all had much higher reported harvest in 1988 vs. earlier censuses. In 1976, the harvest from these three counties was under 3 MMBF; in 1988 the harvest was 39 MMBF. Most of the increase in harvest in these counties occurred on private timberlands and tribal timberlands. Increased mill capacity in southeastern Montana, South Dakota, and Wyoming, and some fire salvage harvests appear to be the reasons for the increased harvest in southeastern Montana.

TABLE 7

Timber Products Harvested, by County
Montana
1976, 1981 and 1988

	1988		1981		1976	
County	Million Board Feet, Scribner	*Percentage of Total*	Million Board Feet, Scribner	*Percentage of Total*	Million Board Feet, Scribner	*Percentage of Total*
Lincoln	324	*26.2%*	267	*25.8%*	293	*25.3%*
Flathead	255	*20.6%*	245	*23.7%*	232	*20.0%*
Sanders	89	*7.2%*	93	*9.0%*	153	*13.2%*
Lake	58	*4.7%*	28	*2.7%*	42	*3.6%*
Missoula	141	*11.4%*	120	*11.6%*	146	*12.6%*
Mineral	40	*3.2%*	45	*4.3%*	50	*4.3%*
Ravalli	36	*2.9%*	41	*4.0%*	35	*3.0%*
Powell	56	*4.5%*	20	*1.9%*	36	*3.1%*
Granite	29	*2.3%*	23	*2.2%*	25	*2.2%*
Gallatin	29	*2.3%*	36	*3.5%*	29	*2.5%*
Madison	18	*1.5%*	3	*0.3%*	2	*0.2%*
Lewis and Clark	17	*1.4%*	26	*2.5%*	27	*2.3%*
Beaverhead	16	*1.3%*	10	*1.0%*	17	*1.5%*
Park	16	*1.3%*	8	*0.8%*	21	*1.8%*
Meagher	15	*1.2%*	16	*1.5%*	18	*1.6%*
Powder River	15	*1.2%*	1	*0.1%*	*	----
Bighorn	12	*1.0%*	3	*0.3%*	*	----
Rosebud	12	*1.0%*	6	*0.6%*	*	----
All other counties	58	*4.7%*	44	*4.3%*	34	*2.9%*
Total harvest	1,236	*100.%*	1,035	*100.0%*	1,160	*100.0%*

Source: Page 51.

Notes: The above volumes include saw logs, veneer logs, pulpwood, utility poles, house logs, post and poles, and cedar products logs. The percentage detail may not add to 100 because of rounding.

*Under .5 MMBF.

TYPES OF TIMBER PRODUCTS HARVESTED

Timber harvest in this report is classified by product type based on the primary products manufactured directly from the timber. In this section, the harvest is divided into four categories: sawlogs, veneer logs, pulpwood, and other timber products. Sawlogs are timber products used to produce sawn products such as lumber, structural timbers, and railroad ties. Veneer logs are logs used to produce veneer for plywood. Pulpwood refers to timber used in round form to produce wood chips for manufacturing pulp and paper. Other timber products refer to utility poles, house logs, cedar products logs, posts and small poles, and other small roundwood products.

Sawlogs remained the primary timber product harvested from Montana timberlands, accounting for 1 billion board feet or about 81 percent of the 1988 harvest. That figure is up from 71 percent (736 MMBF) in 1981 and 74 percent (860 MMBF) in 1976, but down from 86 percent (1,118 MMBF) in 1969 (figure 6).

"Sawlogs remained the primary timber product harvested from Montana timberlands, accounting for 1 billion board feet or about 81 percent of the 1988 harvest."

Veneer logs are the second largest component of Montana's timber harvest, representing about 17 percent (205 MMBF) of Montana's total harvest in 1988. As indicated in Section 1, 1988 strikes had the largest impact on production in the plywood industry, affecting more than half of the state's plywood capacity for nearly three months in 1988. If it had not been for the strikes, veneer logs would have accounted for about 20 percent of the harvest. The veneer log harvest was 223 MMBF in 1981, 262 MMBF in 1976, and 151 MMBF in 1969, accounting for 22, 23, and 12 percent of the harvest respectively.

Since timber is classified by end use, the proportion of the harvest in each category of timber product may indicate changes in the industry structure and market conditions as much as changes in the timber resource. This is especially true in distinguishing between sawlogs and veneer logs.

Timber processed by the plywood industry and categorized as veneer logs is suitable for production of lumber. The development of the plywood industry in the 1960s and 1970s resulted in large volumes of Douglas-fir and western larch timber being processed by the plywood sector and classified as veneer logs. Otherwise, much of this timber would probably have been processed by sawmills and classified as sawlogs.

In spite of a major expansion of the pulp and paper industry in Montana in the early 1980s, only about 11 MMBF -- less than 1 percent of Montana's timber harvest -- was used by the pulp and paper industry in round form in 1988. This is down substantially from the 53 MMBF or 5 percent of the harvest used by the pulp and paper industry in 1981. Pulpwood harvest in 1969 and 1976 was 9 MMBF and 13 MMBF, respectively.

Because the pulp and paper industry in this region prefers mill residue from the manufacture of lumber and plywood as a raw material source, the volume of timber used to produce chips for the pulp and paper industry in this region has been inversely proportional to the level of lumber production. The consumption of chips produced directly from timber vs. from sawmill residue has been greatest during recessionary periods in the lumber industry when production levels in the lumber sector have fallen off much more than production levels in the pulp and paper sector.

The pulpwood harvested from 1981 to 1988 decreased largely because of the high-level increase of lumber and plywood production in the inland Northwest, which resulted in more available pulp chips. In 1981, lumber markets were very weak and lumber production was low, resulting in less available mill residue for pulp chips.

The harvest of a number of other timber products has changed substantially since the 1976 census. The harvest of two timber product types, house logs and small roundwood products such as posts and tree props, has increased substantially in line with increases in the size of those components of the industry, while the harvest of utility poles and cedar products logs has declined.

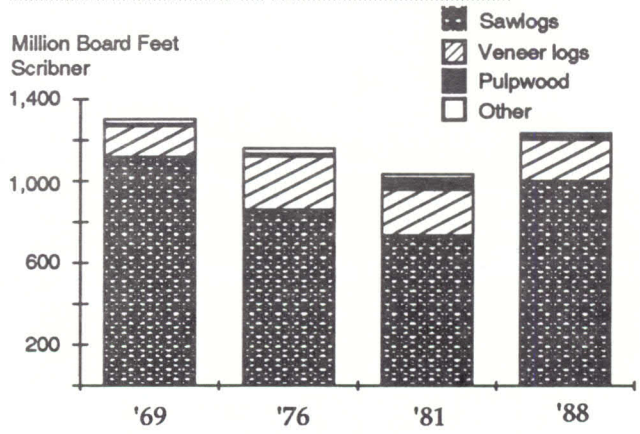
The harvest of house logs increased from the 10 MMBF in 1976 to 11 MMBF reported in 1981 and 14 MMBF in 1988. In contrast to the small roundwood products, the harvest of utility poles declined

substantially. Because only two firms received these timber products specific volumes are not disclosed. Volumes of utility poles harvested were combined with posts and other small roundwood products. The harvest of these products was 3.8 million board feet in 1976, 7.5 million board feet in 1981, and 5.2 million board feet in 1988.

The harvest of cedar products has declined substantially over the last fifteen years. The harvest of cedar products logs, which are used to produce cedar shakes, shingles, and split rail fencing, declined from 4.7 MMBF in 1976 to 2.6 MMBF in 1981 and 0.7 MMBF in 1988.

FIGURE 6

Timber Products Harvested Montana, 1969, 1976, 1981, 1988



Source: Page 49.

END USES OF MONTANA'S TIMBER

As indicated in Section 1, in addition to the mills which process the logs, there is a significant industry in Montana based on the mill residue from lumber and plywood production. To fully illustrate the use of the wood fiber in Montana's timber harvest, this section traces the flow of Montana's timber harvest through the various manufacturing sectors. Since both mill residue from manufacturing facilities and timber products are presented, volumes are given in cubic feet rather than in board feet Scribner. The following conversion factors were used to convert Scribner volume to cubic foot volume: 4.7 board feet per cubic foot for sawlogs, 5.4 board feet per cubic foot for veneer logs, 5 board feet per cubic foot for pulpwood, utility poles, house logs, and cedar products logs, and 1 cubic foot per board foot for posts and poles.

The following figures refer to Montana's timber harvest and include timber products shipped to out-of-state mills. The figures do not include timber harvested in other states and processed in Montana. Figures for the pulp and board sector were combined to avoid disclosing information on individual firms.

In 1988, Montana's timber harvest was approximately 260 million cubic feet (MMCF), exclusive of bark (figure 7). Of this volume, 213 MMCF went to sawmills, 38 MMCF to the plywood plants, 2 MMCF to pulp and board mills, and 7 MMCF to other primary manufacturers.

Sawmills received 213 MMCF of harvested timber and 2 MMCF of peeler cores to manufacture into sawn products. Only 89 MMCF (41 percent) of this volume actually became lumber or other sawn products. The remaining 126 MMCF of wood fiber became mill residue. About 94 MMCF of sawmill residues were sold to the pulp and board sectors; 21 MMCF were used as hog fuel; 1 MMCF was used for miscellaneous purposes such as livestock bedding; and, 10 MMCF remained unused.

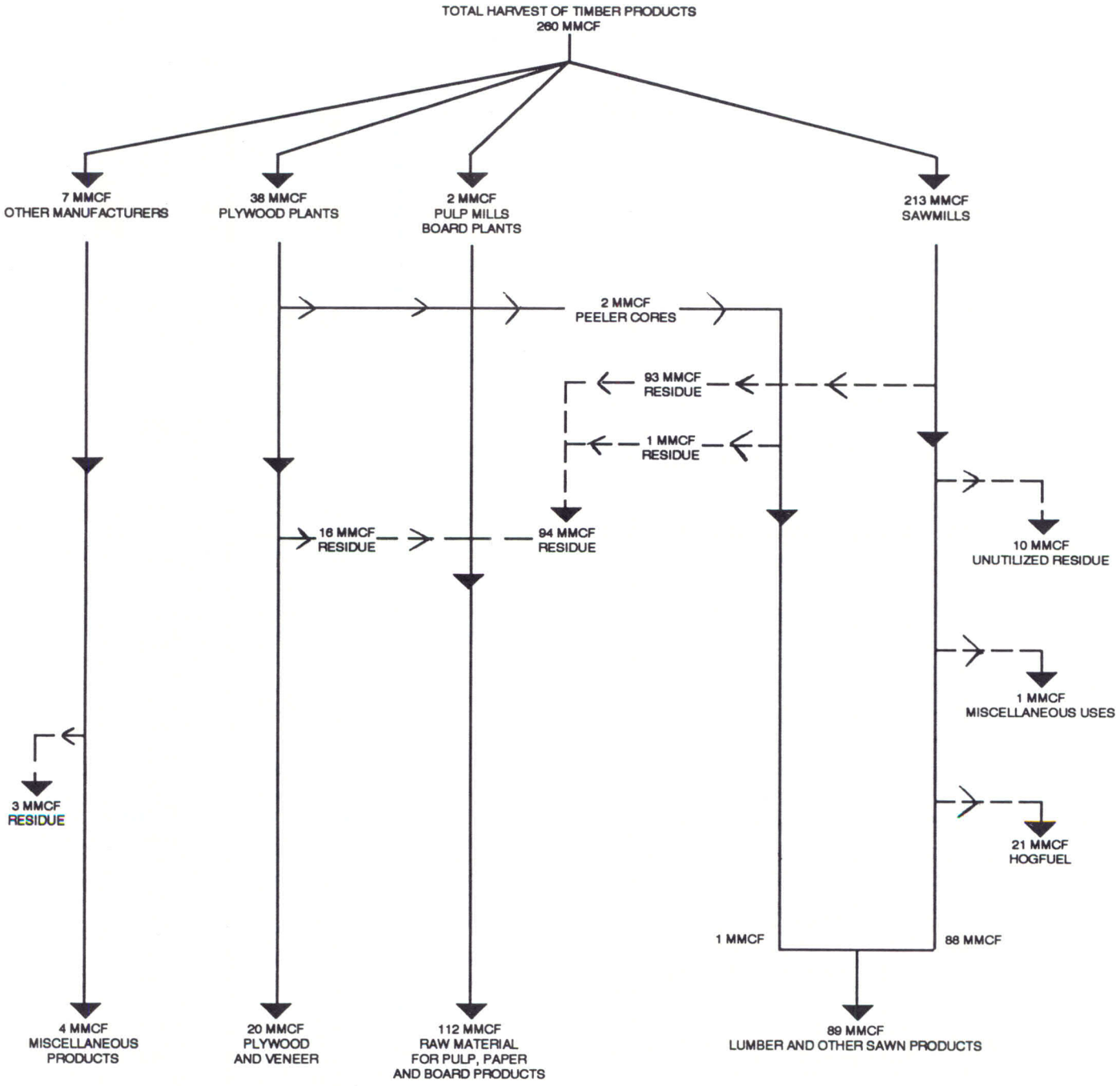
The pulp and paper and reconstituted board sectors received approximately 112 MMCF, with only 2 MMCF furnished from timber in round form. Sawmills supplied 94 MMCF of wood fiber residue, and plywood plants furnished the remaining 16 MMCF.

Plywood plants received 38 MMCF of timber in 1988, of which 20 MMCF became plywood. Of the remaining 18 MMCF, about 16 MMCF became mill residue which was used by the pulp and board sector and 2 MMCF were shipped to sawmills as peeler cores.

Other primary manufacturers received about 7 MMCF of timber products. The percentage of timber that ends up as a finished product in the log home, post and pole, utility pole, and cedar products sectors varies, but several firms indicated that roughly 60 percent of the timber volume ends up as a finished product and the remainder is residue. However, mills in this sector seldom supplied residue for use in other sectors (figure 7). Most of the residue from these sectors was used as livestock bedding, firewood, or remained unused.

FIGURE 7

Utilization of Montana's Timber Harvest 1988



Source: Page 49.

LAND OWNERSHIP AND TYPE OF PRODUCT HARVESTED

The amount of timber harvested from public and private lands varies by type of product. In 1988, public lands supplied 50 percent of the sawlog harvest (503 MMBF), up slightly from the 48 percent in 1981 and 1976. Private lands supplied the remaining 50 percent (497 MMBF) of the sawlog harvest in 1988. The national forests supplied 465 MMBF, or 47 percent of the total sawlog harvest (table 8). Other public lands supplied 38 MMBF in 1988. Industrial and non-industrial private lands furnished 22 and 27 percent, respectively.

Private lands yielded by far the largest volume of veneer logs harvested, 177 MMBF in 1988, or 86 percent of the total of 205 MMBF. This compares to 67 percent in 1981 and 71 percent in 1976. Industrial lands provided 84 percent of the total veneer log harvest and non-industrial lands provided 2 percent in 1988. The remaining 14 percent or 28 MMBF of the veneer log harvest came from public lands, about 18 MMBF or 9 percent from national forests and 5 percent from other public lands.

Private timberlands, including tribal lands, furnished about 91 percent of the 11 MMBF of harvested pulpwood in 1988. In 1981, 88 percent of the pulpwood harvest was provided by private land, while the private harvest of pulpwood in 1976 accounted for 55 percent of the total.

Sixty-nine percent or 14 MMBF of the other timber products harvested in Montana in 1988 came from public lands, while private lands supplied 6 MMBF or 31 percent. In 1981, the harvest of these products was composed of 59 percent timber from public lands and 41 percent from private lands. Public lands provided 68 percent in 1976, while private lands contributed 32 percent.

TABLE 8

Timber Products Harvested, by Ownership Source Montana, 1988

Origin	Sawlogs	Veneer Logs	Pulpwood	Other Roundwood Products	All Products
	Thousand Board Feet, Scribner				
Private timberlands	496,872	177,091	9,866	6,157	689,986
Industrial	223,460	172,479	1,166	748	397,853
Nonindustrial	273,412	4,612	8,700	5,409	292,133
Public timberlands	503,180	28,202	1,000	13,926	546,308
National Forest	464,997	17,606	1,000	13,201	496,804
Other	38,183	10,596	0	725	49,504
All sources	1,000,052	205,293	10,866	20,083	1,236,294
	Percentage of Total				
Private timberlands	*49.7%*	*86.3%*	*90.8%*	*30.7%*	*55.8%*
Industrial	*22.3%*	*84.0%*	*10.7%*	*3.7%*	*32.2%*
Nonindustrial	*27.3%*	*2.2%*	*80.1%*	*26.9%*	*23.6%*
Public Timberlands	*50.3%*	*13.7%*	*9.2%*	*69.3%*	*44.2%*
National Forest	*46.5%*	*8.6%*	*9.2%*	*65.7%*	*40.2%*
Other	*3.8%*	*5.2%*	*0.0%*	*3.6%*	*4.0%*
All sources	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Source: Page 51.

Notes: Other roundwood products include utility poles, house logs, post and poles, and cedar products logs. The percentage detail may not add to 100 because of rounding.

SPECIES COMPOSITION OF THE HARVEST

The species composition of the harvest in 1969, 1976, 1981, and 1988 is shown in table 9. The major change in species composition over the last twenty years is the emergence of lodgepole pine as the predominant species harvested in Montana. In 1988, lodgepole pine accounted for 28 percent of the volume harvested, up from 25 percent in 1981, 21 percent in 1976, and 12 percent in 1969. Improved technology to process smaller diameter timber, as well as large volumes of lodgepole pine timber offered for sale in response to a mountain pine beetle epidemic, especially in northwestern Montana, have been primarily responsible for the increased use of that species.

Douglas-fir, the predominant species harvested in previous years, accounted for 27 percent of the state's harvest in 1988. Douglas-fir has had almost exactly the same proportionate contribution to the harvest for the last twenty years.

The harvest of ponderosa pine provided an increased share of the harvest in 1988 vs. 1981 after declining from 1969 to 1981. A number of factors led to the increased harvest of ponderosa pine from 1981 to 1988. Prices for many of the higher grades of ponderosa pine lumber increased proportionately more than prices for lumber from many of the other major species in Montana (Richards, 1989 and 1985). Concerns over infestation of the pine beetle caused some increased harvesting of ponderosa pine, and major fires in southeastern Montana, and increased demand from South Dakota and Wyoming mills, also led to an accelerated harvest of ponderosa pine in that portion of the state.

Western larch and Engelmann spruce are the other two major timber species in Montana, responsible for 14 percent and 7 percent of the total harvest respectively in 1988. These two species have declined substantially in proportionate contribution since 1969.

Engelmann spruce declined from 15 percent of total harvest in 1969 to 7 percent in 1976. Two factors are generally believed to be responsible for the decreases:

- Reduction from the high harvest rates to combat an insect epidemic in spruce in the late 1950s and into the 1960s.
- A shift, especially on public lands away from harvesting in riparian areas where spruce is most common.

TABLE 9

Timber Products Harvested by Species, Montana 1969, 1976, 1981, and 1988

	Percent of Total			
Species	1988	1981	1976	1969
Lodgepole pine	28	25	21	12
Douglas-fir	27	27	27	26
Ponderosa pine	17	12	15	17
Western larch	14	16	20	20
Engelmann spruce	7	8	7	15
Other species	7	12	11	9
Total	100	100	100	100

Source: Page 51.

Note: The percentage detail may not add to 100 due to rounding.

Western larch has declined proportionately from 20 percent of the harvest in 1969 and 1976 to 16 percent in 1981 and 14 percent in 1988. The decline in the western larch harvest may be in part due to the strong emphasis by national forests in the northwestern parts of the state on harvesting lodgepole pine in response to the mountain pine beetle epidemic.

SPECIES COMPOSITION BY TYPE OF PRODUCT

All commercial softwood tree species in Montana were used to produce lumber in 1988. Lodgepole pine comprised 33 percent of the sawlog harvest; Douglas-fir, 23 percent; ponderosa pine, 19 percent; western larch, 9 percent; and Engelmann spruce, 8 percent (table 10). The veneer log harvest, in comparison, was composed primarily of Douglas-fir and western larch. These two species combined, accounted for 90 percent of the veneer log harvest in 1988. Other species used to produce plywood include Engelmann spruce, ponderosa pine, and the true firs.

The species composition of the pulpwood harvest was mixed. The largest component, true firs, accounted for 28 percent. Lodgepole pine, ponderosa pine, Douglas-fir, and western larch each accounted for more than 10 percent of the pulpwood harvest, with small amounts of Engelmann spruce and western white pine making up the remainder.

The output of other timber products was predominantly lodgepole pine. Lodgepole pine comprised 79 percent of the 20 MMBF harvested in this category, while Douglas-fir accounted for 13 percent. Lodgepole pine was the only species reported processed into utility poles in 1988. Lodgepole pine accounted for 76 percent of the house logs and about 97 percent of the posts and other small roundwood products.

MOVEMENT OF TIMBER PRODUCTS

The concentration of production in large facilities has led to developing manufacturing centers that must draw from large geographic areas to supply their timber needs. As a result, large volumes of timber cross county and state lines. Table 11 depicts the movement of timber among Montana's counties and the surrounding states in 1988.

Across State Lines

Primary wood products manufacturers in Montana received 1,202 MMBF of timber for processing in 1988. The harvest on the state's timberlands was 1,236 MMBF, making Montana a net exporter of 34 MMBF in 1988 (table 12). This is a reversal from 1981 when Montana had net imports of 14 MMBF and in 1976 when there were net imports of 50 MMBF. The net exports of 34 MMBF in 1988 resulted from 83 MMBF of timber harvested in Montana and shipped to users outside of the state,

TABLE 10

Timber Products Harvested by Species and Product, Montana, 1988

	Thousand Board Feet, Scribner				
	Sawlogs	Veneer Logs	Pulpwood	Other Roundwood Products	All Products
Douglas-fir	227,611	104,501	1,284	2,630	336,026
Engelmann spruce	82,391	7,495	95	314	90,295
Lodgepole pine	328,879	------	2,595	15,902	347,376
Ponderosa pine	192,995	9,054	2,505	223	204,777
True firs[a]	44,826	4,795	3,016	------	52,637
Western larch	93,715	79,448	1,344	295	174,802
Western hemlock	1,976	------	------	------	1,976
Western redcedar	16,147	------	------	707	16,854
Western white pine	10,985	------	27	12	11,024
Other	527	------	------	------	527
All species	1,000,052	205,293	10,866	20,083	1,236,294
	Percent				
Douglas-fir	*22.8%*	*50.9%*	*11.8%*	*13.1%*	*27.2%*
Engelmann spruce	*8.2%*	*3.7%*	*0.9%*	*1.6%*	*7.3%*
Lodgepole pine	*32.9%*	------	*23.9%*	*79.2%*	*28.1%*
Ponderosa pine	*19.3%*	*4.4%*	*23.1%*	*1.1%*	*16.6%*
True firs[a]	*4.5%*	*2.3%*	*27.8%*	------	*4.3%*
Western larch	*9.4%*	*38.7%*	*12.4%*	*1.5%*	*14.1%*
Western hemlock	[b]	------	------	------	[b]
Western redcedar	*1.6%*	------	------	*3.5%*	*1.4%*
Western white pine	*1.1%*	------	[b]	[b]	*0.9%*
Other	[b]	------	------	------	[b]
All species	*100.0%*	*100%*	*100.0%*	*100.0%*	*100.0%*

Source: Page 51.
Notes: Other roundwood products include utility poles, house logs, posts and poles, and cedar products logs. The percentage detail may not add to 100 because of rounding.

[a]Includes grand and subalpine fir.
[b]Less than .5 percent.

while Montana mills received only 49 MMBF of timber from out-of-state sources. About 57 MMBF (69 percent of the exports) went to mills in Idaho, 21 MMBF (25 percent) went to mills in Wyoming, and 5 MMBF (6 percent) went to mills in South Dakota. Less than one million board feet was reported shipped to users in other countries. Montana mills received about 44 MMBF of timber from Idaho, 5 MMBF from Canada, and 0.26 MMBF from California and Wyoming.

Sawlogs were the major component of the harvest flowing into and out of Montana. Sawmills imported 35.9 MMBF of sawlogs in 1988, virtually all of it from Idaho. This volume is down from the 39 MMBF that was imported in 1981 and down from the 62.6 MMBF imported in 1976. Montana's veneer log imports were about 6.3 MMBF in 1988, up from the 4 MMBF in 1981 and 5.9 MMBF in 1976. Imports of other timber products was 7.3 MMBF in 1988, down from 9 MMBF in 1981 and 10.7 MMBF in 1976.

Montana exported 82.6 MMBF of sawlogs in 1988, up from the 36 MMBF in 1981 and 25 MMBF in 1976. About 69 percent of those exports went to mills in Idaho, 25 percent to mills in Wyoming, and 6 percent to mills in South Dakota. There were no reported exports of veneer logs from Montana in 1988 or in the previous two census years, and other timber products had exports of 0.6 MMBF. Exports of other timber products were 2 MMBF in 1981 and 4 MMBF in 1976.

Across County Lines -- Western Montana

More than 80 percent of the timber delivered to Montana mills was received by processors in Lincoln, Flathead, Lake, Mineral, Missoula, Sanders, and Ravalli Counties. Of the 978 MMBF received in those counties in 1988 more than 90 percent was harvested from within that seven-county region and in those counties about 62 percent was harvested in the same county it was processed (table 11).

In 1988, Flathead County mills received more timber than mills in any other county in Montana -- 306 MMBF. About 193 MMBF (63 percent) of that timber was harvested in Flathead County and the remaining 113 MMBF (37 percent) came from other counties or states. Lincoln County mills ranked second in timber receipts with 241 MMBF of timber received in 1988, about 191 MMBF (79 percent) from within the county and 50 MMBF (21 percent) from other counties or states. Mills in Lake, Mineral and Sanders Counties together received about 173 MMBF of timber in 1988, about 104 MMBF (60 percent) from within those counties and 69 MMBF (40 percent) from other counties or states. In 1988, mills in Missoula County received 193 MMBF of timber, 101 MMBF (53 percent) of that timber came from within the county and 92 MMBF (47 percent) came from other counties or states. Mills in Ravalli County received 65 MMBF of timber in 1988, about 35 MMBF (53 percent) from within the county and 30 MMBF (47 percent) from other counties or states.

Major Processing Centers

There has been a shift in timber processing within western Montana counties over the last decade. Flathead County has displaced Missoula County as the major timber processing center, and Lincoln County has moved from the third to the second major processing center. Missoula County is now the third major center based on the volume of timber processed.

In 1976, Missoula County mills received 357 MMBF of timber for processing, Flathead County mills received 248 MMBF, and Lincoln County mills received 194 MMBF. In 1981, the ranking was the same, with Missoula County mills receiving 307 MMBF of timber for processing followed by Flathead County with 247 MMBF and Lincoln County with 178 MMBF.

In 1988, Flathead County ranked first in timber receipts with 306 MMBF, followed by Lincoln County mills which received 241 MMBF and Missoula County mills which received 193 MMBF. This switch has come about through expanding the industry in Flathead and Lincoln Counties and decreasing the size of the timber processing industry in Missoula County. The strikes which affected mills in Missoula and Lincoln Counties also had some effect on the 1988 mill receipts in these counties. But even without the strikes, Flathead County would be the major timber processing center, followed by Lincoln and Missoula Counties. Changes in mill capacity are discussed further in Section 4 and are illustrated in table 18.

Accompanying these changes in timber processed was the expansion of timber supply areas by those mills operating in Flathead and Lincoln

TABLE 11

Movement of Timber Products, by Counties of Origin and Receipt Montana, 1988 (Thousand Board Feet, Scribner)

County of Origin	County of Destination: Lincoln	Flathead	Lake Mineral Sanders	Missoula	Ravalli	Beaverhead Madison	Granite Powell Silver Bow	Broadwater Lewis & Clark Meagher	Gallatin	Park	Other Counties	Other States	Total
Lincoln	190,702	61,504	16,179	6,081	1,917	------	------	------	------	------	------	47,506	323,889
Flathead	22,818	193,446	29,429	7,668	1,664	------	------	------	------	------	------	------	255,025
Sanders	12,348	12,130	52,796	6,740	138	------	------	------	------	375	------	4,059	88,586
Lake	------	18,083	20,444	19,006	------	------	------	------	------	------	------	------	57,533
Mineral	------	------	30,284	4,871	83	------	------	------	9	------	------	5,147	40,394
Missoula	------	17,052	11,033	101,477	10,912	------	------	20	------	180	------	------	140,674
Ravalli	------	------	------	914	34,647	------	------	------	------	------	------	------	35,561
Powell	------	------	------	30,552	------	------	25,086	640	67	------	15	------	56,360
Granite	------	------	------	6,037	------	------	23,037	------	151	------	------	------	29,225
Beaverhead	------	------	------	------	3,078	12,488	600	------	------	111	------	155	16,432
Madison	------	------	------	------	------	6,105	------	------	10,617	1,131	3	------	17,856
Lewis and Clark	------	------	------	2,817	------	------	4,888	7,228	1,382	132	885	------	17,332
Jefferson	------	------	------	42	------	30	3,000	3,710	1,328	------	144	------	8,254
Gallatin	------	------	------	------	------	------	------	------	23,236	5,749	------	------	28,985
Park	------	------	------	------	------	------	------	------	3,063	12,541	------	------	15,604
Rosebud	------	------	------	------	------	------	------	------	------	------	5,332	6,811	12,143
Bighorn	------	------	------	------	------	------	------	------	------	272	3,758	7,941	11,971
Powder River	------	------	------	------	------	------	------	------	------	------	5,332	9,284	14,616
Meagher	------	------	------	------	------	------	------	4,125	27	10,652	------	------	14,804
Other Counties	------	3,808	------	889	------	797	7,003	3,877	1,736	4,391	26,108	2,441	51,050
Other States	15,375	------	12,350	5,952	12,791	2,874	------	------	77	111	------	------	49,530
Total	241,243	306,023	172,515	193,046	65,230	22,294	63,614	19,600	41,693	35,645	41,577	83,344	1,285,824

Source: Page 50

Counties and a decrease in timber receipts from outside the county by Missoula County mills.

In 1976, Flathead County mills received about 69 percent of their timber from timberlands within the county, and in 1981 they received about 84 percent from within the county. In 1988, however, these mills received only 63 percent from Flathead County timberlands. Mills in Lincoln County received about 99 percent of their timber from within the county in 1976 and 1981, compared to 79 percent in 1988. In Missoula County, the trend is in the other direction with mills receiving about 31 percent of their timber from within the county in 1976 and 36 percent in 1981, increasing to about 53 percent in 1988.

Across County Lines -- Southwestern and Central Montana

Mills in Beaverhead, Broadwater, Gallatin, Granite, Lewis and Clark, Madison, Meagher, Park, Powell, and Silver Bow Counties received about 183 MMBF of timber in 1988, 15 percent of the state total. More than 75 percent of the timber processed in those counties was harvested within that same group of counties; about 84 MMBF (46 percent) of that timber was harvested in the specific county in which it was processed.

TABLE 12

Exports and Imports of Timber Products Montana, 1988

(Thousand Board Feet, Scribner)

Timber Products	Exports	Imports	Net Exports (Net Imports)
Sawlogs	82,691	(35,971)	46,720
Veneer logs	0	(6,280)	(6,280)
Other	653	(7,279)	(6,626)
Total	83,344	(49,530)	33,814

Source: Page 50.

Note: Other timber products include pulpwood, utility poles, house logs, post and poles, and cedar products logs.

Section 3
Private & Public Timberlands

Private and Public Timberlands

Sources of Raw Material for the Industry's Various Sectors

This section presents a detailed analysis of land ownerships supplying timber to Montana's forest products manufacturers. Section 2 dealt primarily with the harvest of timber from Montana timberlands and the movement and use of that timber. This section focuses on the timber the forest products industry receives for processing. The characteristics of the timber received by Montana mills differs somewhat from the timber harvested in the state because, as indicated in table 12, about 83 MMBF Scribner of timber, 7 percent of the total harvest in Montana, was processed by mills outside of the state and about 50 MMBF, about 4 percent of the timber received by Montana mills, came from other states. Detailed comparisons are shown for 1976, 1981, and 1988 (table 13).

Ownership sources by sector are not readily available prior to 1976. As indicated in Section 2, there were substantial changes in the proportionate contribution of ownerships to Montana's timber harvest from 1969 to 1976. The major change was a decrease in national forest harvest and an increase in private harvest. Since most of Montana's timber harvest is processed within the state, it would seem reasonable to conclude that in the early 1970s national forests generally contributed more to the various sectors than during the 1976 to 1988 period (figure 5 in Section 2).

Public timberlands contributed 44 percent of Montana's mill receipts in 1988, remaining relatively unchanged from the 1981 and 1976 contributed proportions. National forest lands supplied about 40 percent of the receipts in 1988, down slightly from 41 percent in 1981 and 43 percent in 1976. The contribution from other public lands in 1988 was 4 percent of the total timber received. This compares to about 4 percent in 1981 and 2 percent in 1976.

Industrial private timberlands supplied 34 percent of the total timber received by Montana's industry in 1988. This compares to 34 percent in 1981 and 35 percent in 1976. Nonindustrial private timberlands provided about 22 percent of the timber receipts in 1988, while providing 22 percent in 1981 and 20 percent in 1976.

TABLE 13

Source of Timber Products Received by Mills, Montana 1976, 1981 and 1988

Source	1976	1981	1988
	Thousand Board Feet, Scribner		
Private timberlands	660,953	585,063	667,496
Industrial	417,260	352,004	409,405
Nonindustrial	243,693	233,059	258,091
Public timberlands	549,686	464,447	534,984
National forest	528,057	425,650	479,877
Other	21,629	38,797	55,107
All sources	1,210,639	1,049,510	1,202,480
	----- *Percentage of Total* ----		
Private timberlands	*55%*	*56%*	*56%*
Industrial	*35%*	*34%*	*34%*
Nonindustrial	*20%*	*22%*	*22%*
Public timberlands	*45%*	*44%*	*44%*
National forest	*43%*	*41%*	*40%*
Other	*2%*	*4%*	*4%*
All sources	*100%*	*100%*	*100%*

Source: Page 51.

Notes: The above volumes include sawlogs, veneer logs, pulpwood, utility poles, house logs, post and poles, and cedar products logs. Nonindustrial private lands include tribal timberlands. The percentage detail may not add to 100 because of rounding.

OWNERSHIP SOURCES BY INDUSTRY SECTOR

Sawmills, plywood plants, and other primary manufacturers rely on timber from the various land ownerships to differing degrees (table 14). Montana sawmills received 953 MMBF of sawlogs, more than 79 percent of the total volume of timber delivered to Montana's forest products industry in 1988. Just over half (479 MMBF) of the sawlogs delivered to

sawmills came from public lands. Private timberlands furnished the remaining 474 MMBF of sawlog receipts. The ownership source of timber supplying Montana's sawmill industry was very similar in 1976 and 1981, with sawmills receiving 48 percent of their timber from private lands in those two years.

Montana plywood plants received 177 MMBF (84 percent) of their veneer logs from private lands, 82 percent from industrial lands, and 2 percent from non-industrial lands. This is understandable since the two companies that own almost all of the industrial timberland in the state operate the state's four plywood plants. Public timberlands supplied the remaining 34 MMBF (16 percent), 11 percent from national forest land and 5 percent from other public lands. The plywood industry has become more reliant on private lands, particularly industrial private lands, in the last fifteen years. Based on the 1976 and 1981 censuses, plywood plants received 55 and 65 percent respectively of their receipts from private timberlands.

Other primary manufacturers received 21 MMBF (56 percent) of their total mill receipts from public timberlands and about 16 MMBF (44 percent) from private timberlands in 1988. National forest land provided about 15 MMBF (40 percent) of total receipts in these product sectors with other public lands contributing 6 MMBF (17 percent). Non-industrial private lands provided 14 MMBF (37 percent) with industrial private lands contributing 2 MMBF (6 percent). The volume and ownership source of other timber products received by Montana mills has been extremely variable due to the historic large fluctuations in roundwood pulpwood processed (see page 18 for further discussion). For example, in 1976 the volume of timber delivered to processors other than sawmills and plywood plants was 54 MMBF Scribner, 45 percent of which came from private lands. In 1981, the volume was 82 MMBF, 70 percent coming from private lands.

TABLE 14

Ownership Source of Timber Products Delivered to Various Sectors of the Industry Montana, 1988

Source	Sawmills	Plywood Plants	Other Primary Manufacturers	Total
	---------- Thousand Board Feet Scribner ----------			
Private timberlands	474,029	177,091	16,376	667,496
Industrial	234,550	172,479	2,376	409,405
Nonindustrial	239,479	4,612	14,000	258,091
Public timberlands	479,303	34,482	21,199	534,984
National forest	441,135	23,886	14,856	479,877
Other	38,168	10,596	6,343	55,107
All sources	953,332	211,573	37,575	1,202,480
	---------- *Percentage of Total* ----------			
Private timberlands	*49.7%*	*83.7%*	*43.6%*	*55.5%*
Industrial	*24.6%*	*81.5%*	*6.3%*	*34.0%*
Nonindustrial	*25.1%*	*2.2%*	*37.3%*	*21.5%*
Public timberlands	*50.3%*	*16.3%*	*56.4%*	*44.5%*
National forest	*46.3%*	*11.3%*	*39.5%*	*39.9%*
Other	*4.0%*	*5.0%*	*16.9%*	*4.6%*
All sources	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Source: Page 51.

Note: Other primary manufacturers include pulp mills, chipping plants, utility pole plants, house log plants, post and pole plants, and cedar products plants. The percentage detail may not add to 100 because of rounding.

SOURCES OF TIMBER BY COUNTY

The following section describes the ownership sources providing timber to mills in Montana counties in 1988. Due to the small number of mills operating in some counties, timber receipts could not be reported for every county. Counties with similar timber receipt patterns, drawing from generally the same timber supply area, have been combined to avoid disclosing information on the operations of individual firms.

The ownership source of timber received by Montana mills in 1988 varied considerably from county to county (table 15).

The two major timber processing counties in the state received nearly equal volumes of timber from public and private lands. Flathead County mills received 306 MMBF of timber in 1988, receiving 47 percent from national forest lands, 4 percent from other public lands, and 49 percent from private timberlands. Lincoln County mills had timber receipts of 241 MMBF in 1988. National forests contributed 46 percent of this timber and private timberlands contributed 53 percent, with the remaining 1 percent coming from other public land.

Mills in two county groups received in excess of 70 percent of their timber from private lands. Mills in Lake, Missoula, and Granite counties received about 286 MMBF of timber in 1988, obtaining 79 percent of this timber from private lands, 14 percent from national forests, and 7 percent from other public lands. Mills in Broadwater, Gallatin, Lewis and Clark, Madison, Meagher, and Park counties received about 97 MMBF of timber in 1988. Private timberlands provided 74 percent of the timber delivered to these mills, and national forests supplied 23 percent with other public lands contributing 3 percent.

Mills in two county groups received more than 70 percent of their timber from public lands. Mills in Beaverhead, Powell, Ravalli, and Silver Bow

TABLE 15

Source of Timber Products Received by Mills by County of Plant Location Montana, 1988

County Group	---- Percent of Total Volume Received --- National Forest	Other Public	Private	Total	Thousand Board Feet Scribner Received
Beaverhead, Powell, Ravalli, and Silver Bow	66%	9%	25%	100%	130,661
Broadwater, Lewis and Clark, Meagher, Gallatin, Park, Madison	23%	3%	74%	100%	97,190
Flathead, Lincoln	47%	3%	50%	100%	547,266
Lake, Missoula, Granite	14%	7%	79%	100%	285,686
Mineral, Sanders	69%	4%	27%	100%	100,100
Other Counties	15%	3%	82%	100%	41,577
Montana	40%	4%	56%	100%	1,202,480

Source: Page 51.

Notes: The above volumes include sawlogs, veneer logs, pulpwood, utility poles, house logs, post and poles, and cedar products logs. The percentage detail may not add to 100 because of rounding.

counties received about 131 MMBF of timber in 1988. National forests supplied 66 percent of this timber with 9 percent from other public lands and 25 percent from private timberlands. Mills in Mineral and Sanders counties had total timber receipts of 100 MMBF, consisting of 69 percent from national forests, 4 percent from other public lands, and 27 percent from private lands.

Mills in the remaining counties in Montana had total receipts of about 42 MMBF. Private land supplied most of the timber received by these mills (82 percent) and national forests supplied 15 percent with other public lands providing 3 percent.

SOURCE OF SAWTIMBER BY SIZE OF MILL

To examine the relationship between mill size and sawtimber source, mills were combined and divided into size classes based on reported annual capacity to process sawtimber. The derivation of estimated capacity is discussed in more detail in Section 4. The size classes are:

Size Class	Annual Capacity to Process Sawtimber (MMBF, Scribner)
A	Over 40 MMBF
B	Over 25 to 40 MMBF
C	Over 10 to 25 MMBF
D	Over 1 to 10 MMBF
E	1 MMBF and below

Industrial private forest lands and national forest lands were the major sources of sawtimber for the state's largest mills in 1988 (table 16). Mills with capacity to process over 40 MMBF Scribner of timber annually (size class A) received 706 MMBF, 59 percent of the sawtimber received by Montana mills in 1988. These mills received 39 percent of their sawtimber from national forest lands and 44 percent from industrial private lands. Non-industrial private timberlands and other public timberlands together furnished 17 percent of the timber receipts of these larger mills.

Mills with capacity to process between 25 and 40 MMBF Scribner annually (size class B) received 335 MMBF, 28 percent of Montana's sawtimber receipts in 1988. These mills relied more on timber from national forest land than did mills in size class A, receiving 47 percent of their timber from national forests, 22 percent from industrial private lands, 27 percent from non-industrial private lands and 3 percent from other public lands.

Size class C mills (10 to 25 MMBF) received 88 MMBF of timber in 1988, 7 percent of total sawtimber receipts in Montana. Interestingly, these mills relied less on national forest timber than mills in any other size class. Private, non-industrial timberlands supplied 47 percent of the timber received by these mills in 1988, with the remainder consisting of 25 percent national forest, 21 percent industrial private, and 7 percent other public. The heavy dependence of this class on non-industrial private harvest is due in part to the fact that tribal lands are classified as non-industrial private land, and a couple of mills in this class rely heavily on tribal lands for their timber needs.

Mills in size class D (1 to 10 MMBF) received about 51 MMBF of timber in 1988. National forests provided 41 percent of this timber, non-industrial private lands supplied 40 percent, other public lands provided 18 percent, and industrial private lands supplied 1 percent of these receipts.

Non-industrial private land contributed 52 percent of the 6 MMBF of timber received by mills in size class E (1 MMBF and below). National forest lands provided 43 percent of these receipts, with the remainder consisting of 4 percent other public and 1 percent industrial private.

TABLE 16

Source of Sawtimber Received by Mills by Size of Mill Montana, 1988

Capacity to Process Sawtimber	---- Private Timberlands ---- Industrial	Nonindustrial	-- Public Timberlands -- National Forest	Other	All Sources
	---------- Thousand Board Feet, Scribner ----------				
A -- over 40 MMBF	313,807	90,272	274,608	27,313	706,000
B -- over 25 MMBF to 40 MMBF	74,598	92,156	156,063	12,523	335,340
C -- over 10 MMBF to 25 MMBF	18,624	41,986	21,986	5,886	88,482
D -- over 1 MMBF to 10 MMBF	499	20,157	20,978	8,970	50,604
E -- 1 MMBF and below	41	3,177	2,600	245	6,063
All Mills	407,569	247,748	476,235	54,937	1,186,489
	---------- *Percentage of Total* ----------				
A -- over 40 MMBF	44%	13%	39%	4%	100%
B -- over 25 MMBF to 40 MMBF	22%	27%	47%	3%	100%
C -- over 10 MMBF to 25 MMBF	21%	47%	25%	7%	100%
D -- over 1 MMBF to 10 MMBF	1%	40%	41%	18%	100%
E -- 1 MMBF and below	1%	52%	43%	4%	100%
All Mills	34%	21%	40%	5%	100%

Source: Page 51.
Notes: The above volumes include sawlogs, veneer logs, utility poles, and house logs. The percentage detail may not add to 100 because of rounding.

Section 4

Plant Utilization

Plant Utilization by Montana Wood Products Manufacturers

This section includes estimates of production capacity for Montana's primary forest products manufacturers and the proportion of in-place capacity utilized. This analysis focuses on plants processing sawtimber -- sawmills, plywood plants, utility pole plants, and house log plants. Capacity utilization of the non-sawtimber sectors is discussed in less detail.

A DEFINITION OF PRODUCTION CAPACITY

The respondent mills were asked to specify their production capacity, both the estimated capacity per eight-hour shift and the annual capacity, assuming sufficient supplies of raw materials and firm market demand for their products. Most of the larger sawmills -- those with lumber production over 10 MMBF in 1976, 1981, or 1988 -- estimated annual capacity equal to two eight or nine-hour shifts daily for a 230-260-operating-day year. A few of the larger sawmills and the smaller sawmills reported annual capacity equal to one eight-hour shift per day for not more than a 240-operating-day year. Montana's four plywood plants reported capacity of three shifts per day for a 230-260-operating-day year. All manufacturers of house logs, utility poles, posts and small poles, and cedar products reported annual capacity based on one eight-hour shift for not more than a 240-operating-day year.

CAPACITY IN UNITS OF RAW MATERIAL FOR THE SAWTIMBER PROCESSING SECTOR

Sawmill capacity was reported in thousand board feet, lumber tally, and plywood capacity was reported in thousands of square feet on a 3/8-inch basis. Utility pole capacity was reported in numbers of pieces of a given size and house log capacity in lineal feet. To combine the capacity figures for the state's sawtimber users and to estimate the industry's total capacity to process sawtimber, capacity is expressed in units of raw material input (million board feet of timber Scribner) and called processing capacity.

Sawmill capacity figures were adjusted to million board feet of timber Scribner by dividing production capacity in lumber tally by each mill's lumber recovery per board foot Scribner of timber processed. Plywood capacity figures were adjusted to million board feet Scribner by dividing production capacity in square feet of 3/8- inch plywood by the mill's plywood recovery figure. Utility pole and house log capacities were adjusted to thousand board feet Scribner by multiplying capacity in the given finished product unit by an average Scribner volume per piece or per lineal foot. See page 11 and 14 in Section 1 for a discussion of the overrun and plywood recovery factors used.

TABLE 17

Capacity to Process Sawtimber
Million Board Feet, Scribner

County Group	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Lincoln	242	230	220	220	210	200	205	230	230	245	245	295	317
Flathead	310	320	330	340	350	360	365	395	365	355	355	355	378
Lake, Mineral, Sanders	189	200	210	220	230	235	240	240	255	230	230	240	239
Missoula	356	350	350	350	290	290	290	280	280	280	280	280	213
Granite, Powell, Ravalli	89	90	90	90	90	95	105	105	130	140	150	170	165
All Other	403	400	375	350	350	303	275	275	275	255	255	255	249
Total	1,589	1,590	1,575	1,570	1,520	1,483	1,480	1,525	1,535	1,505	1,515	1,595	1,561

Source: Page 51.

THE INDUSTRY'S CAPACITY TO PROCESS SAWTIMBER, 1976 - 1988

This section deals with changes in capacity and capacity utilization from 1976 through 1988. Detail on capacity to process timber is not available prior to the 1976 census. Estimates of capacity and capacity utilization for 1976, 1981 and 1988 are based on complete censuses of the industry done by the Bureau of Business and Economic Research. For the intervening years, capacity and utilization were estimated from an annual survey of major producers begun by the Bureau of Business and Economic Research in 1982, industry directories, and information obtained from various trade associations.

The total estimated capacity to process timber of Montana's sawtimber utilizing sectors declined from 1,589 MMBF Scribner in 1976 to a low of about 1,480 MMBF in 1982 and then rose to 1,561 MMBF in 1988 (table 17).

The percentage of total capacity utilized by the sawtimber sector in 1988 was above the capacity utilization reported in the 1976 and 1981 censuses. In 1988, 79 percent of the sawtimber processing capacity was utilized while only 66 percent was utilized in 1981 and 75 percent in 1976 (table 18).

The highest level of capacity utilization during that 1976-1988 period was in the late 1980s with utilization of 82, 80, and 79 percent of capacity respectively for 1986, 1987, and 1988 (table 18). This is in comparison to the previous good market years 1976 through 1979 when capacity utilization ranged from 75 to 78 percent. Capacity utilization fell off drastically during the weak markets in the early 1980s with 65, 66, and 53 percent utilization for 1980, 1981 and 1982.

Capacity by Sector

Montana sawmills contained the largest proportion of sawtimber processing capacity, about 1,237 MMBF or 79 percent of the total (table 19). In 1976, sawmills had the capacity to process 1,259 MMBF, 22 MMBF more than in 1988, but utilized only 72 percent of this capacity, processing 905 MMBF. The estimated capacity of the sawmill industry fell to 1,207 MMBF in 1981, with only 61 percent of the sawmill capacity utilized.

Montana's plywood manufacturers had the capacity to process 263 MMBF Scribner in 1988, up from the 226 MMBF in 1981 but down from the 289 MMBF in 1976. Capacity in this sector declined with the closure of one of the states five plants in 1980. Capacity at the remaining four plants increased from 1981 to 1988.

Plywood plants traditionally have higher capacity utilization than sawmills. These plants utilized 83 percent of their capacity in 1988, 93 percent in 1976, and 99 percent in 1981. Strikes affecting half of the states plywood capacity for three months is the major reason for this decrease in utilized capacity in 1988.

The annual timber processing capacity of Montana's utility pole and house log sectors increased from 40 MMBF in 1976 to 61 MMBF in 1988. The increase was due to growth in the house log industry.

TABLE 18

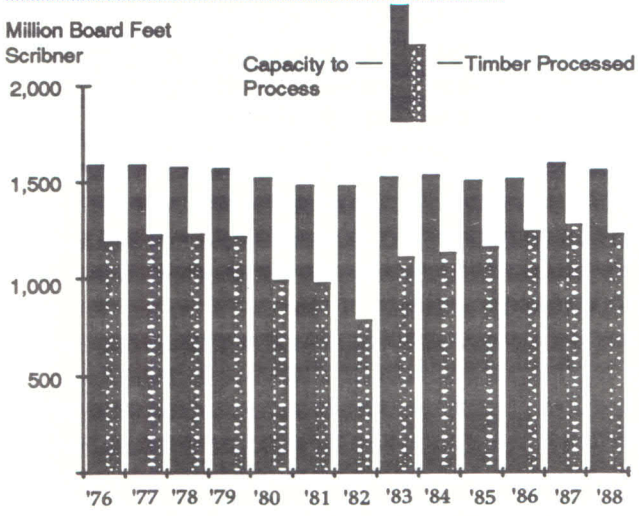
Percentage of Sawtimber Processing Capacity Utilized

	Percentage of Capacity Utilized												
County Group	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*
Lincoln	*83%*	*87%*	*91%*	*91%*	*71%*	*85%*	*66%*	*91%*	*93%*	*88%*	*96%*	*90%*	*77%*
Flathead	*81%*	*75%*	*73%*	*71%*	*66%*	*61%*	*51%*	*66%*	*70%*	*73%*	*79%*	*82%*	*85%*
Lake, Mineral, Sanders	*90%*	*80%*	*74%*	*70%*	*65%*	*57%*	*40%*	*67%*	*63%*	*61%*	*59%*	*63%*	*71%*
Missoula	*100%*	*103%*	*103%*	*103%*	*103%*	*90%*	*78%*	*96%*	*93%*	*95%*	*100%*	*100%*	*86%*
Granite, Powell, Ravalli	*79%*	*72%*	*78%*	*72%*	*67%*	*58%*	*38%*	*62%*	*58%*	*71%*	*80%*	*76%*	*78%*
All Other	*36%*	*50%*	*55%*	*56%*	*29%*	*45%*	*38%*	*53%*	*60%*	*71%*	*75%*	*63%*	*71%*
Total	*75%*	*77%*	*78%*	*77%*	*65%*	*66%*	*53%*	*73%*	*74%*	*77%*	*82%*	*80%*	*79%*

Source: Page 51.

FIGURE 8

Montana Mill Capacity and Timber Processed



Source: Page 49.

SAWTIMBER PROCESSING CAPACITY BY COUNTY OR COUNTY GROUP

Flathead County had the largest capacity to process sawtimber in 1988 at 378 MMBF Scribner followed by Lincoln County at 317 MMBF and Missoula County at 213 MMBF (table 17).

While the capacity to process sawtimber statewide changed only slightly from 1976 to 1988, there have been some dramatic shifts within various counties and geographic areas. In particular in northwestern Montana, capacity to process sawtimber increased by 31 percent in Lincoln County, by 22 percent in Flathead County, and by 26 percent in the three county group of Lake, Mineral, and Sanders counties. In contrast, Missoula County, which had the highest capacity in the state, has declined by 40 percent from 356 MMBF in 1976 to 213 MMBF in 1988.

The county group comprised of Granite, Powell and Ravalli counties showed a substantial increase from 89 MMBF in 1976 to 165 MMBF in 1988.

In total, the capacity to process sawtimber in Montana's nine westernmost counties increased by 11 percent from 1,186 in 1976 to 1,312 in 1988. The capacity in the remainder of the state dropped 38 percent from 403 MMBF to 249 MMBF.

CAPACITY BY SIZE OF MILL

Mills in the sawtimber processing sectors were classified by size based on annual capacity to process sawtimber. Table 20 illustrates these size classes and the amount of used and unused capacity.

Montana's fourteen largest mills -- each with annual processing capacity of more than 40 MMBF -- contained over 55 percent of the state's 1,561 MMBF capacity to process sawtimber. These mills utilized 86 percent of this capacity, processing 738 MMBF.

Capacity utilization dropped off sharply as mill size decreased. Thirteen class B mills (capacity over 25 to 40 MMBF) reported 423 MMBF in available capacity and processed 337 MMBF, utilizing 80 percent of available capacity. The nine class C mills (10 to 25 MMBF) utilized 61 percent of an available 155 MMBF in processing capacity. Size class D mills utilized 49 percent of available capacity, processing 50 MMBF in the 34 mills. The 57 mills in size class E reported processing 6 MMBF of sawtimber, utilizing 32 percent of available capacity.

CAPACITY RELATED TO UNITS OF PRODUCTION

This section briefly presents capacity figures in units of production (finished product) for the sawtimber utilizing sectors.

Montana sawmills manufactured about 1,558 MMBF of lumber in 1988 while having roughly 1,936 MMBF lumber tally of production capacity available. Plywood plants had 736 million square feet 3/8-inch basis, of available production capacity and produced 612 million square feet in 1988. Capacity utilization of both of these major sectors was affected by strikes in 1988. These strikes affected 50 percent of the state's plywood production capacity and 20 percent of the sawmill capacity for approximately three months in 1988. The log home manufacturers had the capacity to produce 14.5 million lineal feet of logs in 1988 and produced 5.5 million lineal feet, utilizing 37 percent of available capacity. Utility pole manufacturers capacity figures could not be disclosed.

TABLE 19

Sawtimber Utilized and Estimated Capacity of Sawmills, Plywood Plants, Utility Pole Plants, and House Log Plants Montana, 1976, 1981, 1988

Plant Type	Capacity to Process Sawtimber (MMBF, Scribner)	Volume Processed (MMBF, Scribner)	*Percentage of Total Capacity Utilized*
	1976		
Sawmills	1,259	905	*72%*
Plywood plants	289	269	*93%*
Utility pole and house log plants	41	16	*39%*
Total	1,589	1,190	*75%*
	1981		
Sawmills	1,207	739	*61%*
Plywood plants	226	224	*99%*
Utility pole and house log plants	50	17	*34%*
Total	1,483	980	*66%*
	1988		
Sawmills	1,237	985	*80%*
Plywood plants	263	219	*83%*
Utility pole and house log plants	61	22	*36%*
Total	1,561	1,226	*79%*

Source: Page 52.

POST AND SMALL POLE AND CEDAR PRODUCTS CAPACITIES

Processing capacity for these two sectors was difficult to quantify. Many of the firms are small "family-type" operations, and their annual capacity is influenced as much by the operator as by the facility. The operators often harvest their own timber, further limiting manufacturing time. These plants are usually seasonal operations and very labor intensive, further complicating production capacity estimates. For example, a cedar fencing plant's capacity might be increased simply by adding more workers to split rails. A capacity figure based on equipment potential could, therefore, be misleading.

Estimates of annual capacity in MMBF Scribner were, however, developed for these two sectors. They are based on estimates by the operators and in virtually all cases were for an eight-hour shift for not more than a 240-operating-day year. Post and pole operators reported the raw material processed and capacity in numbers of pieces of a given size. Using the dimensions provided, the pieces were converted to cubic feet and then to thousand board

feet Scribner using 1 cubic foot per board foot. The cedar products manufacturers reported capacity and volume processed in thousand board feet Scribner. The two sectors reported that approximately 36 percent of their capacity was utilized in 1988. Post and small pole and cedar products manufacturers reported approximately 15 MMBF of available capacity, while processing slightly more than 5 MMBF of timber in 1988.

CAPACITY IN THE RESIDUE UTILIZING SECTOR

The 1988 survey identified one kraft pulp and paper mill, one particleboard plant, one medium density fiberboard plant, and four active wood fuel pellet producers.

Pulp and paper and board mills in Montana rely on wood residue from the production of lumber and plywood for their raw materials. The kraft pulp and paper mill uses both chips and sawdust. The state's two reconstituted board plants use planer shavings, chips or chippable material, and sawdust. Wood fuel pellet producers also rely on residue from the manufacture of other timber products such as lumber.

This section presents the estimated capacity of the pulp and paper and board sectors and wood fuel pellet sector in terms of raw material input. Input (wood fiber residue) is measured in thousand bone-dry units (MBDUs). Each bone-dry unit is 2,400 pounds of wood, oven-dry weight.

In 1988, the pulp and board industries in Montana had the capacity to utilize 1,349 MBDUs of chips, sawdust, and planer shavings as raw material. These firms actually consumed 1,298 MBDUs, utilizing about 96 percent of their capacity in 1988. This compares to a capacity of 1,245 MBDUs and utilization of 1,147 MBDUs in 1981, and capacity of 935 MBDUs and utilization of 794 MBDUs in 1976.

TABLE 20

Sawtimber Utilized and Estimated Capacity of Sawmills, Plywood Plants, Utility Pole and House Log Plants, by Size of Plant Montana, 1988

Size Class	Number of Mills in Size Class	Capacity to Process Sawtimber (MMBF, Scribner)	Volume Processed (MMBF, Scribner)	*Percentage of Total Capacity Utilized*	Unutilized Capacity (MMBF, Scribner)
A -- over 40 MMBF	14	862	738	*86%*	124
B -- over 25 MMBF to 40 MMBF	13	423	337	*80%*	86
C -- over 10 MMBF to 25 MMBF	9	155	95	*61%*	60
D -- over 1 MMBF to 10 MMBF	34	102	50	*49%*	52
E -- 1 MMBF and below	57	19	6	*32%*	13
Total	127	1,561	1,226	*79%*	335

Source: Page 52.

Notes: Sawtimber refers to sawlogs, veneer logs, utility poles, and house logs. MMBF denotes million board feet Scribner.

[a]Based upon annual capacity to process sawtimber.

Section 5

Wood Products Markets

Markets for Finished Products

The respondent mills summarized their shipments of finished products in 1988, providing information on the volume, sales value, and geographic destination. Figure 8 illustrates the shipment destinations.

Mills usually distributed their products in two ways: 1) through their own retail and wholesale outlets; or 2) through independent wholesalers and selling agents. Because of subsequent wholesaling transactions, the geographic destination reported below may not precisely reflect the final delivery points of shipments.

Montana's primary forest products mills had total sales of $898 million F.O.B. the producing mill in 1988 (table 21). The North Central states continue as Montana's major market for wood and paper products. These states received $359.8 million or about 40 percent of the sales volume of finished wood and paper products manufactured by Montana mills in 1988. Based on the two previous censuses in 1976 and 1981, 40 percent and 34 percent respectively of total wood and paper products sales were to buyers in the North Central states.

Shipments to the Far Western states generated more than $155 million in sales or 17 percent of the total for Montana mills in 1988. Other market areas ranked as follows: the Rocky Mountain states (excluding Montana) purchased $94.7 million; Montana $44.9 million; the Southern states $88.5 million; the Northeastern states $66.6 million; exports primarily to Canada and Japan totaled $79.8 million. Sales to markets of unknown destination were $8.4 million in 1988.

MARKET AREAS BY FINISHED PRODUCT TYPE

Lumber sales totaled just over $385 million in 1988. Of this, $170.5 million, 44 percent, was generated in the North Central states in 1988. The Southern states ranked second purchasing $62.5 million of Montana lumber, or 16 percent of the total. The remainder of the lumber sales, in descending order, were 10 percent both in the Far Western and Northeastern states, 9 percent in the Rocky Mountain states (excluding Montana), 7 percent in Montana, 2 percent exports primarily to Japan and Canada, and 2 percent to unknown destinations. Noticeable changes in lumber markets were a shift to lower proportionate sales in Montana, down from 13 percent in 1976 and 1981 to only 7 percent in 1988, and a substantial increase in sales to the Southern states, from 10 percent in 1976 and 11 percent in 1981 to 16 percent in 1988.

Buyers in the North Central states were the major purchasers of plywood, purchasing 58 percent of Montana sales in 1988. This is a major increase from 35 percent in 1981 and 37 percent in 1976. In 1988, the Northeastern states purchased 17 percent of Montana's plywood sales, up slightly from 15 percent in 1981 and 14 percent in 1976. Far Western states purchased only 4 percent of Montana's plywood, down from 17 percent in 1981 and 14 percent in 1976. Sales to the Rocky Mountain states, excluding Montana, also dropped from the 12 percent in 1981 and 14 percent in 1976, to 10 percent of plywood sales in 1988.

Sales of pulp, paper, particleboard, fiberboard, and other residue-related products were $367.3 million in 1988. North Central states accounted for 33 percent of these sales in 1988, slightly lower than the 34 percent in 1981. There was a decrease in the proportion of sales to the Far Western states from 40 percent in 1981 to 28 percent in 1988. Reported exports of residue related products accounted for 19 percent of sales in 1988, a very substantial increase over the 1981 figure of 1 percent. Buyers in the Rocky Mountain states purchased 12 percent of sales in 1988, compared to 13 percent in 1981. The remaining sales in 1988 were 4 percent to the Southern states, and 2 percent to Montana purchasers.

Log home and house log manufacturers generated $29.5 million in sales in 1988. The markets for these products in 1988 were 20 percent in the Rocky Mountain states; 19 percent in the North Central states; 15 percent in the Far Western states; 14 percent in the Southern states; 13 percent in Montana; 12 percent in the Northeast states; and, 7 percent as exports, primarily to Japan.

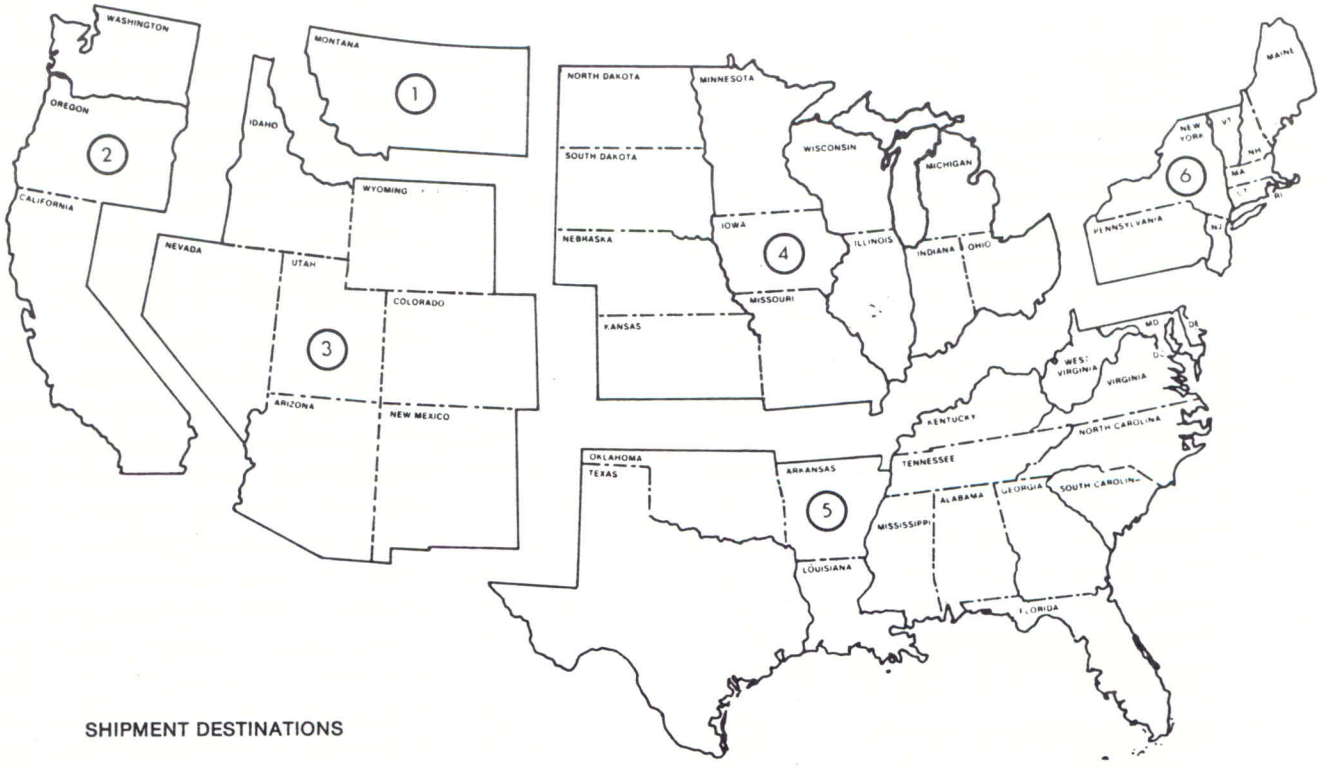
Markets

Sales of utility poles, posts, small poles, and tree stakes were $9.7 million in 1988. The major market for these products was in Montana, which accounted for 40 percent of sales. The remaining sales were 28 percent to the Far Western states; 18 percent to North Central states; 13 percent to Rocky Mountain states; and about 1 percent as exports. The major change since 1981 was an increase in sales reported in the far western states from 19 percent to 28 percent.

In 1988, sales of cedar products, which include primarily cedar shakes, shingles, and split rail fencing, generated about $1.2 million. The major markets for cedar products were the North Central states (40 percent) and Montana (23 percent). In 1981, the primary markets for these products were the North Central states (35 percent) and the Rocky Mountain states other than Montana (22 percent). In 1988, sales of cedar products from Montana in these other Rocky Mountain states had fallen to only 2 percent of the total.

FIGURE 9

Shipment Destination of Wood Products 1988



SHIPMENT DESTINATIONS

1. Montana
2. Far West (including Alaska and Hawaii)
3. Rocky Mountain (except Montana)
4. North Central
5. South
6. Northeast

TABLE 21

Destination of Primary Forest Products Shipments by Value of Shipment Montana, 1988

Thousands of Dollars (F.O.B. the Producing Mill)

Product	Montana	Rocky Mountain	Far West	North Central	South	Northeast	Canada	Other Exports Primarily Japan	Unknown	All Destinations
Lumber and other sawn products	25,357	33,891	40,341	170,510	62,542	37,746	3,288	2,899	8,451	385,025
Plywood	4,268	10,197	4,489	61,111	7,518	17,669	382	23	8	105,665
Pulp, paper, particleboard, and fiberboard and other residue-related products	6,659	43,610	103,320	120,322	14,021	7,405	***	71,185 ***	0	366,522
House logs	3,748	5,755	4,432	5,638	4,270	3,608	0	2,091	0	29,542
Posts and poles and utility poles	3,899	1,306	2,765	1,776	0	0	0	17	0	9,763
Cedar products	266	26	18	461	199	186	0	0	0	1,156
Total	44,197	94,785	155,365	359,818	88,550	66,614	***	79,885 ***	8,459	897,673

Percentage of Total

Lumber and other sawn products	7%	9%	10%	44%	16%	10%	1%	1%	2%	100%
Plywood	4%	10%	4%	58%	7%	17%	----[a]	----[a]	----[a]	100%
Pulp, paper, particleboard, and fiberboard and other residue-related products	2%	12%	28%	33%	4%	2%	***	19% ***	0%	100%
House logs	13%	20%	15%	19%	14%	12%	0%	7%	0%	100%
Posts and poles and utility poles	40%	13%	28%	18%	0%	0%	0%	----[a]	0%	100%
Cedar products	23%	2%	2%	40%	17%	16%	0%	0%	0%	100%
Total	5%	11%	11%	40%	10%	7%	***	9% ***	1%	100%

Source: Page 52.
Notes: The percentage detail may not add to 100 because of rounding. See figure 9 for enumeration of the states included in each region.
[a]Less than 0.5 percent..

Section 6

Wood Residue

Wood Residue from Primary Wood Products Manufacturers in Montana

Wood fiber residue from primary wood products manufacturers (mill residue) is the major source of raw material for Montana's pulp and paper and reconstituted board industry, and an important source of fuel for all major sectors of the wood products industry. Yet unused wood residue creates difficult and expensive disposal problems. The sawmill and plywood sectors generate more than 95 percent of the mill residue. This section details the volumes and uses of mill residue generated by these plants.

There are basically three types of wood fiber residue generated at sawmills and plywood plants:
1) coarse or chippable residue consisting of slabs, edgings, and trim from lumber manufacturing; log ends from sawmills and plywood plants; pieces of veneer not suitable for manufacturing plywood; and peeler cores from plywood plants not sawn into lumber.
2) fine residue consisting of planer shavings and sawdust from sawmills and sander dust from plywood plants; and
3) bark from sawmills and plywood plants.

The census gathered information on the proportions and uses of mill residue in 1988. Actual volumes of marketed residue were reported in bone-dry units. A bone-dry unit is 2,400 pounds of wood, oven-dry weight. Residue factors, applied to lumber

TABLE 22

Estimated Volume of Wood Residue Generated by Sawmills and Plywood Plants Montana, 1969, 1976, 1981, and 1988

Residue Type	Estimated Volume (Thousand Bone Dry Units)			Percentage of Total		
	Utilized	Unutilized	Total	Utilized	Unutilized	Total
Coarse[a]						
1969	689	107	796	87%	13%	100%
1976	658	32	690	95%	5%	100%
1981	809	8	817	99%	1%	100%
1988	873	28	901	97%	3%	100%
Fine[b]						
1969	443	297	740	60%	40%	100%
1976	453	87	540	84%	16%	100%
1981	399	28	427	93%	7%	100%
1988	501	75	576	87%	13%	100%
Bark						
1969	137	355	492	28%	72%	100%
1976	296	104	400	74%	26%	100%
1981	286	35	321	89%	11%	100%
1988	375	61	436	86%	14%	100%
Total						
1969	1,269	759	2,028	63%	37%	100%
1976	1,407	223	1,630	86%	14%	100%
1981	1,494	71	1,565	95%	5%	100%
1988	1,749	164	1,913	91%	9%	100%

Source: Page 52.

[a]Material suitable for chipping, such as slabs, edgings, and trimmings.
[b]Material such as sawdust, planer shavings, and sander dust.

TABLE 23

Production and Disposition of Mill Residue by Sawmills and Plywood Plants by Type of Residue Use Montana, 1988

(Thousand Bone Dry Units)

Residue Type	Total Utilized	Raw Materials Pulp Mills/ Board Plants	Hogfuel	Other Uses	Unutilized	Total
Coarse[a]	873	827	46	0	28	901
Fine[b]	501	327	173	1	75	576
Bark	375	0	348	27	61	436
Total	1,749	1,154	567	28	164	1,913

Source: Page 52.

[a]Material suitable for chipping, such as slabs, edgings and trimmings.
[b]Material such as planer shavings, sawdust, and sander dust.

and plywood production, were used to estimate the unsold quantities. These factors are shown in tables 25 and 26, and represent statewide averages for sawmills and plywood plants.

THE SUPPLY OF MILL RESIDUE

Montana sawmills and plywood plants generated an estimated 1,913 thousand bone-dry units (MBDUs) of manufacturing residue in 1988. This is an increase from the 1,565 MBDUs in 1981 and 1,630 MBDUs in 1976 (table 22), primarily due to increased lumber and plywood output. Total residue generated has declined from 2,028 MBDUs in 1969 primarily due to improved sawing efficiency and increased plywood production which generates less residue per MMBF Scribner of timber processed.

The percentage of manufacturing residue utilized has increased dramatically since 1969, largely because of the expansion of the pulp and paper mill, the opening of the particleboard plant and fiberboard plant, and the increased use of wood residue as an industrial fuel. In 1969, only 63 percent of all manufacturing residue was used, increasing to 86 percent in 1976, and then to 95 percent in 1981. In 1988, 91 percent of the residue was used, down slightly from 1981. Nineteen eighty-one was a year of low lumber production and greatly reduced mill residue availability.

Coarse residue was the largest component of total residue in 1988 (table 23). Mills produced 901 MBDUs, with 97 percent (873 MBDUs) utilized. Pulp and paper mills and the medium density fiberboard plant in Montana and other states received 827 MBDUs, with 46 MBDUs going as industrial fuel. Only 28 MBDUs of coarse residue were unused in 1988.

Of the 576 MBDUs of fine residue produced, 327 MBDUs went to pulp mills and reconstituted board plants as raw material, 173 MBDUs were consumed as fuel or to produce fuel pellets, and about 1 MBDU went for other uses such as animal bedding and mulch. Only 75 MBDUs of fine residue remained unused. Table 24 divides fine residues into planer shavings, sawdust, and sander dust. Planer shavings totaled 240 MBDUs, with 233 MBDUs (97 percent) used and 7 MBDUs (3 percent) unused. Sawdust totaled 324 MBDUs, with 256 MBDUs (79 percent) used and 68 MBDUs (21 percent) unused. All of the 12 MBDUs of sander dust generated by the plywood plants were utilized.

Bark totaled 436 MBDUs in 1988. Of this, 61 MBDUs were unused. Most bark, 348 MBDUs, was consumed as fuel. A small portion (27 MBDUs) was used for miscellaneous products including decorative bark, livestock bedding, and mulch.

The manufacture of utility poles, house logs,

cedar products, and posts and small poles generates several types of residue, including bark, shavings, log ends, cull portions of cedar products logs, and slabs from house log manufacturers. Although little of this material was sold, much of it was used as livestock bedding, garden mulch, or fuel. Log ends from utility pole or house log manufacturers and slabs from house log manufacturers were occasionally sold as firewood. In 1988, 28 MBDUs of this material were used and 1 MBDU was unused.

REVENUE FROM THE SALE OF MANUFACTURING RESIDUE

Wood fiber residue sales generated $25 million in revenue for Montana sawmills and plywood plants in 1988, in addition to the $385 million in lumber sales and $106 million in plywood sales. This is a decline from the $57 million (1988 dollars) of total residue sales reported in 1981.

In 1988, nearly 91 percent ($23 million) of the total stemmed from sales of chips to the pulp and paper industry. The average sales price received for chips in 1988 was $27 per bone-dry unit (BDU) purchased at the manufacturers' plant. This compares to $67 per BDU (1988 dollars) in 1981. The price of chips historically has increased dramatically in years of low lumber production like 1981. This is because production levels in the pulp and paper industry have not fallen proportionately as much as lumber production, creating greater competition for chips. Sawdust, planer shavings, and bark prices averaged $3 to $10 per BDU F.O.B. manufacturers' plant in 1988.

TABLE 24

Mill Residue from Lumber and Plywood Plants Montana, 1988

(Thousand Bone Dry Units)

Residue Type	Utilized	Unutilized	Total
Coarse[a]	873	28	901
Fine			
Planer shavings	233	7	240
Sawdust	256	68	324
Sander dust	12	0	12
Bark	375	61	436
Total	1,749	164	1,913

Source: Page 52.
[a]Material suitable for chipping, such as slabs, edgings and trimmings.

TABLE 25

Sawmill Residue Factors Montana, 1988

Type of Residue	Bone Dry Units/ MBF Lumber Tally
Coarse[a]	.51
Sawdust	.22
Planer shavings	.18
Bark	.21

Source: Page 52.
Note: Bone dry units of residue generated from producing one thousand board feet of lumber.
[a]Material suitable for chipping such as slabs, edgings, trimmings, and log ends.

TABLE 26

Softwood Plywood Residue Factors Montana, 1988

Type of Residue	Bone Dry Units/ MSF Lumber Tally
Coarse[a]	.24
Sander dust	.02
Bark	.12

Source: Page 52.

Note: Bone dry units of residue generated in producing one thousand square feet of 3/8-inch plywood.

[a]Material suitable for chipping such as peeler cores and pieces of veneer not suitable for plywood manufacture.

Section 7

Forest Products & the Economy

The Forest Products Industry and the Montana Economy

An enduring feature of the Montana economy is its heavy reliance upon natural resource industries. Included in these are agriculture, mining, oil and gas extraction, nonresident travel and tourism, and wood and paper products production. Together, these industries have accounted for 60 to 70 percent of the state's economic base in the last two decades.

The economic base of a state or region is made up of area industries whose products or services are generally sold in outside markets (or otherwise largely paid for with outside funds). Sales by basic industries inject new funds into a local economy to the degree that they return to the area and are dispersed in local payrolls, local investments, local purchases, and other linkages to an area's economy. Thus, conditions and trends among an area's basic industries are critical factors in the overall performance of the area's economy.

RECENT TRENDS IN THE MONTANA ECONOMY

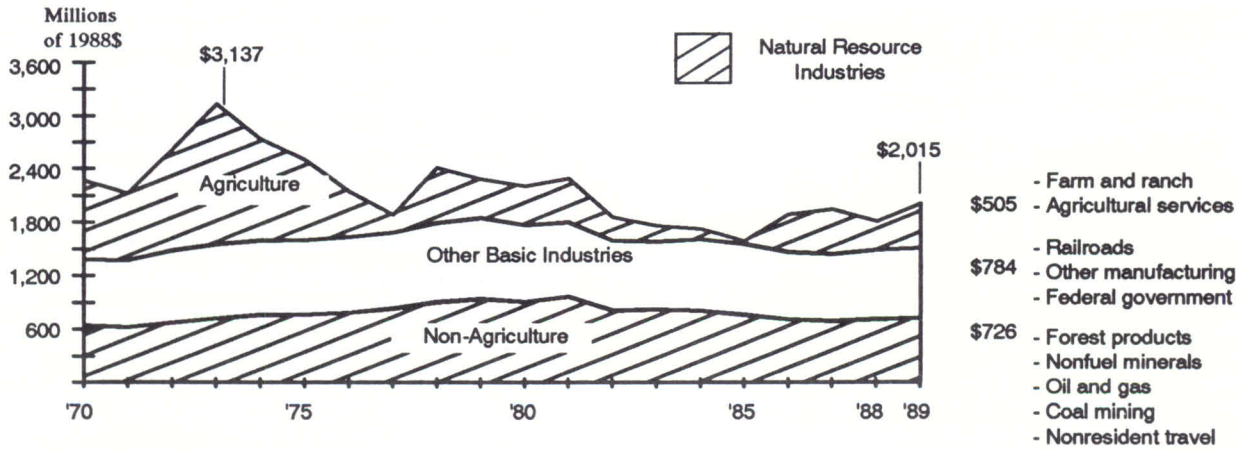
The 1970s were generally a period of growth in the state's natural resource industries, with the exception of agriculture and metal mining in the last half of the decade. In stark contrast, however, much of the 1980s were a period of decline for many of these industries. During the first half of the 1980s, real labor income among nonfarm, natural resource industries as a whole fell by about 3 percent a year. All dollar figures in this section, including labor income, are in inflation adjusted, or constant, 1988 dollars. Labor income received by agricultural producers hit disastrously low levels for several years. As a result, the Montana economy went flat, causing losses in real labor income during much of the period. However, economic conditions in the state have improved in recent years.

Figure 9 shows total real labor income workers earned in Montana's basic industries each year since 1970. The screened portions of the graph show income from natural resource based industries including agriculture, mining, nonresident travel and tourism, and forest products.

Labor income in all of the state's basic industries peaked in 1973 at more than $3.1 billion. In that same year, average labor earnings by all workers in Montana also peaked for the two-decade period at about $21,850 per worker and per capita income in Montana as a percent of per capita income nationwide reached 95 percent, its highest level in decades. In comparison, after settling at about 90 percent in 1979-81, this ratio steadily declined to 78

FIGURE 10

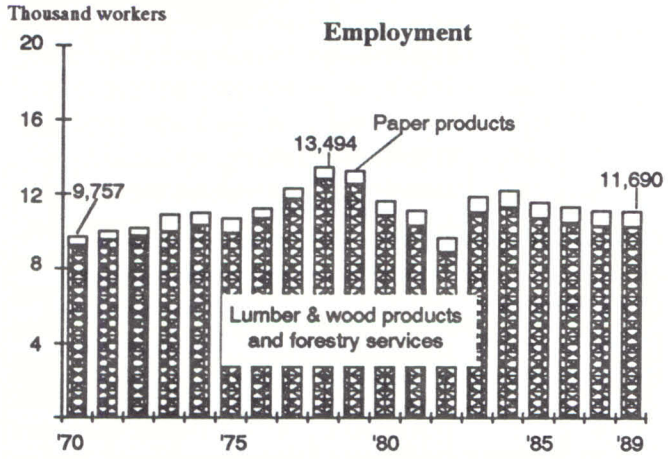
Composition of Montana's Economic Base
Labor Income of Basic Industries

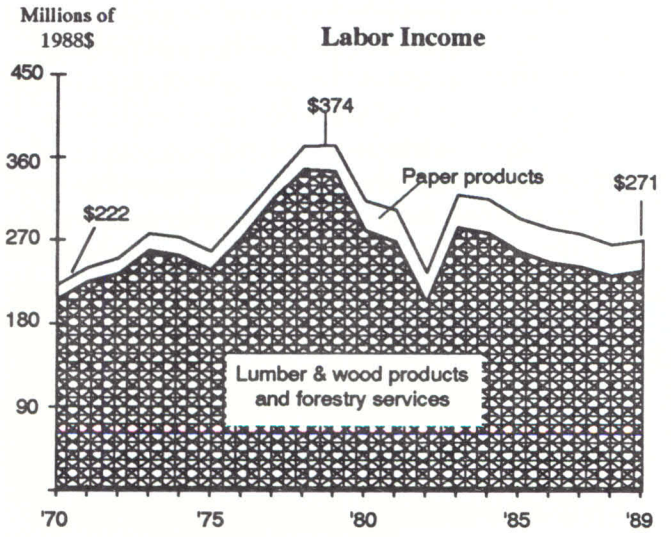


Sources: Page 50.

FIGURES 11 & 12

Industry Employment and Worker Earnings





Source: Page 50.

percent in 1988, the lowest level in the two-decade period. Total real labor income by basic industries in the state fell from about $2.4 billion in 1978 to a low of $1.6 billion in 1985, before improving to $1.9 billion in 1988 and to over $2.0 billion in 1989.

Employment in the state's basic industries gradually increased from 103,000 workers in 1970 to 109,000 workers in 1979 before falling below 100,000 workers in 1986. Recent improvements have pushed basic industry employment back to over 104,000 workers. Significantly, when basic industry employment was at its highest levels in the late 1970s, real labor income by all of the state's workers, both basic and nonbasic, also was at its highest. It totaled about $7.6 billion in both 1978 and 1979 as compared with less than $7 billion a year during much of the 1980s.

LABOR INCOME AND EMPLOYMENT IN THE FOREST PRODUCTS INDUSTRY

The forest products industry includes logging, lumber and wood products manufacturing, services involved in timber management, and paper products manufacturing. Employment in the paper products segment of the industry has been fairly stable in recent years after relatively steady growth during the 1970s and early 1980s. Employment in the rest of the industry (primarily workers in lumber and wood products production) increased steadily through the 1970s, rising from about 9,300 workers in 1970 to more than 12,830 workers in 1978. Employment fell considerably during the national recession years of the early 1980s, then rebounded to about 11,300 workers in 1984. Employment has declined since then and stood at 10,844 workers in 1989.

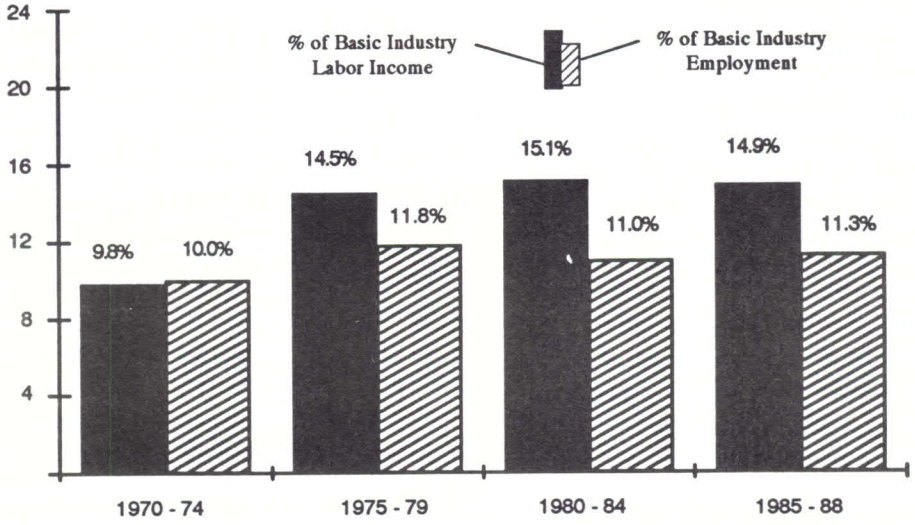
Real labor earnings by the wood and paper products industry as a whole increased markedly through much of the 1970s, peaking at more than $370 million in both 1978 and 1979. Income fell in subsequent recession years before improving in 1983. However, labor income has gradually declined since 1983. The $271 million in labor income workers received in 1989 is more than $100 million less than they received a decade earlier.

Average real labor income per worker in the lumber and wood products industry also peaked in 1978 at more than $27,000 per worker, as compared

FIGURE 13

Changing Share of Montana's Economic Base

Forest Products Industry as a Percent of Total Basic Industry



Source: Page 50.

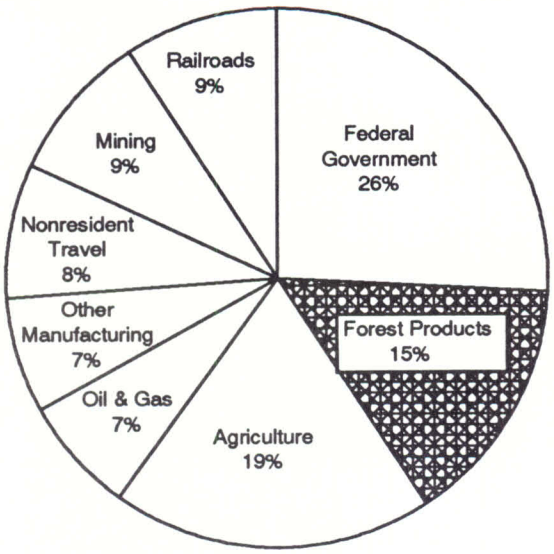
Note: Percentages are annual averages for each five-year period.

FIGURES 14 & 15

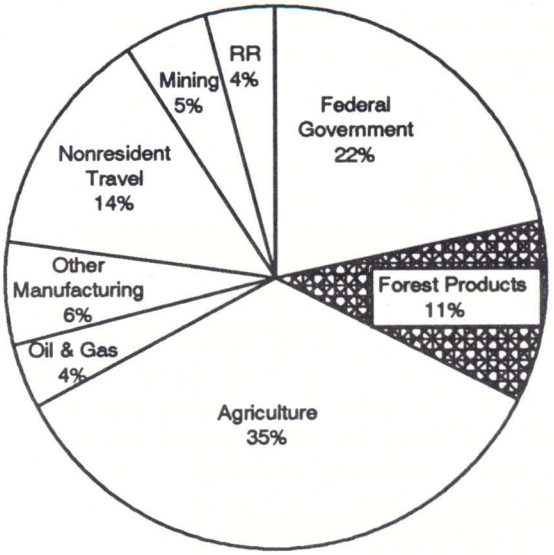
Current Make-up of Montana's Economic Base, 1985 - 89

Industry Shares of Basic Industry Income and Employment

Basic Labor Income



Basic Employment



to about $22,000 in 1989. Workers in the paper products industry earn considerably more, averaging more than $39,000 per worker in 1989, down from over $42,000 in inflation-adjusted 1988 dollars per worker in previous years.

As discussed previously (Section 1), structural changes including expansion of the plywood industry, increases in the use of waste wood from sawmills and an extremely good market for wood products spurred growth in industry employment during the 1970s. Sharp drops in U.S. housing and construction industries beginning late in 1979 led to several very difficult years in the early 1980s. The period from 1983 through 1985 saw high levels of wood products consumption nationwide, but very low prices (due in large part to the relatively high value of the U.S. dollar). Markets improved in 1986 and 1987 and industry production in Montana reached record levels. However, industry employment hasn't increased as a result, largely because of increased mechanization and shifts from large-log sawmills to more automated facilities processing smaller diameter logs.

INDUSTRY'S SHARE OF MONTANA'S ECONOMIC BASE

The forest products industry plays a significant role in the underlying economic base of Montana. Figure 4 shows the industry's share of the state's economic base, both as a percent of total basic labor income and as a percent of total basic employment. These are shown for four recent, five-year time periods: the first half of the 1970s, the second half of the 1970s, and the first and second halves of the 1980s. Measured by real labor income, the forest products industry's share of the state's economic base grew from about 10 percent in the early 1970s to about 15 percent during the 1980s. The industry accounts for a somewhat smaller share of basic employment in the state, averaging about 11 percent during the 1980s, a slightly smaller share than during the late 1970s.

Measured in terms of labor income, the forest products industry is the third largest basic industry in Montana, exceeded only by labor income generated by federal government activities in the state (also considered basic because they are largely financed with outside funds) and by agriculture. As measured by employment, the forest products industry is the fourth largest basic industry, exceeded only by basic employment by agriculture, the federal government, and nonresident travel and tourism.

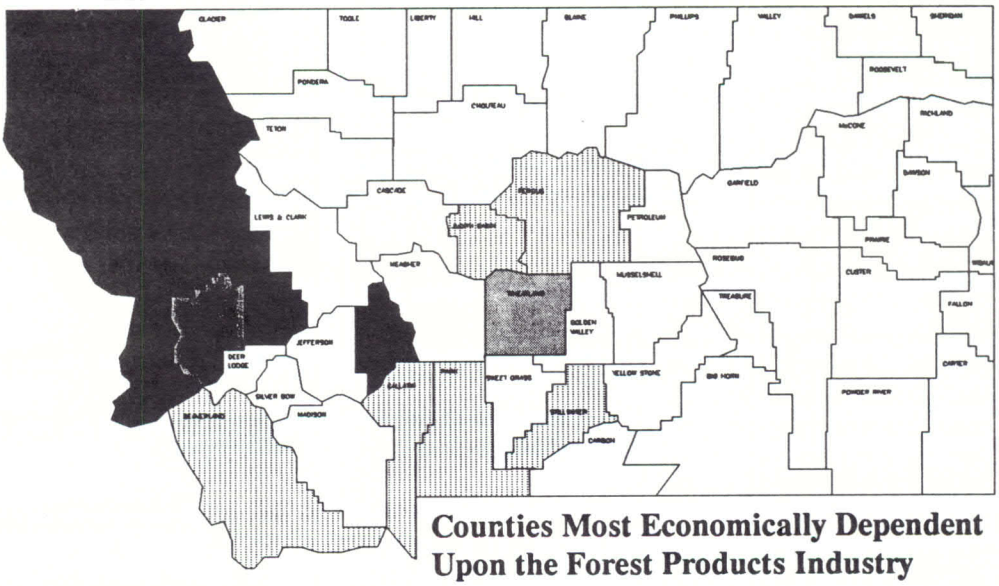
AREAS MOST DEPENDENT UPON THE FOREST PRODUCTS INDUSTRY

In recent years, the forest products industry has accounted for at least 5 percent of the economic base of 17 of Montana's 56 counties. These counties are indicated in the map in Figure 15. However, most of the industry is concentrated in western Montana, with seven contiguous counties accounting for much of the industry's production and employment (including about 85 percent of the labor income generated by the industry statewide). Ranked from highest to lowest in terms of county labor income by the industry during the last few years, these counties include Missoula, Flathead, Lincoln, Ravalli, Lake, Sanders, and Mineral.

For the regional economy made up by these seven counties, the forest products industry accounts for about 43 percent of its economic base (considering only those industries that are both basic to the counties and the state as a whole. Not included in the economic base are locally basic sectors such as state government activities and trade activity tied to sales to state residents outside of the seven-county region).

Based upon past and present levels of activity by Montana's forest products industry, income and employment conditions in the industry will be significant factors affecting overall economic conditions in the state, particularly in western Montana.

FIGURE 16



Counties Most Economically Dependent Upon the Forest Products Industry

Note: Industries included as "basic" are those largely basic to the state as a whole, not more locally basic sectors such as state government and regional trade center activities.

Source: Page 50.

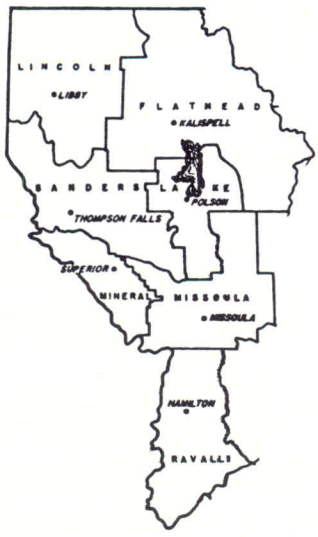
Industry Share of Basic Labor Income, 1988

- 30% and more
- 20% to 30%
- 10 to 20%
- 5 to 10%

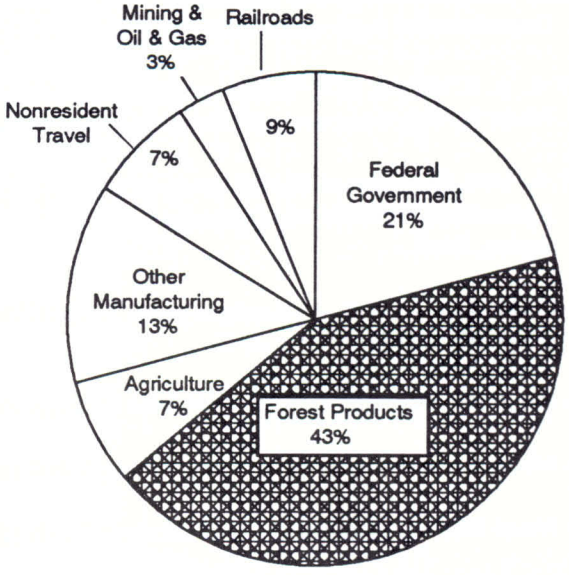
FIGURE 17

Economic Base of the Principal Forest Product Producing Counties in Montana, 1988

Seven Western Montana Counties



Industry Shares of Basic Labor Income



Source: Page 50.

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Figure 1 **LOCATION OF ACTIVE PRIMARY FOREST PRODUCTS PLANTS**

FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 2 **SALES VALUE OF MONTANA'S WOOD AND PAPER PRODUCTS**

Setzer, T. S., 1971. *Estimates of Timber Products Output and Plant Residues, Montana, 1969,* U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Research Note INT-133, Ogden, Utah. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 3 **LUMBER PRODUCTION BY MONTANA MILLS**

Western Wood Products Association, 1989, 1980, 1971. *Statistical Yearbook of the Western Lumber Industry,* Portland, Oregon. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 4 **PLYWOOD PRODUCTION BY MONTANA MILLS**

American Plywood Association, 1989. Unpublished data, Tacoma, Washington. CURFOR: Current forest industries information system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 5 **MONTANA HARVEST BY OWNERSHIP**

U.S. Department of Agriculture, Forest Service, Region One, 1990. Unpublished data compiled by the respective land management agencies throughout Montana, Missoula, Montana. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 6 **TIMBER PRODUCTS HARVESTED**

Setzer, T. S., 1971. *Estimates of Timber Products Output and Plant Residues, Montana, 1969,* U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Research Note INT-133, Ogden, Utah. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 7 **UTILIZATION OF MONTANA'S TIMBER HARVEST**

FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Figure 8 **MONTANA MILL CAPACIY AND TIMBER PROCESSED**

American Plywood Association. 1989. Unpublished data, Tacoma, Washington. Western Wood Products Association, 1989, 1980, 1971. *Statistical Yearbook of the Western Lumber Industry*, Portland, Oregon. CURFOR: Current forest industries information system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana. Miller Freeman, 1976-1989. [1976-1989] *Directory of the Forest Products Industry*, San Francisco, California. Moore, P., 1976, 1985, 1987. *Directory of Montana's Forest Products Industry.* Montana Department of State Lands, Division of Forestry, Missoula, Montana.

Figure 9 **SHIPMENT DESTINATION OF WOOD PRODUCT**

Figure 10 **COMPOSITION OF MONTANA'S ECONOMIC BASE**

U.S. Department of Commerce, Bureau of Economic Analysis; and University of Montana, Bureau of Business and Economic Research.

Figures 11 & 12 **INDUSTRY EMPLOYMENT AND WORKER EARNINGS**

U.S. Department of Commerce, Bureau of Economic Analysis.

Figure 13 **CHANGING SHARE OF MONTANA'S ECONOMIC BASE**

University of Montana, Bureau of Business and Economic Research.

Figures 14 & 15 **CURRENT MAKEUP OF MONTANA'S ECONOMIC BASE**

University of Montana, Bureau of Business and Economic Research.

Figure 16 **COUNTIES MOST ECONOMICALLY DEPENDENT UPON THE FOREST PRODUCTS INDUSTRY**

University of Montana, Bureau of Business and Economic Research (derived from U.S. Department of Commerce, Bureau of Economic Analysis, data).

Figure 17 **ECONOMIC BASE OF THE PRINCIPAL FOREST PRODUCT PRODUCING COUNTIES IN MONTANA**

University of Montana, Bureau of Business and Economic Research.

SOURCES FOR TABLES

Tables 1 & 2

FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

Table 3

Setzer, T. S., 1971. *Estimates of Timber Products Output and Plant Residues, Montana, 1969*, U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Research Note INT-133, Ogden, Utah. Berg, H. W., L. Cummins, M. Johnson, C. Brinck, and G. Cokelet, 1974. *Environmental impact statement on the proposed expansion of Hoerner-Waldorf's Missoula Pulp and Paper Mill*, Missoula, Montana. American Plywood Association. 1989. Unpublished data. Tacoma, Washington. Western Wood Products Association, 1989, 1980, 1971. *Statistical Yearbook of the Western Lumber Industry*, Portland, Oregon. FIDACS: Forest industries data collection system [data base], 1990. Bureau of Business and Economic Research, University of Montana, Missoula, Montana.

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Tables 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

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Table 22

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