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timber resources and the timber economy of Okanogan County. Washington

EDITOR'S
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Abstract

In 1972, forest industries in Okanogan County, Washington, accounted for 23 percent of total employment and 29 percent of wages paid. Total forest industrial employment has increased since 1953 but represents a smaller proportion of total employment in the county due to the increase in other industries, mainly construction and trade. Timber harvest has nearly doubled since 1953, from 116 million board feet (Scribner

scale) to 198 million. In 1972, 90 percent of the timber harvest was from public lands compared with 76 percent in 1953.

Timber supplies are projected to decline slightly—about 4 percent—by the year 2020, though the value is expected to increase about threefold. Employment in forest industries is projected to decline about 60 percent by the year 2020, but forest industrial payrolls only 27 percent.

KEYWORDS: Forest surveys, employment (forest labor), Washington (Okanogan County).

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Preface

This report was prepared for the Pacific Northwest River Basins Commission's comprehensive Joint Plan for the Pacific Northwest. The Plan is being developed under the authority of Public Law 89-80, the Water Resources Planning Act of 1965. This report was financed by U.S. Forest Service, Region 6.

The basic forest resource data used in this report were collected by the Forest Survey project of the Pacific Northwest Forest and Range Experiment Station and the Okanogan National Forest in 1965-67. Updating of data to 1973 was done by Forest Survey.

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Introduction

Okanogan is the largest county in the State of Washington with a total land area of 3,392,640 acres, yet it ranks 23d in total population, having 25,867 persons at the time of the 1970 census. Only five of the 39 counties in Washington are as sparsely populated in terms of people per square mile, and the least populated county, Ferry, borders Okanogan County on the east. Most of the people live in a few small towns along the Okanogan, Methow, Nespelem, and Columbia Rivers. Much of the county is mountainous, with the rugged Cascade Range in the western part and the lower Okanogan Highlands in the east. Annual precipitation ranges from about 10 inches at Omak to 60 inches in the far western part of the county in the high Cascades. The climate over much of the county is semiarid with hot summers, cold winters, and a rather short growing season.

Natural vegetation ranges from desert scrub in the low elevations, through extensive

areas of very open ponderosa pine forests, grading into stands of Douglas-fir, to higher elevation forests of lodgepole pine, western larch, Engelmann spruce, and true firs.

An outstanding characteristic of Okanogan County is its remoteness from population centers. The nearest major city, Spokane, is 137 miles from Omak; Seattle is 236 miles from Omak across the Cascade Range. Construction of the North Cascades highway has greatly facilitated movement between Okanogan County and the western part of the State.

Okanogan County's population growth rate exceeded that of the State between 1890 and 1950. Between 1950 and 1960 Okanogan County's population declined 12 percent, while the State's population increased 20 percent. Since 1960 Okanogan County's population has remained fairly constant while the State's population has continued to rise sharply (fig. 1). Not immediately apparent in

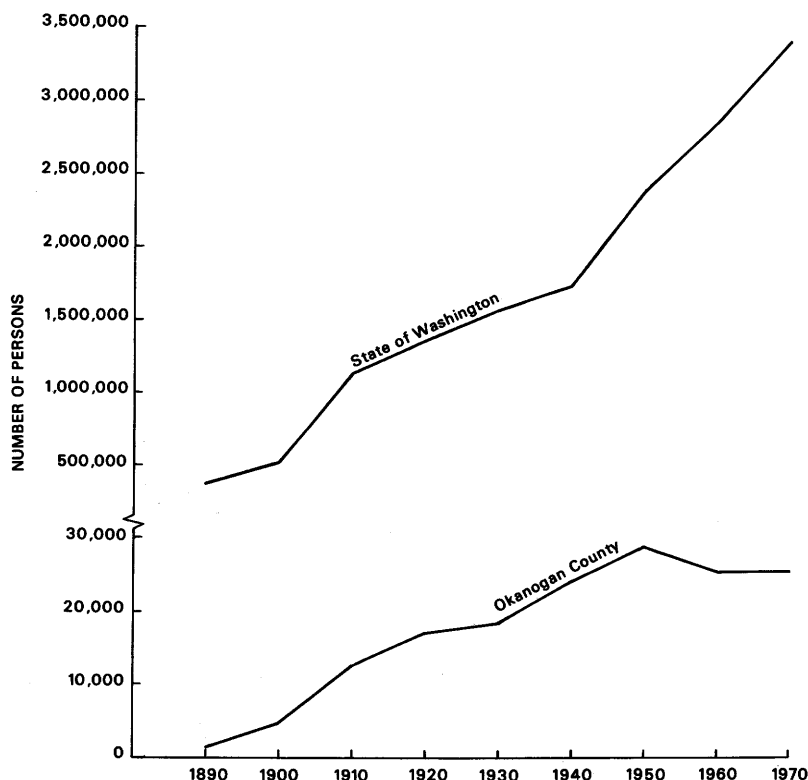


Figure 1.—Population of the State of Washington and Okanogan County, 1890 to 1970.

the population statistics is Okanogan's migration rate. Between 1960 and 1970, 1,328 more persons moved out than moved in, but a high birth-death ratio helped stabilize the county's population during this decade.

Total reported employment not counting State and Federal Government in Okanogan County has increased by 90 percent since 1950, in spite of a declining population. On the other hand, employment in the entire State has increased by only 74 percent, yet the population has increased by 43 percent.¹

In 1972, the reported covered employment in Okanogan County was 7,122 people and the total wages paid was \$55,416,172. Wholesale and retail trade employed the largest number of people but ranked fourth in total wages paid. Forest industries ranked second in employment and third in wages paid. Contract construction, fourth in employment, ranked first in wages paid. Other important sources of employment were government; services; agriculture; transportation, communication, and utilities; and finance, insurance, and real estate, in that order.

The Forest Industry

Employment by forest industries in Okanogan County was higher in 1972 than in 1950 (fig. 2), yet the proportion of total employment and wages attributable directly to forest industries decreased as other industries expanded. In 1950, forest industries accounted for 36 percent of the employment and 40 percent of the wages paid; and in 1972, they accounted for 23 percent of the employment and 29 percent of the wages paid. Industries that showed the greatest expansion in Okanogan County were:

Contract construction—employment up 320 percent and wages up 770 percent.²

Wholesale and retail trade—employment up 220 percent and wages up 240 percent.²

¹Reported employment prior to 1960 is probably understated, making the apparent increase somewhat exaggerated. The comparison of the State with Okanogan County should still be valid, though.

²Wage comparisons are in terms of 1967 dollars.

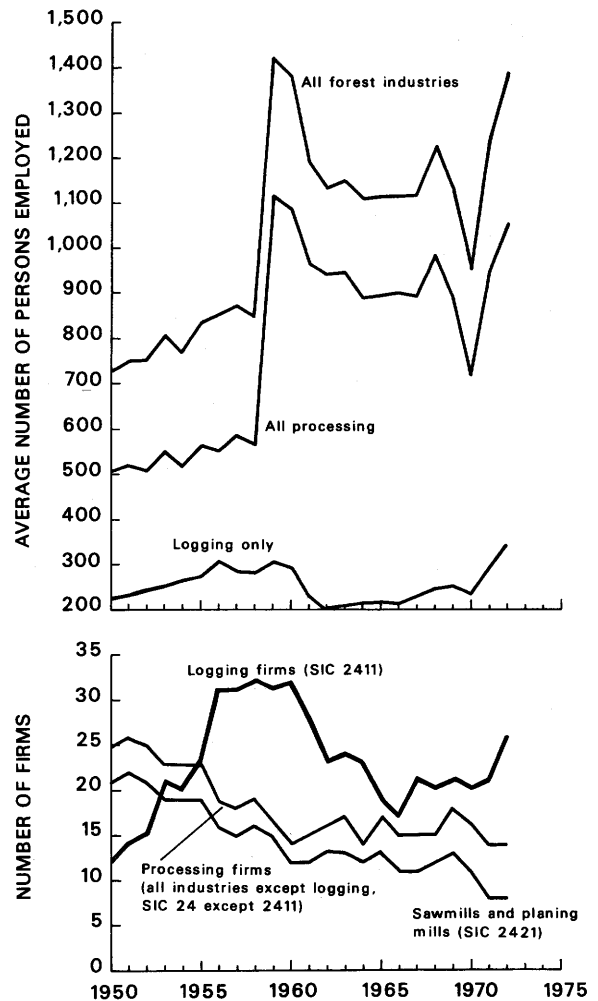


Figure 2.—Forest industry employment and number of forest industry firms, Okanogan County, Washington, 1950-72.

Services—employment up 225 percent and wages up 330 percent.²

The trend in the forest industry in Okanogan County, as in the region in general, has been from many firms to a few (fig. 2). In 1925 there were 22 sawmills. During the Depression years, in the 1930's, the number of sawmills dropped to 12 but then climbed

back up to a high of 27 after World War II. By 1965 there were only 13; and in 1972, according to the Washington Department of Natural Resources (Bergvall and Ormrod, 1974), there were only 6 sawmills in the county. A plywood and veneer plant began operation in 1970.

Of the six sawmills in operation in the county, two are owned by the same major forest products company that owns the plywood and veneer plant. About 90 percent of the total log consumption in the county in 1972 took place in the three mills owned by this corporation. Until 1973, these mills were locally owned.

Installed 8-hour capacity of the six sawmills in Okanogan County is 432,000 board feet, lumber tally. Installed 8-hour capacity of the veneer and plywood plant is 190,000 square feet (3/8-inch basis).

Total log consumption in 1972 by all mills in Okanogan County was 167,442,000 board feet; 96 percent came from within Okanogan County; and according to the timber harvest reports, nearly 90 percent was from public and Indian lands (see tables 10 and 14). About 90 percent of the logs consumed were from old-growth (100 + years) trees. Douglas-fir made up 44 percent of the reported consumption and ponderosa pine ran a close second with 42 percent. Western larch amounted to 12 percent of the consumption and Engelmann spruce 2 percent. Small amounts (less than 0.5 percent) of other species reported as harvested in the county include lodgepole pine, true firs, white pine, and hardwoods.

Timber Harvest

Total reported timber harvest in Okanogan County in 1972 for all ownerships was 197,863,000 board feet (Scribner scale), the highest in history. Fifty-seven percent came from the Okanogan National Forest, 21 percent from the Colville Indian Reservation, and 12 percent from State lands. Forest industry lands contributed 2 percent of the timber and nonindustrial lands, 8 percent. There has been a generally long-term upward trend in timber

harvest on public lands and a slight downward trend on private lands since 1953 (fig. 3); although since 1965, private lands have shown a slight upward trend.

Okanogan County's timber harvest has contributed an increasing proportion to the total State harvest—from 0.6 percent in 1925 to 2.8 percent in 1972.

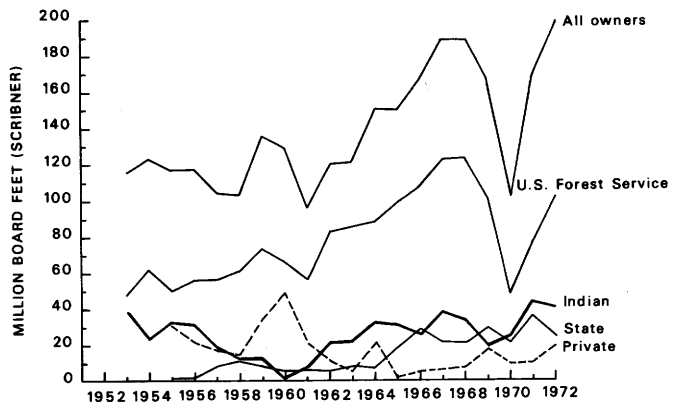


Figure 3.—Timber cut 1953-72, Okanogan County, Washington.

Timber Resources

Total area of commercial forest land³ is estimated to be 1,618,000 acres or 48 percent of the total land area in the county. The Okanogan National Forest contains 765,000 acres or 47 percent of this, and the State 218,000 acres or 13 percent. Other public agencies, including Bureau of Land Management and Corps of Engineers, own 16,000 acres.

The Colville Indian Reservation contains 320,000 acres or 20 percent of the commercial forest land in the county. About 29,000 acres of commercial forest land are owned by forest industry, and another 45,000 acres are leased by forest industry for timber cutting. Farmer and miscellaneous private owners, excluding Indian land, hold 270,000 acres

³See "Appendix 2. Definition of Terms," page 30.

including the 45,000 leased by forest industry.

Forest Productivity Low

Okanogan County's forests are relatively low in productivity because of low precipitation, steep, rocky terrain, and the short growing season in mountainous areas. Only 16 percent of the commercial forest land is classified as capable of growing more than 85 cubic feet per acre per year, compared with 31 percent in all of eastern Washington and 42 percent in the entire State. Even this low figure needs further discounting. Studies in similar areas made since the Okanogan survey show that forests in the arid ponderosa pine fringe are capable of producing even less than formerly thought. In addition to limitations on yields, growing successive timber crops is difficult because of regeneration problems. These problems are severest in the lower elevation forests where most of the nonindustrial private lands occur, which partly explains why 64 percent of the private commercial forest land excluding Indian land in Okanogan County is less than 40 percent stocked with conifer trees, and 33 percent is nonstocked.

Timber Volume Declining

Total sawtimber volume in Okanogan County is estimated to be 10,165 million board feet (Scribner rule), and growing stock volume is estimated to total 2,780 million cubic feet. Over all ownerships, sawtimber volume has declined 2.3 percent in the past 5 years; private sawtimber declined 5.7 percent, National Forest sawtimber declined 2.6 percent, and other public sawtimber declined 0.4 percent. Douglas-fir, the most prevalent species, declined about 1.5 percent; and ponderosa pine, the second most prevalent species and historically the major timber species in much of eastern Washington, declined 6.5 percent. Western larch, the third most prevalent species, declined 11.4 percent. Other species, because they are presently used very

little by the industry, increased in total volume. Included were lodgepole and white bark pines, Engelmann spruce, cedars, true firs, and hardwoods.

Future Timber Supplies

The Okanogan National Forest, the Colville Indian Reservation, and the State forest managed by the Department of Natural Resources are the three largest forest tracts in Okanogan County. Containing about 80 percent of the commercial forest land, they have contributed over 90 percent of the county's timber cut during the past 10 years. Each agency has a calculated "allowable cut" which reflects its management objectives and is based on current inventory volume, timber growth rates, and expected response to management activities. For these lands, the agencies' "allowable cut" figures were used as a basis for projecting timber supplies. For the 16,000 acres of other public lands, the average of the past 10 years' cutting was used as a sustainable harvest. For private lands, it was assumed that future timber harvests will decline slightly by the year 2020, due to a declining inventory of merchantable timber (see appendix 1 for detailed analysis). Following are the projected timber supplies from these ownerships.

Ownership	Projected annual timber supplies (Million board feet, Scribner)		
	1973-80	1980-2000	2000-2020
Okanogan National Forest	88.1	86.1	84.0
Colville Indian Reservation ⁴	35.0	35.0	35.0
State	17.4	17.4	17.4
Other public	.8	.8	.8
Private	16.0	15.0	13.3
	157.3	154.3	150.5

⁴The Colville Indian Reservation does not have an "allowable cut" for its Okanogan County land, but for the entire reservation. The average cut for the past several years—35 million board feet—was assumed to represent the allowable cut for that part of the reservation in Okanogan County.

The forest industry has been tooling up for handling smaller logs—down to 4-5 inches. As additional smaller material becomes available from thinnings and from fuller utilization of small and defective logs in timber stands being harvested, some additional volume beyond that shown above will become available. Only moderate increases in the use of mill residues can be expected, since in 1972, 92 percent of all mill residues were already being used.

Changing Species

Future timber harvests will consist of less ponderosa pine and western larch and more Douglas-fir, spruce, true firs, and possibly lodgepole pine. Though the Douglas-fir inventory is currently declining, this species is expected to hold its own in the future under the projected level of timber cutting. Much of the current ponderosa pine volume, especially on National Forest lands, occurs in association with more tolerant species, mainly Douglas-fir. Partial cutting tends to reduce the amount of pine and favor the Douglas-fir in these stands. The private forest lands being converted to nonforest uses are mostly in the lower elevations in the ponderosa pine type.

Some effort is being made through planting and stand density control measures to perpetuate ponderosa pine on public lands, and western larch seedlings have been planted in a few areas. These activities will probably have little effect on the species mix available for industrial use during the projection period, though they help minimize the decline of ponderosa pine and larch in the mixed-conifer types.

The stumpage prices for various species have differed considerably; ponderosa pine has been worth about twice as much as east side Douglas-fir, though the trend seems toward equalization of prices. The shifting of species in the future is not viewed as a serious problem to the industry or to the economy of Okanogan County.

Projected Value of Future Timber Harvest

Though the total volume of timber available for industrial use is expected to decline slightly, the total value is expected to increase.

Stumpage prices in Okanogan County, though lower than regional price levels, have fluctuated more or less in concert with regional price trends (see fig. 4) for west side Douglas-fir. Future price trends in Okanogan are projected to approach regional and national prices. For these projections an annual rate of increase of 3 percent was used.⁵

Factors that would guide prices toward the regional average include:

- A. Increased national and international demand for timber, which would bring in more prospective buyers of Okanogan timber.
- B. As reserves of old-growth timber, especially the higher-valued west-coast Douglas-fir and old-growth ponderosa pine, are depleted, there will be less quality difference in timber from one locality to the next. Okanogan timber would be more like timber from other parts of the region.
- C. As unroaded areas in Okanogan County become accessible and as technology in logging and processing develops, there will be fewer cost differences between Okanogan County timber and timber in other localities.

Table 1 shows the approximate volume and value of stumpage of timber sold on the Okanogan National Forest, the Colville Indian Reservation, and State lands from 1968 to 1973. Table 2 shows projected value of timber harvest for decadal years to 2020 for all ownerships, using average stumpage price from 1969 through 1973 and a 3-percent annual rate of increase.

⁵ West side Douglas-fir stumpage prices have been projected to increase at an annual rate of 2-1/2 percent (USDA Forest Service 1973).

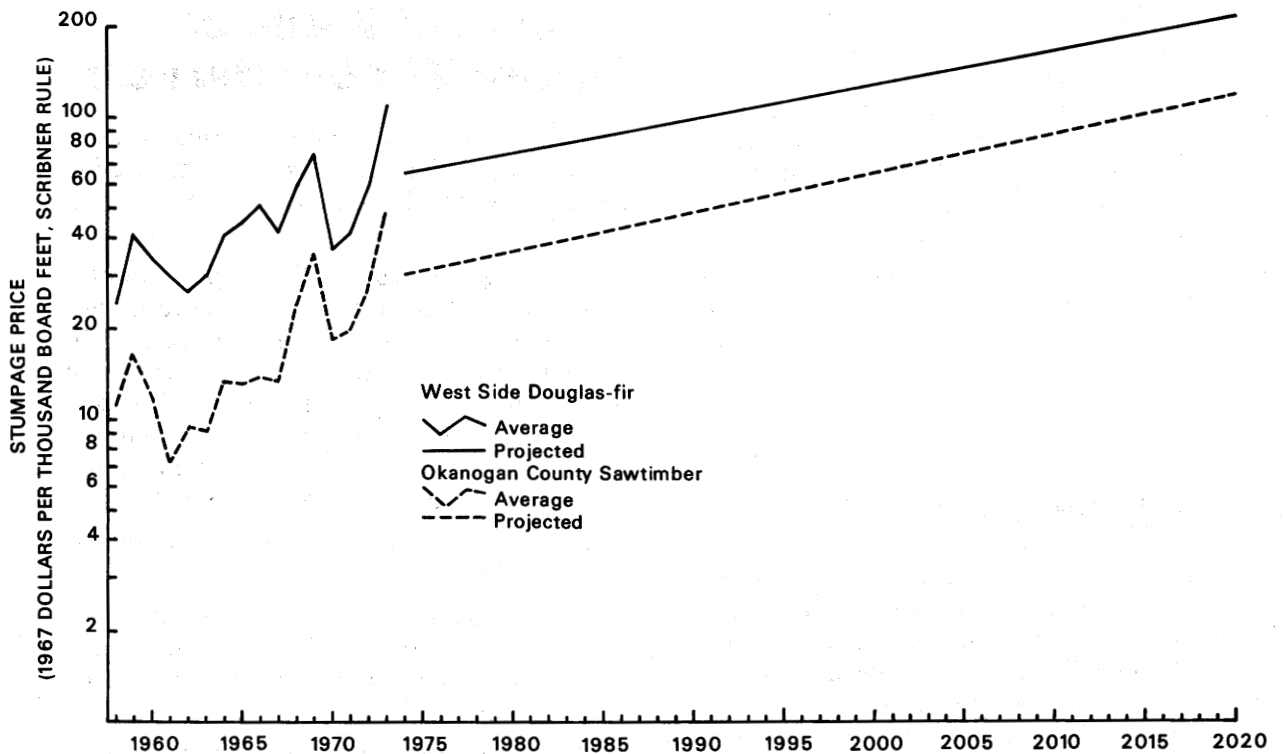


Figure 4.—Average stumpage prices for sawtimber sold on the Okanogan National Forest 1958-73, on the Colville Indian Reservation 1958-73, on State lands in Okanogan County 1968-73 and for Douglas-fir sawtimber sold on National Forests in western Oregon and Washington 1958-73, and projected stumpage prices to 2020. Projections for Okanogan County are based on the average for 1969-73 compounded at 3 percent per year. Projections for Douglas-fir are based on the average for 1969-73 compounded at 2-1/2 percent per year.

Table 1.--Approximate volume and value of stumpage of timber sold on the Okanogan National Forest, the Colville Indian Reservation, and State lands in Okanogan County, Washington, 1968-73

Year	Volume	Value	Average
	<i>Million board feet, Scribner scale</i>	<i>Thousands of 1967 dollars</i>	<i>1967 dollars per thousand board feet</i>
1968	167	3,908	23.40
1969	130	4,635	35.65
1970	137	2,466	18.00
1971	149	2,962	19.88
1972	165	4,353	26.38
1973	137	6,684	48.79

Sources of data: State of Washington Advertised Timber Sales Reports, U.S. Forest Service Region 6 Timber Cut and Sold Reports, Bureau of Indian Affairs Timber Sale Receipts Records.

Table 2.--Projected value of timber harvest in Okanogan County, Washington using the average stumpage price from 1969 through 1973

Year	Volume cut on all ownerships	3-percent annual increase	
		Mean value	Total value
	<i>Thousand board feet, Scribner scale</i>	<i>1967 dollars</i>	<i>Thousands of 1967 dollars</i>
1980	157,300	36.16	5,688
1990	154,300	48.59	7,497
2000	152,000	65.31	9,927
2010	150,500	87.76	13,208
2020	149,000	117.95	17,575

Trends in Forest Industrial Employment

Average annual employment in logging, sawmilling, and veneer and plywood production per unit of wood consumption has declined over time, reflecting the development of more efficient logging methods and conversion plants. This apparent increase in employee productivity is expected to continue in all areas. In Okanogan County, however, there are reasons to expect the future increase in productivity to be somewhat less than for the State or half-State. Okanogan County is nearly a closed system as far as current harvesting and processing of timber are concerned. Very little volume of unprocessed logs flowed into or out of the county in 1972. Future relationships could vary from those shown here should the timber flow pattern alter.

Logging employment⁶ makes up about one-fourth of the total forest industrial employment in the county. Employment per unit of wood harvested is projected to decline only moderately. Even though the bulk of Okanogan's standing timber volume⁷ is in old-growth stands and about 90 percent of the current timber harvest is in old-growth trees, Okanogan's forest has the lowest average volume per acre of Washington counties on the east slope of the Cascades—20 percent less than the average for all of eastern Washington. Both volume per acre and size of trees logged are expected to decrease in Okanogan County at a faster rate than in the half-State area. To harvest timber at the expected future rates, loggers will be working in sparser timber stands, in more difficult terrain, in the remote reaches of the county. The low productivity of Okanogan's forest land will also tend to require a higher level of employment per unit of wood harvested. Partially cut stands are expected to respond

slowly to "release," and regeneration of denuded sites will often be difficult. Young-growth volume will build up at a slower rate than in the entire half-State area. Future stands will carry low per-acre volumes.

Employment in logging in 1972, and for the period 1968-72, averaged about 1.65 persons per million board feet cut. By the year 2020 it is projected to decline to about 1.50 persons per million board feet (fig. 5).

Lumber and all other wood products manufacturing⁸ were combined for employment projection purposes. Though these industries have different rates of employee productivity for the entire State, the differences are considered negligible in this county. The veneer and plywood industry contributes only 14 percent of the total forest industrial employment. The veneer and plywood mill operated at near capacity in 1973. The current plywood market and the reported peeler log supply in Okanogan County suggest that further expansion of this industry is unlikely.

Sawing, planing, and millwork make up over 60 percent of the total forest industrial employment in the county. Though employment is projected to decline, it is not expected to decline as rapidly as in all of eastern Washington,⁹ nor as rapidly as it appears to have declined since the peak years of 1959 and 1960. Sudden changes in future labor efficiency should not be expected in the two new mills and the older one that has recently been modernized. The trend from many small mills to a few large mills, an important factor in the declining employment rate, cannot continue much longer because very few small mills are left, and those that remain may be prolonged by the recent "small business set-aside" timber sales program on the National Forest. No pulp or paper plant will be built in or near Okanogan County in the State of

⁶Standard Industrial Classification (SIC) code 2411.

⁷Old-growth timber makes up somewhere between 70 and 85 percent of total volume, the exact amount depending on the unknown volume in old trees in "mixed age" stands.

⁸SIC 24 except 2411.

⁹Brian R. Wall and Daniel D. Oswald. A technique and relationships for projections of employment in the Pacific Coast forest products industries. USDA Forest Service Research Paper PNW-189, 49 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 1975.

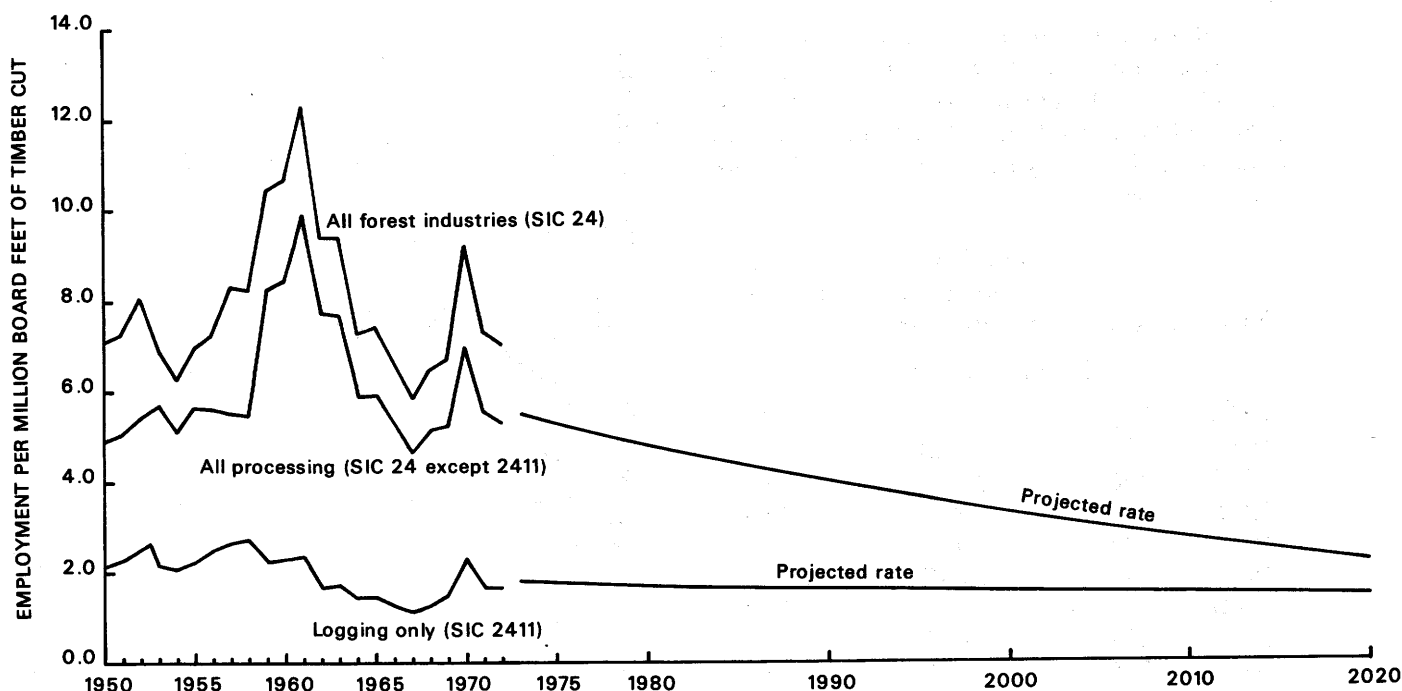


Figure 5.—Forest industrial employment per million board feet of timber cut in Okanogan County, Washington, 1950-72 with projections to 2020.

Washington in the foreseeable future due to the unavailability of water. However, it is possible that wood chips may be shipped out of the county in appreciable quantities in the future.

Employment in sawing, planing, millwork, and veneer and plywood production in Okanogan County averaged 5.53 persons per million board feet for the period 1968-72. Projections indicate it may decline to about 2.20 by 2020.

Employment per million board feet of timber cut in Okanogan County for logging and for sawing, planing, millwork, and veneer and plywood production for selected years between 1950 and 1972 and projected rates at 10-year intervals to 2020 are shown in the following tabulation.

Year	Industry ¹⁰	
	Logging	Lumber and wood products manufacturing
		(Number of employees per million board feet of timber cut)
1950	2.16	4.91
1955	2.27	4.67
1960	2.29	8.45
1965	1.45	5.97
1970	2.30	6.97
1972	1.72	5.30
1980	1.75	4.80
1990	1.67	4.00
2000	1.61	3.35
2010	1.53	2.70
2020	1.50	2.20

¹⁰ Reported employment prior to 1960 is probably somewhat understated, thus tending to exaggerate the change between 1955 and 1960.

Total average annual employment in logging and lumber and wood products manufacturing in Okanogan County for selected years between 1950 and 1972 and projected employment at 10-year intervals to 2020 are shown below:

Year	Logging	Lumber and wood products manufacturing	Total employ- ment
(Number of employees)			
1950	223	506	729
1955	272	560	832
1960	296	1,090	1,386
1965	218	895	1,113
1970	237	718	955
1972	340	1,049	1,389
1980	275	755	1,030
1990	258	617	875
2000	245	509	754
2010	230	406	636
2020	224	328	552

Forest Industrial Payrolls

Total wages paid by all forest industries¹¹ in Okanogan County were \$12.3 million in 1972 (10.2 million in 1967 dollars), an increase of about 100 percent in constant dollars since 1950. Average annual wages per person have climbed steadily from about \$4,250 in 1950 to \$7,300 in 1972 (fig. 6). Total wages per thousand board feet of timber harvested in the county have not changed in any discernible direction since 1950 but have varied inversely to the ups and downs of the timber harvest (fig. 7). When production is low, wages per unit of production are high and vice versa, since employment fluctuates much less than consumption and production.

Wages were projected under the assumption that a constant wage will be paid per unit of production, which means that as fewer

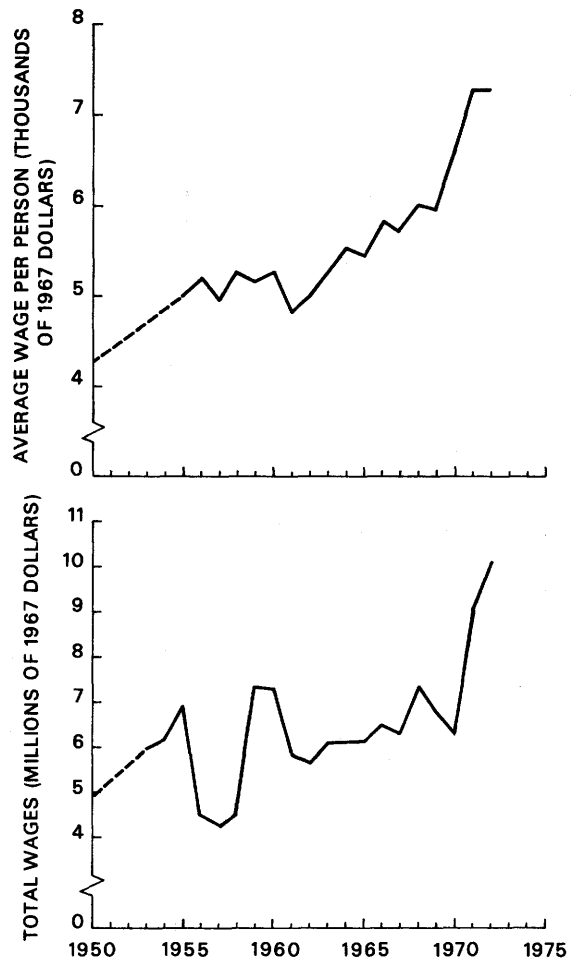
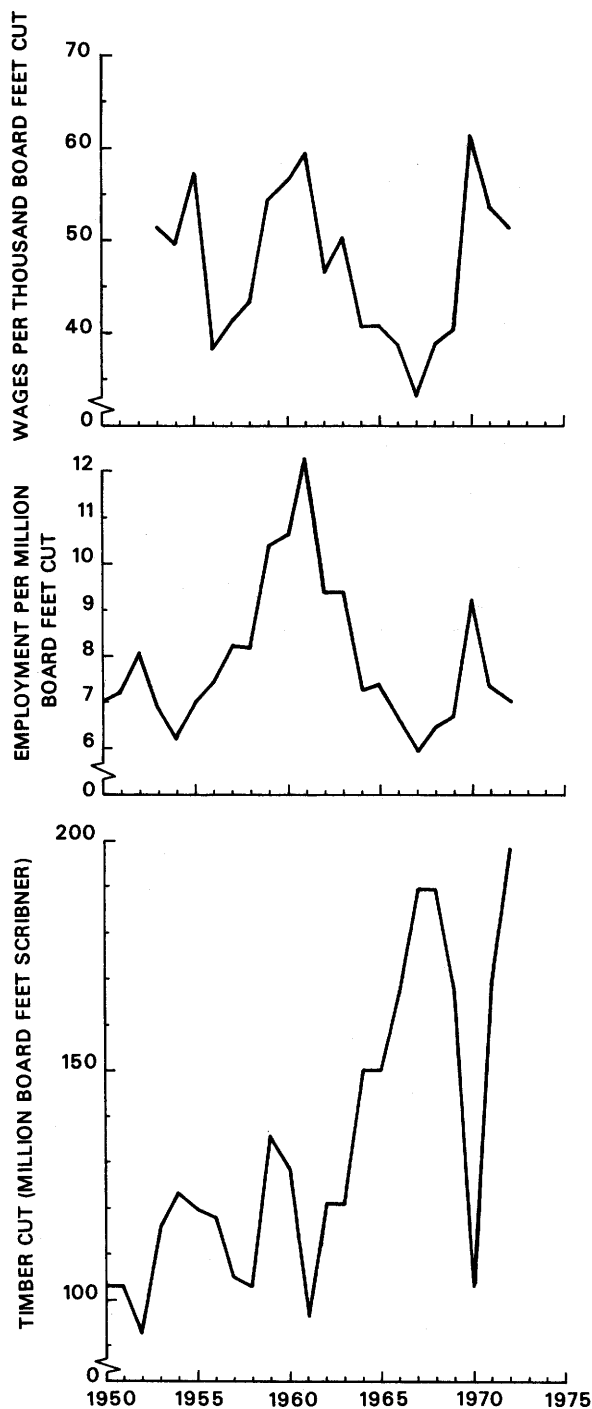


Figure 6.—Average annual per person and total wages paid by all forest industries, Okanogan County, 1950-72.

employees are required to accomplish a unit of work, their wages will increase accordingly. Under this assumption, wages are projected to decrease to about \$7.4 million in 2020. The projected values are not considered very reliable, since many factors that change payrolls could not be considered. The direction of the change, however, is reasonable under the assumption that past trends will continue and that external factors (such as a change in national policy on energy and other resources, and unforeseen technological innovation) will not upset current relationships. The following tabulations show wages paid in all forest

¹¹ All SIC 24.



industries in Okanogan County during 1950, 1960, and 1972 and projected wages for 1980, 1990, 2000, 2010, and 2020.

Year	Total wages paid (In thousands of 1967 dollars)
1950	4,874
1960	7,303
1970	6,340
1972	10,179
Projected wages¹²	
1980	7,865
1990	7,715
2000	7,600
2010	7,525
2020	7,450

Figure 7.—Wages per thousand board feet of timber cut, employment per million board feet of timber cut, and total timber harvested, Okanogan County, 1950-72. (All board feet Scribner scale.)

¹² Assuming increasing workman productivity with constant dollar "efficiency." Level assumed = \$50 per thousand board feet cut (approximate average of past 5 years).

Table 3.--Area by ownership and land class, Okanogan County, Washington, January 1, 1973

(In thousand acres)

Ownership class	Forest land			Nonforest	Total land
	Commercial forest land ¹	Productive reserved	Unproductive		
National Forest	765	177	² 396	161	1,499
Bureau of Land Management	12	--	] 84	] 957	] 1,894
Miscellaneous Federal	4	--			
State	218	(³)			
Indian ⁴	320	--			
Forest industry	29	--	] 480	] 1,118	] 3,393
Farmer	214	--			
Miscellaneous private	56	--			
All ownerships	1,618	177	480	1,118	⁵ 3,393

¹Estimates of area of commercial forest land for specific ownerships may not agree with the owner's estimates because of differences in definitions and procedures.

²Includes about 161,000 acres in the Pasayten Wilderness.

³Less than 500 acres.

⁴Indian lands are private property held by the United States in trust for Indians. The Bureau of Indian Affairs manages tribal timber in accordance with principles of sustained yield, and timber on individually owned allotments upon consideration of the needs and best interests of the Indian owner and his heirs..

⁵U.S. Bureau of Census, Land and Water Area of the United States, 1960 (revised 1965).

Source: Bassett and Choate (1974).

Table 4.--Area of commercial forest land, by forest type¹ and ownership class,
Okanogan County, Washington, January 1, 1973

(In thousand acres)

Type	National Forest	Other public ²	Private	All ownerships
Douglas-fir	381	244	109	734
Ponderosa pine	142	180	57	379
True firs	29	9	--	38
Western larch	45	34	--	79
Engelmann spruce	40	21	9	70
Lodgepole pine	107	24	--	131
Whitebark pine	2	--	--	2
Other softwoods	1	--	--	1
Hardwoods	8	--	43	51
Nonstocked	10	42	81	133
All types	765	554	299	1,618

¹Acres by forest type was determined by applying the January 1, 1968, forest type proportions to the January 1, 1973, total commercial forest area in each ownership. There is ample evidence that forest type conversion is taking place, but no way to quantify it is available.

²Includes Indian land.

Table 5.--Area of commercial forest land, by cubic-foot site class
and ownership class, Okanogan County, Washington
January 1, 1973

(In thousand acres)

Site class ¹ (cubic feet)	National Forest	Other public ²	Private	All ownerships
225 or more	0	0	0	0
165 to 224	2	0	0	2
120 to 164	4	0	9	13
85 to 119	104	111	33	248
50 to 84	458	347	194	999
20 to 49	197	96	63	356
All classes	765	554	299	1,618

¹A classification in terms of capacity for cubic-foot annual growth per acre at culmination of mean annual growth.

²Includes Indian land.

Table 6.--Volume of growing stock and sawtimber on commercial forest land, by species and ownership, Okanogan County, Washington, January 1, 1973

Species	National Forest				Other public ¹				Private				All ownerships		
	Million cubic feet	Million board feet		Million cubic feet	Million board feet		Million cubic feet	Million board feet		Million cubic feet	Million board feet		International 1/4-inch	Scribner	
		International 1/4-inch	Scribner		International 1/4-inch	Scribner		International 1/4-inch	Scribner						
Softwoods:															
Douglas-fir	747	3,673	3,144	337	1,431	1,227	123	378	314	1,207	5,482	4,685			
Ponderosa pine	253	1,575	1,424	253	1,140	1,003	70	263	226	576	2,978	2,653			
True firs	136	368	313	29	49	39	0	0	0	165	417	352			
Western larch	114	625	568	148	664	565	9	43	30	271	1,332	1,163			
Engelmann spruce	189	822	709	69	358	301	16	44	36	274	1,224	1,046			
Lodgepole pine	208	187	151	40	36	29	0	0	0	248	223	180			
Whitebark pine	8	16	14	2	0	0	0	0	0	10	16	14			
Other softwoods	1	9	6	0	0	0	0	0	0	1	9	6			
Total	1,656	7,275	6,329	878	3,678	3,164	218	728	606	2,752	11,681	10,099			
Hardwoods	9	39	38	2	3	3	17	28	25	28	70	66			
All species	1,665	7,314	6,367	880	3,681	3,167	235	756	631	2,780	11,751	10,165			

¹ Includes Indian lands.

Table 7.--*Net annual growth of all growing stock on commercial forest land, by species and ownership class, Okanogan County, Washington*¹
(In thousand cubic feet)

Species	National Forest	Other public ²	Private	All ownerships
Softwoods:				
Douglas-fir	7,800	5,357	2,742	15,899
Ponderosa pine	1,500	5,315	2,021	8,836
True firs	1,500	711	--	2,211
Western larch	300	³ -191	³ -998	³ -889
Engelmann spruce	2,300	1,119	166	3,585
Lodgepole pine	2,800	1,344	--	4,144
Whitebark pine	100	31	--	131
Total	16,300	13,686	3,931	33,917
Hardwoods	200	³ -18	217	399
All species	16,500	13,668	4,148	34,316

¹Net annual growth shown in this table is the average annual gross growth minus the average annual mortality measured on permanent forest inventory plots originally established in 1957-59 on the Okanogan National Forest and remeasured in 1965-66, and originally established on all other lands in 1958-59 and remeasured in 1967.

²Includes Indian land.

³Minus net growth is caused by mortality exceeding gross growth.

Table 8.--*Net annual growth of sawtimber on commercial forest land, by species and ownership class, Okanogan County, Washington (International ¼-inch rule)*¹

(In thousand board feet)

Species	National Forest	Other public ²	Private	All ownerships
Softwoods:				
Douglas-fir	38,900	22,629	5,982	67,511
Ponderosa pine	7,100	18,351	5,743	31,194
True firs	4,200	2,862	--	7,062
Western larch	³ -300	³ -1,515	³ -2,916	³ -4,731
Engelmann spruce	10,700	19,940	1,310	31,950
Lodgepole pine	3,400	4,024	--	7,424
Whitebark pine	300	--	--	300
Other softwoods	100	--	--	100
Total	64,400	66,291	10,119	140,810
Hardwoods	1,600	44	³ -90	1,554
All species	66,000	66,335	10,029	142,364

¹Net annual growth shown in this table is the average annual gross growth minus the average annual mortality measured on permanent forest inventory plots originally established in 1957-59 on the Okanogan National Forest and remeasured in 1965-66, and originally established on all other lands in 1958-59 and remeasured in 1967.

²Includes Indian land.

³Minus net growth is caused by mortality exceeding gross growth.

Table 9.--*Net annual growth of sawtimber on commercial forest land, by species and ownership class, Okanogan County, Washington (Scribner rule)*¹

(In thousand board feet)

Species	National Forest	Other public ²	Private	All ownerships
Softwoods:				
Douglas-fir	33,800	19,134	3,729	56,663
Ponderosa pine	6,400	16,029	4,973	27,402
True firs	3,500	2,238	--	5,738
Western larch	³ -100	³ -984	³ -3,639	³ -4,723
Engelmann spruce	9,300	15,944	1,142	26,386
Lodgepole pine	2,800	3,191	--	5,991
Whitebark pine	300	--	--	300
Other softwoods	100	--	--	100
Total	56,100	55,552	6,205	117,857
Hardwoods	1,400	44	³ -84	1,360
All species	57,500	55,596	6,121	119,217

¹Net annual growth shown in this table is the average annual gross growth minus the average annual mortality measured on permanent forest inventory plots originally established in 1957-59 on the Okanogan National Forest and remeasured in 1965-66, and originally established on all other lands in 1958-59 and remeasured in 1967.

²Includes Indian land.

³Minus net growth is caused by mortality exceeding gross growth.

Table 10.--Okanogan County, Washington, timber harvest, 1945-72

(In thousand board feet, Scribner scale)

Year	State	Other Non-Federal public	U.S. Forest Service	Indian	Other Federal	Private				All ownerships
						Industrial	Large non- industrial	Small non- industrial	Total	
1945	--	--	--	--	--	--	--	--	--	68,715
1946	--	--	--	--	--	--	--	--	--	71,426
1947	--	--	--	--	--	--	--	--	--	--
1948	--	--	--	--	--	--	--	--	--	--
1949	(1)	--	34,800	43,320	--	--	--	--	¹ 19,622	97,742
1950	(1)	--	30,700	32,535	--	--	--	--	¹ 39,652	102,887
1951	(1)	--	45,800	36,862	--	--	--	--	¹ 20,320	102,982
1952	(1)	--	35,000	32,296	--	--	--	--	¹ 25,521	92,817
1953	(1)	--	47,900	39,237	1,085	--	--	--	¹ 27,819	116,041
1954	(1)	--	62,300	23,959	4,062	--	--	--	¹ 33,014	123,335
1955	990	--	49,642	32,563	6,243	--	--	--	30,530	119,968
1956	3,249	--	56,900	30,162	4,636	--	--	--	22,880	117,827
1957	8,594	--	56,934	19,445	1,790	--	--	--	18,145	104,908
1958	10,308	--	61,030	12,448	4,130	--	--	--	15,415	103,331
1959	8,731	--	73,329	13,002	5,793	--	--	--	35,021	135,876
1960	5,075	--	67,503	2,098	5,226	--	--	--	49,318	129,220
1961	6,622	--	56,706	7,786	5,136	--	--	--	20,759	97,009
1962	6,034	--	83,106	20,350	286	--	--	--	11,284	121,054
1963	8,633	--	85,000	22,762	56	--	--	--	5,950	122,401
1964	7,444	--	87,200	32,419	562	--	--	--	22,438	150,063
1965	19,004	60	99,400	28,986	116	--	--	--	2,019	149,585
1966	28,601	--	106,400	25,324	1,905	--	--	--	5,080	167,310
1967	23,083	--	121,300	38,495	793	400	1,158	3,921	5,479	189,150
1968	21,711	--	121,600	34,135	3,200	2,373	1,401	4,992	8,766	189,412
1969	28,241	--	103,890	18,250	874	2,750	6,536	7,148	16,434	167,689
1970	21,771	--	47,474	23,952	5	4,377	890	4,819	10,086	103,288
1971	36,134	100	77,075	43,016	7	3,280	7,205	2,644	13,129	169,461
1972	24,432	--	111,848	41,020	--	4,713	7,850	8,000	20,563	197,863

Source: USDA Forest Service, timber harvest reports, 1945-72.

¹1949-54 private and State combined.

Table 11.--*Installed 8-hour capacity of forest industry mills by class of mill, Okanogan County, Washington, 1972*

Class of mill	Number of mills	Total capacity per 8-hour shift
<i>Board feet (lumber tally)</i>		
Sawmill (installed capacity, board feet per 8-hour shift):		
Less than 80,000	3	67,000
80,000+	3	365,000
Total	6	432,000
<i>Square feet (3/8-inch basis)</i>		
Veneer and plywood mill	1	190,000

Source: Unpublished data collected by State of Washington Department of Natural Resources in its 1972 mill survey.

Table 12.--*Consumption of logs by class of mill and ownership, Okanogan County, Washington, 1972¹*
(In thousand board feet, Scribner scale)

Class of mill	Ownership origin					Total consumption
	National Forest	Indian	State	Private		
				Own	Other	
Sawmill (installed capacity, board feet per 8-hour shift):						
Less than 80,000	6,553	0	0	90	766	7,409
80,000+	74,791	10,759	7,173	5,977	18,536	117,236
Total	81,344	10,759	7,173	6,067	19,302	124,645
Veneer and plywood mill	18,830	7,703	5,135	4,280	6,847	42,795
All mills	100,174	18,462	12,308	10,347	26,149	167,440

Source: Unpublished data collected by State of Washington Department of Natural Resources in its 1972 mill survey.

Table 13.--Consumption of logs from old-growth and young-growth timber,
by class of mill, Okanogan County, Washington, 1972

(In thousand board feet, Scribner scale)

Class of mill	Old-growth timber ¹	Young-growth timber	Total
Sawmill (installed capacity, board feet/8-hour shift):			
Less than 80,000	6,025	1,384	7,409
80,000+	105,512	11,724	117,236
Total	111,537	13,108	124,645
Veneer and plywood mill	38,516	4,279	42,795
All mills	150,053	17,387	167,440

¹100+ years.

Source: Unpublished data collected by State of Washington
Department of Natural Resources in its 1972 mill survey.

Table 14.--*Flow of logs to and from Okanogan County, Washington, 1972*
(In thousand board feet, Scribner scale)

Item	County of origin			County of use			
	Okanogan	Chelan	Total volume of logs used in Okanogan County	Okanogan	Ferry	Stevens	Total volume of logs originating in Okanogan County
Logs used in Okanogan County	159,967	7,475	167,442	--	--	--	--
Logs originating in Okanogan County	--	--	--	159,967	11,720	563	172,250

Source: Unpublished data collected by State of Washington Department of Natural Resources in its 1972 mill survey.

Table 15.--*Volume of logs consumed in Okanogan County, Washington, by class of mill and species, 1972*
(In thousand board feet, Scribner scale)

Class of mill	Douglas-fir	Ponderosa pine	Engelmann spruce	Western larch	Total
Sawmill	48,240	65,357	2,178	8,870	124,645
Veneer and plywood	25,677	4,279	2,140	10,699	42,795
Total	73,917	69,636	4,318	19,569	167,440

Source: Unpublished data collected by State of Washington Department of Natural Resources in its 1972 mill survey.

Tree Species

Principal tree species found on the commercial forest land in Okanogan County include:

Softwoods:

- Douglas-fir (*Pseudotsuga menziesii*)
- Engelmann spruce (*Picea engelmannii*)
- Grand fir (*Abies grandis*)
- Lodgepole pine (*Pinus contorta*)
- Mountain hemlock (*Tsuga mertensiana*)
- Ponderosa pine (*Pinus ponderosa*)
- Subalpine fir (*Abies lasiocarpa*)
- Western hemlock (*Tsuga heterophylla*)
- Western larch (*Larix occidentalis*)
- Western redcedar (*Thuja plicata*)
- Western white pine (*Pinus monticola*)
- Whitebark pine (*Pinus albicaulis*)^{1 3}

Hardwoods:

- Black cottonwood (*Populus trichocarpa*)
- Quaking aspen (*Populus tremuloides*)
- Western paper birch (*Betula papyrifera* var. *commutata*)

^{1 3} Found only in high mountains, often on noncommercial forest land.

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APPENDIX 1

Timber Supply Projections

PUBLIC AND INDIAN LANDS

Timber supply projections for Federal, State, and Indian lands were made under the assumption that the policies and conditions that affect the cutting level will not change. A discussion follows.

Okanogan National Forest

The current 10-year programmed yield for the Okanogan National Forest is 881 million board feet (Scribner), or 88.1 million per year. The actual cut for a given year may be higher or lower than 88.1 million. In 1972 the cut was 111.8 million; the average for the past 5 years is 92.4 million. The total programmed yield of 88.1 million includes 72.7 to be tractor-logged and 15.4 to be cable-logged. Some recent timber sales have been logged by helicopter. Increasing use of helicopter is making it possible to get to timber already programmed for harvesting but not previously available without damaging other values. About 80 percent of the programmed yield for the current cutting cycle is from regeneration cutting, and 18 percent is from commercial thinning. The balance is mortality salvage. Forest fires on the Okanogan National Forest have burned over 20,000 acres since the most recent timber inventory.¹⁴ The Okanogan National Forest estimated that the allowable cut would be reduced by about 2 million board feet if the loss of timber growth by fire were considered. The forest decided not to reduce the cut at that time, because a reinventory of timber resources is planned for fiscal year 1976-77, and a new programmed yield will be calculated. For this report the present allowable cut has been projected to 1980 at its present level of 88.1 million board feet, then reduced by 2 million for the period

1980-2000, and by 2.1 million for 2000-2020 for losses by fire.

No increases in yields over those shown in the timber management plan were assumed, because of the lack of knowledge as to how stands in marginal arid regions such as Okanogan County respond to various management intensities.

The present allowable cut does not include lodgepole pine. An increased interest in lodgepole pine would allow the 107,298 acres of this type to be placed in the programmed yield category. According to the Okanogan National Forest timber management plan, this could increase the annual allowable cut by as much as 3.5 million board feet. However, lodgepole pine stands are remote, often in steep terrain, and on poor sites with short growing seasons. Logging would be costly because of the low per-acre volumes in lodgepole pine stands. There are also doubts that the present growth rate on some of the fragile sites could be maintained under a cutting program.

A number of factors have operated to keep timber yields relatively low. Some may be amenable to control in the future; others will probably have an increasing impact on yields.

Devastating fires have occurred and will probably continue. With the increasing use by recreationists, the greater intensity of roads, and more frequent entry into stands for management purposes, the chances of fires starting will be increased.

Insect and disease infestations have been common. Mistletoe is a problem in Douglas-fir, ponderosa pine, and western larch and tends to get worse as stands are opened up in logging or other activities. The larch casebearer has invaded the forest since the latest inventory. It doesn't usually kill trees outright but affects growth. Total impact may not be evident for years. There is some concern that

¹⁴There were four major fires: Forks (1970), Fourth of July Mountain (1968), Mitchell Creek (1970), and Honeymoon (1970).

the tussock moth may strike. It caused some damage on the Colville Indian Reservation in Ferry County immediately east of Okanogan County but was checked by DDT spraying in the summer of 1974. The spruce budworm has infested an extensive area of Douglas-fir type. A survey in September 1974 showed that visible defoliation had doubled since 1973 and that top-killing had begun due to repeated defoliation. Mortality has been light but could become serious if the infestation persists. Growth has been reduced an unknown but probably significant amount, since the budworm attacks young and old trees alike.

Additional land may be set aside for nontimber use; more forest land will be physically converted to roads, powerlines, and other developments. The forest currently holds eight applications for geothermal exploration, and in response to the renewed interest in minerals is reexamining about 800 mining claims. The new cross-State highway may bring in more recreationists and increase the pressure for nontimber use of the forest. Private land near the National Forest boundary is starting to sell for recreational development; this may affect timber cutting practices and reduce yields.

Colville Indian Reservation

Though there is no allowable cut as such for that portion of the Colville Indian Reservation in Okanogan County, in practice the cut has averaged about 35 million board feet over the past several years. The allowable cut for the entire reservation is based on present management intensity. Under more intensive management, an increase in annual cut could be expected, though some of the factors that have reduced yields on other lands may also affect reservation forests—mistletoe, spruce budworm, fire, and poor regeneration, for example.

State Lands

The allowable cut of 17.4 million board feet is not expected to change before the year 2000. The total inventory is expected to be reduced as the old stands on State land are

cut for the first time. No quantitative estimate of the volume reduction is available. It is assumed that the 17.4 million board-foot annual cut can be sustained to the year 2020. The State's policy is to manage its Okanogan County lands as part of its total investment opportunity. In keeping with their mandate to maximize sustained economic benefits to the trusts to which the land is dedicated, they will invest forestry money on higher site lands elsewhere in the State. For this reason an increase in yields under present levels of demand and technology seems very unlikely.

PRIVATE LANDS

The net annual growth—which is gross growth less mortality for all private lands as estimated from plots originally established in 1958-59 and remeasured in 1967—was 6.1 million board feet (Scribner). This gives an average of 20.4 board feet per acre per year, or about 7 cubic feet per acre per year, extremely low even for arid Okanogan County. For all of central Washington, the net annual growth rate averaged 113 board feet, or 28 cubic feet, per acre. Gross growth for private lands was 21.3 million board feet, giving an average of 71.2 board feet or about 24 cubic feet per acre per year, over three times the net growth rate.

The high mortality rate which resulted in a low net growth during the remeasurement period was due largely to a forest fire that burned an unusually heavy stand of timber, and to old-growth larch trees dying from mistletoe. One might ask if the estimates of fire losses and larch mortality, both much greater on private lands than on public lands, are merely the results of a sampling accident, or could be logically explained as consequences of past events and natural phenomena.

The area burned and frequency of fires seem reasonable. The fire season is longer in the drier, lower elevations where private lands are. Stands are disturbed more often. There are probably more chances for fires to start, especially in areas of residential development and where there is continuous activity by people and machinery.

The heavy larch mortality by mistletoe might be the logical result of heavy logging, roadbuilding, and other stand-opening activities on private lands, which tend to promote the spread of light-demanding mistletoe. Furthermore, it may be true that larch mistletoe is naturally more virulent on the poorer forest sites in the lower elevations, in much the same way that ponderosa pine mistletoe, according to Daubenmire (1961), is found mainly in the habitat types associated with the poorest sites in the lower elevations of eastern Washington and northern Idaho.

For projecting timber supplies on private lands, the net growth of 6.1 million board feet was adjusted to 16.0 million by reducing the mortality to an expected future level. The future level of mortality was derived by assuming that future fires will burn average acres of timber instead of heavier stands, and that the larch mortality which has been generally confined to old trees will decrease as the old-growth trees are cut or die.

At first glance one might conclude that the 16 million board feet of growth would indefinitely maintain the inventory if 16 million feet were cut annually. This is not the case, because the stands with the heavier volumes—which are also the stands most likely to be logged first—are also the stands on which growth is occurring. This is true because on private lands there are essentially no old-growth stands that have ceased growing, and many areas that have been logged have not restocked well. About 80 percent of the conifer volume and 65 percent of the conifer growth are concentrated on less than 40 percent of the area, and more than 60 percent of the area is nonstocked to poorly stocked (33 percent is nonstocked).

Not only is stocking poor, but many stands are made up of diseased, damaged, and poorly formed trees. Nearly half of the medium- and well-stocked stands are infected with mistletoe. Douglas-fir and ponderosa pine, the two major species, as well as larch, are affected, which means that management opportunities such as thinning are limited without some kind of mistletoe control. Many trees are deformed by porcupines, other

animals, and insects; damaged in logging, or growing in open stands on severe sites; and are of limited merchantability with large limbs clear to the ground.

Because of all these factors it was assumed that growth would not increase in the near future. Holding growth level for each volume-per-acre stand and cutting the larger volume stands first, it was estimated that a cutting rate of 16 million per year would reduce the total inventory 17 percent by the year 2000. Growth and inventory will start building up, though, in stands that now have low volumes so that by the year 2020 the total reduction in inventory will be only 14 percent of the 1973 level.

Since timber will become increasingly harder to get as the heavier stands are logged, a cutting rate somewhat related to the inventory level was assumed. For the period 1980-2000, the expected timber supplies from private lands were reduced to 15.0 million board feet; and for 2000-2020, they were reduced to 13.3.

Another factor that will probably reduce private timber yields somewhat will be the loss of commercial forest land to nonforest uses, such as road, powerline, and reservoir construction, grazing, and residential and recreational development. Since most nonforest developments do not take place without some timber cutting, the timber harvest levels projected to 2020 were not reduced.

APPENDIX 2

Definition of Terms

Land Area

Total land area is that reported by the Bureau of the Census and includes dry land and land temporarily or partially covered by water (such as marshes, swamps, and river flood plains), streams, sloughs, and canals less than 1/8-mile wide, and lakes, reservoirs, and ponds less than 40 acres in area.

Forest land is at least 16.7 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

Nonforest land has never supported forests or was formerly forested and is currently developed for nonforest uses. Included are areas used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and their right-of-way clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Forest-Land Classes

Adverse location areas are productive forest land, often having merchantable stands of timber, but which, because of physical location, are impossible or difficult to harvest.

Commercial forest land is capable of producing at least 20 cubic feet per acre per year of industrial wood on a continuous basis and not withdrawn from timber utilization. Includes areas that are accessible and operable as well as areas that are currently inaccessible or inoperable. In Okanogan County forest land was classified as commercial on the basis of site index, unless steepness or rockiness precluded management for continuous crops of wood. For example, Douglas-fir site index 50 or lower, and ponderosa pine site index 40

or lower, indicate a productivity of less than 20 cubic feet per acre per year. Land for which average site index was higher than these was classified as commercial forest.

Noncommercial forest land includes unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Productive-reserved public forest land is withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualified as commercial forest land. Also included are forest areas managed exclusively for Christmas tree production.

Unproductive forest land is incapable of yielding crops of industrial wood products because of adverse site conditions such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking, considering both size and spacing.

Tree Classes—Growing Stock

Sawtimber trees, poletimber trees, saplings, and seedlings are included; that is, all live trees except cull trees.

Sawtimber trees are 11.0-inch d.b.h. and larger, live, and of commercial species. Softwood trees must contain at least one 12-foot saw log with a top diameter not less than 6 inches inside bark; hardwood trees must contain at least one 8-foot saw log with a top diameter not less than 8 inches inside bark. At least 25 percent of the board-foot volume in a tree must be free of defect for either softwoods or hardwoods.

Poletimber trees are 5.0- to 10.9-inch d.b.h., live, and of commercial species, not less than 50 percent sound on a cubic-foot basis, and with no disease, defects, or deformities which are likely to prevent their becoming growing-stock sawtimber trees.

Sapling and seedling trees are less than 5.0-inch d.b.h., live, of commercial species, and have no disease, defects, or deformities which are likely to prevent their becoming growing-stock poletimber trees.

Stand-Size Classes

Sawtimber stands are at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees and with sawtimber stocking equal to or greater than poletimber stocking. In *large sawtimber stands*, the majority of the sawtimber stocking is in trees 21.0 inches and larger at breast height. In *small sawtimber stands*, the majority of the sawtimber stocking is in trees from 11.0 to 20.9 inches at breast height.

Poletimber stands are at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

Sapling and seedling stands are at least 16.7 percent stocked with growing-stock trees, with more than half of this stocking in saplings, seedlings, or both.

Nonstocked areas of commercial forest land are less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is an expression of the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified stand-

ards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range which represents full site occupancy. This is called 100-percent stocking. The upper limit to full stocking has been set at 132 percent. Sites with less than 100-percent stocking represent understocking with less than full site occupancy. Overstocking is characterized by sites that have over 132-percent stocking.

Age

Stand age is based upon growing-stock stocking. In order for a stand to be even-aged, a majority of the growing-stock stocking must be in two adjacent age classes. Stands that do not meet this criterion are classified as uneven-aged.

Timber Volume

Live Sawtimber

Net volume of live sawtimber trees of commercial species is measured in board feet. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner rule is the common board-foot log rule used locally in determining volume of sawtimber. Scribner volume is measured in terms of 16-foot logs.

International 1/4-inch rule is the standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Growing Stock

Net volume of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark is measured in cubic feet. Net volume equals gross volume less deduction for rot and missing bole sections.

Net Annual Growth

The net increase in volume of trees during a specified year is included. (Components of net annual growth include: (a) the increment in net volume of trees at the beginning of the specified year surviving to the year's end, plus (b) the net volume of trees reaching the size class during the year, minus (c) the net volume of trees that died during the year, minus (d) the net volume of trees that became culls during the year.)

Ownership Classes

National Forest lands are Federal lands which have been designated by Executive order or statute as National Forests or purchase units and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones title III lands.

Other public lands are Federal lands other than National Forests, including lands admin-

istered by the Bureau of Land Management and miscellaneous Federal agencies, and lands owned by States, counties, and local public agencies or lands leased by these governmental units for more than 50 years.

Indian lands belong to Indians, either tribal, or individual allotments, and are managed by the Bureau of Indian Affairs for the Indian owners under Secretarial Regulations (25 CFR 141) promulgated by authority of the Act of June 25, 1910, as amended by the Act of June 18, 1934; the Act of April 30, 1964; and others.

Forest industry lands are owned by companies or individuals, other than Indians, operating wood-using plants.

Farmer-owned lands are owned by operators of farms, other than Indians.

Miscellaneous private lands are privately owned other than forest industry or farmer-owned lands, or Indian-owned lands.