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COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
JAN 71 J BOOTH, R DAWSON, A M GRANO

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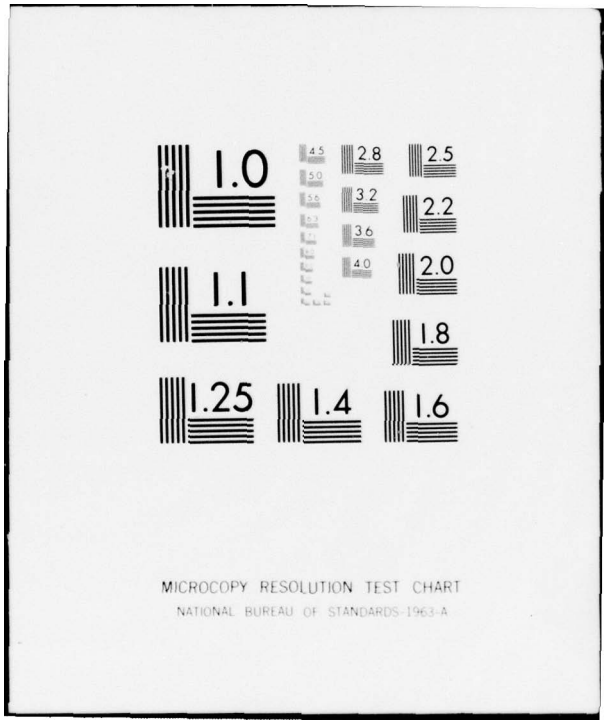
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ECONOM

& PROJE

This appendix is one of a series making up the complete Columbia-North Pacific Region Framework Study on water and related lands. The results of the study are contained in the several documents as shown below:

Main Report

Brochure Report

Appendices

I. History of Study

II. The Region

III. Legal & Administrative Background

IV. Land & Mineral Resources

V. Water Resources

VI. Economic Base & Projections

VII. Flood Control

VIII. Land Measures & Watershed Protection

IX. Irrigation

X. Navigation

XI. Municipal & Industrial Water Supply

XII. Water Quality & Pollution Control

XIII. Recreation

XIV. Fish & Wildlife

XV. Electric Power

XVI. Comprehensive Framework Plans

Pacific Northwest River Basins Commission
1 Columbia River
Vancouver, Washington

(1)

Economic Base and Projections

(6) APPENDIX VI

Columbia-North Pacific Region Comprehensive Framework Study of Water and Related Lands. Appendix VI. Economic Base and Projections,

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Prepared by
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APPENDIX VI
Economic Base & Projections

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This appendix to the Columbia-North Pacific Region Framework Report was prepared at field level under the auspices of the Pacific Northwest River Basins Commission. It is subject to review by the interested Federal agencies at the departmental level, by the Governors of the affected States, and by the Water Resources Council prior to its transmittal to the President of the United States for his review and ultimate transmittal to the Congress for its consideration.

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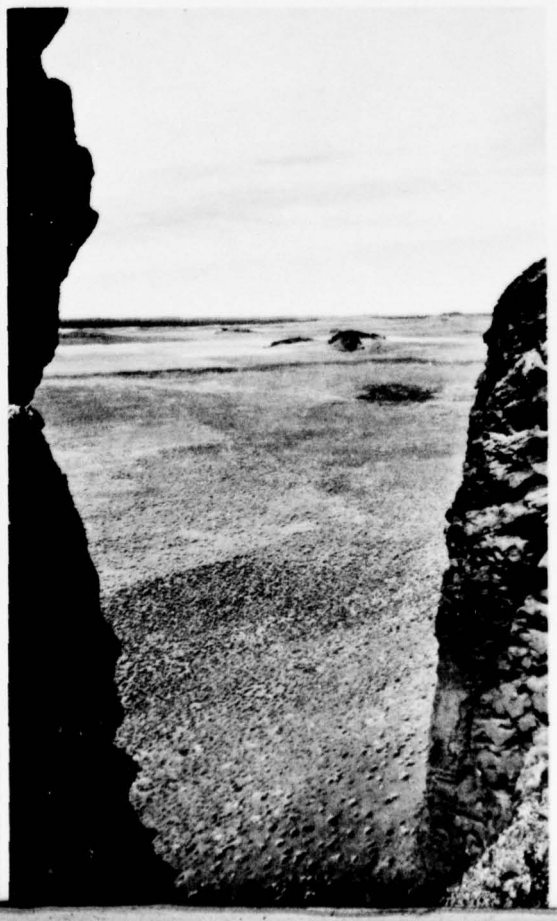

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PURPOSE AND SCOPE

The Economic Base and Projections Appendix is one of the five major components of the Columbia-North Pacific Framework Study. The purpose of this appendix is to provide basic inputs for the evaluation of present and future needs for water and related land resources and the formulation of framework plans for the management, use, and development of these resources. In addition, the report provides a basis for evaluation of the impacts of alternative resource developments on economic activity. The major elements of the study are as follows:

(1) Inventory and analysis of economic activity and population in the study area, its linkage with related economic activity exogenous to the region, and analysis of significant relationships between economic activity and the quality and quantity of available natural resources, and

(2) Projections of economic activity and population in the region based upon specific assumptions of national economic growth and the availability and quality of resources within and outside the geographic area of concern.

The Columbia-North Pacific Region, as defined for purposes of this water resource study, occupies about 274,000 square miles of the northwestern corner of the conterminous United States, commonly known as the Pacific Northwest. The region includes all of the Columbia River Basin in the United States, those basins in Oregon and Washington draining into the Pacific Ocean, the Straits of Georgia or Juan de Fuca within Washington, and that part of the Great Basin lying in Oregon. Some 39,500 square miles of the upper Columbia River drainage lie in Canada and are not included in the study area.

The region encompasses all of the State of Washington, most of Oregon and Idaho, that part of Montana west of the Continental Divide, and portions of Utah, Wyoming, and Nevada that are drained by tributaries of the Columbia River. The area amounts to almost 8 percent of the conterminous United States. Of the 20 regions slated for study under the Water Resources Planning Act, it is the third largest, being exceeded only by the Missouri and Arkansas-White-Red.

On the east, the area is bounded by the Continental Divide of the Rocky Mountains, on the north by the Canadian border, and on

the west by the Pacific Ocean. Its southern boundary is the southern rim of the Snake River Basin and the Oregon State line, except the Oregon portion of the Goose Lake, Klamath, and Smith River drainages which are excluded.

The boundaries for the Economic Base Study, together with the hydrologic subregion boundaries, are shown in figure 1. The economic study area is comprised of 126 counties located in Idaho, Oregon, Washington, Western Montana, and Wyoming. These counties have been divided into 12 subregions, which approximate the hydrological subregions for study purposes. There is, therefore, no major economic significance to the subregion delineations. Data and information utilized in the economic base study, as well as projected data, are based on county data, unless otherwise specified.

RELATIONSHIP TO OTHER PARTS OF THE FRAMEWORK STUDY

Appendix VI, Economic Base and Projections, is one of three basic appendices used in preparing the nine functional appendices, the comprehensive framework plan, and the main reports. The other two basic appendices are Land and Mineral Resources, and Water Resources.

The economic base study provides a basis for the appraisal of current and long-term problems and aids in assessing the need for water and related land resources. The study provides data concerning past and present economic activity in the region and subregions, and projections of population growth and economic development for the years 1980, 2000, and 2020. These economic and demographic projections will be translated into the demands and/or needs for water and related land resources. The translation into needs is being accomplished in the nine functional appendices. Consequently, the economic base study, the other two basic appendices, and the nine functional appendices will provide the inputs for the formulation of framework plans that will serve as a broad guide for the management, use, and development of the region's water and related land resources to meet short and long-term needs.

METHODS OF ANALYSIS

Much of the analysis and projections incorporated in this study has been prepared by the Office of Business Economics of the Department of Commerce and the Economic Research Service and Forest Service of the Department of Agriculture in accordance with an agreement executed by the Water Resources Council.

COLUMBIA - NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

THE REGION

1968

FIGURE 1

However, other agencies participating in the study have made substantial contributions to the study, utilizing, to the extent possible, the numerous economic studies which are underway or completed by the various private, state, and federal agencies and institutions (especially the Bonneville Power Administration Economic Base Study). Description of the methods of analysis used in various portions of the study is included in later sections of this report.

Generally, the projections for the Columbia-North Pacific Region and subregions were developed as part of a national study which made national projections which were then disaggregated into small area projections. 1/ The regional projections were developed by first projecting income and employment, and then population, as follows:

1. Income and employment: The country was divided into 167 economic areas consisting of urban centers and their surrounding areas. Historical series of income and employment were developed for these areas from county data. The components of income and employment for each of these areas were then expressed as percents of the corresponding national total, and historical trends in these percentage shares were analyzed and projected. These component projections were compared and adjustments were made as necessary, then they were applied to the national projections which had been independently developed to arrive at economic area projections. The economic area projections were then apportioned among their constituent counties and regrouped to obtain projections for water resource areas (subregions).

2. Population: Economic area population was assumed to be a function of area employment plus an adjustment to take into account the fact that selected areas attract an especially large number of retired persons. Historical population/employment ratios for each area were adjusted for full employment conditions and trends in these ratios were projected to approach the projected national average ratio. Application of these ratios to area employment projections together with the adjustment for migration of retirees yielded economic area population projections which were then re-allocated to water resource areas as for income and employment.

1/ A detailed description of the methodological procedures and assumptions in the National-Regional projections program can be found in the following publications: (64), (67), (74).

ASSUMPTIONS

Certain assumptions regarding the probable direction and levels of national economic growth must necessarily be adopted for general guidance in any set of projections. These anticipated trends and conditions set the broad framework of economic development potential of sub-national areas. While all assumptions may not be fully realized, the specific identification of these constraints will permit adjustments to be made as conditions change.

The population and economy of the nation will continue to grow during the projection period. National population totals used are from the Series C projections published by the Bureau of the Census in Projections of the Population of the United States by Age and Sex: 1964 to 1985 with Extensions to 2010, Population Estimates Series P-25, No. 286, July 1964. The 2010 figures in this publication were extended to 2020 in accordance with the projected average rate of growth from 1960 to 2010.

Nationwide labor force figures were calculated by applying to projected population the labor force participation rates. Total labor force is assumed to increase at a rate of 1.4 percent as compared to a population rise of 1.3 percent.

National totals of all-industry employment were derived from the labor force projections by assuming a four percent rate of unemployment in the target years.

Total gross national product was derived as the product of projected employment and projected productivity per man. The derived rate of growth in gross national product over the span 1965 to 2020 is four percent per year. Hours worked per person in the private economy are assumed to decline from an average of 2020 in year 1965 to 1749 in 2020.

National personal income was derived from the projected gross national product on the basis of past trends in the relationship between the two.

National totals of employment and of personal income by industry were derived from the projected totals of gross national product and personal income on the basis of 1947-63 trends of productivity, industrial structure of national output, and composition of income. These were allocated by industry to the regions and from them was derived regional population.

The explicit assumptions are:

1. Sufficient quantities of water of acceptable quality will be available by timely development to avoid being a constraint to economic growth.

2. The Federal Government, as a matter of national policy, will actively support programs designed to stimulate economic growth.

3. There will be no general war or any appreciable cessation of the cold war throughout the period to 1980. Expenditures on national security will continue to account for approximately 10 percent of gross national product.

4. There will be a continued relaxation of trade tariffs and quotas accompanied by an expansion in international commerce.

Table 1 contains the summary national totals used in developing the industrial breakdowns required for the regional disaggregations.

A comparison of the economic projections developed for this appendix with respect to assumptions and methodology are compared with the two Type 2 studies conducted in the Puget Sound and Willamette Subregions in an Addendum starting on page 183. In addition to detailed discussions concerning the assumptions and methodology of each study, the Addendum shows projected differences for total employment, population, and per capita incomes.

Table 1 - Selected National Aggregates

Year	Total Population (Census) (Thou.)	Population 14 Years Old and Over (Census) (Thou.)	Labor Force Participation Rates (Computed)	Labor Force (BLS) (Thou.)	Civilian Labor Force (BLS) (Thou.)	Unemployment Rate (BLS)	Civilian Employment (BLS) (Thou.)
1950	152,271	113,438	.571	64,749	63,099	.053	59,957
1955	165,931	119,440	.577	68,896	65,848	.044	63,193
1960	180,684	127,335	.574	73,126	70,612	.056	66,681
1965	194,592	138,261	.567	78,357	75,635	.046	72,179
Rate 1950-1965	1.6%	1.3%		1.3%	1.2%		1.3%
1980	235,212 1/	174,234 1/	.578	100,707	98,107	.040	94,183
2000	307,803 1/	227,470 1/	.583	132,615	130,015	.040	124,814
2020	398,642 1/	294,956 1/	.583	171,959	169,359	.040	162,585
Rate 1965-2020	1.3%	1.4%		1.4%	1.5%		1.5%

(continued)

Table 1 - Selected National Aggregates -- Cont'd.

Year	Civilian Government Employment (BLS) (Thou.)	Civilian Private Employment (BLS) (Thou.)	Private Economy Hours per Man Year (BLS)	Private Economy Product per Man Hour (Computed) (1958 dol.)	Private Economy Gross Product (Computed) (Mil.) (1958 dol.)	Gross National Product (Computed) (Mil.) (1958 dol.)
1950	5,817	54,140	2,125	2.79	319,410	355,288
1955	6,838	56,355	2,091	3.34	392,007	437,963
1960	7,943	58,738	2,026	3.68	438,523	487,682
1965	9,623	62,556	2,020	4.42	558,671	616,659
Rate 1950-1965	3.4%	1.0%	-0.3%	3.1%	3.8%	3.7%
1980	14,365	79,818	1,949	6.89	1,071,474	1,151,794
2000	22,232	102,582	1,850	12.44	2,361,517	2,479,538
2020	33,122	129,463	1,749	22.47	5,087,660	5,257,745
Rate 1965-2020	2.3%	1.3%	-0.26%	3.0%	4.1%	4.0%

(continued)

Table 1 - Selected National Aggregates -- Cont'd.

Year	Total Manpower Civilian Plus Military (BLS) (Thou.)	Product per Man (Computed) (1958 dol.)	Product per Capita (Computed) (1958 dol.)	Total Personal Income (OBE) (Mil.) (1958 dol.)	Personal Income per Capita (OBE) (1958 dol.)	Domestic Personal Income (OBE) (Mil.) (1958 dol.)	Domestic Earnings (OBE) (Mil.) (1958 dol.)
1950	61,607	5,767	2,333	274,571	1,803	272,820	225,084
1955	66,241	6,612	2,639	335,010	2,019	332,108	277,573
1960	69,195	7,048	2,699	389,653	2,157	387,447	317,575
1965	74,901	8,233	3,169	494,719	2,542	491,979	396,867
Rate 1950-1965	1.3%	2.4%	2.1%	4.0%	2.3%	4.0%	3.9%
1980	96,783	11,901	4,897	967,104	4,112	963,000	750,237
2000	127,414	19,460	8,056	2,204,086	7,161	2,196,684	1,672,112
2020	165,185	31,829	13,189	4,947,748	12,412	4,934,146	3,721,948
Rate 1965-2020	1.4%	2.5%	2.6%	4.3%	2.9%	4.3%	4.2%

1/ Except for these figures, all projected values are those of the Office of Business Economics.
Source: U.S. Department of Commerce, Office of Business Economics.

POPULATION CHARACTERISTICS

CHARACTERISTICS OF POPULATION AND THE ECONOMY

POPULATION

Total

The Columbia-North Pacific Region had a total population of slightly over 5,426,000 in 1960 (table 2). This was an increase of more than 56 percent over the 1940 population. However, the rate of growth was not uniform throughout the time period. Between 1940 and 1950 the population increased by 33 percent, but growth was only 18 percent between 1950 and 1960. These figures compare with national rates of growth of 14 percent for the first decade and 19 percent for the second. These relationships are illustrated in figure 2.

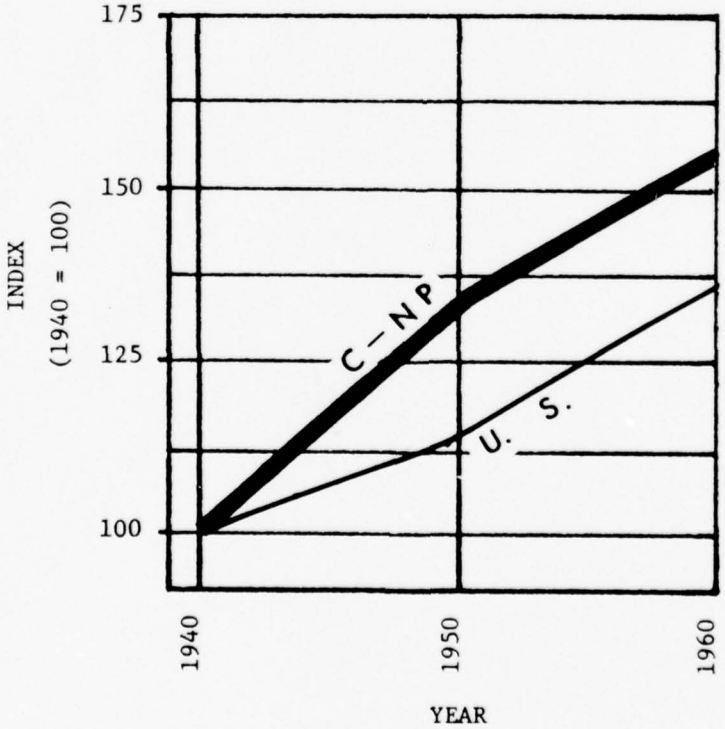


FIGURE 2. Index of Population Growth, United States and Columbia-North Pacific Region.

Table 2 - Population, Columbia-North Pacific Region and Subregions, and United States, 1900 to 1965

Subregion	1900	1910	1920	1930	1940	1950	1960	1965
				(Thousands)				
1	180.2	326.1	361.8	378.0	417.4	489.4	563.7	595.1
2	45.9	109.6	112.6	112.0	130.1	157.4	193.6	198.6
3	23.2	68.2	92.4	106.5	131.3	209.3	227.6	236.7
4	45.6	109.0	184.4	187.8	217.8	242.5	277.2	302.0
5	56.0	106.3	130.9	136.4	178.3	215.3	252.4	268.2
6	96.1	131.7	132.8	130.3	137.3	148.9	156.0	163.3
7	86.6	123.5	128.8	130.1	143.2	184.9	198.7	210.5
8	47.2	87.6	101.2	139.1	161.3	214.0	224.5	240.1
9	233.3	416.4	496.3	609.9	691.2	992.4	1,168.9	1,338.9
10	89.9	151.1	172.2	215.8	235.6	328.8	381.4	405.5
11	264.5	607.2	772.5	909.9	1,007.1	1,418.4	1,768.1	1,904.1
12	5.4	8.7	8.0	10.8	11.7	12.8	13.9	13.3
C-NP	1,174.0	2,245.3	2,693.9	3,066.4	3,462.3	4,614.0	5,426.1	5,876.1
				(Millions)				
U.S.	76.1	92.4	106.5	123.2	132.2	151.3	179.3	194.0

Source: Estimated from Census of Population.

Although a rate of growth slightly less than the national average was the general condition for the Columbia-North Pacific Region from 1950 to 1960, there were two exceptions. Subregions 2 and 11 both experienced larger percentage increases than the national average. The increase in subregion 11 (Puget Sound) is typical of the population trends for such industrial centers. Subregion 2 is a different situation. It is primarily a rural area containing relatively small agricultural communities. It is areas such as these that generally have not kept pace proportionately with national increases in population. However, the whole subregion experienced a 23 percent increase in population between 1950 and 1960. The increase was not uniform throughout the subregion. That part of the subregion contained in the Columbia Basin irrigation development project experienced a 114 percent increase (77). The remainder of the subregion had a net decrease in population.

The distribution of population within the region by urban, rural, and rural non-farm classifications has closely followed the national pattern. The trend has generally been an increase in urban, a decrease in rural-farm, and on the average, a relatively stable rural non-farm population. Comparisons of these trends are illustrated in figure 3. Detailed data on population characteristics of the region are contained in table 3. Approximately 61 percent of the population in the region is concentrated west of the Cascades (figure 4).

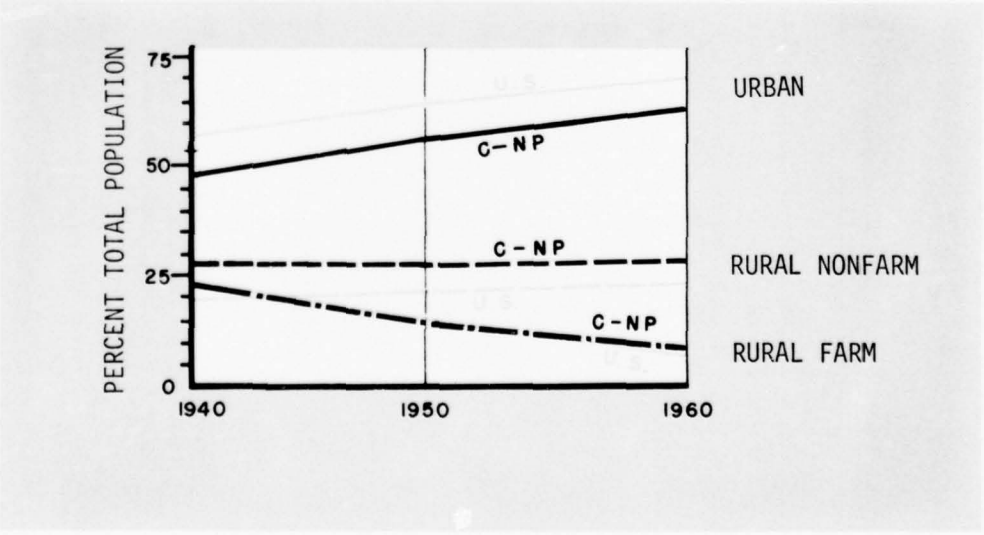
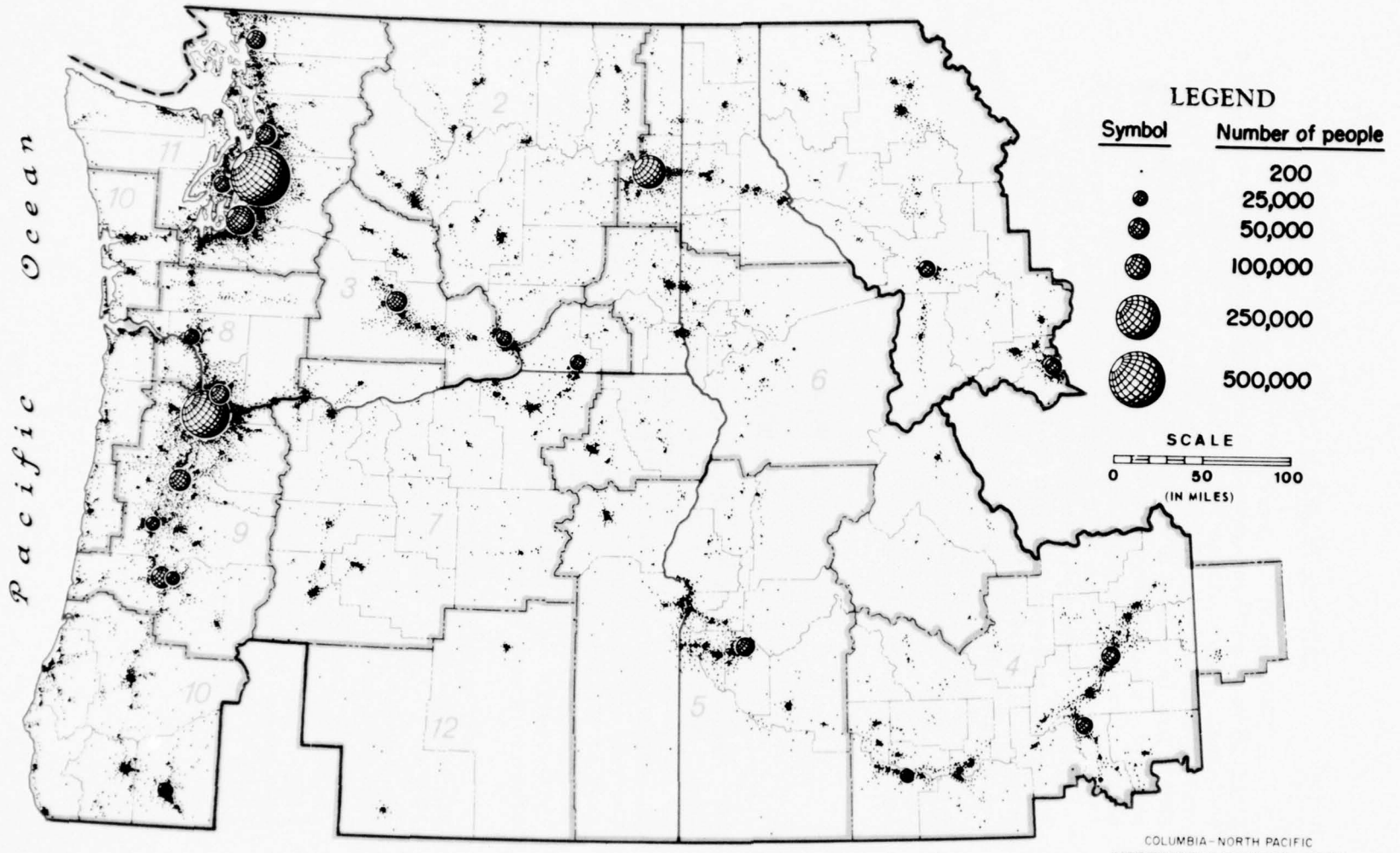


Figure 3. Percent Urban, Rural Non-Farm and Rural Farm of Total Population, United States and Columbia-North Pacific Region.

Table 3 - Population Characteristics 1940, 1950 and 1960, Columbia-North Pacific Region and Subregions

Item	POPULATION													
			SUBREGIONS											
	U.S. 1/	C-NP	1	2	3	4	5	6	7	8	9	10	11	12
1940 Total	131,669,235	3,462,344	417,414	130,130	131,302	217,772	178,305	137,338	143,194	161,290	691,204	235,612	1,007,116	11,667
Urban	74,423,702	1,684,723	225,139	22,110	36,848	72,137	68,632	34,695	49,549	58,930	403,387	89,593	621,137	2,566
% of Total	57	49	54	17	28	33	38	25	35	36	58	38	62	22
Rural Farm	30,216,188	812,736	81,140	50,557	46,666	92,049	66,983	51,733	47,751	51,113	130,522	57,679	133,114	3,429
% of Total	23	23	19	39	36	42	38	38	33	32	19	24	13	29
Rural Nonfarm	27,029,385	964,885	111,135	57,463	47,788	53,586	42,690	50,910	45,894	51,247	157,295	88,340	252,865	5,672
% of Total	20	28	27	44	36	25	24	37	32	32	23	38	25	49
1950 Total	150,697,361	4,614,026	489,391	157,388	209,328	242,522	215,258	148,850	184,891	214,021	992,387	328,806	1,418,422	12,762
% Change from 1940	14	33	17	21	59	11	21	8	29	33	44	40	41	9
Urban	96,467,686	2,631,877	299,385	45,429	109,873	99,285	102,503	62,595	74,808	93,768	633,202	115,424	989,681	5,924
% of Total	64	57	61	29	52	41	47	42	41	44	64	35	70	46
Rural Farm	23,048,350	682,569	56,108	42,927	43,906	77,964	61,717	37,147	40,947	43,643	116,548	50,084	108,433	3,145
% of Total	15	15	12	27	21	32	29	25	22	20	12	15	8	25
Rural Nonfarm	31,181,325	1,299,580	133,898	69,032	55,549	65,273	51,038	49,108	69,136	76,610	242,637	163,298	320,308	3,693
% of Total	21	28	27	44	27	27	24	33	37	36	24	50	22	29
1960 Total	179,325,671	5,426,108	563,748	193,594	227,649	277,249	252,430	155,991	198,665	224,480	1,168,899	381,384	1,768,117	13,902
% Change from 1950	19	18	15	23	9	14	17	5	7	5	18	16	25	9
Urban	125,283,783	3,429,657	362,318	68,319	123,430	132,169	131,993	74,031	89,651	105,829	858,620	152,394	1,324,120	6,783
% of Total	70	63	65	35	54	48	52	48	45	47	73	40	75	49
Rural Farm	13,444,898	443,320	36,319	35,732	32,602	69,455	47,869	26,615	28,513	20,054	68,982	27,164	47,860	2,155
% of Total	7	8	6	18	14	25	19	17	14	9	6	7	3	16
Rural Nonfarm	40,596,990	1,553,131	165,111	89,543	71,617	75,625	72,568	55,345	80,501	98,597	241,297	201,826	396,137	4,964
% of Total	23	29	29	47	32	27	29	35	41	44	21	53	22	35

1/ Data for the United States for years 1940 and 1950 exclude Alaska and Hawaii.
Source: Census of Population.



SOURCE: North Pacific Division, U. S. Army, Corps of Engineers. Adapted from population map prepared by Pacific Power and Light Company for Battelle Memorial Institute, The Pacific Northwest, 1967.

COLUMBIA-NORTH PACIFIC
COMPREHENSIVE FRAMEWORK STUDY

1960 POPULATION

THE REGION

FIGURE 4

Standard Metropolitan Statistical Areas

In 1940, about 44 percent of the population of the region lived in metropolitan areas denoted by the Bureau of the Census as Standard Metropolitan Statistical Areas (SMSA's). By 1960, the proportion of the regional population living within SMSA's had increased to nearly 50 percent. A comparison of rates of growth shows the SMSA's to be growing considerably faster than the remainder of the region.

As was reported earlier, the total region experienced a 33 percent increase in population between 1940 and 1950. Breaking this down, the SMSA's had an increase of nearly 44 percent for the same period while the increase in the remainder of the region was about 25 percent. These relative positions held through the following decade but with lower rates for the SMSA's, the remainder of the region, and for the region in total. Detailed statistics are presented in table 4.

ECONOMY

Employment

There were 1.98 million persons employed in the region in 1960. This compares with 1.73 million in 1950 and 1.19 million in 1940. The level of employment was quite stable, amounting to slightly over one-third of the population in each instance. The regional employment level followed a pattern very close to that of the nation during this period. Figure 5 compares employment growth rates of the region and nation. The stability exhibited in the general level of employment has not been present in some industries.

Manufacturing within the region has shown a large increase in employment from about 230,000 in 1940 to about 447,000 in 1960. Retail trade has increased from 184,000 in 1940 to 309,000 in 1960. Professional services have more than doubled during this period. Agriculture, on the other hand, has decreased from about 221,000 in 1940 to 156,000 in 1960 with the bulk of the decrease taking place between 1950 and 1960. The decrease in agricultural employment has been caused in part by increased mechanization and improved farming methods resulting in less demand for farm labor. Figure 6 illustrates employment trends for some selected major industries. Tables 5, 6, and 7 present detailed employment statistics by subregion.

Table 4 - Population of Standard Metropolitan Statistical Areas in the Columbia-North Pacific Region, 1940, 1950, and 1960

Area	Population				
	1940	% Change From 1940	1950	% Change From 1950	1960
Total Columbia-N. Pacific	3,462,344	33.3	4,614,026	17.6	5,426,108
Columbia-N. Pacific (excluding SMSA's)	1,951,506	25.1	2,441,412	12.0	2,734,185
SMSA's 1/					
Eugene 2/	69,096	82.1	125,776	29.5	162,890
Portland	501,275	40.6	704,829	16.6	821,897
Seattle	593,734	42.2	844,572	31.1	1,107,213
Spokane	182,081	51.5	275,876	16.6	321,590
Tacoma	164,652	34.6	221,561	25.6	278,333
Subtotal (SMSA's)	1,510,838	43.8	2,172,614	23.9	2,691,923
% of Total C-NP	43.6	--	47.1	--	49.6

1/ SMSA boundaries for 1940 were adjusted to correspond with the county boundaries delineating the 1950 and 1960 SMSA's.

2/ Eugene was not classified as an SMSA in 1940 but the area figures are included here for comparison.

Source: Census of Population.

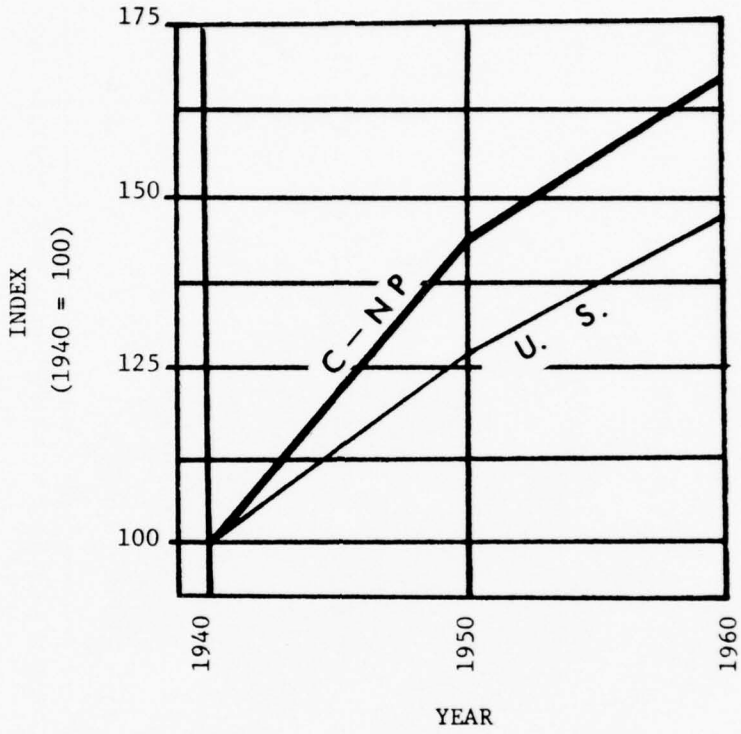


FIGURE 5. Employment Growth, United States and Columbia-North Pacific Region.

Personal Income and Earnings

In 1962, the major sources of income in the region were wages and salaries (65 percent), proprietors (13 percent), property (13 percent), transfer payments (six percent), and other (three percent). Manufacturing is the major source of income in the form of wages and salaries, with government, services, and trade also important. Total personal income in the region increased from $4.6 billion in 1940, to $13 billion in 1962, as measured in constant 1958 dollars. This amounted to an increase of 180 percent over the period compared with a national increase of 144 percent, the difference being due largely to more rapid population growth.

Per capita income in the region has compared favorably with the national average. Regional per capita income exceeded the national level each of the census years 1940,

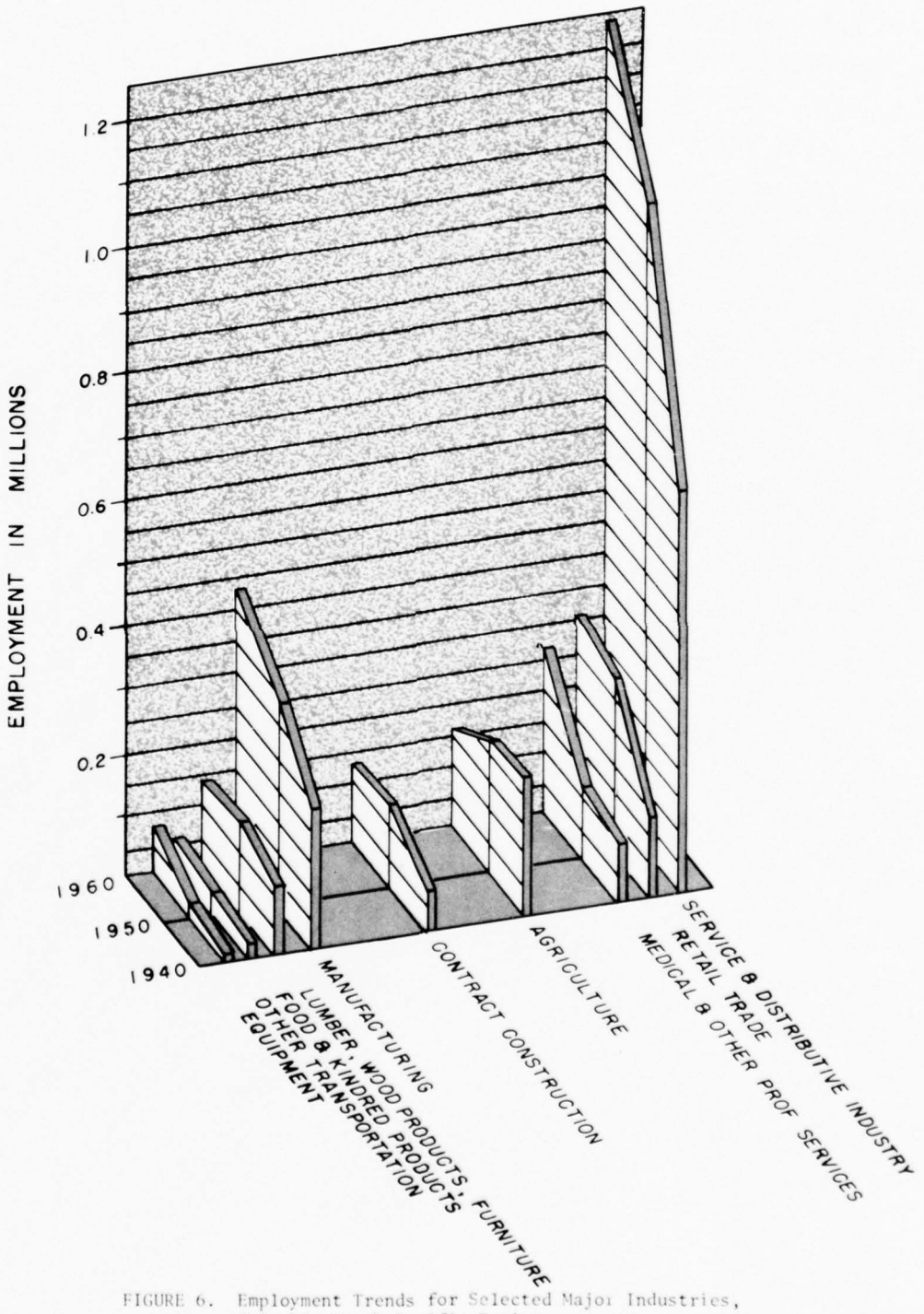


FIGURE 6. Employment Trends for Selected Major Industries, Columbia-North Pacific Region.

Table 5 - Employment by Selected Industries, Columbia-North Pacific Region and Subregions, 1940 1/

Industry	Columbia North Pacific	EMPLOYMENT SUBREGIONS 1	2	3	4	5	6	7	8	9	10	11	12
Agriculture	220,872	19,465	16,311	15,992	28,853	21,395	16,275	17,263	9,142	33,809	13,242	27,507	1,618
Forestry & Fishery	8,326	900	201	60	136	200	259	206	627	636	1,590	3,481	30
Mining	24,044	13,629	1,198	1,125	510	1,505	1,106	486	161	583	1,260	2,460	21
Construction	67,915	6,837	6,246	2,304	2,715	3,266	2,145	3,031	2,910	13,556	3,993	20,690	222
Manufacturing	229,995	19,770	3,240	3,063	2,774	4,287	4,562	7,461	19,370	50,626	26,444	87,248	1,150
Food & Kindred Products	30,380	3,232	407	1,226	1,548	1,125	512	1,272	815	7,116	2,447	10,647	33
Textile Mill Products	3,193	33	5	7	16	10	10	62	281	2,363	21	385	0
Apparel	3,896	149	15	17	20	22	8	15	45	1,490	22	2,092	1
Lumber, Wood Products & Furniture	115,291	9,025	2,004	1,041	262	1,565	3,444	5,338	13,117	22,667	21,695	34,050	1,083
Paper & Allied Products	0 2/												
Printing & Publishing	14,961	1,844	277	338	463	680	359	431	403	4,129	677	5,337	23
Chemicals & Allied Products	2,822	175	53	70	33	21	7	23	24	791	38	1,587	0
Petroleum	0 2/												
Primary Metals	0 2/												
Fabricated Metals	0 2/												
Machinery, Excl. Electrical 3/	5,946	624	84	108	111	199	70	136	99	1,998	196	2,315	6
Electrical Machinery	0 2/												
Motor Vehicles & Equipment	1,337	111	2	7	16	16	5	15	3	465	7	690	0
Transportation Equipment	15,055	70	11	11	2	196	2	4	46	380	158	14,175	0
Other Manufacturing	37,114	4,507	382	238	303	453	145	165	4,537	9,227	1,183	15,970	4
Railroads & Railway Express	33,474	6,741	1,423	824	2,696	1,382	1,383	1,785	1,205	7,249	912	7,819	55
Trucking & Warehousing	15,578	1,640	481	642	926	707	486	597	594	3,681	957	4,829	38
Other Transportation	20,899	1,214	434	387	278	251	272	409	683	4,067	1,399	10,496	9
Communications	11,282	1,295	280	240	474	510	333	417	291	2,578	511	4,330	23
Utilities & Sanitary Service	15,993	2,211	503	440	634	763	479	562	590	3,640	1,086	5,059	26
Wholesale Trade	41,133	4,140	963	2,046	3,125	1,686	961	1,225	727	10,475	1,459	14,285	41
Retail Trade	183,839	22,653	5,075	5,673	8,333	8,146	5,640	6,721	6,256	43,152	11,210	60,522	458
Eating & Drinking	34,454	4,633	1,171	920	1,375	1,298	992	1,276	1,231	7,570	2,263	11,637	88
Other Retail	149,385	18,020	3,904	4,753	6,958	6,848	4,648	5,445	5,025	35,582	8,947	48,885	370
Finance, Insurance & Real Estate	37,085	4,566	615	847	1,052	1,169	736	826	829	9,835	1,343	15,215	52
Hotels, Lodgings	49,175	6,461	1,570	1,279	2,477	2,216	1,638	1,948	1,521	11,031	3,438	15,395	201
Business & Repair Services	27,596	3,170	884	930	1,426	1,289	1,027	1,141	970	6,494	1,618	8,553	94
Entertainment & Recreation	11,422	1,408	405	406	631	559	388	472	348	2,508	672	3,596	29
Medical, Professional Services	95,159	11,565	2,751	2,757	4,569	4,172	4,411	4,007	3,245	22,564	5,208	29,665	245
Private Households	38,166	3,967	1,131	1,259	1,393	1,611	1,398	1,863	1,392	9,223	2,382	12,443	104
Public Administration	44,271	5,197	1,533	1,254	1,891	2,482	1,512	1,630	1,221	10,529	2,078	14,772	172
Armed Forces	15,873	2,563	0	0	0	101	0	0	1,612	16	1,047	10,534	0
Total	1,192,097	139,392	45,244	41,528	64,893	57,697	45,011	52,050	53,694	247,252	81,849	358,899	4,588

1/ Estimated from OBE data and Census of Population.

2/ 1940 industry detail is not available for paper and allied products, petroleum, primary metals and fabricated metals, but is included in this classification.

3/ Electrical and non-electrical machinery are combined into a single category for 1940.

Table 6 - Employment by Selected Industries, Columbia-North Pacific Region and Subregions, 1950 1/

Industry	EMPLOYMENT												
	Columbia North Pacific	SUBREGIONS											
		1	2	3	4	5	6	7	8	9	10	11	12
Agriculture	210,478	17,290	15,011	17,662	26,6[illegible]	22,281	13,702	15,620	8,482	34,458	12,285	25,436	1,651
Forestry & Fishery	11,876	1,028	213	77	197	262	317	382	628	1,128	2,485	5,089	70
Mining	17,694	11,443	842	726	381	611	524	243	201	841	420	1,443	19
Construction	132,391	12,113	9,671	8,481	6,472	6,665	3,460	7,119	5,016	28,916	7,590	36,655	233
Manufacturing	338,905	27,724	4,604	11,306	4,205	6,394	7,419	11,100	26,580	79,944	44,256	114,145	1,228
Food & Kindred Products	40,621	4,033	595	2,110	2,184	1,927	708	1,863	1,259	8,932	3,631	13,352	27
Textile Mill Products	4,108	48	11	12	9	19	10	108	666	2,759	28	437	1
Apparel	4,746	82	9	25	23	23	9	15	195	1,989	19	2,357	0
Lumber, Wood Products & Furniture	153,180	9,461	2,526	1,095	330	2,279	5,844	7,823	14,892	38,088	37,088	32,616	1,138
Paper & Allied Products	18,858	391	34	42	0	28	80	54	5,912	4,344	1,042	6,931	0
Printing & Publishing	20,915	2,187	466	656	657	791	446	592	718	6,098	969	7,303	32
Chemicals & Allied Products	11,210	256	129	6,461	298	97	28	78	129	1,429	87	2,217	1
Petroleum	1,728	330	0	0	75	34	0	0	79	487	0	723	0
Primary Metals	18,169	7,865	90	54	25	106	13	24	1,539	3,312	101	5,040	0
Fabricated Metals	8,951	421	35	65	59	168	27	114	167	3,354	128	4,413	0
Machinery, Excl. Electrical	9,344	644	151	399	173	302	77	142	255	3,398	303	3,488	12
Electrical Machinery	2,168	176	29	17	15	18	13	15	67	799	102	915	2
Motor Vehicles & Equipment	2,110	321	3	16	17	8	7	2	16	559	26	1,135	0
Transportation Equipment	29,311	106	21	17	4	11	9	54	72	590	218	28,209	0
Other Manufacturing	13,486	1,403	505	337	336	583	148	216	614	3,806	514	5,009	15
Railroads & Railway Express	46,969	9,620	2,002	1,097	3,743	2,091	1,781	2,313	1,793	11,116	1,087	10,263	63
Trucking & Warehousing	23,938	2,243	1,011	1,927	2,357	1,066	594	990	550	5,938	1,078	6,135	49
Other Transportation	32,286	1,880	425	475	777	701	337	718	1,242	7,017	2,170	16,524	20
Communications	23,713	2,293	621	630	1,131	1,232	603	861	935	5,935	1,221	8,221	30
Utilities & Sanitary Service	26,460	2,778	1,179	1,179	1,374	1,674	507	993	1,371	6,417	1,987	6,957	44
Wholesale Trade	65,243	6,488	1,355	2,269	3,884	2,899	1,206	1,932	1,441	18,978	2,838	21,867	85
Retail Trade	279,458	31,166	7,993	10,366	13,563	12,692	7,745	10,464	10,458	66,333	18,603	89,437	638
Eating & Drinking	60,826	7,445	1,988	2,115	2,676	2,623	1,867	2,521	2,292	13,804	4,540	18,805	150
Other Retail	218,632	23,721	6,005	8,251	10,887	10,069	5,878	7,943	8,166	52,529	14,063	70,632	488
Finance, Insurance & Real Estate	58,132	5,906	1,068	1,542	1,756	2,337	1,103	1,346	1,477	15,837	2,595	23,080	85
Hotels, Lodgings	59,540	7,178	1,906	1,987	3,277	2,438	1,897	2,464	1,916	13,146	4,448	18,705	178
Business & Repair Services	45,943	4,891	1,431	1,599	2,439	2,357	1,547	2,044	1,755	11,148	3,117	13,423	192
Entertainment & Recreation	16,090	1,586	459	597	804	751	398	600	534	4,081	928	5,308	43
Medical, Professional Services	162,247	17,764	4,069	5,875	6,677	6,625	7,681	6,267	6,277	40,018	8,837	51,811	346
Private Households	33,874	3,127	986	1,255	1,494	1,558	1,108	1,389	1,327	8,908	2,074	10,534	114
Public Administration	81,106	7,259	2,722	2,365	2,953	3,746	1,719	2,856	2,557	17,294	3,913	33,534	188
Armed Forces	61,029	3,830	1,546	117	188	149	111	94	252	912	2,080	51,748	2
Total	1,727,372	177,607	59,114	71,532	84,273	78,529	53,759	69,795	74,793	378,365	124,012	550,315	5,278

1/ Estimated from OBE data and Census of Population.

Table 7 - Employment by Selected Industries, Columbia-North Pacific Region and Subregions, 1960 1/

Industry	EMPLOYMENT SUBREGIONS											
	Columbia North Pacific	1	2	3	4	5	6	7	8	9	10	11	12
Agriculture	155,767	10,504	14,411	15,461	21,910	17,861	10,229	11,753	4,876	21,714	8,117	17,824	1,107
Forestry & Fishery	11,672	1,549	302	93	308	511	521	712	614	1,622	2,119	3,149	172
Mining	11,418	8,346	289	150	174	193	251	187	75	525	467	681	80
Construction	129,460	11,621	6,978	6,210	6,726	7,597	3,048	5,669	4,929	28,264	7,230	40,891	297
Manufacturing	447,025	32,764	8,255	15,053	10,169	11,565	9,311	12,678	28,111	97,333	45,184	175,244	1,358
Food & Kindred Products	58,903	4,539	1,022	3,329	4,773	5,287	1,040	2,741	2,264	12,884	3,973	16,994	57
Textile Mill Products	3,944	32	8	23	36	16	9	120	830	2,386	12	472	0
Apparel	7,347	104	0	335	73	58	20	30	423	2,997	20	3,287	0
Lumber, Wood Products & Furniture	143,012	11,494	3,325	1,257	355	2,539	6,095	6,926	11,927	34,796	35,891	27,198	1,209
Paper & Allied Products	26,171	616	193	382	101	51	979	433	7,280	5,310	1,472	9,348	6
Printing & Publishing	27,320	2,602	767	900	885	1,006	510	774	1,045	7,013	1,357	10,417	44
Chemicals & Allied Products	16,334	612	481	7,529	2,426	205	92	93	209	1,746	53	2,888	0
Petroleum	2,824	324	0	0	23	5	0	0	93	424	27	1,928	0
Primary Metals	19,942	7,709	743	34	44	80	16	505	1,630	4,634	214	4,328	5
Fabricated Metals	14,487	651	97	202	171	296	56	217	304	4,570	138	7,785	0
Machinery, Excl. Electrical	16,029	1,057	243	283	428	410	159	191	679	5,873	709	5,968	29
Electrical Machinery	9,354	729	139	90	39	94	20	58	196	4,770	82	3,133	4
Motor Vehicles & Equipment	4,223	323	8	44	36	114	8	73	47	1,234	30	2,306	0
Transportation Equipment	77,267	565	721	107	37	532	25	134	309	3,498	323	71,016	0
Other Manufacturing	19,868	1,407	508	538	742	872	282	383	875	5,198	883	8,176	4
Railroads & Railway Express	35,786	6,909	1,313	771	3,117	1,558	1,207	1,936	1,522	8,804	756	7,862	31
Trucking & Warehousing	29,610	2,521	1,042	1,875	2,646	1,279	711	843	906	7,783	1,807	8 138	59
Other Transportation	32,758	1,526	509	519	685	831	238	671	1,532	6,953	2,372	16,910	12
Communications	26,460	2,809	807	726	1,111	1,160	512	881	754	6,617	1,430	9,579	74
Utilities & Sanitary Service	28,957	2,900	1,972	1,340	1,710	1,924	447	995	1,119	6,890	1,941	7,668	51
Wholesale Trade	82,813	8,189	2,808	3,626	4,721	3,747	1,511	2,352	1,615	22,815	3,280	28,054	85
Retail Trade	309,366	33,229	9,883	11,680	16,131	14,930	8,790	11,945	10,780	70,921	20,264	100,133	680
Eating & Drinking	63,498	6,933	2,085	2,110	3,446	2,949	2,035	2,598	2,217	14,384	4,668	19,894	179
Other Retail	245,868	26,296	7,798	9,570	12,685	11,981	6,755	9,347	8,563	56,537	15,596	80,239	501
Finance, Insurance & Real Estate	79,937	7,706	1,798	2,108	2,941	3,391	1,343	1,873	1,921	21,154	3,623	31,968	111
Hotels, Lodgings	59,986	7,148	1,903	2,153	3,379	3,160	1,702	2,417	1,886	13,162	4,596	18,313	167
Business & Repair Services	49,185	4,671	1,248	1,493	3,790	2,416	875	1,531	1,553	12,971	2,722	15,811	104
Entertainment & Recreation	14,982	1,728	461	504	773	646	401	441	424	3,215	881	5,467	41
Medical, Professional Services	259,688	27,029	7,485	9,231	10,596	10,154	10,509	9,706	9,611	64,341	14,821	85,675	530
Private Households	52,527	5,489	2,150	2,330	2,350	2,665	1,776	2,569	2,180	11,219	3,295	16,338	166
Public Administration	98,861	9,800	3,403	3,015	4,279	5,016	1,962	3,678	3,166	22,581	5,040	36,671	250
Armed Forces	62,498	7,429	3,529	1,158	434	3,746	256	217	162	2,210	1,835	41,369	153
Total	1,978,756	193,867	70,546	79,496	97,960	94,350	55,600	73,054	77,736	431,094	131,780	667,745	5,528

1/ Estimated from OBE data and Census of Population.

1950, and 1960. However, since 1950 the rate of increase in per capita income for the region has been lower than for the nation. Although the regional per capita income has been relatively high, there has been considerable disparity among the subregions.

In 1940, Subregion 4, the Upper Snake River Area, had a per capita income of only $906 while that of the Puget Sound Area, Subregion 11, was some 72 percent higher at $1,574. These same subregions also represented the two extremes in 1962, but the difference between them was less. Table 8 presents statistics on personal income and per capita income for the subregions, the region, and the nation.

Table 8 - Income, Total Personal and Per Capita, Columbia-North Pacific Region, Subregions and United States 1940, 1950, and 1962.

Area	Total Personal Income 1/			Per Capita Income 1/				
	1940	1950	1962	1940	% Change From 1940	1950	% Change From 1950	1962
	Mil. dol.	Mil. dol.	Mil. dol.	Dol.		Dol.		Dol.
Subregion 1	571	881	1,187	1,369	31.1	1,795	14.6	2,057
2	160	322	447	1,227	66.3	2,040	11.3	2,271
3	160	389	519	1,213	52.6	1,851	20.5	2,230
4	189	358	542	906	69.0	1,531	26.6	1,938
5	195	346	544	1,102	45.4	1,602	29.8	2,080
6	137	271	326	1,002	81.2	1,816	11.9	2,032
7	182	371	453	1,275	56.5	1,996	12.1	2,237
8	192	397	502	1,192	55.2	1,850	17.0	2,165
9	976	1,945	2,835	1,417	37.3	1,946	19.6	2,328
10	279	630	770	1,188	60.4	1,905	6.8	2,034
11	1,589	2,979	4,826	1,574	33.0	2,093	25.8	2,633
12	18	32	32	1,570	57.9	2,479	-0.8	2,459
Columbia North-Pacific	4,649	8,922	12,982	1,348	43.1	1,929	20.5	2,325
United States	172,235	274,097	419,629	1,300	38.8	1,805	25.1	2,258

1/ In 1958 dollars.
Source: OBE, March 1968.

FORESTRY & THE ECONOMY

FORESTRY IN THE REGION'S ECONOMY

INTRODUCTION

Forest products manufactured in the Columbia-North Pacific Region contribute significantly to the Nation's timber economy. Increasing national and world demand for wood assures that the region's production will be limited only by the economically available supply of timber. The future levels of timber harvest, which would be required by the projected industrial development, are based on the assumption that forest landowners, both public and private, would continue to increase their investments in forestry. Projected industrial wood consumption based on this timber harvest will be realized only if present trends in forest land loss continue in the future and if logging and industrial technology are further developed. The volume of sawtimber inventory will continue to decline as young trees replace old-growth timber, while concurrently there will be an increase in forest growth rates. Changing national demand will alter the forest product mix; the paper and allied products industry will become the dominant consumer of wood fiber by the year 2020.

National and regional projections of the demand for wood products and the available supply of forest resources were developed from several studies (22)(64) (66) (78).

The following statistical data and most of the narrative were developed from Wall's 1969 report (78). Additional detail, including state breakdown of subregional information, is presented in this publication.

THE TIMBER RESOURCE

Forests cover 85.8 million acres or nearly 50 percent of the total land area in the Columbia-North Pacific Region. Of this area, 70.4 million acres are classed as commercial forest land, supporting over 1 trillion board feet of standing timber. This amounts to 14 percent of the Nation's commercial forest area and 41 percent of its sawtimber volume.

Of the 15.4 million acres classed as noncommercial forest land, 5.1 million acres are of commercial character but are in areas reserved for use as National Parks; wild, wilderness and primitive areas; and other Federal, state, county, and municipal reserves. The remaining 10.3 million acres of noncommercial forest lands are unsuitable for growing commercial timber crops because of their low productivity or other factors.

The principal commercial species are the conifers, Douglas-fir, the pines, true firs, hemlock, spruce, cedar and larch. The principal hardwoods of commercial value are the cottonwood, alder, maple and oak.

The National Forests make up the largest forest land ownership in the region, with 51 percent (36 million acres) of commercial area. Private ownerships are next, with 34 percent (24 million acres). State ownerships account for six percent (4 million acres), public domain and O&C with four percent (2.9 million acres), and Indian lands with three percent (2.4 million acres). Miscellaneous other public ownerships account for the remaining one percent. The detail of this ownership is presented in the Forest Land Section of Appendix IV, Land and Mineral Resources.

The Columbia-North Pacific Region contains an estimated net sawtimber volume of 1,046 billion board feet (table 9). This is over 40 percent of the nation's total sawtimber inventory, and almost half its softwood volume. Live, sound trees account for 97 percent of this volume; the remaining three percent is in sound and salvable dead trees.

Public owners account for 71 percent of the sawtimber volume and the National Forests account for three-fourths of this (table 10). The remaining 29 percent is in private ownership with forest industries owning about two-thirds of it.

Four species groups make up 79 percent of the total sawtimber volume in the region. These are Douglas-fir (44 percent), western hemlock (14 percent), the true firs (12 percent), and ponderosa and Jeffrey pine (nine percent).

About 41 percent of the sawtimber inventory is over 29 inches in diameter at breast height. The largest sawtimber is generally concentrated in western Oregon and western Washington, although the ponderosa pine area also has substantial volumes of large timber. Over the years, the average size of the sawtimber inventory has been declining with the continued harvest

Table 9 - Area of Commercial Forest Land and Volume of Sawtimber in the Columbia-North Pacific Region and Subregions, 1966

Subregion	Commercial Forest Land[1]		Volume[2]		Average Volume per Acre
	Thousand Acres	Percent	Million Bd. ft.	Percent	Bd. ft.
1	15,759	22	115,802	11	7,359
2	4,547	6	37,266	3	7,635
3	1,273	2	29,168	3	17,731
4	2,515	4	15,684	2	7,049
5	2,819	4	34,498	3	9,382
6	10,257	15	74,557	7	8,395
7	6,516	9	61,964	6	10,488
8	2,474	4	96,571	9	27,319
9	4,961	7	168,542	16	28,591
10	12,834	18	260,365	25	25,493
11	5,004	7	134,589	13	22,169
12	1,409	2	16,709	2	10,575
C-NP	70,368	100	1,045,715	100	14,886

1/ Pacific Northwest and Intermountain Forest and Range Experiment Station county data adjusted to hydrologic subregions.
2/ International 1/4 inch Rule.

Table 10 - Sawtimber Volume by Ownership Class, Columbia-North Pacific Region, 1966

Ownership Class	Sawtimber Volume (Million board feet)[1]	Percent
National Forest	565,823	54
Other Public	176,868	17
Total Public	742,691	71
Private	303,024	29
Total, All Owners	1,045,715	100

1/ International 1/4 inch Rule.
Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

of the old growth. New manufacturing technology in both primary and secondary manufacturing has been developing as the timber harvest of small-size trees has been increasing. This trend toward smaller log utilization will continue in the future, and will tend to reduce the present differences in tree size across the region. At the present time, a wide differential in size of trees still exists. For instance, the proportion of the number of trees under 20 inches d.b.h. ranges from 18 percent in western Oregon to 67 percent in western Montana.

In 1962, the net growth of the sawtimber in the region amounted to 11.4 billion board feet, or 20 percent of the nation's sawtimber growth (table 11). Western Washington accounted for 43 percent of the region's net annual growth, reflecting the presence of thrifty second-growth stands, good site, and favorable stocking. The net growth in other areas is lower in part due to poorer sites and due to a greater proportion of old-growth stands. In all areas forest management can increase timber yields through augmented investments in more intensive forest management practices.

Table 11 - Net Annual Growth of Growing Stock and Sawtimber on Commercial Forest Land in the Columbia-North Pacific Region, by State Area, 1962 1/

Area	Sawtimber		Growing Stock	
	Total Million Bd. Ft.2/	Bd. Ft. per Acre	Total Million Cu. Ft.	Cu. Ft. per Acre
Western Oregon	2,700	196	595	42
Western Washington	4,920	484	1,137	105
Eastern Oregon	955	84	279	25
Eastern Washington	997	119	304	36
Northern Idaho	707	108	169	26
Southern Idaho	505	70	114	15
Western Montana	647	62	160	15
Total	11,431	158 3/	2,758	38 3/

1/ Includes all of Washington, Oregon, Idaho, and western Montana and is based on data in "Timber Trends in the United States".

2/ International 1/4 inch Rule.

3/ Weighted average.

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

THE PRESENT FORESTRY INDUSTRY

In 1869, about 218 million board feet (International 1/4 inch Rule) of logs were harvested in the Columbia-North Pacific Region. By 1899, 2.5 billion board feet of timber were harvested. Between 1899 and 1929 the region's forest economy went through its greatest period of expansion and the timber cut supporting the industrial capacity increased about 500 percent to 15 billion board feet. During the depression the region's timber harvest declined with the drop in national demand, but during World War II production increased. In recent years, the timber harvest has continued to increase but at a slower rate. During the period 1952 through 1964, production increased from 18.4 to 21.0 billion board feet (table 12).

Table 12 - Annual Log Production, Columbia-North Pacific Region and Subregions, 1952, 1956, 1962 and 1964

Subregion	1952	1956	1962	1964
		(Thousand board feet) 1/		
1	1,182,636	1,834,549	1,702,565	1,882,016
2	318,126	425,080	446,934	523,089
3	175,509	171,677	302,800	381,675
4	20,464	48,728	45,555	73,905
5	222,355	386,724	402,593	482,790
6	743,706	1,055,742	935,079	1,005,647
7	898,970	1,141,542	955,746	1,001,185
8	1,481,105	1,986,809	1,933,165	2,384,241
9	4,007,062	3,313,927	3,652,629	3,695,742
10	7,026,620	6,707,254	5,507,301	6,411,451
11	2,144,332	2,298,433	2,169,364	2,784,339
12	156,306	314,484	232,368	339,059
C-NP	18,377,191	19,684,949	18,286,099	20,965,139

1/ International 1/4 inch Rule.

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

The Lumber Industry

Lumber is the region's major forest product. Production of lumber increased greatly up to 1929, declined during the 1930's, and then recovered by the 1940's. Since 1950, lumber

production has fluctuated between 12 and 15 billion board feet, and in 1965 nearly 15 billion board feet of lumber were produced by 925 sawmills (table 13 and table 14).

The Douglas-fir area is the leading lumber-producing zone in the region with about 8.6 billion board feet of production in 1966. Both lumber production and the number of sawmills have been declining in western Oregon and western Washington. Between 1950 and 1966 lumber production declined 14 percent, and during the 1956-64 period the number of sawmills declined 38 percent in western Oregon and 37 percent in western Washington.

The inland sawmills, east of the Cascade Range, have been increasing their total production. Their share of the region's lumber production has increased from 25 percent in 1950 to 38 percent in 1965. Eastern Washington's lumber output has been growing more rapidly than most other areas in the western United States; in 1950 eastern Washington had a lumber production of 668 million board feet and by 1965 it has increased to 1.2 billion board feet. A recent study of eastern Washington showed that the number of sawmills has been declining there despite increasing lumber production (82). In 1953 there were 296 mills and by 1963 the number had dropped to only 77. It is estimated that in 1967 there were only 66 mills remaining in eastern Washington. In general, the smallest sawmills are the ones which have disappeared.

Between 1950 and 1962 lumber production increased 26 percent in eastern Oregon, but the number of sawmills dropped from 70 to 30. In the business expansion period 1961 through 1967, the number of sawmills increased from 30 to 50 mills and lumber production has been increasing.

In Idaho and western Montana lumber production has been generally increasing since the early 1950's, but the number of sawmills has been declining. In 1956 Idaho had 311 sawmills in operation and by 1962 there were only 193 mills remaining. In all of Montana there were 333 mills operating in 1956, but only 209 remained in 1962 (87). Western Montana has had the greatest growth (up 122 percent) in lumber production in the Columbia-North Pacific Region during the 1950-1962 period, while in Idaho production increased the least (17 percent).

The Plywood Industry

The Columbia-North Pacific Region has been the leading plywood supplier in the nation since Douglas-fir plywood was first shown as a potential product at the Lewis and Clark

Table 13 - Total Output of Timber Products by Product, Columbia-North Pacific Region and Subregions, 1965

Sub-region	Lumber[1]	Plywood[2] (3/8-in.)	Woodpulp[3]	Particleboard[4] (3/4-in.)	Misc. Products[5]	Foreign Log Exports[6]
	MBF	(MM) Sq. Feet	Tons	(MM) Sq. Feet	(M) Cu. Ft.	(M) Cu. Ft.
1	2,108,261	532	315,232	3	8,430	-
2	531,116	-	16,507	-	6,740	500
3	260,886	125	-	-	3,310	-
4	51,020	-	-	-	220	-
5	375,846	69	-	-	2,347	-
6	1,087,174	250	251,000	-	5,211	-
7	1,271,978	213	219,018	17	6,151	-
8	1,279,826	798	1,649,526	3	16,889	12,250
9	3,165,402	3,873	634,462	132	19,736	7,617
10	3,208,567	3,933	709,674	133	24,062	71,000
11	1,435,222	1,278	1,595,58[illegible]	-	22,409	58,800
12	181,173	10	-	-	492	-
C-NP	14,956,471	11,081	5,391,000	288	115,997	150,167

1/ Based on 1964-65 Statistical Yearbook by Western Wood Products Association.
2/ Based on 1965 APA softwood plywood data, and forest industries' hardwood plywood data.
3/ Estimates of woodpulp production based on preliminary wood consumption data for the West (Bureau of Census).
4/ Based on 1965 Census of Manufactures' data.
5/ Pilings, poles, posts, fuelwood, ties, excelsior, shingles, bolts, etc.
6/ Based on 1965 U. S. Department of Commerce data.
Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

Table 14 - Number and Capacity of Manufacturing Plants by Type, Columbia-North Pacific Region and Subregions, 1965

Subregion	Sawmills 1/		Veneer only 1/		Particle-Board 2/3/		Plywood 1/ 3/		Woodpulp 4/	
	No. of plants	Daily Capacity	No. of Plants	Annual Capacity (1/8-inch Basis)	No. of Plants	Annual Capacity (3/4-in. Basis)	No. of Plants	Annual Capacity (3/8-in. Basis)	No. of Plants	Daily Capacity
		Bd. ft.		Million Sq. ft.		Million Sq. ft.		Million Sq. ft.		Tons
1	207	9,087,880	--	--	1	8	7	582	2	837
2	48	2,218,500	--	--	--	--	--	--	1	50
3	9	922,000	1	9	--	--	1	132	--	--
4	32	412,630	--	--	--	--	--	--	--	--
5	31	1,487,760	--	--	--	--	2 3/	66	--	--
6	67	4,341.090	--	--	--	--	2 3/	248	1	650
7	42	4,452,000	2	77	1	33	3	216	3	730
8	51	4,870,000	6	688	1	7	9	844	7	5,160
9	185	12,265,000	21	3,247	6	257	41	3,897	11	2,705
10	138	12,393,500	12	2,253	5	260	45	4,075	7	2,720
11	110	6,260,000	3	521	--	--	20	1,416	14	4,833
12	5	655.000	--	--	--	--	1	80	--	--
C-NP	925	59,365,360	45	6,795	14	565	131	11,556	46	17,685

1/ 1966 Directory of Forest Products Industry.
2/ 1967 Directory of the Forest Products Industry.
3/ Plants under construction are not included.
4/ Lockwood's Directory of Paper and Allied Trades, 1966.

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

Exposition in 1905. This industry developed in the Puget Sound Subregion and was chiefly associated with door manufacturers in its early stages. New technology in making plywood aided in making better and more acceptable products, and after World War II the industry grew rapidly, especially in western Oregon.

In 1940 the region accounted for 100 percent of the softwood plywood production in the nation, and in 1965 it accounted for about 87 percent of the nation's plywood production (11 billion square feet, 3/8 inch basis) (table 13). Subregions 9 and 10 account for about two-thirds of the region's plywood capacity. In recent years, Idaho and western Montana's plywood industry has been growing relative to that in Washington and Oregon. The growth of the plywood industry in California and the southern states has reduced the region's share of national plywood production.

The Pulp Industry

A one year paper mill operation in 1866 at Oregon City, Oregon is recognized as the first pulp and paper enterprise in the Northwest (27). In 1868, a mill was installed on the Clackamas River and was moved to Camas, Washington in 1883. After a slow start the industry began to enlarge in the 1880's, with the Washington state industry growing most rapidly through the 1920's due to a ready supply of raw materials needed for the sulphite pulping process. As technology changed, use of a wider range of species became possible through the sulfate pulping process. Washington attracted even more pulp industry development and in 1965 this state ranked second in woodpulp production in the nation. The major pulp industry growth in Oregon, Idaho and western Montana has occurred since World War II and especially in the late 1950's and early 1960's. In 1947 the region's pulp industry produced about two million tons of pulp, and in 1965 it produced approximately 5.4 million tons, or 16 percent of the nation's woodpulp (table 13).

In 1965 the Lower Columbia and the Puget Sound Subregions together accounted for 60 percent (3.2 million tons) of the pulp production in the region. Subregions 9 and 10 are also major pulp producers, with approximately 710,000 tons and 634,000 tons of production, respectively. Subregions 1 and 6 were the largest pulp producers on the east side of the Cascades, with about 315,000 tons and 251,000 tons of production, respectively, in 1965. Due to favorable raw material and water supply factors, the subregions in eastern Washington, Idaho and western Montana offer some of the best chances for new pulpmill installations in the coming decades.

The expansion of the pulping activity in the region has been based, in part, on the availability of wood residues from other manufacturing processes. In 1950, roundwood accounted for 81 percent of the total wood fiber consumption by the region's pulpmills. By 1965, however, it was estimated that 68 percent of all the wood fiber consumed was residue from sawmills, planing mills and plywood plants. Opportunities for further expansion based on available residue supplies appear to be limited. Increased export of chips to Japan is expected to peak in the near future and finally decline prior to the year 2000. A long-term leveling off of mill residue production is expected, which will effectively place a ceiling on this raw material source for pulp.

The Particleboard Industry

During the 1950's the particleboard industry was established, based on available supplies of sawmill residues. For this reason, the industry located mostly in Oregon near large raw material supplies. In 1965 only about 51 percent of the installed particleboard capacity was used to produce 288 million square feet (3/4 inch) of particleboard (table 13).

Foreign Log Exports

The 1960's have been marked by a rapid rise in foreign demand for roundwood from the region. In 1961, 56 million cubic feet of timber were exported and by 1965 log exports had increased 2.7 times to 150 million cubic feet. Since 1965 the export of roundwood has continued to climb, reaching 171 million cubic feet in 1966 and 262 million cubic feet in 1967. Japan purchases most of this exported roundwood, although its share of the total exports has varied over time. In 1961 it took 98 percent of the total volume exported. In 1965 this decreased to 80 percent, with Canada increasing its share from two percent to 13 percent. In 1967 Japan (95 percent), Canada (three percent), and South Korea (two percent) were the major importers of the region's roundwood (28).

In 1965 the Coastal Subregion of western Oregon and western Washington ranked first in foreign log exports with a total of 71 million cubic feet. The Puget Sound Subregion exported the second largest roundwood volume to foreign countries--59 million cubic feet. These exported volumes were not necessarily harvested in these subregions.

In 1968 Congress passed a law limiting the foreign export

of logs from federal lands. The law came into being after the projections were made for this study; however, the recent developments indicate that the projections will not be significantly affected.

Employment

There has been a long-term downward trend in total forest industry employment due, in part, to increases in productivity. But this influence which reduces employment has been somewhat offset by changes in industry mix and the increase in further manufacturing. Employment in logging, sawmills, and planing mills has been declining since 1950, and that in miscellaneous wood manufacturing has been relatively stable. Employment in plywood plants and the pulp, paper and allied products industry has been increasing over the past 15 years. In 1950, about 169,000 workers were employed by the forest industries of the region, and in 1965 the employment level was nearly three percent lower at 165,789 workers. Because of the excellent business conditions in 1965 and the intensive use of plant capacity, employment levels in that year were above the long-term average.

In 1965, the State of Oregon, exclusive of Klamath County, had the largest forest industry employment in the region (78,765), Washington was second (66,724), and Idaho was third (12,385). The Willamette Subregion had the largest forest industry employment of any subregion--39,944. The Coastal Subregion ranked second with 35,913 workers, and the Puget Sound Subregion ranked third with 31,360 workers (table 15).

Although the manufacture of lumber provides the most employment in the forest industry for the region as a whole, it leads the other major forest industries in only Idaho and western Montana. Here, employment in sawmills and planing mills (SIC[1/] 242) accounted for 7,719 and 4,740 employees, respectively, in 1965. In Washington the pulp, paper and allied products industry (SIC 26) was the leading employer with 19,789 workers. Sawmills and planing mills (SIC 2421) in Washington ranked second with 16,421 workers; whereas, veneer and plywood plants (SIC 2432) ranked third with 10,480 workers. In all of Oregon, including Klamath County, the veneer and plywood industry (SIC 2432) was the largest single forest industry employer with 27,629 workers in 1965; sawmills and planing mills (SIC 2421) ranked second with 25,510 employees.

1/ Standard Industrial Classification.

Table 15 - Forest Industry Employment by Industry, Columbia-North Pacific Region and Subregions, 1965

Subregion	Logging (SIC 241)	Sawmills & Planing Mills (SIC 242)	Veneer, Millwork Plywood, Prefabricated Structures (SIC 243)	All Other (SIC 24)	Total (SIC 24)	Paper & Allied Products (SIC 26)	Total (All)
			(Number of persons)				
1	2,446	8,136	2,094	454	13,130	750	13,880
2	716	2,043	29	17	2,805	83	2,888
3	402	1,039	298	60	1,799	168	1,967
4	73	203	34	--	310	70	380
5	379	1,949	679	33	3,040	--	3,040
6	1,634	4,202	238	96	6,170	800	6,970
7	1,369	4,095	1,547	240	7,251	660	7,911
8	3,750	4,822	3,296	--	11,868	8,463	20,331
9	5,626	9,866	17,140	1,933	34,565	5,379	39,944
10	8,756	10,369	14,535	--	33,660	2,253	35,913
11	4,501	7,484	8,645	885	21,515	9,845	31,360
12	82	1,092	31	--	1,205	--	1,205
C-NP	29,734	55,300	52,284	1/	137,318	28,471 2/	165,789 2/

1/ Data for "All other, (SIC 24)" have been combined with "SIC 243" to avoid disclosure of figures for individual companies.

2/ Totals differ from the official State totals because of modifications made in the data for several subregions to avoid disclosing figures for individual companies.

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

of logs from federal lands. The law came into being after the projections were made for this study; however, the recent developments indicate that the projections will not be significantly affected.

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1/ Standard Industrial Classification.

The employment data are based on statistics compiled by the respective state employment agencies. Employment totals presented in the detailed table may differ slightly from official figures because, when disclosure of covered employment for individual mills was a possibility, estimates of employment were developed based on average data for the industry.

THE FUTURE FOREST ECONOMY

The forest economy of the Columbia-North Pacific Region has been projected in terms of wood consumption, employment, and payrolls for the 1965-2020 period. The basic wood consumption projections were made first on a regional and half-state basis; then they were allocated to subregions on the basis of existing industry distribution. However, in some cases such as in the pulp, paper, and allied products industry, allowance was made for new plant investment at new industrial sites in the various subregions.

The timber economy of the region has been changing in several ways which differ from those foreseen several years ago in studies such as "Timber Trends in the United States" and "Prospective Economic Developments Based on the Timber Resources of the Pacific Northwest." For example, the demand for logs for foreign exports is much greater; eastern Oregon's projected increase in consumption of wood has not materialized; southern plywood production has captured more of the nation's plywood market than projected; production of veneer and plywood has turned downward in western Oregon and western Washington, while that industry's output has increased more in the inland portion of the region than was projected; and public agencies have raised their annual allowable cuts in many areas. The increasing demand for all forest resources has been rapidly changing the outlook for both public and private owners concerning their timber production alternatives. Thus, for this study, a new look has been taken at the timber economy. As a result, the new projections of wood consumption by the forest industries differ from earlier studies such as the Willamette River Basin Report and the Puget Sound and Adjacent Waters Report.

Future National Demand for Wood Products

The principal markets for forest products of the region are distributed over the whole nation. It is assumed that the future production of the forest industries of the Pacific Northwest will be strongly influenced by national demand. Also, the increasing worldwide demand for wood products, especially from the Pacific Rim countries, will continue to exert strong

pressure to divert materials produced in the Pacific Northwest away from the nation's marketplace. As a result, more wood will be demanded in future time periods.

National trends in quantities of wood products which will be demanded have been projected by the Forest Service (66). The projections were based on five major factors. These included population, household formation, gross national product, disposable personal income, and construction activity.

Total demand for lumber in the United States is projected to increase 22 percent between 1962 and 1985, even though lumber demand per capita is expected to decline (table 16). Plywood and veneer demand should double by 1985, with the south expected to supply an increasing share of the future market. Paper and board demand per capita should continue to increase so that total demand will continue to rise throughout the projection period at historic rates. The projections indicated that the demand for minor industrial products will remain about the same, while consumption of fuelwood is expected to decline. Although the domestic forests are expected to meet most of the increase in the nation's future demand, imports of lumber, veneer logs, and pulpwood are nevertheless expected to increase in the future.

The Timber Supply Situation

The timber supply situation has been studied for each state. The relationship of the forest economy to the physical timber supply is complex, for it involves not only timber demands, but the goals of the various forest landowners. Consideration has been given to trends in log production, land use, forest growth, forest mortality, forest inventory, forest ownership, and anticipated owner goals in making projections of the available timber supplies for the future. Many of these timber supply relationships have been derived from earlier studies and others have been prepared specifically for this study.

Projecting the acreage available for future timber production posed complex problems in this study. It was generally assumed that the present regional trends in forest land loss will continue in the future. It was also assumed that the private forest land adjacent to Puget Sound would not have commercial harvests after 1985. On the other hand, it was assumed that logging technology will continue to improve, allowing timber harvests on forest land which cannot be logged by today's standards due to soil instability or steepness. These lands are classed as commercial forest lands in this study because they are capable of producing adequate timber yields.

Table 16 - Summary of Total Demand for Major Timber Products, 1952 and 1962, with Projections to 1985, United States

Product	Standard unit of measure	1952	1962	1970	1975	1980	1985
Lumber:							
Total	Million board feet	41,460	37,300	39,700	41,600	43,400	45,500
Per capita	Board feet	263	200	191	187	180	175
Plywood and veneer:							
Softwoods	Million square feet, 3/8-inch basis	--	9,250	14,400	15,600	17,000	18,500
Hardwoods	Million square feet, 3/8-inch basis	--	2,770	3,500	4,200	5,000	5,700
Total		--	12,020	17,900	19,800	22,000	24,200
Per capita	Square feet	--	64	86	89	91	93
Woodpulp:							
Total	Million tons	--	29.5	38.2	44.8	52.4	60.5
Paper and board:							
Total	Million tons	--	42.4	52.7	60.2	69.3	79.2
Per Capita	Pounds	--	454	507	540	575	609

Source: Timber Trends in the United States.

Even though western Oregon has a large part of the nation's best forest-growing land, the future timber harvest in western Oregon will not be adequate to maintain the present level of wood consumption if present downward trends in private production continue and if present allowable cuts on the public lands are adhered to. This situation reflects the history of heavy cutting on private lands, leaving inventories of sawtimber at a low level, thus limiting the economically available supply of private timber. As evidence of this, log production from private lands has a distinct downward trend, even though prices for stumpage have been increasing.

It is assumed that this trend toward lower private production will continue until cut and net growth come more into balance. The tendency toward higher stumpage prices and the expectation of increasing future demand for wood is assumed to be a motivating force in attracting a moderate level of continued reinvestment in private forestry, bringing these lands into a sustained level of physical production. This level will be much lower than the private timber harvest in 1965.

The public agencies in the Douglas-fir area are now evaluating alternatives in managing their own forest resources. They are considering their forest production alternatives in relation to projected private timber production and are studying the effect on the economy of alternative courses of cutting action. On the basis of these studies, future policy regarding timber harvests will be formulated.

It has been assumed for this study that the public agencies in western Oregon will increase their timber harvests above the 1965 levels as private production declines. The public effort will nearly stabilize the total flow of roundwood during most of the 1970-2020 projection period at a point somewhat below the 1965 harvest. As a result of this assumption, the level of economic activity projected in this study for western Oregon may be regarded as a high projection for it implies rather large investments by the public in forestry activities.

In western Washington, the period of heavy private cutting came earlier than in western Oregon. Lumbermen began cutting the private lands in the mid-1800's and the private harvest reached its peak in the 1920's. Because this is an easily reforested area, most of the private lands regenerated quickly and now have a young, fast-growing inventory. In addition, substantial areas of old growth remain which are still being harvested. The harvest on private lands is once again moving upward, stimulated by increasingly higher stumpage prices, new logging technology, and increased market acceptability of

smaller timber. An increase in the harvest is projected to continue in the 1965-2020 period.

Public owners have been increasing their allowable cuts in the state of Washington. The Department of Natural Resources recently evaluated the potential of their lands and greatly raised their planned harvests based on new inventory data and an accelerated thinning program. The Bureau of Indian Affairs has accelerated the Indian timber harvests for about a 15 year period in western Washington. The Forest Service has been increasing their allowable cut and it has been assumed for this study that further increases will take place.

The production of logs in eastern Oregon has been increasing since the 1940's with most of the increase coming from the national forests. During the past decade the harvest from private lands has decreased.

Eastern Oregon is projected to have an increasing demand for raw materials as timber supplies become limited west of the Cascade Range. The prices for east-side timber should rise and, as a result, private landowners will eventually increase their log production (21)(22).

Eastern Washington's forest economy has been generally growing since 1932 with more rapid growth in recent years. Like eastern Oregon, the public agencies have been supplying the increased raw material used in the past decade, with private log production data showing a slight downward trend in the past 10 year period.

Log production from public lands is projected to increase in eastern Washington during the 1965-2020 period. The projected growth of eastern Washington's forest industries will stimulate an increase in private log production in the future. Because of the favorable net growth relationships projected for private lands, it is expected that the inventory can sustain a much higher level of harvesting activity than in the past.

The timber economy of the Idaho and western Montana area will continue to grow during the 1965-2020 projection period, assuming the demands for timber products in the nation continue to rise as projected and that new logging and wood processing technology enable manufacturers to hold costs at levels allowing them to compete in the nation's marketplace.

Idaho and western Montana have a large but under-utilized forest resource. For many years the national demand for timber was met by available timber supplies in other areas of the country and the lower quality timber of the Rocky Mountain area

was not used. The increasing demand for timber products has resulted in a trend toward intensive use of all forest lands, including even the less productive segment of the commercial forest land. In the 1960's the forest economy in Idaho and western Montana began to broaden and develop. It is anticipated that, as industrial growth continues, more of the less productive and presently inaccessible commercial forest land in Idaho and western Montana will be included in the timber-producing base.

The production levels established for this area are based on the projections made by the Forest Service (66). The projections for private lands were changed to bring future levels of cut and net growth more in line in order to sustain a vigorous timber inventory. National forests account for the largest part of the projected increase in future timber harvests in Idaho and western Montana and it is assumed that they will make the large investments in forestry required to produce these projected timber volumes.

Roundwood Consumption by Lumber and Wood Products Industry

In 1965 the lumber and wood products industry (SIC 24) and foreign log exports consumed 3.5 billion cubic feet of roundwood in the region (table 17). During the 1965-2020 projection period the roundwood consumption by this group of forest-based industries will decline 11 percent; whereas, the roundwood consumption by the pulp and paper industry (SIC 26) will increase.

It has been assumed in making these projections that when raw material is scarce the forest industry, which adds the most value to its wood input during the manufacturing process, will be better able to outbid other wood users for the resource. For example, plywood plants and log exporters have increased their shares of total timber harvest at the expense of sawmills in the Douglas-fir region. In making projections for the region it was assumed, based on present trends, that the distribution of timber harvest among its various end uses will continue to change. The degree of change will vary by subregions, depending on the availability of timber supply.

Saw Log Consumption

In 1965, sawmills consumed 2.3 billion cubic feet of roundwood. By the year 2020, saw log consumption in the region is projected to decline 29 percent to 1.7 billion cubic feet (table 18). This decline takes place despite the projected increased national demand. The downward projection reflects the

assumption that many of the lumber industry's historical problems will continue into the future. The lumber industry is highly competitive; there are good substitutes for lumber and increased costs of doing business cannot easily be passed on to the consumer. The costs of doing business in the lumber industry have risen, especially in the form of stumpage and labor costs. The price of the end product has been relatively stable, tending to squeeze out the profits of the sawmill. In part, this may explain why so many sawmills have been going out of business. With the projected increased demands for other uses of stumpage by the plywood and the pulp industries, it is expected that the sawmill will be at a relative disadvantage in acquiring raw material and, as a result, its share of the region's timber harvest will decline.

Table 17 - Roundwood Consumption by the Lumber and Wood Products Industry - 1965, with Projections for 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions 1/

Subregion	1965	1980	2000	2020
		(Million Cubic Feet)		
1	385	380	350	336
2	92	125	143	150
3	54	75	91	100
4	7	8	8	7
5	67	75	82	76
6	195	228	249	236
7	219	239	255	269
8	294	271	281	259
9	836	580	575	606
10	916	755	707	670
11	406	472	457	385
12	28	29	29	30
C-NP	3,499	3,237	3,227	3,124

1/ Includes foreign log exports.
Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Exp. Sta., Portland, Oregon, February 1969.

Veneer Log Consumption

Veneer and plywood plants consumed 878 million cubic feet of roundwood in 1965 in the Columbia-North Pacific Region. The growth of the plywood industry reflects its favorable competitive

position among building materials and the technological breakthroughs in economically peeling smaller and rougher logs. In the long run, it has been assumed that the plywood industry will continue to increase, although not at its historical rate. The total consumption of veneer logs is projected to increase 40 percent to 1.2 billion cubic feet during the 1965-2020 period (table 18).

Table 18 - Roundwood Consumption by the Lumber and Wood Products Industry by Type of Use, 1965, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region

Type of Use	1965	1980	2000	2020
		(Million Cubic Feet)		
Veneer	878	926	1,112	1,228
Saw logs	2,343	1,819	1,734	1,663
Misc. wood products	128 2/	155	186	176
Foreign log exports	150	337	195	57
Total roundwood	3,499	3,237	3,227	3,124

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Exp. Sta., Portland, Oregon, February 1969.

Roundwood Consumption for Miscellaneous Wood Products

The estimated trend level of roundwood consumption for miscellaneous products in 1965 was 128 million cubic feet. Miscellaneous products include such products as poles, pilings, posts, fuelwood, and shingles. The miscellaneous products roundwood consumption is projected to increase by 48 million cubic feed to 176 million cubic feet in 2020 (table 18). It is likely that the mix of miscellaneous products will change by 2020, with increasing emphasis on manufacturing in future time periods.

Foreign Log Exports

The quantities of timber demanded by foreign countries along the Pacific Rim is projected to increase during the early part of the Projection period. Experience has shown

that log exporters have been effective in purchasing their timber requirements from this region. The export of roundwood is projected to increase 2.2 times to 337 million cubic feet between 1965 and 1980 with most of the increase coming during the 1960's (table 18). Log exports are expected to decline starting in 1980 because of the increasing demand for roundwood in the United States, the increasing availability of wood from countries such as the Soviet Union, and the increasing domestic production of roundwood in Japan (13). By 2020 they are projected to amount to 57 million cubic feet, which is 38 percent of the log export volume in 1965.

In 1965, sawmills, planing mills, veneer plants, and plywood plants in the region produced 8.2 million tons of coarse residue, four million tons of sawdust, and 2.8 million tons of shavings. Projections of potential mill residue production are based on the projected output of lumber and veneer. Because the projected decline in lumber production will more than offset the increase in veneer production, the output of mill residue will also decline. Coarse residue production is projected to decline 11 percent to 7.3 million tons by 2020; sawdust production will drop 29 percent to 2.9 million tons; and shaving production will drop 30 percent to about two million tons (table 19).

Table 19 - Production of Mill Residue, 1965, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region 1/

Type of Residue	1965	1980	2000	2020
		(Thousand Tons)		
Coarse	8,186	6,954	7,180	7,295
Sawdust	4,065	3,166	3,015	2,899
Shavings	2,807	2,143	2,032	1,952

1/ Assumes no change in utilization of roundwood.
Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Exp. Sta., Portland, Oregon, February 1969.

Pulpwood Consumption

In 1965 an estimated 839 million cubic feet of pulpwood was consumed by pulpmills in the region. It was estimated that 68 percent of this total wood fiber consumption (567 million cubic feet) was residue from the lumber and wood products industry.

By the year 2020 the total wood consumption by the pulp, paper, and allied products industry is projected to increase 1.6 times to 2.2 billion cubic feet (table 20). As the available supply of plant residues becomes fully utilized an increasing part of pulpwood production will come from roundwood sources. It is projected that roundwood consumption by pulpmills will increase from 272 million cubic feet in 1965 to 1.4 billion cubic feet in 2020. Roundwood will then account for 65 percent of the total pulpwood consumption rather than the present 32 percent.

Table 20 - Wood Consumption by the Paper and Allied Products Industry, 1965, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions. 1/

Subregion	1965	1980	2000	2020
		(Million Cubic Feet)		
1	59	115	194	212
2	3	8	13	20
3	--	--	--	--
4	--	--	12	35
5	--	14	37	75
6	48	58	66	75
7	38	51	81	89
8	249	368	529	575
9	95	203	257	267
10	106	201	264	280
11	241	342	499	546
12	--	--	--	--
C-NP	839	1,360	1,952	2,174

1/ Includes hardboard industry data.
Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

Almost every subregion is assumed to share in the expansion of the pulp, paper, and allied products industry, but Subregions 8 and 10 will remain the most important pulpwood-consuming areas in the region with 575 million cubic feet and 546 million cubic feet of wood consumption, respectively, in 2020.

Forest Industry Employment

Projections of forest industry employment have been made for selected years during the 1965-2020 period for the Columbia-North Pacific Region. The historical relationship between employment and wood input was studied for the period 1950 to 1965 for the major forest industries in broad areas within each state except for Idaho and western Montana, where state data was generally combined. Regressions were developed for SIC 2411, logging; SIC 2421, sawmills and planing mills; SIC 2432, veneer and plywood; and SIC 26, pulp, paper, and allied products. The historic trend in the employment-consumption relationship was projected to 2020 for each forest industry. Using this and the projected wood consumption by industry, future forest-based employment was calculated for the subregions. In this text, and the following tables, the employment projections have not been rounded so that data for small geographic areas can be added and reconciled with various regional totals. This is not meant to imply that the projections are accurate to the detail shown.

Log sizes are changing, worker productivity is increasing, log utilization is improving, and the work week has been getting shorter. These various factors are reflected in the trend of the employment-consumption relationship, even though each individual factor influences employment differently. Thus, the method of projecting employment implicitly takes into account a number of factors which have been changing and assumes that the same trends will continue in the future.

Total forest industry employment is projected to decline 37 percent during the 1965-2020 period to about 104,000 (table 21). This decline is entirely the result of decreased employment in the lumber and wood products industry where increasing worker productivity, coupled with a declining projected wood consumption, is projected to reduce employment 46 percent during the 1965-2020 period. Total employment in the lumber and wood products industry is projected to be 73,816 in 2020, compared to 137,318 in 1965.

Pulp, paper, and allied products employment is projected to increase six percent to 30,189 employees. This increase reflects the rapid growth which is projected for the industry.

Table 21 - Forest Industry Employment by Industry Group, 1965, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	Industry Group	Standard Industrial Classification Code	1965	1980	2000	2020
				(Number of Persons)		
1	Lumber & wood products	24	13,130	10,811	8,261	7,143
	Pulp & paper	26	750	922	1,140	1,161
	Total		13,880	11,733	9,401	8,304
2	Lumber & wood products	24	2,805	3,003	2,469	2,055
	Pulp & paper	26	83	83	76	79
	Total		2,888	3,086	2,545	2,134
3	Lumber & wood products	24	1,799	1,981	1,741	1,570
	Pulp & paper	26	168	254	300	306
	Total		1,967	2,235	2,041	1,876
4	Lumber & wood products	24	310	297	240	200
	Pulp & paper	26	70	76	227	454
	Total		380	373	467	654
5	Lumber & wood products	24	3,040	3,167	2,707	2,374
	Pulp & paper	26	--	222	479	822
	Total		3,040	3,389	3,186	3,196
6	Lumber & wood products	24	6,170	5,094	3,824	2,865
	Pulp & paper	26	800	841	784	752
	Total		6,970	5,935	4,608	3,617
7	Lumber & wood products	24	7,251	6,072	5,081	4,427
	Pulp & paper	26	660	884	1,142	1,022
	Total		7,911	6,956	6,223	5,449
8	Lumber & wood products	24	11,868	8,560	7,012	5,694
	Pulp & paper	26	8,463	9,224	9,578	8,172
	Total		20,331	17,784	16,590	13,866
9	Lumber & wood products	24	34,565	23,226	19,527	17,949
	Pulp & paper	26	5,379	7,607	7,060	5,782
	Total		39,944	30,833	26,587	23,731
10	Lumber & wood products	24	33,660	22,770	18,686	16,505
	Pulp & paper	26	2,253	2,756	2,728	2,288
	Total		35,913	25,526	21,414	18,793
11	Lumber & wood products	24	21,515	16,944	14,670	12,601
	Pulp & paper	26	9,845	10,311	10,896	9,351
	Total		31,360	27,255	25,566	21,952
12	Lumber & wood products	24	1,205	804	564	433
	Pulp & paper	26	--	--	--	--
	Total		1,205	804	564	433
C-NP	Lumber & wood products	24	137,318	102,729	84,782	73,816
	Pulp & paper	26	28,471	33,180	34,410	30,189
	Total		165,789	135,909	119,192	104,005

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

Washington State is projected to lead in forest employment by 2020 (46,932), with Oregon dropping to second (44,012). Idaho will have 8,657 forest industry employees in 2020 and western Montana will have 4,404 employees (tables 21 and 22).

Table 22 - Employment in Forest Management, 1962, with Projections to 1980, 2000, and 2020, United States, Columbia-North Pacific Region and Subregions 1/ 2/

Subregion	1962	1980	2000	2020
		(Number of Persons)		
1	1,572	2,246	3,340	4,185
2	436	622	926	1,160
3	318	455	677	848
4	61	88	130	163
5	402	575	856	1,072
6	840	1,200	1,786	2,237
7	836	1,195	1,778	2,227
8	1,990	2,843	4,230	5,298
9	3,085	4,404	6,558	8,216
10	5,352	7,646	11,376	14,250
11	2,324	3,321	4,940	6,189
12	284	405	603	755
C-NP	17,500	25,000	37,200	46,600
U.S.	90,800	129,300	191,600	239,900

1/ The protection and management for the production of timber and related products.

2/ Allocation of forest management employment to subregions was based on 1964 timber harvest relationships.

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

Forest Management Employment

In 1962 it was estimated that the number of persons employed in forest management amounted to 17,500. Forest management employment includes all workers, both publicly or privately engaged in the protection and management of forest lands for the production of timber and related products. It also includes

the time worked by part-time employees and forest owners converted to an equivalent full-time basis.1/

The trend toward more intensive forest management on all forest lands in the region will continue in the 1962-2020 period. More forest management personnel will be needed as the multiple uses of forest lands are stressed and it is projected that forest management employment will increase 1.7 times during the study period to 46,600 persons in the year 2020 (table 22).

Forest-Related Payrolls

In 1962, worker incomes in all forest-related activities amounted to $945 million. Workers in the lumber and wood products industry received 73 percent of the total; those in pulp, paper, and allied products received 18 percent; and forest management employees received nine percent of the total 1962 payroll in the forest economy. Between 1965 and 2020, total payrolls in the forest economy are projected to increase 1.4 times to a total of about $2.3 billion. Payrolls are assumed to increase commensurate with worker productivity. Payrolls in the lumber and wood products industry in 2020 will amount to 34 percent of the total, or $765 million; whereas, the pulp, paper and allied products payroll will be $537 million, or 23 percent. Forest management payrolls are projected to be $975 million in 2020, or 43 percent of the total (table 23).

SUMMARY

The Columbia-North Pacific Region has a large timber resource and a large forest industry based on that resource. After more than a century, lumber is still the primary forest product. Manufacture of pulp, paper, and allied products, veneer and plywood, and board products, has been, and will continue to be, of increasing importance. With the nation's population increasing and personal incomes rising, the demand for timber products will increase. However, limited timber supply will be a constraint on the growth of the timber economy.

The forest industry's period of most rapid growth can probably be regarded as past history. While continued growth of forest production can be expected, it will be at a much

1/ Based on a concept of forest management developed in "The economic importance of timber in the United States," U.S.D.A. Forest Service, Misc. Pub. 941, July 963.

Table 23 - Forest Industry Income (Payrolls) by Industry Group, 1962, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	Industry Group	Standard Industrial Classification Code	1962	1980	2000	2020
				(Thousand Dollars) 1/		
1	Lumber & wood products	24	66,273	82,207	77,026	74,059
	Pulp & paper	26	4,061	9,338	15,981	20,662
	Forest management 2/ 3/		7,858	17,502	42,655	87,582
2	Lumber & wood products	24	13,842	22,835	23,021	21,306
	Pulp & paper	26	536	841	1,065	1,405
	Forest management		2,179	4,853	11,828	24,285
3	Lumber & wood products	24	8,876	15,064	16,233	16,278
	Pulp & paper	26	1,001	2,573	4,205	5,446
	Forest management		1,592	3,547	8,645	17,750
4	Lumber & wood products	24	1,613	2,258	2,238	2,074
	Pulp & paper	26	452	769	3,182	8,080
	Forest management		306	682	1,662	3,414
5	Lumber & wood products	24	15,697	24,081	25,240	24,614
	Pulp & paper	26	--	2,248	6,715	14,629
	Forest management		2,012	4,483	10,925	22,432
6	Lumber & wood products	24	31,818	38,735	35,655	29,704
	Pulp & paper	26	5,003	8,518	10,990	13,383
	Forest management		4,200	9,355	22,800	46,814
7	Lumber & wood products	24	36,143	46,171	47,375	45,899
	Pulp & paper	26	4,003	8,953	16,009	18,189
	Forest management		4,182	9,316	22,705	46,619
8	Lumber & wood products	24	58,649	65,090	65,379	59,035
	Pulp & paper	26	50,764	93,421	134,264	145,437
	Forest management		9,949	22,160	54,008	110,892
9	Lumber & wood products	24	172,685	176,611	182,070	186,095
	Pulp & paper	26	33,416	77,043	98,967	102,902
	Forest management		15,426	34,361	83,742	171,945
10	Lumber & wood products	24	167,740	173,143	174,228	17.,124
	Pulp & paper	26	13,693	27,913	38,241	40,720
	Forest management		26,758	59,601	145,255	298,247
11	Lumber & wood products	24	106,196	128,842	136,783	130,647
	Pulp & paper	26	58,801	104,430	152,740	166,420
	Forest management		11,620	25,883	63,080	129,520
12	Lumber & wood products	24	6,018	6,114	5,259	4,489
	Pulp & paper	26	--	--	--	--
	Forest management		1,418	3,157	7,695	15,800
C-NP	Lumber & wood products	24	685,550	781,151	790,507	765,324
	Pulp & paper	26	171,730	336,047	482,359	537,273
	Forest management		87,500	194,900	475,000	975,300

1/ 1962 Constant Dollars

2/ The protection and management of forests for the production of timber and related products.

3/ Allocation of forest management employment and payrolls to subregions was based on 1964 timber harvest relationships.

Source: Wall, Brian R., Projected Developments of the Timber Economy of the Columbia-North Pacific Region, USDA, Forest Service, Pacific Northwest Forest & Range Experiment Station, Portland, Oregon, February 1969.

slower rate and employment may be expected to decline. In those areas with major untapped timber supplies, the industry can be expected to grow faster than in the region as a whole. Generally, this new expansion will occur east of the Cascade Range.

With the shift in the product mix and the leveling off of wood fiber consumption in the future, the characteristics of the industry will continue to change. There will be fewer lumber mills and plywood plants but the average capacity per mill will increase. Because of the need for better utilization of wood in such a competitive wood market, firms will tend to continue their integration of wood processing facilities. The capital supply, the raw material supply, the technical skills required, and the long-range outlook required suggest a continuing trend toward more mergers and consolidation of forest land ownership. The forest industry labor force will be shifting from lumber manufacture to plywood manufacture, pulp and paper processing, and secondary manufacturing of wood products.

As markets continue to expand within the region, new types of industry will be attracted and the region will become less dependent on its timber economy. However, due to the nature of the forest industries and their tendency to locate near raw material supplies, many smaller communities will continue to be highly dependent on timber-based activities.

The projected population increase in the region and the nation will act as a constraint on timber supply. People need water, roads, power, industrial sites, recreation areas and home sites, and forested land is frequently required to fulfill these needs. For example, when forests are taken out of production for roads, powerlines and homesites, this, in effect, reduces the long-run potential supply of timber and it is possible that consumers may have to pay higher prices for timber products in the future. Recreation use also removes some forest land from production. It is assumed that present trends in forest land loss would continue in the region and the projections of wood fiber consumption reflect this limitation.

Man is more and more concerned with his environment and how it is affected by industrial activity. Allowance was made for this concern in making projections and it has been assumed that technology of pollution abatement will advance sufficiently to allow the projections of consumption to be realized. Economic activity ought to make man better off. It is hoped that, in some measure, this study of the timber economy will contribute to that end.

AGRICULTURE IN THE ECONOMY

AGRICULTURE IN THE REGION'S ECONOMY

CHARACTERISTICS OF AGRICULTURE

Agriculture is an important industry in the economy of the Columbia-North Pacific Region. In 1964 the value of agricultural commodities produced exceeded $1.5 billion. About 60 percent of the value was from crops and 40 percent from livestock and poultry. The industry utilizes a significant proportion of the region's land and water resources for producing a great variety of agricultural commodities. About a third of the land area is in farms, and extensive quantities of publicly owned land are utilized by livestock for grazing. Of the 21 million acres of cropland, about seven million acres were irrigated in 1966. In 1960, approximately 156 thousand persons were employed in agriculture and about eight percent (443 thousand) of the region's population was classified as rural farm.

Farm and farm characteristics of the region and subregions in 1964 are presented in table 24. In 1964 there were approximately 117 thousand farms in the region. Since 1949 the number decreased by nearly 56 thousand (over 30 percent). They have also decreased in all subregions, however, the rates of decline vary considerably between subregions. Generally, the subregions west of the Cascades have experienced greater rates of decline than those east of the Cascades. In Subregion 2, which contains the Columbia Basin project, the decrease in number of farms was only three percent.

From 1949 to 1964, land in farms increased from 52 million acres to about 57 million acres. Subregions west of the Cascades experienced a decline of land in farms, while those east of the Cascades generally had an expansion of acreage of land in farms.

The average size of farm in the region was about 482 acres in 1964. This was an increase of about 180 acres per farm from 1949. Average farm sizes range from as low as 71 acres in the Puget Sound Subregion to over 3,700 acres in the Closed Basin. These size differentials are associated with the type of farming enterprises in the respective subregions. The average size of farm has increased substantially in all subregions since 1949.

The decrease in land in farms and decrease of farm numbers

Table 24 - Farms and Farm Characteristics, Columbia-North Pacific Region and Subregions, 1964 [1/]

Subject	Unit	C-NP	SUBREGION 1	2	3	4	5	6	7	8	9	10	11	12
Farms	No.	117,448	10,203	9,730	7,426	14,140	10,392	7,054	7,289	7,204	20,366	8,534	14,488	622
Land in farms	Acre	56,648,966	5,496,728	8,721,958	3,334,257	7,371,769	5,995,389	6,090,990	11,287,717	645,784	2,423,638	1,916,580	1,032,512	2,331,674
Average size of farm	Acre	482	540	896	449	521	577	864	1,549	90	119	225	71	3,749
Farms by type:														
Field crop	No.	4,697	135	341	501	2,540	759	39	181	15	143	9	34	0
Vegetable	No.	1,633	30	9	283	10	72	14	194	42	657	39	283	0
Fruit & nut	No.	7,891	102	1,817	1,986	15	197	65	553	168	2,062	357	569	0
Poultry	No.	1,893	132	29	44	83	58	28	69	209	584	117	539	1
Dairy	No.	11,164	726	289	278	1,909	2,361	119	216	675	966	1,144	2,473	8
Livestock	No.	18,288	2,446	1,420	1,021	2,557	2,351	1,460	1,499	773	1,712	1,399	1,301	349
General	No.	10,612	713	1,334	609	2,509	1,616	490	641	189	1,975	229	240	67
Miscellaneous	No.	50,528	4,899	2,304	2,432	2,630	2,773	1,897	2,358	5,127	11,691	5,220	9,033	164
Farms by economic class:														
Commercial	No.	71,408	5,731	7,610	5,152	11,663	7,764	5,310	5,073	2,463	9,817	3,858	6,499	468
Class 1	No.	7,825	316	1,017	790	1,277	731	789	885	150	1,008	184	620	58
Class 2	No.	11,576	657	1,743	882	2,052	1,027	1,257	1,004	232	1,292	400	939	91
Class 3	No.	15,607	1,088	1,868	1,039	3,249	1,900	1,191	1,097	386	1,606	684	1,395	104
Class 4	No.	14,339	1,259	1,387	982	2,732	1,935	967	870	405	1,879	714	1,099	110
Class 5	No.	13,093	1,379	1,054	984	1,808	1,582	701	765	569	2,231	874	1,080	66
Class 6	No.	8,968	1,032	541	475	545	589	405	452	721	1,801	1,002	1,366	39
Other	No.	46,040	4,472	2,120	2,274	2,477	2,628	1,744	2,216	4,741	10,549	4,676	7,989	154
Farms by tenure of operator:														
Full owners	No.	79,859	6,861	5,619	5,335	7,965	6,552	3,416	4,241	5,811	15,636	7,003	11,058	362
Part owners	No.	26,225	2,602	2,963	1,444	3,947	2,481	2,501	2,159	1,048	3,468	1,015	2,407	190
Managers	No.	796	52	83	96	163	88	67	64	8	76	39	48	12
All tenants	No.	10,568	688	1,065	551	2,065	1,271	1,070	825	337	1,186	477	975	58

Source: 1964 Census of Agriculture.

in those subregions west of the Cascades is associated with population growth and industrial expansion, which has been considerably greater in the western part of the region. In those subregions east of the Cascades, resource developments (such as irrigation) and other factors have caused acreages of land in farms to either increase or, at least, to be restricted in their rate of decline. Also, they have caused the rate of decline in the number of farms to be less than that in the western part of the region. The number of farms has been decreasing as the average size of farm has been increasing. This has been associated with the necessity of reducing costs per unit of production by the use of advanced technologies, coupled with a declining return per unit of output. Also, it allows farm enterprises to take greater advantage of economies in size of operation and maintain or increase total net income.

The classification of farms by type are those used in the Census of Agriculture, which is based on a description of the major source of income from farm sales. Thus, dairy farms are defined as farms with 50 percent or more of the total value of farm sales from dairy products. Miscellaneous and general farms are those receiving their income from three or more sources and do not meet the criteria for any other type.

Over half of the farms in the region are classified as general and miscellaneous. These farms are most numerous in the subregions west of the Cascades, where the farm enterprises are most diversified. Dairy farms are generally concentrated in southern Idaho and in the subregions west of the Cascades. Livestock farms are well distributed throughout all subregions. Vegetable and poultry farms in the region are relatively small in number, but they are concentrated in Subregions 3, 9, and 11. Over half of the field crop farms are located in Subregion 4.

About 60 percent of the farms are commercial farms. In general, all farms were classified as commercial if the value of sales amounted to $2,500 or more, or if the operator was under 65 years of age and did not work off the farm more than 100 days, or has nonfarm income greater than farm income. Noncommercial (other) farms are those farms with less than $2,500 annual sales, where the operator works off the farm more than 100 days, or has nonfarm income greater than farm income. These are generally part-time farms or farms on which the operator is retired. These noncommercial farms comprise about 40 percent of all farms in the region, and over 50 percent of all farms in Subregions 8, 9, 10, and 11.

Over two-thirds of the farms in the region are owner operated; part-owners operated 22 percent, and tenants operated 10 percent of all farm enterprises. The employment of farm managers

acounted for less than 1 percent of all farm operations. These farm tenure relationships were somewhat similar throughout the subregions.

AGRICULTURAL PRODUCTION

In 1964 the value of agricultural commodities produced in the region exceeded $1.5 billion. About 60 percent of the value was from crop production and 40 percent from the production of livestock and livestock products and poultry and poultry products. Many of the products grown are important in both national and international markets. An additional $2.1 million of farm income was derived from providing hunting, fishing, and other recreational services.

Tables 25, 26, and 27 present the volume and value of major agricultural commodities produced in the region and subregions. Other studies have presented comprehensive and detailed historical and current descriptive analyses of the geographical location and quantities of production of agricultural commodities produced in the Pacific Northwest (29) (46) (47) (48) (49) (50) (69). Consequently, only a brief description is presented in this report.

Small grains (barley, corn, oats, rye, and wheat) are produced throughout the region. Wheat is the major cereal and its production is concentrated in the Columbia Basin area and southeastern Idaho. Oat production is not concentrated in any one part of the region; however, the Willamette Subregion is the heaviest single production area. Barley production is concentrated in the same areas as wheat production, the Columbia Basin area and southeastern Idaho. The most important corn growing areas are located in Subregions 2, 3, 5, and 9. The production of small grains was over 6 million tons in the region in 1964 and its value over $322 million. Small grains are the major source of agricultural income. Subregions 2, 4, 6, and 7 are the major production areas.

Hay production is another major commodity produced and source of agricultural income. Production of hay is not centralized in any subregion, but significant quantities are produced in Subregions 1, 2, 4, and 5. The region produced 7.7 million tons of hay in 1964, valued at over $166 million.

Other major crops grown, in terms of value, are fruits, nuts, and berries. The value of these crops was over $152 million in the region in 1964. A large variety of deciduous tree fruits, berries, and nuts are grown in relatively concentrated areas. Important crops grown are apples, pears, cherries, strawberries, raspberries, walnuts, and filberts. The production

Table 25 - Production of Agricultural Commodities, Columbia-North Pacific Region and Subregions, 1964 1/

Commodity	Unit	C-NP	SUBREGION 1	2	3	4	5	6	7	8	9	10	11	12
							(Thousands)							
Crops:														
Small Grains 2/	Tons	6,096.4	435.8	1,307.6	184.8	927.0	205.1	1,524.5	1,175.3	8.6	288.8	8.5	10.8	19.6
All Hay	Tons	7,747.3	843.9	962.9	324.8	2,034.8	1,143.7	536.6	563.9	183.8	382.9	200.7	294.4	274.9
Dry Beans & Peas	Cwt.	6,833.6	669.4	795.0	9.7	1,929.4	112.2	3,099.2	193.4	t	2.5	.8	11.9	0.0
Sugar Beets	Tons	4,587.7	57.1	708.5	563.8	1,740.6	1,448.5	1.4	66.6	0.0	1.2	0.0	0.0	0.0
Potatoes	Cwt.	55,419.1	749.8	8,753.4	1,245.6	32,313.4	7,648.5	383.8	2,776.9	143.2	580.7	30.7	792.9	.2
Vegetables	Cwt.	20,464.1	90.8	798.4	2,007.4	594.0	3,805.9	389.3	2,7[illegible]6.2	283.5	7,384.4	120.2	2,253.9	t
Fruit, Nuts & Berries	Tons	1,258.3	5.1	404.5	460.9	1.7	53.5	4.8	100.6	10.2	106.5	81.6	28.9	t
Miscellaneous Crops 3/	lbs.	407,221.9	941.8	4,705.7	41,747.2	4,971.4	26,105.5	72,281.5	15,953.3	227.7	238,653.7	1,606.4	27.8	0.0
							(Millions)							
Livestock & Livestock Products:														
Beef & Veal	lbs.	1,427.7	131.6	117.7	84.9	236.2	237.6	118.5	151.4	45.4	81.0	66.8	98.0	58.6
Pork	lbs.	141.6	16.3	12.4	6.0	20.0	15.3	22.9	13.9	2.1	24.5	2.8	5.2	.2
Lamb & Mutton	lbs.	132.4	3.3	4.0	5.4	55.9	14.2	8.2	8.7	.9	17.4	11.5	1.1	1.8
Milk	lbs.	4,549.9	220.3	116.1	126.8	842.8	691.1	47.5	89.5	271.4	418.7	458.5	1,264.9	2.3
Broilers	lbs.	124.3	.2	0.0	1.8	8.6	10.0	3.0	4.0	15.6	29.1	3.7	48.3	0.0
Turkeys	lbs.	41.0	t	.2	4.2	t	2.7	.1	2.7	1.3	24.7	2.8	2.1	t
Farm Chickens	lbs.	30.4	3.2	.4	.7	1.3	1.1	.5	.7	3.1	7.1	1.2	11.1	.1
Eggs	lbs.	231.4	24.1	2.6	5.3	9.9	8.4	3.7	5.7	23.9	54.1	8.9	84.8	t

1/ Estimated from Census of Agriculture and Statistical Reporting Service data.
2/ Small grains include barley, corn, oats, rye, and wheat.
3/ Miscellaneous crops include forage seeds, hops, and mint.
t = trace

Table 26 - Value of Production of Agricultural Commodities, Columbia-North Pacific Region and Subregions, 1964 1/

Commodity	C-NP	SUBREGIONS 1	2	3	4	5	6	7	8	9	10	11	12
						(1,000 Dollars)							
Major Crops:													
Small Grains 2/	322,219.4	22,689.7	70,824.6	9,592.2	48,068.8	10,074.2	81,672.3	62,724.4	384.7	14,364.8	365.3	509.8	948.6
All Hay	166,567.0	18,143.8	20,702.4	6,983.2	43,748.2	24,589.6	11,536.9	12,123.8	3,951.7	8,232.4	4,315.0	6,329.6	5,910.4
Dry Beans & Peas	34,276.4	2,758.8	4,439.5	57.8	12,810.2	790.8	12,573.0	784.5	0.0	10.1	3.2	48.5	0.0
Sugar Beets	52,758.6	656.6	8,147.8	6,483.7	20,016.9	16,657.8	16.1	765.9	0.0	13.8	0.0	0.0	0.0
Potatoes	75,601.6	1,004.7	11,729.6	1,669.1	44,640.0	10,249.0	514.3	3,721.0	191.9	778.1	41.1	1,062.5	.3
Vegetables	60,778.1	269.7	2,371.2	5,962.0	1,764.2	11,303.5	1,156.2	8,126.5	842.0	21,931.7	357.0	6,694.1	t
Fruits, Nuts & Berries	152,024.4	542.6	40,935.4	46,638.5	186.7	5,442.6	523.2	10,454.4	2,405.9	26,860.4	9,443.6	8,591.1	t
Miscellaneous Crops 3/	84,639.6	150.7	1,788.2	22,126.0	745.7	6,004.3	10,842.2	3,828.8	334.7	38,184.6	514.0	120.4	0.0
Livestock & Livestock Products:													
Beef & Veal	283,826.8	26,162.1	23,398.8	16,878.1	46,956.6	47,234.9	23,557.8	30,098.3	9,025.5	16,102.8	13,279.8	19,482.4	11,649.7
Pork	22,882.6	2,634.1	2,003.8	969.6	3,232.0	2,472.5	3,700.6	2,246.2	339.4	3,959.2	452.5	840.3	32.3
Lamb & Mutton	21,726.8	541.5	656.4	886.1	9,173.2	2,330.2	1,345.6	1,427.7	147.7	2,855.3	1,887.2	180.5	295.4
Milk	198,375.6	9,605.1	5,062.0	5,528.5	36,746.1	30,132.0	2,071.0	3,902.2	11,833.0	18,255.3	19,990.6	55,149.6	100.3
Broilers	21,131.0	34.0	0.0	306.0	1,462.0	1,700.0	510.0	680.0	2,652.0	4,947.0	629.0	8,211.0	0.0
Turkey	8,841.4	t	43.3	910.1	t	585.1	21.7	585.1	281.7	5,352.5	606.8	455.1	t
Farm Chickens	2,187.0	229.4	28.7	50.2	93.2	78.9	35.9	50.2	222.3	509.1	86.0	795.9	7.2
Eggs	50,537.8	5,263.4	567.8	1,157.5	2,162.2	1,834.6	808.1	1,244.9	5,219.8	11,815.4	1,943.8	18,520.3	t

1/ Values based on normalized prices and Statistical Reporting Service data.
2/ Small grains include barley, corn, oats, rye, and wheat.
3/ Miscellaneous crops include forage seeds, hops and mint.
t = trace

Table 27 - Value of Production of Major Agricultural Commodity Groups, Columbia-North Pacific Region and Subregions, 1964 1/

Commodity Groups 2/	C-NP	SUBREGIONS 1	2	3	4	5	6	7	8	9	10	11	12
						(1,000 Dollars)							
Total Value	1,558,374.1	90,686.2	192,699.5	126,198.6	271,806.0	171,480.0	150,884.9	142,763.9	37,832.3	174,172.5	53,914.9	126,991.1	18,944.2
Total Value-Crops	948,865.1	46,216.6	160,938.7	99,512.5	171,980.7	85,111.8	118,834.2	102,529.3	8,110.9	110,375.9	15,039.2	23,356.0	6,859.3
Field Crops	523,062.8	43,592.3	95,966.5	16,633.2	104,627.2	35,454.6	105,782.2	75,632.7	4,336.4	22,607.3	4,683.5	6,887.9	6,859.0
Other	425,802.3	2,624.3	64,972.2	82,879.3	67,353.5	49,657.2	13,052.0	26,896.6	3,774.5	87,768.6	10,355.7	16,468.1	.3
Total Value-Livestock	609,509.0	44,469.6	31,760.8	26,686.1	99,825.3	86,368.2	32,050.7	40,234.6	29,721.4	63,796.6	38,875.7	103,635.1	12,084.9
Livestock & Products	526,811.8	38,942.8	31,121.0	24,262.3	96,107.9	82,169.6	30,675.0	37,674.4	21,345.6	41,172.6	35,610.1	75,652.8	12,077.7
Poultry & Products	82,797.2	5,526.8	639.8	2,423.8	3,717.4	4,198.6	1,375.7	2,560.2	8,375.8	22,624.0	3,265.6	27,982.3	7.2

1/ Production estimated from Census of Agriculture and Statistical Reporting Service data. Values based on normalized prices and Statistical Reporting Service data.

2/ Items included in each commodity group are as follows: Field crops = small grains, hay, dry beans and peas
Other crops = sugar beets, potatoes, vegetables, fruits, nuts, berries, and miscellaneous crops
Livestock & products = beef and veal, pork, lamb and mutton, and milk
Poultry & products = broilers, turkeys, farm chickens, and eggs.

of these commodities are concentrated in Subregions 2, 3, 7, and 9.

Potatoes and sugar beets are also major crops. They are generally grown on the irrigated lands in Subregions 2, 3, 4, and 5. Potato production amounted to 55 million hundredweight in the region in 1964 and its value was over $75 million. Sugar beet production was over four and a half million tons and its value about $53 million.

Miscellaneous crops (hops, mint, and forage seeds) are grown principally in Subregion 9, but Subregions 3, 5, and 6 are also important. Hops and mint are grown mainly in the Yakima and Willamette Subregions. The production of grass and cover-crop seeds is most heavily concentrated in the Willamette Subregion, with secondary concentration in Subregions 5 and 6. The value of production of these crops was about $85 million in 1964.

Dry beans and peas are grown primarily in Subregions 4 and 6. Dry field peas are produced in a concentrated area in southeastern Washington and the adjacent portion of Idaho north of the Snake River. Production of dry field peas is centered in the Twin Falls area of southern Idaho (Subregion 4), and the Columbia Basin project area (Subregion 2). In 1964, about 6.8 million hundredweight of dry beans and peas were produced and their value exceeded $34 million.

The production of livestock and livestock products and poultry and poultry products is an important segment of the agricultural economy of the region. The total value of this production exceeded $600 million in 1964. Livestock and livestock products accounted for $527 million, and poultry and poultry products, $83 million.

The production of cattle and calves (beef and veal) is distributed throughout the region. Beef cattle operations fall into three categories; (1) range cattle ranching, (2) farm beef production, and (3) cattle finishing or feedlot enterprises. Cattle ranching is generally a large scale enterprise, usually located in subregions east of the Cascades. Farm beef production is generally combined with other farm enterprises throughout the region and feedlot enterprises are commonly found in irrigated areas such as by the Snake River and in the Yakima Valley. Beef and veal production in the region was over 1.4 billion pounds in 1964 and its value about $284 million.

Milk is a major livestock product. The production of

milk is concentrated in those areas of the region where population is located (mainly west of the Cascades, and also in Subregions 4 and 5). Over 4.5 billion pounds of milk was produced in 1964. The value of milk production was about $198 million.

The production of lamb and mutton and pork in 1964 was 132 and 142 million pounds, respectively. The production of these commodities occurred throughout the region. Subregions 4, 6, and 9 were the most important in the production of pork and lamb and mutton.

The production of poultry and poultry products is concentrated in those subregions west of the Cascades. Eggs and broilers are the most important products, but turkeys and farm chickens are significant in some subregions. The total value of output from poultry and poultry products in 1964 was about $83 million. The value of egg production was about $51 million, and broilers, $21 million.

The projected future levels of agricultural production for the region and subregions relies heavily upon the National-Regional Program of Economic Analysis and Projections of the Economic Research Service for the Water Resources Council (64). The national program provided estimates of requirements for food and fiber for the United States. These estimates were essential because many of the agricultural commodities produced in the region are exported to national and international markets, as well as being consumed within the region. Also, regional projections of agricultural production were made for these same commodities by the national program.

Certain assumptions relating to the future economy and its structure were made in the national program. These assumptions of basic economic indicators provided the framework within which the projections were developed and are common to all sections of this report. The agricultural projections consider, implicitly or explicitly, important factors which will shape the growth and development in agriculture. Several important factors that affect the future agricultural economy were explicitly considered in developing the national projections of food and fiber. These are as follows:

(1) Population growth;

(2) Rising per capita income, changes in consumer tastes and their influence on per capita use of agricultural commodities;

(3) Industrial and other uses of agricultural commodities;

(4) Livestock feeding efficiencies and composition of the feed ration; and

(5) The foreign market for agricultural products.

The national projections of production requirements, presented in table 28, represent an agricultural economy where agricultural production is in balance with estimated future demand. A detailed discussion of the assumptions and procedures used in the national program is reported in several other studies (64)(67).

In developing the regional projections, primary emphasis was placed on the examination and extrapolation of past trends in production patterns in the region relative to the nation. These historical relationships were projected to 1980, with only minor modifications beyond that period. For those commodities for which national projections were not developed (such as berries, hops, mints, forage seeds), the major factors considered in developing the projections were historical trends in production and national population growth. In general, the historical production patterns indicated an increasing relative share of national production. This is reflected in the regional projections up to the year 1980. The procedures used for developing the subregional projections were similar to those used for the region. The major factors considered were historical production in each subregion relative to the region, production trends, population growth and, to the extent possible, the availability of resources for agricultural production.

The projected values and volumes of production of major crops and livestock commodities for the Columbia-North Pacific Region and the 12 subregions are presented in tables 29 and 30. The value (in constant dollars) and volume of all agricultural commodities is projected to increase about two and a half times by 2020. The production of all crops will increase by 160 percent and all livestock by 131 percent. By 2020 the value of all crops produced will represent about 64 percent of the total value of production, and livestock and poultry, 36 percent. The major increases will be in those commodities such as sugar beets, potatoes, vegetables, fruits, nuts and berries, beef and veal, eggs and broilers. These regional projections reflect the changing national requirements for food and fiber. The projected increases of agricultural production vary between the subregions, ranging from an increase of over 200 percent in Subregion 2 to less than 100 percent in other subregions, such as 10 and 12.

Table 28 - Production Requirements for Agricultural Commodities, United States, 1959-61, with Projections to 1980, 2000 and 2020 1/

Commodity	Unit	1959-61	1980	2000	2020
			(Thousands)		
Feed grains (corn equiv.)	Tons	145,128	197,200	244,100	298,700
Corn	do.	106,010	141,500	178,400	222,400
Oats	do.	17,167	17,800	15,800	11,000
Barley	do.	9,995	12,300	12,200	11,000
Sorghum	do.	15,445	25,600	37,700	54,300
Food crops					
Wheat	Bu.	1,237,700	1,873,600	2,127,500	2,458,600
Rye	do.	27,868	41,400	54,100	71,800
Rice (rough)	Cwt.	54,154	83,300	93,600	107,000
Flaxseed	Bu.	24,605	21,800	27,000	33,500
Soybeans	do.	589,257	1,268,900	1,531,900	1,860,900
Peanuts (farm stock)	Lbs.	1,705,500	2,428,000	3,179,000	4,133,000
Sugar	Tons	3,290	7,300	11,400	16,500
Dry beans	Cwt.	19,048	22,900	28,900	36,600
Dry peas	do.	3,927	5,300	6,100	7,200
Potatoes	do.	265,609	319,100	420,600	551,200
Sweet potatoes	do.	16,508	17,500	23,200	30,600
Fruits and Vegetables					
Citrus fruits	Tons	8,028	11,000	14,100	17,900
Noncitrus fruits	do.	9,952	12,600	17,200	22,900
Vegetables	Cwt.	403,902	615,900	801,800	1,034,600
Tree nuts (shelled)	Lbs.	170,000	147,700	275,700	436,000
Fiber crops					
Cotton	Lbs.	7,191,300	8,083,000	9,405,000	11,064,000
Tobacco	do.	1,934,200	2,134,000	2,668,000	3,337,000
Livestock and products					
Beef and veal	Lbs.	28,898,500	45,506,000	60,588,000	79,506,000
Pork	do.	20,220,000	25,947,000	33,990,000	44,056,000
Lamb and mutton	do.	1,683,000	1,630,000	2,164,000	2,831,000
Farm chickens	do.	1,251,700	1,396,000	1,824,000	2,362,000
Turkeys	do.	1,600,900	3,413,000	4,448,000	5,746,000
Eggs	No.	62,302,000	72,613,000	95,251,000	123,886,000
Milk	Lbs.	123,460,700	139,372,000	181,490,000	234,226,000
Broilers	do.	6,207,100	10,263,000	13,293,000	17,094,000

1/ Projections based on Series C population estimates.

Table 29 - Value of Production of Major Agricultural Commodity Groups, Columbia-North Pacific Region, 1964, with Projections to 1980, 2000, and 2020 1/

Commodity Groups 2/	1964	1980	2000	2020
		(1,000 Dollars)		
Total Value	1,558,374.1	2,364,107.3	3,028,301.7	3,878,579.6
Total Value Crops	948,865.1	1,543,964.7	1,947,278.5	2,470,093.4
Field Crops	523,062.8	811,688.2	948,215.5	1,137,929.8
Other	425,802.3	732,276.5	999,063.0	1,332,163.6
Total Value Livestock & Poultry	609,509.0	820,142.6	1,081,023.2	1,408,486.4
Livestock & Products	526,811.8	794,856.0	930,470.4	1,213,464.6
Poultry & Products	82,697.2	115,286.6	150,552.8	195,121.6

1/ Production estimated from Census of Agriculture and Statistical Reporting Service data. Values based on normalized prices and Statistical Reporting Service data.

2/ Items included in each commodity group are as follows:
Field crops = small grains, hay, dry beans and peas
Other crops = sugar beets, potatoes, vegetables, fruits, nuts, berries, and miscellaneous crops
Livestock & products = beef and veal, pork, lamb and mutton, and milk
Poultry & products = broilers, turkeys, farm chickens, and eggs.

Table 30 - Projections of Production of Major Agricultural Commodity Groups, 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	Commodity Groups 1/	Projections 2/ Index Numbers 1964=100 1980	2000	2020
1	All Crops, Livestock & Poultry	145	180	226
	All Crops	161	190	231
	Field Crops	164	193	233
	Other	116	155	203
	All Livestock & Poultry	127	168	220
	Livestock & Products	125	166	216
	Poultry & Products	144	189	245
2	All Crops, Livestock & Poultry	193	246	315
	All Crops	198	250	319
	Field Crops	185	216	260
	Other	217	301	406
	All Livestock & Poultry	171	226	295
	Livestock & Products	172	228	298
	Poultry & Products	103	136	175
3	All Crops, Livestock & Poultry	149	199	255
	All Crops	150	201	257
	Field Crops	168	204	205
	Other	147	200	267
	All Livestock & Poultry	144	190	249
	Livestock & Products	146	193	253
	Poultry & Products	125	164	213
4	All Crops, Livestock & Poultry	161	207	268
	All Crops	167	213	275
	Field Crops	155	183	228
	Other	187	259	349
	All Livestock & Poultry	149	197	256
	Livestock & Products	149	196	256
	Poultry & Products	162	211	273
5	All Crops, Livestock & Poultry	168	219	285
	All Crops	194	252	326
	Field Crops	211	249	298
	Other	182	255	347
	All Livestock & Poultry	142	187	244
	Livestock & Products	140	185	241
	Poultry & Products	174	227	293
6	All Crops, Livestock & Poultry	129	153	182
	All Crops	130	149	171
	Field Crops	129	146	164
	Other	136	178	231
	All Livestock & Poultry	127	168	220
	Livestock & Products	128	169	221
	Poultry & Products	109	142	183
7	All Crops, Livestock & Poultry	143	178	230
	All Crops	146	177	227
	Field Crops	140	162	205
	Other	163	218	287
	All Livestock & Poultry	137	181	237
	Livestock & Products	140	185	242
	Poultry & Products	96	126	163

Continued

Table 30 - Projections of Production of Major Agricultural Commodity Groups, 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions--Con.

Subregion	Commodity Groups 1/	Projections 2/ Index Numbers 1964=100 1980	2000	2020
8	All Crops, Livestock & Poultry	125	162	210
	All Crops	134	167	213
	Field Crops	110	124	151
	Other	161	217	284
	All Livestock & Poultry	122	160	209
	Livestock & Products	114	150	195
	Poultry & Products	143	187	243
9	All Crops, Livestock & Poultry	151	196	252
	All Crops	155	201	258
	Field Crops	151	175	210
	Other	156	208	270
	All Livestock & Poultry	143	187	243
	Livestock & Products	135	178	231
	Poultry & Products	157	205	266
10	All Crops, Livestock & Poultry	115	151	198
	All Crops	148	197	260
	Field Crops	116	143	184
	Other	162	221	294
	All Livestock & Poultry	102	134	174
	Livestock & Products	105	138	180
	Poultry & Products	71	93	120
11	All Crops, Livestock & Poultry	122	160	207
	All			
	All Crops	136	178	228
	Field Crops	47	58	75
	Other	174	229	292
	All Livestock & Poultry	119	156	202
	Livestock & Products	115	151	195
	Poultry & Products	129	169	219
12	All Crops, Livestock & Poultry	118	150	190
	All Crops	131	156	187
	Field Crops	131	156	187
	Other	---	---	---
	All Livestock & Poultry	110	146	192
	Livestock & Products	110	146	192
	Poultry & Products	---	---	---
C-NP	All Crops, Livestock & Poultry	152	194	249
	All Crops	163	205	260
	Field Crops	155	181	218
	Other	172	235	313
	All Livestock & Poultry	135	177	231
	Livestock & Products	134	177	230
	Poultry & Products	139	182	236

1/ Items included in each commodity group are as follows:
Field crops = small grains, hay, dry beans and peas
Other crops = sugar beets, potatoes, vegetables, fruits, nuts, berries, and miscellaneous crops
Livestock & products = beef and veal, pork, lamb and mutton, and milk
Poultry & products = broilers, turkeys, farm chickens, and eggs.
2/ Projections are indexes of physical volumes weighted by prices, 1964 = 100.

CROP YIELDS

The adoption of modern technology and resource developments has been responsible for a rapid increase of yields for many crops grown in the region. Forms which technology has taken include improved crop varieties, better methods for control of weeds and insects, improved water supply and management of land and water resources, higher levels of fertilization, improved harvesting and marketing facilities, and other improvements. The development and adoption of these improvements had been made possible by research, extension, education, and technical services available from institutions and agencies, as well as the increased availability of capital. The growth of irrigation is another significant factor affecting crop yields. In 1944 the Census of Agriculture estimated that irrigated land amounted to about 3.5 million acres in the region. In 1964, 5.6 million acres were irrigated. In addition, other land measures and watershed protection measures, such as drainage, have had an influence on increased yields.

To aid in the identification of future problems and the determination of the need for land and water resources, projections of crop yields were developed for the region. The projections are presented in table 31 and are based on a cooperative study with the state Agricultural Experiment Stations.

Each state Experiment Station was provided with common assumptions to specify the conditions under which the projections were estimated. The projections were to reflect the actual level of performance at an average level of management, and not such performance levels as might be expected from controlled plot and above average levels of management. The specific guideline assumptions are as follows:

1. General economic stability will prevail during the projection period. No major war or economic recession will occur and a high level of economic activity and nearly full employment will be maintained. This does not rule out periodic cyclical adjustments in economic activities.

2. Government programs are expected to exist during the projection period; however, market forces will be assumed to be the dominant factor in the allocation of resources. This implies a gradual decrease in production restraints and greater market influence during the projection period.

3. Government programs in extension and research will continue at present levels.

4. Marketing and transportation facilities will be

adequate to handle agricultural production.

5. Current normal price relationships among inputs, and between inputs and outputs, will continue throughout the projection period.

6. Credit availability, tenure arrangements, zoning, and taxation policies will not interfere with agricultural adjustments, including farm consolidation or adaptation of new technologies.

7. Fertilizer and livestock feeds of needed types and in sufficient quantities will be available at current normal prices.

8. Assuming existing cropping patterns and level of resource developments, disregard the effects on productivity of additional resource developments or changing cropping patterns.

In addition to the assumptions, the Experiment Stations were provided with time-series analysis of crop yields for the years 1939-1963 and 1949-1966, from Statistical Reporting Service data, and historical crop yields from selected Bureau of Reclamation projects as a statistical aid to the effort.

A wide variety of factors will affect the projected increases of crop yields. Gains in crop yields per acre will generally result from the following major factors:

1. Improvements in the average level of management. The average level of management for the projection periods will be at a higher level than that existing during the base year.

2. Conservation and improvement of the soil resource through continued and more widespread land treatment measures which prevent soil loss, conserve moisture, and prevent crop damage.

3. Improved varieties of crop strains.

4. Improved tillage methods, rate and date of seeding, seed treatment, and cultivation will be more widely adopted.

5. Insecticide and herbicide improvement, management and use has great potential for improved yields.

6. Greater use of fertilizer and improved types of fertilizer.

Table 31 - Projections of Weighted Yields for Crops in the Columbia-North Pacific Region

Crop	Irrigated or Non-Irrigated	Projections Index Numbers 1964=100 1980	2000	2020
Barley	I	134	158	186
Barley	NI	118	141	162
Corn for Grain	I	107	128	147
Corn for Grain	NI	105	115	115
Winter Wheat	I	133	182	215
Winter Wheat	NI	121	145	163
Spring Wheat	I	160	186	236
Spring Wheat	NI	131	155	174
Oats	I	126	189	231
Oats	NI	109	124	141
Small Grains Cut for Hay	I	101	104	107
Small Grains Cut for Hay	NI	98	107	115
Corn Silage	I	101	127	164
Corn Silage	NI	149	133	138
Alfalfa Hay	I	127	156	186
Alfalfa Hay	NI	128	147	164
All Other Hay	I	143	165	219
All Other Hay	NI	155	176	198
Dry Beans 1/	I	130	152	172
Dry Peas 1/	I	140	163	187
Dry Peas	NI	112	128	143
Potatoes	I	142	171	192
Sugar Beets	I	132	146	159
Hops	I	127	150	171
Mint Crops	I	140	168	201
Forage Seed Crops 2/	3/	104	132	157
Snap Beans	3/	145	218	256
Sweet, Green Peas 2/	3/	150	205	251
Sweet Corn	I	180	244	304
Strawberries	I	191	280	413
Strawberries	NI	101	91	91
Rye	3/	183	216	248
Onions	3/	125	143	166
Apples	I	195	296	374
Apples	NI	211	318	398
Pears	I	173	285	421
Pears	NI	174	259	388
Sweet Cherries	I	254	328	532
Grapes	I	149	164	180
Prunes	I	149	211	332
Prunes	NI	165	180	175
Peaches	I	167	219	271
Peaches	NI	157	171	214
Apricots	I	154	170	212
Apricots	NI	152	166	207
Filberts 2/	I	200	296	394
Walnuts 2/	I	43	86	143

1/ Oregon excluded.
2/ Idaho excluded.
3/ Includes both irrigated and non-irrigated acreage and production.

7. Greater effort toward adoption of crops and management systems for the natural environment.

8. Greater acceptance of water management practices, improved land preparation, water supply, and timeliness of irrigation will improve response of all crops on irrigated land.

The projected trends in crop yields were not uniform for every crop in each state, consequently, the state projections were weighted by acreages of the crops in each state to develop a weighted average yield for the region. These projections of weighted crop yields for the region are presented in table 31 as indices. The indices for the region can be used for developing subregional, or other geographical area, projections by being applied to the absolute levels of yield in those areas. The indices reflect a considerable degree of difference between crops, and for crops grown on both irrigated and nonirrigated land.

LAND RESOURCES AND USE

The data concerning land uses in this section of the report are based on the hydrologic drainage areas of the subregions and region, and not on the county boundary approximations as all the other economic data.

About 21 million acres of land are currently classified as cropland, of which approximately seven million acres are irrigated (table 32). Cropland comprises less than 12 percent of the total land area of the region. Forest land, on the other hand, accounts for nearly 50 percent of the land area of the region. Rangeland, in 1966, was nearly 59 million acres, or approximately 34 percent of the total land area. Other land (urban-industrial areas, farmsteads, airports and other areas) utilizes over eight million acres of the region. Each of these major land uses have different proportional relationships to the total land area in the subregions. A detailed discussion of these relationships is found in other study appendices (48) (49)(50). Also, detailed discussions and data concerning cropping patterns for irrigated and nonirrigated cropland is presented in those appendices, as is more detailed information on forest, range and other land uses.

Although cropland comprises less than 12 percent of the total land area, additional extensive areas of land are available in the region which are suitable for cultivation and crop production (table 33). About 51 million acres of land are

Table 32 - Major Uses of Land, Columbia-North Pacific Region and Subregions, 1966

Subregion	Cropland	Forest Land	Rangeland	Other Land	Total
			(1,000 Acres)		
1	1,552.1	18,242.1	1,698.1	1,327.1	22,819.4
2	3,308.8	5,652.1	4,583.9	536.0	14,080.8
3	686.3	1,508.9	1,534.8	121.4	3,851.4
4	3,781.3	4,296.9	13,555.8	1,047.8	22,681.8
5	1,628.9	4,190.5	16,838.7	739.4	23,397.5
6	3,077.8	13,537.1	5,041.8	714.5	22,371.2
7	3,570.6	8,328.3	6,358.1	565.2	18,822.2
8	201.1	2,665.0	67.9	258.6	3,192.6
9	1,456.1	5,272.0	58.8	815.9	7,602.8
10	584.8	13,828.6	168.6	472.2	15,054.2
11	591.0	6,429.0	105.0	1,321.6	8,446.6
12	365.0	1,893.0	8,733.1	403.7	11,394.8
C-NP	20,803.8	85,843.5	58,744.6	8,323.4	173,715.3

Source: Appendix IV, Land and Mineral Resource, Columbia-North Pacific Framework Study.

Table 33 - Acreages of Land Suitable for Crop Production by Capability Class, 1966, Columbia-North Pacific Region and Subregions

Subregion	Capability Class I	II	III	IV	Total
		(1,000 Acres)			
1	1.0	415.1	1,135.6	3,003.0	4,554.7
2	69.1	500.0	2,518.0	1,503.1	4,590.2
3	51.8	255.3	330.6	425.2	1,062.9
4	---	569.2	2,233.4	1,124.2	3,926.8
5	43.6	478.3	857.0	489.6	1,868.5
6	3.0	424.1	2,497.4	933.4	3,857.9
7	20.0	555.8	1,974.2	3,037.5	5,587.5
8	11.6	217.0	434.7	466.7	1,130.0
9	171.5	906.2	851.9	872.2	2,801.8
10	1.8	602.5	843.6	2,119.1	3,567.0
11	---	315.0	521.0	1,231.0	2,067.0
12	---	94.5	510.0	545.0	1,149.5
C-NP	373.4	5,333.0	14,707.4	15,750.0	36,163.8 1/

1/ About 15 million acres of desert land in capability class VI are also potentially suitable for cropland when irrigated.
Source: Appendix VIII, Land Measures and Watershed Protection, Columbia-North Pacific Framework Study.

suitable for crop production, which permits considerable opportunity for expansion of agricultural production if needed.

The projections of major uses of land are presented in table 34. Projections of the total land areas for each subregion were made by the Soil Conservation Service and were based upon the estimated changes in total water area for each time period by subregion, with the regional estimate being the sum of the subregional projections. The decrease in total land area by 2020 is about one-half of one percent.

Projections of cropland acres were based on several sources and factors. Historical trends of cropland for each subregion and the region were analyzed from Census of Agriculture data. Secondly, projections of irrigated cropland and nonirrigated cropland harvested for each subregion were obtained and analyzed from Appendix IX, Irrigation. Also, the historical relationship between irrigated cropland and total nonirrigated cropland, and nonirrigated cropland harvested and total nonirrigated cropland were examined. The projections of irrigated cropland had been related to the projections of agricultural production and crop yields in the Irrigation appendix. Based on the Projections of irrigated land and the nonirrigated cropland harvested, and their historical relationships to total cropland, projections for total cropland were determined for each subregion and summed to the region total.

The projected increase of total cropland in the region is about four percent by 2020 (less than a million acres). In general, cropland acreages in those subregions east of the Cascades will be increasing. Those subregions west of the Cascades will experience a decrease in cropland acreages as urban and industrial expansion occurs. Projected changes in the subregions are consistent with the past trends.

Projections of forest land were determined by estimating the losses or gains of forest land to or from the other major uses of land by the Forest Service. Forest land is projected to decline from about 86 million acres in 1966 to 84 million acres in 2020 (slightly over two percent). Nearly all subregions will experience a loss of acreages of forest land.

Other land is comprised of four distinct classifications for the purpose of comprehensive study; (1) barren land, (2) roads and railroads, (3) small waters, and (4) miscellaneous. The latter classification, miscellaneous, includes urban-industrial areas, farmsteads, airports and other areas. Projected changes in other land were derived from an analysis of areas and population in urban places. Regression analysis was used to relate population to acreages in urban areas. Also,

Table 34 - Major Uses of Land, 1966 and Projections for 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	Land Use	1966 1/	1980	2000	2020
		(Thousands of Acres)			
1	Cropland	1,552	1,737	1,739	1,930
	Forest	18,242	18,118	17,974	17,784
	Range	1,698	1,439	1,411	1,237
	Other	1,327	1,414	1,530	1,644
	Total	22,819	22,708	22,654	22,595
2	Cropland	3,309	3,451	3,345	3,300
	Forest	5,652	5,624	5,653	5,674
	Range	4,584	4,363	4,360	4,300
	Other	536	570	616	662
	Total	14,081	14,008	13,974	13,936
3	Cropland	686	724	736	768
	Forest	1,509	1,500	1,490	1,468
	Range	1,535	1,486	1,462	1,428
	Other	121	135	153	173
	Total	3,851	3,845	3,841	3,837
4	Cropland	3,781	3,906	3,872	3,860
	Forest	4,297	4,273	4,254	4,206
	Range	13,556	13,362	13,355	13,350
	Other	1,048	1,069	1,097	1,127
	Total	22,682	22,610	22,578	22,543
5	Cropland	1,629	2,082	2,184	2,453
	Forest	4,191	4,174	4,152	4,129
	Range	16,839	16,332	16,200	15,897
	Other	739	764	795	830
	Total	23,398	23,352	23,331	23,309
6	Cropland	3,078	3,058	3,046	3,035
	Forest	13,537	13,492	13,436	13,380
	Range	5,042	5,040	5,038	5,036
	Other	714	763	823	882
	Total	22,371	22,353	22,343	22,333
7	Cropland	3,571	3,729	3,735	3,805
	Forest	8,328	8,274	8,206	8,118
	Range	6,358	6,176	6,162	6,106
	Other	565	613	675	733
	Total	18,822	18,792	18,778	18,762
8	Cropland	201	176	145	134
	Forest	2,665	2,652	2,649	2,618
	Range	68	65	60	60
	Other	259	282	312	344
	Total	3,193	3,175	3,166	3,156
9	Cropland	1,456	1,384	1,420	1,250
	Forest	5,272	5,221	5,056	5,089
	Range	59	55	50	48
	Other	816	911	1,031	1,156
	Total	7,603	7,571	7,557	7,543
10	Cropland	585	472	421	370
	Forest	13,829	13,795	13,747	13,700
	Range	168	160	150	140
	Other	472	587	676	764
	Total	15,054	15,014	14,994	14,974
11	Cropland	591	470	403	385
	Forest	6,429	6,419	6,336	6,189
	Range	105	105	100	92
	Other	1,322	1,433	1,576	1,737
	Total	8,447	8,427	8,415	8,403
12	Cropland	365	363	361	352
	Forest	1,893	1,874	1,842	1,805
	Range	8,733	8,726	8,741	8,767
	Other	404	413	424	436
	Total	11,395	11,376	11,368	11,360
C-NP	Cropland	20,804	21,552	21,407	21,642
	Forest	85,844	85,416	84,795	84,160
	Range	58,745	57,309	57,089	56,461
	Other	8,323	8,954	9,708	10,488
	Total 2/	173,716	173,231	172,999	172,751

1/ Land and Mineral Resources, Appendix IV, Columbia-North Pacific Framework Study (rounded).
2/ Totals do not include large water bodies which are projected to increase.

several other studies provided additional information which was used in developing and evaluating the projections (59). Information from the Type 2 Willamette and Puget Sound Comprehensive River Basin Studies was utilized after making adjustments for different definitions of land uses and other criteria. The losses of forest lands to other land was also accounted for explicitly.

The projections of acres classified as other land increased from about 8.3 million acres in 1966 to 10.5 million in 2020. This is nearly a 26 percent increase. Those subregions west of the Cascades will have the largest increases in the other land category because of the greater expansion of population and industry.

Rangeland was determined as a residual after the projections of cropland, forest land, other land, and total land were derived. Generally, acreages of rangeland will decrease in nearly all the subregions and the region. Rangeland will decrease from about 58.7 million acres in 1966 to about 56.5 million acres (four percent) in 2020 in the region.

EMPLOYMENT

Agricultural employment decreased from 18 percent of total employment in the region in 1940 to about seven percent in 1960. Employment in agriculture has exhibited substantial decreases since 1940, while accompanied by significant increases in agricultural output. Agricultural employment decreased by approximately 30 percent from 1940 to 1960 (221 thousand to 156 thousand). However, the rate of decline was much greater during the 1950-1960 decade when employment dropped from 210 thousand to 156 thousand, according to the Census of Population. In agriculture, an increasing total output has been achieved by rapid increases in labor productivity and a substitution for farm-based inputs of materials and services purchased from other than farm sources. Greater labor efficiency has been accomplished in part by greater specialization, increased mechanization, and adoption of improved practices, which is indicated by the increase of inputs purchased by farmers from nonfarm sources.

Every subregion in the Columbia-North Pacific Region has experienced a decline in agricultural employment since 1940. Some subregions, such as 1 and 9, have experienced substantial decreases.

Projections of agricultural employment for the nation and water resources regions were developed in the national program.

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COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
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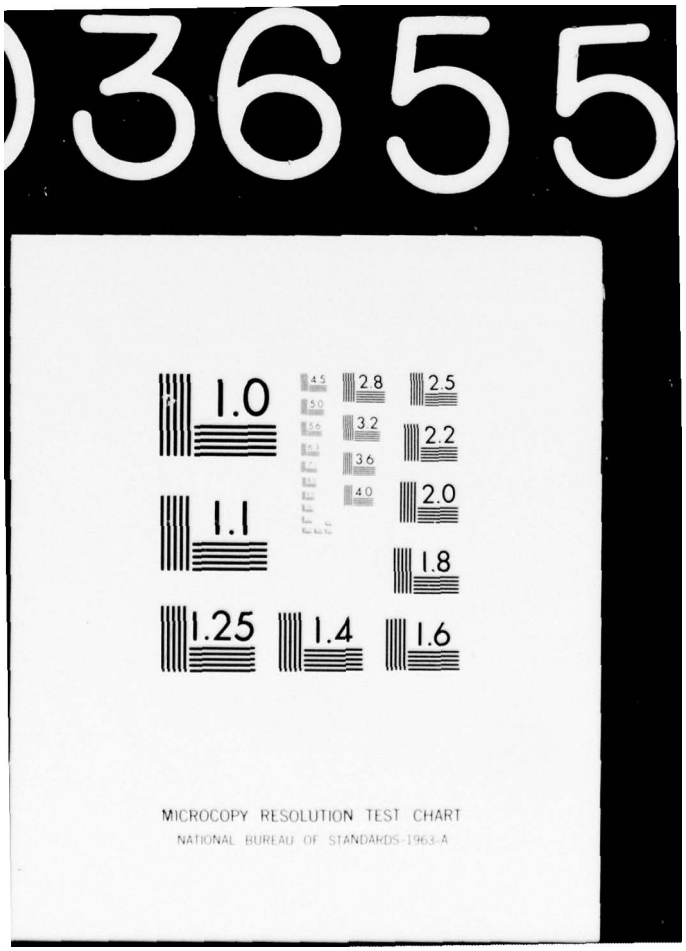
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Regional projections of agricultural employment indicate that there will continue to be substantial decreases. By 2020, employment in agriculture will decline to about 90 thousand employees and will be only about two percent of total employment in the region (table 35). Projections of agricultural employment for the subregions are all declining. These projections are based on past trends in agricultural employment and the relationships between projected changes in agricultural output and worker productivity. They assume that there will be increases in the number of full-time employees as under-employed farmers move out of agriculture, and also, decreases in seasonal part-time employees.

FARM POPULATION

As in the nation, the Columbia-North Pacific Region has experienced a substantial decrease in the rural farm population. National and regional trends indicate that while the rural farm population was declining, total population was increasing. Thus, about 23 percent of the total population was classified as rural farm in 1940 but by 1960 only seven to eight percent were so classified in the nation and region. Associated with these changes, the nonfarm (urban and rural nonfarm) population comprised about 77 percent of total population in 1940 and increased to about 93 percent by 1960 in both the nation and region.

Table 36 presents the population characteristics for all subregions and the region for 1960, with projections for 1980, 2000, and 2020.

Projections of total population for the region and subregions are from the Office of Business Economics study, prepared for Water Resources Council (67). The projections of the farm population for each subregion were based on several types of analysis. Historical trends of the nonfarm population for the period 1940 to 1960 were extended as projections from Census of Population data. Projections of the nonfarm population were then subtracted from total population to estimate the farm population. The rural farm estimates were then analyzed with respect to trends in farm numbers and farm employment.

Based on these factors, the rural farm population for the region was projected to decline from 443 thousand persons in 1960 to about 185 thousand in 2020. The rural farm population in 2020 will comprise only about one and a half percent of the total population. The nonfarm population (urban and rural nonfarm) will increase from about 93 percent of total population

Table 35 - Agricultural Employment 1960, with Projections for 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	1960 1/	1980	2000	2020
		(Thousands)		
1	10.5	7.6	6.3	5.2
2	14.4	12.3	11.9	10.4
3	15.5	12.8	12.2	10.5
4	21.9	16.6	15.3	12.8
5	17.9	13.7	12.8	11.1
6	10.2	7.4	6.1	4.9
7	11.8	8.9	8.4	6.8
8	4.9	3.6	3.3	2.5
9	21.7	16.0	14.7	11.2
10	8.1	7.1	6.5	5.4
11	17.8	13.0	10.7	8.4
12	1.1	1.0	.9	.8
C-NP	155.8	120.0	109.1	90.0

1/ Estimated from OBE and Census of Population.

Table 36 - Total Farm and Nonfarm Population, 1960 with Projections for 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregions	Population Characteristic	1960 1/	1980	2000	2020
			(Thousands)		
1	Total	563.7	699.1	897.1	1,140.4
	Farm	36.3	23.3	19.7	15.5
	Nonfarm 2/	527.4	675.8	877.4	1,124.9
2	Total	193.5	253.0	334.0	431.3
	Farm	35.7	24.5	20.6	16.2
	Nonfarm	157.8	228.5	313.4	415.1
3	Total	227.6	280.7	355.2	443.7
	Farm	32.6	23.2	19.0	15.4
	Nonfarm	195.0	257.4	336.2	428.3
4	Total	277.2	350.9	450.5	576.0
	Farm	69.4	51.2	43.0	35.2
	Nonfarm	207.8	299.7	407.5	540.4
5	Total	252.5	328.7	430.4	553.5
	Farm	47.9	30.1	25.5	20.0
	Nonfarm	204.6	298.6	404.9	533.5
6	Total	155.9	193.5	234.6	274.3
	Farm	26.6	18.4	15.0	11.7
	Nonfarm	129.3	175.1	219.6	262.6
7	Total	198.7	251.4	321.9	404.4
	Farm	28.5	19.1	15.5	12.0
	Nonfarm	170.2	232.3	306.4	392.4
8	Total	224.5	277.9	349.4	441.3
	Farm	20.1	13.3	10.1	7.1
	Nonfarm	204.4	264.6	339.3	434.2
9	Total	1,168.9	1,727.3	2,397.6	3,237.1
	Farm	69.0	43.4	32.8	25.6
	Nonfarm	1,099.9	1,683.9	2,364.8	3,211.5
10	Total	381.4	465.4	575.4	708.9
	Farm	27.2	17.6	14.7	10.9
	Nonfarm	354.2	447.8	560.7	698.0
11	Total	1,768.1	2,449.7	3,345.3	4,448.1
	Farm	47.9	23.8	17.8	13.7
	Nonfarm	1,720.2	2,425.9	3,327.5	4,434.4
12	Total	13.9	16.3	18.7	21.3
	Farm	2.1	1.9	1.7	1.6
	Nonfarm	11.8	14.4	17.0	19.7
C-NP	Total	5,426.1	7,293.9	9,710.1	12,680.3
	Farm	443.3	289.8	235.4	184.9
	Nonfarm	4,982.8	7,004.1	9,474.7	12,495.4

1/ Census of Population, 1960.
2/ Sum of Urban and Rural-Nonfarm population.

in 1960, to about 98 percent in 2020. All subregions will experience declining farm populations in the future, especially those subregions west of the Cascades where population growth and industrial expansion is the greatest.

SUMMARY

Agriculture is an important industry in the region. In 1964 the value of agricultural production exceeded $1.5 billion and over 150,000 persons were employed in agriculture. About 60 percent of the value was from crops and 40 percent from livestock and poultry. The industry utilizes a significant proportion of the region's land and water resources for producing a great variety of agricultural commodities. Of the 21 million acres of cropland, about seven million acres are irrigated (49). Rangeland and forest land are also utilized by the livestock industry.

Agriculture is expected to continue as an important industry in the future, with output increasing nearly one and a half times by the year 2020. The production of all crops will increase by about 160 percent, and all livestock and poultry, 131 percent. By 2020 the value of all crops produced (in constant dollars) will represent about 64 percent (60 percent in 1964) of the total value of production, and livestock and poultry, 36 percent (40 percent in 1964). Increases in output by subregions will range from two to threefold by 2020. Employment, on the other hand, will decrease substantially in the region and subregions by 2020.

Projected increases in agricultural output will be accompanied by changes in the structure of the agricultural industry. Substitution of capital inputs for labor and land, as well as shifts in the organization and use of resources, will continue. Further reductions in the numbers of farms are in prospect as smaller farms are consolidated into larger commercial farms. Increased productivity per worker and per acre will be influenced primarily by additional resource development, such as irrigation and drainage, new technology, and more extensive use of capital inputs.

MINERALS IN THE ECONOMY

THE MINERAL INDUSTRY IN THE REGION'S ECONOMY

INTRODUCTION

The Columbia-North Pacific Region contains a wealth of mineral resources. The Coeur d'Alene mining district in northern Idaho has produced mineral wealth exceeding $2 billion, mostly as silver, lead, and zinc. The Butte mining district in southwestern Montana has exceeded $3.8 billion in value of production, mostly as copper. Very few mining districts in the world have reached a total production of such proportions. Both of these districts have produced continuously for the past 100 years and have potential reserves to continue production for decades in the future.

The total mineral production value in the region in 1965 was $388 million. In that year, Idaho mineral production was valued at $105 million, Washington's was valued at $86 million, and Oregon's was $81 million. In Montana for 1965, production of copper, gold, silver, lead, and zinc, virtually all of which were produced within the Columbia-North Pacific Region, was $101 million.

An important segment of total mineral production is the industrial mineral operations which are found in each of the 12 subregions. Production of sand and gravel, crushed rock, limestone, pumice, expandable shale, brick and tile clay, and refractory clay is often a local activity with the mine and the market in close proximity. The construction industry is heavily dependent on commodities such as sand and gravel and stone. Production of these commodities in 1965 in the Columbia-North Pacific Region totaled 103 million tons valued at $125 million.

Bituminous coal has been produced in significant quantities in the past; however, Diesel fuels, hydroelectric power and natural gas have, to a major extent, displaced coal as a source of energy in the region. Mining of coal has shown a declining trend over the past several decades. A potential for coal production exists in the future as a fuel source for coal-fired, steam-electric-generating plants.

Trend analysis and projections in this report have been done in terms of constant dollar value using Bureau of Mines developed price deflators for various commodity groupings. The

constant dollar series reduces the bias caused by price level variations, thus showing more nearly the real change in the annual value of mineral production. The annual totals were constructed by summing the constant dollar value of several mineral groups. These groups were converted to 1957-59 constant dollars by dividing the group current dollar value by the appropriate group implicit price deflator.

METALS

Mines in the region, particularly those in Idaho and Montana, have supplied important portions of the U. S. base-metal output. Montana, the leading copper-producing state from 1887 to 1907, has generally ranked among the top three states in copper output with a cumulative total of over eight million tons, mostly from the Butte mining district. Montana also was the leading zinc-producing state in five post-World War II years. In 14 of 20 postwar years, Idaho ranked either first or second in zinc output among the states and ranked second to Missouri in lead output during all but five years since 1907.

Nearly all of the known base-metal and silver reserves and resources in the region are in the areas that have supplied most of the production of these metals to date. The Coeur d'Alene mining region of Shoshone County, Idaho, contains the largest lead ore reserves, while northeastern Washington hosts the biggest zinc deposits, and most copper ore exists in the Butte district. Idaho has substantial quantities of silver ore, but large amounts of silver are contained in base-metal ores in the Butte district. Known Oregon deposits contain only small quantities of copper, lead, zinc, and silver. Vast tonnages of submarginal lead and zinc are inferred to exist in northeastern Washington with lesser quantities in Idaho and Montana. The Cascade Mountains of Washington contain sizable deposits of low-grade copper ore which may be profitably extracted in the future. The average gold and silver content of most Pacific Northwest base-metal deposits is small, with the exception of silver in Idaho lead-zinc ores, but the overall total is significant because of the large tonnages of ore involved. The silver content of many Coeur d'Alene district base-metal ores ranges up to 20 ounces per ton. At many deposits in the region, by-product recovery is important to the profitability of the operation.

NONMETALS

Nonmetallic mineral commodities have been produced in substantial quantities in the region. Total value of nonmetal commodities produced from 1948 through 1965 has exceeded $2 billion. Sand and gravel and stone output has accounted for a major portion of this total ($1.2 billion). Other major nonmetal commodities produced over the base period were cement, clays, lime, magnesite, olivine, phosphate rock and vermiculite. The aforementioned nine major nonmetal commodities, over the base period 1948-65, have accounted for over 97 percent of the total nonmetal production value for the region. The share that these nine commodities have contributed to the nonmetal total has ranged from 95 to 99 percent annually.

Sand and gravel is a ubiquitous material in the region; however, only deposits near urban markets or convenient to construction projects are generally developed or considered of economic value. The total supply of sand and gravel is virtually inexhaustible; however, some problems arise locally due to the increasing competition of other land uses, particularly in and near urban centers.

Dimension stone and crushed stone are the principal stone products in the region. Dimension stone is used for buildings, fireplaces, and other construction; its production is of minor economic importance as the market is small and irregular. Crushed stone is produced in large quantities from many varieties of raw material such as limestone, basalt, ultramafic and granitic intrusive rocks, sandstone, quartzite, and other sedimentary and metamorphic rocks. Principal uses for crushed stone are for concrete aggregate, road surfacing, and railroad ballast. Most of the roadstone is produced from small roadside quarries used intermittently when there is local need for the material. Numerous stone quarries are situated near urban centers where there is a large and continuous need for aggregate. Limestone has many uses in addition to that of aggregates or roadstone. These other uses depend on the purity of the deposit. Limestone is quarried in Montana for metallurgical use and manufacture of lime. In Idaho it is quarried for cement, lime, pulp and paper manufacture, sugar refining, metallurgical and agricultural use.

Clay occurs widely over the region. Its physical and mineralogical character largely determines its use. Common clays are the most widely distributed and are mined in numerous places (generally near urban centers or areas of denser population and industry), for manufacturing common brick and tile. The higher grade refractory-type clays and high-alumina clays, which are much more valuable and are found in more limited areas,

occur in Latah County, northern Idaho (where a plant at Troy is producing firebrick and refractories, and a plant at Bovill produces paper-filler-grade clay); near Spokane; and near Seattle, where intermediate to high heat duty refractories are produced. Deposits of refractory-grade clays are well known in Cowlitz and Lewis Counties, Washington, and in Marion, Washington, and Lane Counties, Oregon, but very little production has come from these areas in the past.

Phosphate rock production is of major importance to the economy of Montana and Idaho. It is used in manufacture of phosphate fertilizers, elemental phosphorus, and some minor products. Phosphate rock is mined north of Garrison in Powell County and near Maxville, Granite County, in Montana. A plant produces elemental phosphorus in Silver Bow County from raw material from outside the region. Bingham, Caribou, and Bannock Counties in southeastern Idaho are the center of western phosphate resources and production. Fertilizer and elemental phosphorus plants are located at Pocatello and Soda Springs.

Vermiculite is mined at a large open-pit mine near Libby, Montana. This mine is the principal source of this material in the United States. Resources are extensive, and an increase in future production is anticipated.

Fluorspar is mined from deposits near Darby, Montana. The mine has been producing since 1952, and reserves are sufficient for several more years at the present rate.

Barite is produced near Greenough, Montana. Production is limited by available markets.

Garnet comes from placer deposits in Benewah County, Idaho. Production is limited mainly by available markets. Resources are adequate for many years of future production.

The olivine production in the region comes from Skagit and Whatcom Counties, Washington. This is one of the largest deposits known in the nation. Reserves are sufficient for many years at the present production rate.

Pumice and volcanic cinders are present in many areas of southeastern Idaho, in Washington, and Oregon. The resources are virtually inexhaustible. Production is limited by presently available markets.

MINERAL FUELS

The predominant coal reserves of the region are in western Washington; coal reserves remaining in Washington are estimated to be 6.2 billion tons. Approximately 150 million tons of coal has been produced from mines in the state; in 1965 production was 55,000 tons. Interest in coal has been revived in recent years based on plans for coal-fired thermal-electric plants to supplement the present hydroelectric generating capacity. Most of the known coal reserves are in King, Kittitas, Pierce, Lewis, and Cowlitz Counties, Washington. Oregon has some formerly productive coal fields, but there has been no production in recent years. Most of the coal reserves of the state are in the Coos Bay area of southwestern Oregon.

There are no producing oil or gas fields in the Columbia-North Pacific Region. There has been considerable exploratory drilling. Some gas and a few oil shows have been discovered but, to date, none have proved economic.

PROJECTIONS

Metals

The copper, lead, and zinc industries of the Columbia-North Pacific Region were reviewed for the Bonneville Power Administration (BPA) (33). In that study, production of copper, lead, and zinc from Pacific Northwest mines was projected through 1985 (table 37). Extensions of trends also were made for smelter production for the period 1985-2010 (33).

Table 37 - Estimated Production of Copper, Lead, and Zinc, 1965, with Projections to 1970, 1980, and 1985, Pacific Northwest

Year	Copper	Lead	Zinc
	(Tons of Recoverable Metal Content)		
1965 1/	120,000	79,920	114,000
1970 2/	146,000	85,000	137,000
1980 2/	168,000	85,000	142,000
1985 2/	178,000	85,000	145,000

1/ Bureau of Mines Minerals Yearbook.

2/ Knostman, Richard W., and Gary A. Kingston. Copper, Lead, and Zinc Industries in the Pacific Northwest, report prepared for Bonneville Power Administration, Portland, Oregon, 1966.

The review of the copper, lead, and zinc outlook for BPA was based on economic and population projections which were greater than those adopted as basic assumptions for the Columbia-North Pacific study. The projections made for the copper, lead, and zinc industry outlook in this report take into account the lower economic and population projections, and the resulting projections have been scaled downward accordingly.

Metal projections through 1980 are tied largely to the copper, lead, and zinc industry outlook study done for BPA and to a silver study by the Bureau of Mines. Copper, lead, zinc, silver and gold production have accounted for over 90 percent of the metal output value in the region over the past 20 years. Therefore, the metals projections for the Columbia-North Pacific Region were based mainly on projected values for these commodities.

Projections of copper, lead, and zinc production for the years 2000 and 2020 were made largely by extending trends projected for the period 1965-85. Silver projections beyond 1980 were based on increases projected for copper ore output from which silver is recovered as a co-product. Also, an assumption was made that no price change would be experienced in the outlook period for gold. Any significant price change could alter the outlook for this metal.

Metals produced over the past 18 years, other than base and precious metals, were manganese, chromium, tungsten, mercury, nickel, antimony, uranium, vanadium, cobalt, columbium-tantalum, and rare earths. Production value has ranged from $8 million to $18 million over this period with peak production being reached in 1956. Manganese has accounted for predominant production value under the "other metals" category. Nickel, uranium, tungsten, antimony, and cobalt all have been produced in significant amounts. In 1965, nickel, manganese, uranium, vanadium, and mercury supplied the bulk of the "other metals" total.

Projections of metals production values for the Columbia-North Pacific Region for target years 1980, 2000, and 2020 are shown in table 38.

Nonmetals

Markets for certain of the nonmetal commodities, such as olivine, vermiculite, and phosphate rock, extend outside the Columbia-North Pacific Region and, in certain instances, the markets are national in scope. Markets for sand and gravel,

Table 38 - Value of Mineral Production, 1965, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region

Mineral Group	1965 1/	1980	2000	2020
	(Thousand 1957-59 Dollars)			
Metals	153,074	189,000	215,000	233,500
Nonmetals	200,086	226,200	326,700	442,500
Fuels	694	24,000	24,000	24,000
Total	353,854	439,200	565,700	700,000

1/ Bureau of Mines data.

stone, cement, lime, and clays are generally tied more closely to regional development and regional markets.

The methods of projecting certain of the major commodities are reviewed in the following sections. Projections in many instances were based largely on production trends of the past 15 to 20 years.

Sand and Gravel and Stone

A leading mineral industry activity, both in terms of quantity and value, in the region is the production of sand and gravel and stone. Since 1948, production of these commodities has totaled over one billion tons valued at over $1.2 billion. Production of these commodities over the past five years has averaged 72 million tons and $99 million annually. In 1965, output of these commodities totaled 103 million tons valued at $127.6 million f.o.b. pit or quarry.

The projection of sand and gravel and stone production in the region was calculated from the relationship of the output of these commodities with population of the region over the base period of 1948-65. The least squares linear equation which describes this relationship for this period is as follows:

$$y = -122.87 + 31.06(x)$$
$$r^2 = .89$$

where

y = sand and gravel and stone production, million tons, and
x = population of the Columbia-North Pacific Region, millions.

The production data, whenever possible, were adjusted to exclude tonnages of sand and gravel and stone required by the

U. S. Army Corps of Engineers at dam projects and related works in the area. These requirements were large and of a periodic nature and introduced fluctuations in the output total from year to year.

Assuming the population reaches the projected 7.3 million by 1980, and that the relationship between aggregate production and population continues as during the base period, production of sand and gravel and stone would be 104 million tons annually.

Projecting aggregate production by the least squares linear equation for target years 2000 and 2020 placed production of these commodities at what was judged to be unrealistic annual output totals. The rapid growth in the use of construction aggregates is expected to modify as the region ages; therefore, projections for the growth of sand and gravel and stone production were arbitrarily reduced to correspond to the anticipated population growth in years subsequent to 1980. Even so, the projected tonnages resulting from this extropolation probably should be considered as high-range estimates.

Based on the projected population growth, output of these commodities in the region would be approximately 138 million and 180 million tons in 2000 and 2020, respectively. The projections beyond 1980 should be viewed as little more than a point of reference. The demand will result primarily from construction needs of an expanding population.

Cement

Continuing expansion is foreseen for cement consumption as requirements increase to supply a growing population. Nearly one-half of the demand for cement nationally results from residential construction; therefore, population growth should continue to serve as a major factor. Highway construction under the Federal-State highway program uses significant quantities of cement and it is anticipated that highway building will continue to require substantial quantities for this purpose.

Cement consumption in the region could not be related to total aggregate output because quantities of these materials were used for road base, asphalt surfacing, railroad ballast, and miscellaneous fill. A recent study forecasts cement consumption for the Pacific Northwest at 1.8 barrels per capita which results in a long-term growth rate of about 2.1 percent annually through 1985 (52). Per capita consumption of cement in the four Pacific Northwest states has averaged 1.82 barrels

for the period 1948-65. Based on past trends of per capita consumption and the projected regional population, cement production for the region was projected at an average annual growth rate of approximately 1.5 percent for the outlook period.

Phosphate Rock

The phosphate rock mining and processing industry of the Pacific Northwest was reviewed for BPA in 1964 (53). In this report, production of phosphate rock by producers in the Western States was projected to be 7.2 million long tons by 1980, 16.2 million tons by 2000, and 24.0 million tons in 2010.

Production of phosphate rock in the Columbia-North Pacific Region has trended well with the Western States production; consequently, projections for the region production were made based on the outlook for Western States industry for the years 1980, 2000, and 2010. Projections to 2020 were made by extending the trend projected for the decade 2000 to 2010.

Vermiculite

The consumption of vermiculite will be influenced largely by the volume of future residential and public building activities. The trend in construction design is toward the greater use of lightweight concrete aggregate, and consumption of vermiculite is expected to increase for this use as well as for the use of vermiculite as masonry fill. Vermiculite for acoustical and fireproofing purposes, pipe covering, and horticultural use is expected to maintain a gradual increase. Vermiculite produced in Montana goes to national markets; therefore, growth was tied largely to population growth projections for the United States during the outlook period. Crude vermiculite produced in Montana has been showing a moderate upward trend over the past decade. A continuation of this trend was projected for the outlook period resulting from the construction requirements of an expanding population.

Lime

Primary lime production in the region was projected based on anticipated increased lime consumption in the area. Long-term annual growth rate for production of primary lime was projected at a rate of approximately 2.3 percent.

Lime consumption (primary open-market) in the region was projected on the basis of past trends in per capita consumption.

Per capita use, based on a time-series trend, would increase from 54 pounds in 1965 to 67 pounds by 1980. Based on population projections for the Columbia-North Pacific Region and the per capita trend forecast, annual primary open-market lime consumption in the region by 1980 would be 244,000 tons.

Clays

Clay production was projected on the basis of a time-series linear trend. The value of total clays produced in the Columbia-North Pacific Region was projected to increase at an average annual rate of approximately 1.3 percent through 1980. The growth rate was projected to be somewhat lower after 1980.

Other Nonmetal Commodities

In addition to the foregoing major nonmetal commodities produced in the region, each year there are produced significant quantities of barite, natural carbon dioxide, diatomite, fluorspar, garnet, grinding pebbles, perlite, pumice, and soapstone. The value of these commodities produced in 1965 totaled $3.3 million, about two percent of the total value of nonmetallic mineral production. The value of these commodities over the base period 1948-65 has ranged from $1.6 million to $5.2 million and, percentagewise, these commodities have accounted for one to five percent of the total value of nonmetal mineral production.

Diatomite, garnet, fluorspar, perlite, and pumice have accounted for the major portion of the other nonmetal category total over the past two decades. Reserves of diatomite, garnet, and perlite are significant and the potential for increased production of these commodities over the outlook period appears favorable.

Projection for the "other nonmetals" category was made on the relationship between this group of commodities and the other major nonmetals over the past 18 years.

Projected nonmetal mineral production values for target years 1980, 2000, and 2020 are shown in table 38.

Fuels

Bituminous Coal

Mining of coal began in the Columbia-North Pacific Region over 100 years ago but the industry achieved major importance only in the state of Washington.

Bituminous coal occurrences are known in Teton, Bonneville, Fremont, and Clark Counties in Idaho; however, production of coal in Idaho has been small because of competition of higher rank coal from neighboring states and high-cost mining caused by deformation of the coal beds (71).

There are no official records of commercial bituminous coal production from known deposits in western Montana; however, coal has been mined on a small scale to supply local demand from time to time.

The potential for the coal mining industry in the Pacific Northwest was reviewed for BPA in 1965 (52). From the conclusions reached in this study, it appears that the best potential for Pacific Northwest coal is as a fuel for generating electric energy at mine-mouth, steam-electric plants.

Projections for Pacific Northwest coal production, as shown in the BPA report, are given in table 39.

Table 39 - Coal Production, 1965, with Projections to 1980, 2000, and 2010, Pacific Northwest

1965 1/	1980 2/		2000 2/		2010	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
	(Thousand Tons)					
55	11,465	100	40,285	--	47,705	--

1/ Bureau of Mines data.
2/ Perry, Harry and others, and H. F. Jones, H. Zinder & Associates, Engineers and Consultants, Coal, Report prepared for Bonneville Power Administration, 1965, pp. 176 and 192.

The coal requirements that were projected to be supplied from mines in the Pacific Northwest (table 39) exhibit a wide range between the maximum and the minimum for each of the target years 1980, 2000, and 2010.

Because most of the major hydroelectric sites in the Pacific Northwest will be developed by 1975, it is anticipated that the area will require at least one million kilowatts of new thermal generation for energy purposes each year thereafter. This means that the region will require at least one large steam plant, nuclear or coal-fired, each year beginning in 1975(70).

Because there is a lack of more precise estimates and specific figures to project coal production, output from mines in the region was arbitrarily projected at 50 percent of the maximum shown in the above quoted report for the target year 1980 and approximately 15 percent for target years 2000 and 2020. The value of fuels output in the region in constant dollars for selected years for the period 1965-2020 is shown in table 38.

The projections were made on the basis of anticipated coal requirements for the steam-electric generation plant under construction near Centralia, Washington.

Petroleum and Natural Gas

Despite significant drilling and exploration efforts in the past, no significant commercial discoveries of petroleum or natural gas are known to have been made in the Columbia-North Pacific Region.

The petroleum resources of the State of Montana occur east of the Continental Divide beneath the Great Plains. This area is outside the region.

The potential for petroleum and natural gas is impossible to assess with any degree of accuracy at this time. Because of the negative results of the discovery attempts to date, no petroleum or natural gas output was projected over the outlook period.

REVIEW BY SUBREGIONS

Table 40 reviews the mineral production trends in the 12 economic subregions of the Columbia-North Pacific Region.

Mineral production trends in terms of constant dollars are shown for the individual subregions (table 40). Projections for the various subregions were done largely by disaggregating the overall Columbia-North Pacific projections shown in the tables and reviewed in the foregoing sections. Subregional shares of the region's future output was allocated largely on the basis of the production value that a particular subregion

Table 40 - Mineral Production Value, 1950, 1960, and 1965, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	Actual 1/			Projected		
	1950	1960	1965	1980	2000	2020
	(Thousand 1957-59 Dollars)					
1	165,696	114,363	159,591	192,500	226,000	259,000
2	16,892	15,393	13,292	13,900	16,500	20,500
3	4,190	2,531	2,928	5,400	5,400	6,800
4	6,669	14,390	29,159	37,600	69,900	103,000
5	6,791	6,831	11,868	13,900	16,600	20,500
6	3,353	3,370	6,787	12,400	15,700	19,000
7	2,253	16,509	17,299	5,400	6,600	7,800
8	1,515	2,197	3,677	26,400	26,600	27,500
9	10,453	22,470	32,932	43,400	59,500	78,200
10	3,853	14,727	23,126	15,000	19,500	22,300
11	16,816	25,475	39,885	73,000	103,000	135,000
12	22	386	1,459	300	400	400
Undistributed 2/	12,981	7,856	11,851	--	--	--
C-NP	251,484	246,498	353,854	439,200	565,700	700,000

1/ Bureau of Mines data.
2/ Value of mineral commodities produced that could not be assigned to specific counties of origin -- largely sand and gravel and stone.

has contributed to the overall region total during the past 15 to 20 years. Allocation was made by means of ratio and/or regression analysis of the subregion and region data for the base period 1948-65. When the resource potential did not appear to be adequate to support the continuation of the past trends or when development of a resource potential appeared underway or imminent, the individual commodity projections were tied to other variables, such as expected population growth, or to other studies done previously on a commodity, regional, or national basis.

The aggregated grouping of all metals, nonmetals, and fuels was used in projecting the subregional mineral production values.

EMPLOYMENT IN MINING

Trends and projections for employment in mining in the Columbia-North Pacific Region and for the 12 economic subregions of the area are given in table 41.

Estimates of average employment in mining were made on the basis of trends in mineral production value per employee during the period 1940-60, based on three points in time: 1940, 1950, and 1960. Projections of employment were made by dividing the projected value of mineral production in constant dollar terms by the projected value of output per employee in constant dollars, consistent with productivity trends of the past 20 years.

Attempts to account for productivity increases over the base period by subregion introduced biases because of the different base from which employment figures are derived as opposed to the mineral production values as measured by the Bureau of Mines. Cement and lime add significantly to the Bureau's mineral production values; however, employment data for these industries are reported under the manufacturing classification. This factor has become increasingly significant in recent years as greater tonnages of limestone have been imported and used for raw material at cement and lime plants in the Pacific Northwest. Also, considerable employment engaged in producing sand and gravel is classified under the ready-mixed concrete category of Standard Industrial Classification Group 32, Stone, Clay, and Glass Products. In 1965, over 3,500 employees were reported under the ready-mixed concrete category in Oregon and Washington.

Mining employment for the region was projected taking into consideration past productivity trends and extending these

Table 41 - Employment in Mining, 1940, 1950, 1960, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Subregion	Actual 1/			Projected		
	1940	1950	1960	1980	2000	2020
1	13,629	11,443	8,346	7,200	5,800	4,900
2	1,198	842	289	260	220	200
3	1,125	726	150	190	120	110
4	510	381	174	530	670	670
5	1,505	611	193	220	180	160
6	1,106	524	251	480	420	360
7	486	243	187	90	100	110
8	161	201	75	250	230	220
9	583	841	525	800	900	900
10	1,260	420	467	250	230	190
11	2,460	1,443	681	1,700	2,100	2,000
12	21	19	80	30	30	30
C-NP	24,044	17,694	11,418	12,000	11,000	9,850

1/ U. S. Department of Commerce, Office of Business Economics.

trends through the outlook period. The regional totals were then allocated on the relationship that the productivity per employee in the individual subregions has held to the overall regional productivity over the past 15 to 20 years, and on the basis of the projected subregional mineral production values for target years 1980, 2000, and 2020. Mining employment had been projected in previous studies of the Willamette and Puget Sound subregions (23)(54).

OTHER COMMODITY INDUSTRIES

OTHER COMMODITY PRODUCING INDUSTRIES

PETROLEUM REFINING AND RELATED PRODUCTS

The petroleum industry only recently became of significance to the Columbia-North Pacific Region. Prior to 1954 the region had some paving and roofing materials manufacturers and other petroleum-related activities, but petroleum refining activity was limited to four very small refineries producing less than 10,000 barrels per day in total. Since then, refining capacity has become fairly substantial, and prospects for further expansion are good.

Petroleum Refining

In 1954 a 35,000 barrel-per-day refinery was constructed on the northeast shore of Puget Sound. It was followed by three more refineries in the next several years and by 1964 regional refinery capacity amounted to 180,000 barrels per day.

The principal refineries in the region are all located on Puget Sound where especially deep harbors allow easy access for modern deep-draft tankers carrying crude petroleum or refinery products. Crude petroleum is now supplied mainly through the Trans-mountain pipeline from Alberta, and products are marketed via the Olympic pipeline down through major population centers to the Columbia River and beyond via the Southern Pacific pipeline through the Willamette Valley to Eugene. Growth in capacity has been mainly to supply regional markets, however, a significant part of production is exported from the region. In 1966 waterborne shipments of refinery products amounted to about 81,000 barrels per day.

Regional markets for the local refining industry are mainly confined to the heavily populated area west of the Cascades which contains about 2/3 of the regional population. The principal market areas east of the Cascades are supplied by product pipelines from Utah and eastern Montana running in an arc through southern Idaho, the Spokane area, and western Montana. By 1964 local refinery capacity amounted to about 50 percent of regional consumption. Growth of regional markets and growth in the proportion of consumption locally produced is expected to require about 400,000 barrels-per-day capacity by

1980 without regard for potential export production (12-61).

The likelihood of export production from local crude oil supplies has largely disappeared in the absence of significant discoveries in recent explorations off the Oregon and Washington coasts, but supplies from the Prudhoe Bay discovery in northern Alaska are anticipated to require additional refinery capacity in the Columbia-North Pacific Region.

Related Products

Other activities of the petroleum industry include the productions of asphalt and tar paving mixtures, and roofing felts, cements and coatings, and the compounding of lubricating oils and greases. These activities are less concentrated geographically than refining, and they have been extant in the region a longer period of time. In 1966 there were 31 employer units (establishments) employing 569 workers in these industries.1/

Table 42 - Employment in Related Petroleum Products, *Columbia-North Pacific Region Excluding Western Montana*, 1966

Industry	Employer Units	Employment
Paving and roofing materials	19	498
Misc. products of petroleum and coal	12	71
Total related petroleum products	31	569

Source: Data from employment security agencies of Idaho, Oregon and Washington.

Regional consumption of the products of these industries is extensive and expanding. In 1962 regional sales of petroleum asphalts totalled over 850,000 tons, and sales of lubricating oils and greases amounted to 1,280,000 barrels (12-122). Demand for both these product categories will expand substantially in the future.

Employment Projections

Projections of future employment by the Office of Business

1/ Excluding western Montana.

Economics indicate some growth in employment to 1980 in the petroleum and related products industries, but declining employment in the years beyond as productivity gains outrun increases in output.

Table 43 - Petroleum and Related Products Employment, 1960, with Projections to 1980, 2000 and 2020, Columbia-North Pacific Region and Subregions

Subregion	1960	1980	2000	2020
1	324	372	397	382
9	424	670	589	474
11	1,928	1,661	1,625	1,290
All other subregions 1/	148	353	363	332
C-NP	2,824	3,056	2,974	2,478

1/ Projections not disclosed by subregion but included in regional total.

Source: U.S. Department of Commerce, Office of Business Economics, Preliminary Report on Economic Projection for Selected Areas, January 1969.

CHEMICALS AND ALLIED PRODUCTS

Employment in the chemicals industry in the Columbia-North Pacific Region was about 16,000 in 1960 and accounted for approximately 1% of total regional employment. This was about 60% of the number which would have been employed if the industry had been of the same relative size in the region as it was in the nation as a whole.

The regional industry is dominated by nuclear materials production (included in SIC 281, Basic Industrial Chemicals), but it is nevertheless widely diversified. Every one of the eight industrial categories comprising the industry nationally is represented in the region. The structure of the industry regionally, however, differs from the nation's. Apart from basic industrial chemicals, the most important categories in the region are: agricultural chemicals; paints and allied products; and miscellaneous chemicals. In the nation, aside from basic industrial chemicals, they are: plastics, resins, and fibers; drugs; and soaps, detergents, and cosmetics.

Table 44 - Percentage Composition of Chemicals and Allied Products Employment, Columbia-North Pacific Region and United States, 1963

SIC	Category	C-NP Region	United States
281	Basic industrial chemicals	77.6%	32.1%
282	Plastics, resins, fibers	2.3	19.6
283	Drugs	2.3	13.4
284	Soap, detergents, cosmetics	1.3	11.6
285	Paints and allied products	4.9	8.3
286	Gum and wood chemicals	.1	.9
287	Agricultural chemicals	7.0	5.8
289	Miscellaneous chemicals	4.6	8.2
	Total	100.0%	100.0%

Source: 1963 Census of Manufactures, Industry Statistics. Regional data estimated in part.

The principal export products (interregional) of the regional industry are nuclear and phosphatic materials. Production of plutonium and other nuclear materials (in Subregion 3 with associated test facilities in Subregion 4) has been mainly for government use. Elemental phosphorus, phosphoric acid, and related fertilizer products produced from phosphate deposits in Subregion 4 are marketed for agricultural use throughout the western and central parts of the country.

Most of the other chemical production in the region is located in or near major population centers, and is for regional markets, especially in regional industry. Chlorine and caustic soda are produced chiefly for the regional pulp and paper industry although some caustic soda is marketed outside the region. Adhesives for the plywood industry, ammonia and sulphuric acid for fertilizers, and paints and allied products are also important products for industrial use. A surprisingly broad range of other basic and intermediate chemicals are produced for industrial markets. Drugs, soap, cleaning materials, and cosmetics go mainly to regional consumer markets.

Character of the Industry

The chemicals industry is the most heterogeneous of all industries. It encompasses more products, processes, and raw materials than any other industry, and its activities are in a constant state of flux. Products of the industry are often highly substitutable in use, and the same product can be produced by a number of alternative techniques using different raw materials. These considerations make judgments about the future of the industry difficult, but some generalizations can be made.

The chief raw materials of the basic inorganic chemicals industry are salt, lime, phosphate, potash and sulphur. The basic organic chemicals are now principally obtained from petroleum. A large part of these basic chemicals are, in turn, the raw materials of the rest of the chemical industry, and they may be transformed into intermediate products to serve as raw materials for further processing within the chemicals industry several times before emerging as end-products of the industry as a whole.

Markets for the industry are diverse, but specific markets for a major share of production can be identified. The distribution of output for the major parts of the industry was compiled in the 1958 input-output study for the nation (68). It shows that drugs, cleaning, and toilet preparations (representing about 27 percent of the whole chemical industry's production) go largely to medical services (9%) and consumers (56%). About six percent of this sector's production goes back into the industry for further processing and the rest is broadly distributed.

Markets for the other parts of the chemicals industry are almost solely industrial. Paints and allied products (accounting for eight percent of the chemical industry's products) are sold mainly to maintenance and repair construction (47%), new construction (11%), and governments (5%), with the balance going to other industries such as automobiles, furniture, etc.

Plastics and synthetics (17% of industry production) are used largely in textiles and apparel industries (34%), the rubber industry (21%), and the chemical industry itself (9%). Other significant users of this sector's output, each consuming over two percent of production, include pulp and paper, tobacco, glass, and non-ferrous metals.

The rest of the chemicals industry, including the basic chemicals, agricultural chemicals, and miscellaneous chemical

products (totalling 49 percent of chemical production), supplies the chemicals industry (37%), agriculture (10%), governments (8%), petroleum (4%), pulp and paper (3%), rubber (3%), and more minor amounts to almost every other industry in the economy.

The location of industries is normally influenced to a considerable degree by the location of their raw materials and their markets. In the case of the chemicals industry, the basic raw materials which have exerted a significant influence on location are phosphate rock and petroleum refinery products. Other basic raw materials are fairly ubiquitous or economically shipped to points of consumption. Raw materials produced by the chemicals industry itself influence plant locations for further processing in varying degrees. Markets are a more pervasive locational influence. Roughly 50 percent of the output of the chemicals industry is consumed in manufacturing activities (including chemicals), thus the industry tends to agglomerate in manufacturing centers. Production of soaps, cleaning materials, toilet preparations and paints and allied products tends to correspond with population distribution, but drug production is heavily concentrated in several eastern states due largely to institutional factors.

Prospects for the Regional Industry

The prospects for future development of the industry in the region must be characterized as fairly modest in terms of the extremely high expectations of the national industry. While resources or raw materials limitations are not likely to severely handicap development, neither is an abundance of raw materials likely to promote sharp growth. Phosphate deposits, one of the two raw materials significant to plant location, are adequate in the region. The other significant raw material, petroleum refinery products for the petrochemical industry, is not presently available in sufficient supply to support significant development, although it now appears plausible that expanded refinery operation resulting from the Alaskan North Slope discovery may permit establishment of this sector. A chemicals industry based on wood akin to the coal and petroleum chemicals industries has long been a matter of interest to the region, however, the absence of progress on the technical problems involved makes the possibility of such a development remote.

Markets for the regional industry may be expected to expand more rapidly than the growth of industry and population would suggest because of the increasing use of chemicals. Major industrial users in the region, particularly agriculture and the wood products industries, will require substantially

augumented supplies of chemicals, and the need for chemicals in manufacturing as a whole will grow as the region's share of manufacturing increases. The future of the nuclear products sector is the most uncertain factor in the industry's prospects. Production of power reactor fuel or treatment of wastes are potential major activities, but production volumes or employment requirements cannot be projected with any confidence. Other substantial demands for nuclear production may develop, but they are not now on the immediate horizon.

Projections of national chemical production to the year 2000 made by Resources for the Future have been extrapolated to 2020 here as rough guides to expectations for the regional industry.

Table 45 - Projections of Production in Chemicals, United States

Category	Projections Index Numbers 1960=100 1980	2000	2020
Chemicals and Products	243	531	1,159
Chemical Products	205	433	913
Drugs, soaps, toiletries	226	492	1,068
Paints	111	185	308
Fertilizers	182	290	461
Industrial Chemicals	274	613	1,370
Inorganic chemicals	238	564	1,337
Organic chemicals	288	630	1,380
Basic organic	249	462	858
Synthetic	332	827	2,059

Source: Lundberg, H. H., et al, Resources in America's Future, Resources for the Future, Johns Hopkins Press, 1963, p. 326. Converted to 1960 base and extrapolated from 2000 to 2020 on basis of growth rate from 1980 to 2000.

Projections of regional production to 1985 for several important chemicals in the region have been made in three industry studies for the Bonneville Economic Base Study (26) (39)(53).

Projections of regional employment made by the Office of Business Economics are presented in table 46. Productivity increases will restrict employment growth relative to production.

Table 46 - Chemical and Allied Products Employment, 1960, with Projections to 1980, 2000 and 2020, Columbia-North Pacific Region and Subregions

Subregion	1960	1980	2000	2020
1	612	844	1,186	1,634
2	481	615	767	919
3	7,529	9,400	11,632	13,982
4	2,426	3,653	5,358	7,341
8	209	232	349	489
9	1,746	2,683	4,037	5,655
11	2,888	4,110	5,745	7,591
All other subregions 1/	443	778	1,193	1,728
C-NP	16,334	22,315	30,267	39,339

1/ Projections not disclosed by subregion but included in regional total.

Source: U.S. Department of Commerce, Office of Business Economics, Preliminary Report on Economic Projections for Selected Areas, January 1969.

FOOD AND KINDRED PRODUCTS

Food and kindred products processing is an important segment of the manufacturing complex in the Columbia-North Pacific Region. Census of Manufacturers data indicate that during 1963 the value added by manufacturing food and kindred products was approximately 745 million dollars. In the states of Oregon and Washington, the value added in manufacturing these products accounted for 15 and 13 percent, respectively, of all manufacturing during the year 1963. In this year over 82 million production worker man-hours were utilized in food processing operations.

Total food and kindred products processing (Standard Industrial Classification 20) has been divided into eight distinct product classifications for clarification and presentation in this section. These classifications and their included commodities are: 201 - meat and poultry slaughtering;

202 - dairy products; 203 - canning and preserving fruits, vegetables, potatoes and seafoods; 204 - grain mill products; 205 - bakery products; 206 - sugar beets for sugar; 207 - confectionary and related products; 208 - beverages. An additional product classification, miscellaneous food and kindred products, has been incorporated under the total food and kindred products heading. This procedure was followed because of the diverse nature of the products within this classification as well as its relative magnitude--five percent. of the adjusted value added by manufacturing during 1963.

Processing of manufactured food items varies substantially with respect to the particular subregion and product classification. During 1963, Subregion 11 accounted for 31 percent of the adjusted value added by manufacturing in the region (table 47) while Subregion 12 accounted for less than one-tenth of one percent. Canning and preserving fruits, vegetables, and seafoods comprised 31 percent of the adjusted value added for the region while dairy products processing contributed 15 percent. Approximately 25.9 million dollars of value added is not shown in table 47 due to disclosure rules not allowing appropriate three digit industry breakdown. This omission amounts to approximately 3.5 percent of the total adjusted value added by manufacturing.

Average annual employment in food and kindred products processing in the region during 1960 was approximately 59,000 employees (table 48). A large portion of these employees, 40 percent, were employed in canning and preserving fruits, vegetables, potatoes and seafoods. The Puget-Willamette Trough (Subregions 8, 9, and 11) employed over 54 percent of the annual employment in the region.

Factory production of manufactured food and kindred products for the year 1963 is shown in table 49. Canned, frozen and dehydrated fruits, vegetables, potatoes and seafoods comprised the largest single processed commodity group with over 4.8 billion pounds of product input.

The slaughtering and processing of meat and poultry products during 1963 accounted for more than 1.5 billion pounds of plant input. The Puget-Willamette Trough slaughtered and processed 914 million pounds of meat and poultry products, or 59 percent of the region's total. Approximately 65 percent of slaughtering in the region was beef, with pork accounting for an additional 21 percent.

Of the more than 2.1 billion pounds of dairy products produced during 1963, approximately 77 percent was distributed in the form of fluid milk and cream. Cheese and ice cream

Table 47 - Adjusted Value Added in Manufacturing Food and Kindred Products, by Industry Code, Columbia-North Pacific Region and Subregion, 1963

	Subregion	Total (20)1/	Industry Code 201	202	203	204	205	206	207	208
					(Thousand Dollars)					
1.	Clark Fork-Kootenai-Spokane	44,435	9,291	13,918	923	2,982	6,972	3,739	240	4,434
2.	Upper Columbia	21,956	895	1,097	5,284	262	74	11,447	310	1,079
3.	Yakima	33,467	4,351	6,089	11,794	78	1,746	5,119	60	2,219
4.	Upper Snake	64,532	3,183	11,761	23,429	2,932	1,218	19,682	2/	1,621
5.	Central Snake	66,693	5,162	6,886	27,099	2,517	2,785	20,261	--	927
6.	Lower Snake	6,210	596	1,178	2,678	447	645	--	--	666
7.	Mid Columbia	44,931	794	1,335	36,831	2,541	413	--	--	2,161
8.	Lower Columbia	17,787	2,074	2,452	4,310	654	37	--	60	7,916
9.	Willamette	159,628	14,420	23,627	45,015	8,875	40,035	29	3,672	12,746
10.	Coastal	38,805	1,005	5,080	23,740	1,344	5,155	--	60	1,745
11.	Puget Sound	221,051	25,047	33,897	42,178	22,074	29,947	--	5,196	46,294
12.	Oregon Closed Basins	82	48	--	--	--	--	--	--	34
	C-NP Total	719,577	66,866	107,320	223,281	44,706	89,027	60,277	9,598	81,842

1/ Total of SIC 20 omits approximately 25,893 thousand dollars due to disclosure rules not allowing appropriate three-digit classification. Includes Miscellaneous Food and Kindred Products (209).

2/ Dashes indicate data not available or no manufacturing of the appropriate commodities within the subregion.

Table 48 - Employment in Manufacturing Food and Kindred Products, Columbia-North Pacific Region and Subregions, 1960

Subregion	1960
1	4,539
2	1,022
3	3,329
4	4,773
5	5,287
6	1,040
7	2,741
8	2,264
9	12,884
10	3,973
11	16,994
12	57
C-NP	58,903

Source: Office of Business Economics, USDC, 1968.

(including ice milk and milk sherbert) were the next major dairy product categories, each accounting for approximately seven percent of total output. Subregion 9 was the largest producer of dairy products with approximately one-third of total regional output. Subregion 11, with 22 percent of the region's output, and Subregion 1, with 14 percent, were the other two areas of major dairy products processing.

The composition of processed fruits, vegetables, potatoes, nuts and seafood (SIC 203) varied greatly between subregions. Subregions 4 and 5, which produced 46 percent of the regional output in this product classification, specialized in canned and frozen fruits and vegetables and frozen and dehydrated potato products. Subregions 9 and 11 processed large quantities of canned and cured seafoods, frozen packaged fish, and canned and frozen fruits and vegetables.

Approximately 80 percent of the flour milling and milling of prepared feeds for animals and fowl was done in the Puget-Willamette Trough in 1963. Blended and prepared flours produced in this area are used extensively by firms processing bread and related products (SIC 205). In fact, 83 percent of the region's output of bread and related products was produced in this same area.

During 1963 sugar beet processing was mainly confined to

Table 49 - Factory Production in Manufacturing Food and Kindred Products, by Industry Code, Columbia-North Pacific Region and Subregions, 1963

Subregion	Total (20) 1/	Industry Codes 201 2/	202 3/	203 4/	204 5/	205 6/	206 7/	207 8/	208 9/
					(Thousand Pounds)				
1	1,140,154	187,612	295,567	31,030	270,073	52,314	105,300	1,388	157,603
2	537,635	16,932	23,333	91,150	23,691	611	326,249	1,762	23,190
3	671,789	82,352	129,501	203,634	7,107	14,360	145,891	320	47,668
4	2,144,310	113,442	191,774	1,197,077	10/	6,965	565,026	--	41,529
5	2,014,520	183,224	112,844	1,027,382	34,563	15,496	583,565	--	23,743
6	220,726	13,538	21,724	136,726	29,416	3,652	--	--	15,670
7	900,977	19,714	27,693	544,963	253,908	1,839	--	--	39,260
8	399,659	39,252	51,983	72,726	59,226	306	--	320	170,059
9	3,020,624	400,688	476,027	500,843	886,683	343,545	--	19,438	215,369
10	645,893	26,505	102,523	315,633	134,265	25,280	--	320	30,042
11	5,531,363	474,104	721,005	727,749	1,999,487	246,258	--	29,849	998,589
12	1,206	1,024	--	--	--	--	--	--	182
C-NP	17,228,856	1,558,387	2,153,974	4,848,913	3,698,419	710,626	1,726,031	53,397	1,762,904

1/ Includes Miscellaneous Food and Kindred Products (209).
2/ Includes beef, veal, pork, lamb and mutton, chicken and turkey in liveweight equivalents. Does not include secondary processing under SIC 2013.
3/ Indluces creamery butter, all cheese, condensed and evaporated milk, ice cream and frozen desserts, and fluid milk in pounds of final product.
4/ Includes canned, frozen and dehydrated fruits, vegetables, potatoes, nuts and seafoods in pounds of input. Does not include frozen and canned specialties, some preserves, jams and jellies.
5/ Includes flour and prepared feeds for animals and fowl. Does not include data for southern Idaho.
6/ Production data estimated from regional consumption of bread, biscuits, crackers, etc.
7/ Sugar production estimated at 305 to 320 pounds of sugar per ton of sugar beets, depending on the particular subregion.
8/ Weight of confectionery and related items distributed on the basis of number of employees in SIC 207 per subregion.
9/ For beverage industries: weight of still wines converted from wine gallons; beer production converted from barrels of 31 wine gallons; distilled spirits converted from tax gallons; soft drink production estimated from 1963 per capita consumption.
10/ Dashes indicate data not available or no manufacturing of the appropriate commodities within the subregion.

Subregions 2, 4, and 5. They processed approximately 85 percent of the region's sugar production. Quantities of sugar are shipped to Subregions 9 and 11 where 92 percent of the region's confectionary and related items were manufactured during 1963.

Approximately 80 percent of the beverages produced in the region during 1963 came from Subregions 8, 9, and 11. The region's major producers of malt and malt liquors are located in these subregions.

Projection Methodology

Projections of manufacturing food and kindred products for the region were drawn from an analysis of food processing operations during the years 1950 through 1965. Two methods were used in formulating these projections:

1. Plant marketing areas for each commodity were analyzed, and

2. Production-consumption ratios for each commodity and commodity group were computed.

Except where data limitations prevented such an approach, both of the above methods were used in projecting food manufacturing.

Marketing areas for individual commodities and commodity groups were studied to determine the total population served by each group of processors. Table 50 illustrates how the final demand for various processed food items, using the state of Washington as an example, serves varying marketing areas. The meat, dairy, bakery and soft drink industries market their products primarily in the Pacific Northwest. Other firms, such as those involved in processing fruits, vegetables, potatoes and seafoods, market their products over a national and international area.

An analysis of regional demand for certain processed foods can be extended to a study of subregion demand due to a high concentration of marketing activities to individuals and institutions located in counties surrounding each particular firm. By assuming some degree of short-run processing efficiency during the production year 1962-1963 among subregions, the average number of employees involved in processing a particular commodity within a subregion were compared to the total population of that subregion (44)(45)(67). Least-squares regressions illustrated that these employee-population relationships were highly significant for all subregions.

Table 50 - Washington State Marketing Areas Served by Firms, by Type of Product and Accumulated Percentage of Firms Marketing in Each Area, 1964 1/

Marketing Area	Accumulated Percentage of Marketings Reported					
	Meat	Dairy	Canned and Frozen Foods	Grain Mill	Bakery	Bottled and Canned Soft Drinks
Local Counties	57.8	75.7	11.7	23.8	45.5	88.9
State of Washington	73.5	82.8	16.5	27.0	59.1	96.3
Pacific Northwest	85.3	95.7	27.9	66.7	86.4	100.0
Western United States	91.2	95.7	38.1	71.5	95.5	
National	93.2	97.1	71.4	90.5	95.5	
Export	100.0	100.0 2/	100.0	100.0 3/	100.0	
Number of Product-firm Listings	102	140	273	63	22	27

1/ Compiled from Washington Manufacturer's Guide, 1964. Based on individual product grouping basis and maximum distance of shipment.
2/ Condensed and evaporated milk only.
3/ Eighty percent of these firms exported prepared feeds for animals and fowl only.

Factory production of each particular commodity for a subregion was estimated from employment data and then summed to a three digit Standard Industrial Classification breakdown.

Secondly, projected factory production was calculated in a manner similar to that used by Stallings (56). It was assumed that the ratio of production to consumption within a region, for a particular processed commodity, would reflect demand as well as various costs of production and other factors affecting comparative advantage in production. Consumption-production ratios were calculated for 116 processed foods, each of which were adjusted to reflect changes in population, regional consumption differences, income, per capita consumption and family size for the period 1950-1965 where data were available (57)(58). These ratios were projected forward to 1980 and adjusted for per capita consumption changes estimated by Daly, Egbert and others (14). Per capita consumption of individual processed foods for the year 2000 and 2020 were held at the 1980 projection level. Projected production was then derived from the consumption-production ratios calculated for the period 1959-1961. Preliminary population estimates furnished by the Office of Business Economics, Department of Commerce, were used in determining total region and subregion consumption. Comparisons were then made to assure consistency between the projected levels of agricultural production and processing requirements for a subregion, combination of subregions, and the region.

In only one product classification was the above methodology not followed. Projected processing of sugar beets for sugar was based on the projected production of sugar beets from OBERS and assumed levels of sugar content.

Projected employment in food and kindred products processing is based on projected production within the region and subregions and adjusted for estimated changes in worker productivity on a three-digit Standard Industrial Classification basis (56-17)(62)(63). Differences in projected worker productivity between subregions for any particular industry group is the result of product differentiation for those subregions during the base year.

In projecting the manufacturing of processed foods by specific product classifications, the question of new products and new industries is quite important. It should be noted that the projections made in the following section fit within a present industrial classification definition. This means that new products, developed during the projection period, will be manufactured by an industry with a general composition as known today. Changes in the product mix by food processing

industries have been occurring for a number of years and a continuation of these changes is inherent to these projections.

Projections

Projected processing of food and kindred products for each subregion and industry code are shown in table 51 for the years 1980, 2000 and 2020. This table illustrates varying rates of industrial growth for the three projection years.

The largest projected change in factory output between the years 1963 and 2020 is in the sugar beet processing industry (SIC 206). This large industrial growth is due, in part, to the assumption that the United States will maintain constant sugar import quotas after 1980.

Substantial increases in meat slaughtering are projected to occur in the region. Most of this increase will be associated with beef, with relatively large increases occurring in Subregions 4 and 5.

Output changes in dairy products processing will be associated with the following products: creamery butter, cheese (including cottage cheese), ice cream, ice milk, and milk sherbert, and fluid milk and cream. Total output of processed dairy products is projected to increase 2.3 times the base period quantity by the year 2020 for the region.

The commercial processing of principal fruits and vegetables will continue to be an important segment of food processing in the region. Coupled with the projected output of processed potatoes and seafoods, the volume of processed commodities listed under SIC 203 is expected to more than triple by the year 2020. Processed sweet corn, green and waxed beans and potatoes will continue to play a major role in food processing. Subregion 11 is expected to continue its dominant role in processing fishery products.

Projected indices of adjusted value added in manufacturing are shown in table 52. The value added in manufacturing was derived by multiplying the projected quantities of output of an individual commodity times its price during the year 1963. Individual commodities were then summed to a three-digit Standard Industrial Classification total. Subregion 2 is expected to experience the greatest relative growth in value added due to continued expansion in fruit, vegetable, potato and sugar beet production.

Table 51 - Projected Indices of Factory Production in Manufacturing Food and Kindred Products, by Industry Code, Columbia-North Pacific Region and Subregions, 1980, 2000, and 2020 1/

Subregion	Year and SIC Codes																											
	Total (20) 2/			201 3/			202 4/			203 5/			204 6/			205 7/			206 8/			207 9/			208 10/		
	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020	1980	2000	2020
1. Clark Fork-Kootenai-Spokane	129	179	246	153	211	291	120	166	229	171	236	287	150	207	286	136	178	246	--11/	--11/	--11/	140	194	267	149	219	302
2. Upper Columbia	217	344	522	157	216	298	120	165	229	175	242	336	150	207	286	136	188	259	254	421	655	140	193	267	156	221	305
3. Yakima	162	236	339	157	216	298	120	165	228	175	242	336	150	207	286	136	204	281	189	314	488	140	194	268	156	220	305
4. Upper Snake	170	246	313	176	243	335	136	187	259	182	250	278	---	---	---	136	188	260	156	259	403	---	---	---	155	220	304
5. Central Snake	163	236	305	176	242	334	135	189	261	181	250	285	150	207	286	152	210	290	133	219	342	---	---	---	155	220	304
6. Lower Snake	184	254	279	161	221	305	128	176	243	207	285	279	150	207	286	141	195	270	---	--	---	---	---	---	155	220	304
7. Mid Columbia	166	230	318	157	216	298	121	167	230	177	244	339	150	207	286	219	303	418	---	--	---	---	---	---	156	221	305
8. Lower Columbia	154	215	297	157	216	298	120	165	228	176	242	338	150	207	286	136	187	258	---	--	---	140	194	268	156	221	305
9. Willamette	148	205	286	157	215	297	122	168	232	173	239	247	150	207	286	129	178	246	---	---	---	140	193	267	156	221	305
10. Coastal	163	225	312	163	224	310	122	168	232	178	246	242	150	207	286	210	292	404	---	---	--	140	194	268	156	221	305
11. Puget Sound	150	209	288	157	216	298	120	165	228	175	242	336	150	207	286	136	189	260	---	---	---	140	193	267	155	220	304
12. Oregon Closed Basins	161	321	440	142	283	391	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	130	330	456
C-NP Total	157	222	302	160	220	304	123	169	234	179	247	311	150	207	286	136	188	259	160	265	412	140	193	267	155	220	304

1/ Year 1963 = 100 for all index numbers.
2/ Includes Miscellaneous Food and Kindred Products (209).
3/ Includes beef, veal, pork, lamb and mutton, chicken and turkey in liveweight equivalents. Does not include secondary processing under SIC 2013.
4/ Includes creamery butter, all cheese, condensed and evaporated milk, ice cream, and frozen desserts, and fluid milk in pounds of final product.
5/ Includes canned, frozen and dehydrated fruits, vegetables, potatoes, nuts and seafood in pounds of input. Does not include frozen and canned specialties, some preserves, jams and jellies.
6/ Includes flour and prepared feeds for animals and fowl. Does not include data for southern Idaho.
7/ Production data estimated from regional consumption of bread, biscuits, crackers, etc.
8/ Sugar production estimated at 305 to 320 pounds of sugar per ton of sugar beets, depending on the particular Subregion.
9/ Weight of confectionery and related items distributed on the basis of number of employees in SIC 207 per Subregion.
10/ For beverage industries: weight of still wines converted from wine gallons; beer production converted from barrels of 31 wine gallons; distilled spirits converted from tax gallons; soft drink production estimated from 1963 per capita consumption.
11/ Dashes indicate that production projections were not made due to lack of information or no manufacturing of the appropriate commodities during the base period.

Table 52 - Projections of Adjusted Value Added in Manufacturing All Food and Kindred Products, Columbia-North Pacific Region and Subregions, 1980, 2000, and 2020

Subregion	Projection Year and Index Number 1/		
	1980	2000	2020
1	137	189	260
2	210	327	493
3	161	231	328
4	158	230	307
5	161	233	308
6	171	221	277
7	172	237	330
8	131	217	300
9	145	203	281
10	172	238	330
11	150	208	288
12	161	302	418
C-NP	154	219	302

1/ The base year for all index numbers is 1963, in 1963 dollars.

Employment in manufacturing food and kindred products is projected to decrease slightly over the 57 year projection period. By the year 2020, this decrease will be equal to approximately five percent of the 1960 labor force (table 53). Employment is projected to decrease within the region due primarily to the projected annual rate of worker productivity being assumed to be slightly greater than changes in total production.

Table 53 - Food and Kindred Products Employment, 1960, with Projections to 1980, 2000 and 2020, Columbia-North Pacific Region and Subregions

Subregion	1960 1/	1980	2000	2020
1	4,539	3,610	3,213	3,325
2	1,022	1,386	1,404	1,478
3	3,329	3,243	3,136	3,130
4	4,773	6,105	6,111	5,769
5	5,287	4,653	4,588	4,372
6	1,040	1,002	979	892
7	2,741	3,047	2,931	2,846
8	2,264	2,110	2,082	2,095
9	12,884	12,197	11,916	11,928
10	3,973	4,211	4,034	3,715
11	16,994	15,907	15,913	16,311
12	57	35	35	35
C-NP	58,903	57,471	56,342	55,896

1/ Employment data obtained from the Office of Business Economics, 1968.

PRIMARY METALS INDUSTRIES

The primary metals industries are a relatively small but important component of the region's economy. In 1960 these industries comprised just over one percent of total employment in the region compared with the two percent they represented nationally. Regional producers, nevertheless, are major contributors to national supplies of aluminum, copper, zinc and some minor metals. These industries also are vital elements of the regional economy in providing products which serve as raw materials to other industry in the region.

The primary metals industries in the Columbia-North Pacific Region developed in large part to process regional mineral

resources, but major influences in the recent past have been the low cost hydroelectric power and water transportation facilities and the expanding markets of the region.

The outlook for these industries is described in the following sections. Outlooks for the primary smelting and refining industries represented by SIC codes 331, 332 and 333 are reviewed by the Bureau of Mines. Projections for the other industries in this industrial group have been prepared by the Corps of Engineers.

The reviews by the Bureau of Mines are based primarily on special industry studies completed for the Bonneville Power Administration as part of that agency's Economic Base Study of the Pacific Northwest. Production and employment projections are limited to those industries that the Bureau of Mines previously had reviewed for the Bonneville Power Administration and an aluminum study done for the Bonneville agency by Ivan Bloch and Associates.

Copper, Lead and Zinc

The primary copper, lead, and zinc smelting industry in the Columbia-North Pacific Region consists of a copper smelter and refinery at Tacoma, Washington; a copper smelter at Anaconda, Montana; a lead smelter at Kellogg, Idaho; and zinc smelters at Kellogg and Anaconda (24)(33)(54). The region's base metal mining industry is also served by two facilities outside the region; a lead smelter at East Helena, Montana and a copper refinery at Great Falls, Montana.

As markets for refined copper, lead and zinc in the region are small, most is sold to users in the Midwest and Eastern United States, although increasing amounts are being sold in California markets. A large portion of the refined metal from the Tacoma copper smelter is shipped to overseas markets.

Copper smelting within the region is expected to grow at a slower rate than the projected rate of increase in domestic consumption of over three percent annually. Using a productivity rate of 2.7 percent annually to 1985, as shown in a report for the Bonneville Power Administration (33), and extending productivity at 2.25 percent after 1985, indicates that employment in copper smelting will decline to 750 by the year 2020. Projected production and employment for copper as well as lead and zinc are shown in table 54.

Lead smelting growth within the region will continue to be influenced by the large reserves and accompanying smelter

capacity being developed in Missouri. It is believed that these eastern reserves can be exploited at less expense than can most western resources. A possible mitigating factor would be a sharp rise in the price of silver. Western operations would benefit more because western lead deposits characteristically contain a higher silver content than do eastern ores. The possible loss of certain segments of the lead market to substitute materials, that is, lead in gasoline due to pollution problems or turbine engine development, would decrease demand and adversely affect the western lead producer's situation.

Table 54 - Projected Copper, Lead and Zinc Production and Employment, Columbia-North Pacific Region, 1980, 2000 and 2020 1/

	Copper		Lead		Zinc		
Year	Tons	Employment	Tons	Employment	Tons	Employment	Total Employment
1980	288,300	1,460	95,000	325	180,000	655	2,440
2000	326,000	1,050	100,000	210	200,000	460	1,720
2020	368,000	750	105,000	145	220,000	325	1,220

1/ Productivity to 1985 projected at 2.7 percent annual growth; from 1985 to 2020, the rate was 2.25 percent.

The outlook for continuing zinc output is good because of the large quantity of low-grade resources existing within the region's confines--particularly in northeastern Washington--that could be utilized with improved technology and/or market prices. Smelting sizable amounts of foreign concentrates is anticipated to continue.

Ferroalloys

Abundant low-priced industrial power and expanding wartime needs for the alloys for steel brought numerous companies into the Pacific Northwest region (30)(32). Union Carbide Corporation erected a plant at Tacoma, Washington in 1941 and at Wenatchee, Washington for the government in 1942. The Anaconda Company constructed a plant at Anaconda, Montana to produce ferromanganese. Keokuk Electro-Metals Company, in 1948, purchased the Wenatchee plant built by Ohio Ferroalloys Corporation. Union Carbide Corporation built an alloy plant for the government at Mead, near Spokane, Washington to produce ferrosilicon for use in an adjacent magnesium plant. The Mead facility was

leased by Pacific Northwest Alloys, Inc. after the war to produce ferrochromium. Silicon metal continues to be produced from a plant built in 1953 at Springfield, Oregon by National Metallurgical Company. Hanna Nickel Smelting Company began producing ferronickel near Riddle, Oregon in 1954, utilizing nickel ore from a nearby deposit.

Ferrochromium production by Pacific Northwest Alloys, Inc. was terminated in 1962. Ohio Ferroalloys Corporation, in 1966, announced planned termination of production at Tacoma, Washington. Ferromanganese output by The Anaconda Company has ceased and will resume only if product value should increase significantly. It is not expected that other regional plants will be closed in the near future, but by 1975 production economics could require larger furnace size, which in turn might result in fewer plants. Estimated production and employment by the alloy industry for 1980, 2000, and 2020 are shown in table 55.

Table 55 - Projected Alloy Metal Production and Employment, Columbia-North Pacific Region, 1980, 2000 and 2020

	1980	2000	2020
Production (tons) 1/	275,000	524,000	975,000
Employment	750	425	350

1/ Production totals include ferrosphosphorus.
Source: Kingston, Gary A., and Robert A. Miller, Alloy Metals Outlook in the Pacific Northwest States, report prepared for Bonneville Power Administration, Portland, Oregon 1966.

Steel

Current steel production is centered in the most densely populated areas of the Pacific Northwest, Seattle and Portland. Although integrated steel plants in California, Colorado and Utah could be a depressant to steel production expansion in the Pacific Northwest, the geographic pattern of steel output has been breaking up and trending toward plant locations near the market areas. This, in fact, has been part of the reasoning behind steel development in the western United States; therefore, it follows that there will be market advantages favoring further expansion of Northwest steel output (24)(31)(54).

The projections of steel ingot production were based on the demand for rolled steel products. In order to arrive at the following projections, the historical pattern as well as the

current status of the industry and the related economic and technologic factors were examined. Because of the predominant role of steel mill production compared with the regional steel castings output, the principal emphasis for defining employment is on mill products, expressed as steel ingot. The assumption was that market factors influencing steel ingot also influence steel casting production.

It was further assumed, based on the growth of steel production in California, that the production of steel in the Pacific Northwest would grow from a production-to-market relationship of 32 percent to one of 45 percent by 1985; that is, 45 percent of the steel used in the Pacific Northwest would be produced in the region.

Table 56 - Steel Production and Employment, 1960, with Projections to 1980, 2000 and 2020, Columbia-North Pacific Region

Year	Steel Ingot	Steel Castings	Employment 1/
	Tons	Tons	
1960	381,000	35,500	4,400
1980	900,000	46,600	5,500
2000	1,400,000	58,900	5,300
2020	1,900,000	71,500	3,800

1/ Productivity increase of 2.75 percent from 1960 through 1980 and 2.25 percent after 1980.

Titanium

Expansion in titanium sponge production is expected in the next two decades (20)(54). National consumption of titanium sponge was projected to total 100,000 tons by 1985, an average annual rate of growth of about 13 percent from 1963 to 1985.

The regional industry was projected to grow until it equaled at least 40 percent of the national sponge production--approximately 40,000 tons annually. It was assumed production by 1970 would be 2,000 tons per year in the region.

Innate properties that impart desirable physical and chemical qualities to paint pigments also provide a heavy demand for another titanium product--titanium dioxide. Some of the same properties that make it so useful in the manufacture of paint are also desired by the paper-making industry. Nationally, use of titanium pigment by the paint and paper-making industries accounts for about 72 percent of the total of titanium pigment

consumed. The Bureau of Mines estimated that consumption of TiO_2 in the west (Rocky Mountain and Pacific States) in 1958 was 31,600 tons, of which 66 percent (21,000 tons) was used in making paint. A rough estimate of consumption by 1962 showed that growth in Western States had furnished a market for 45,000 to 50,000 tons of titanium dioxide.

Projections of titanium dioxide productive capacity for the Northwest are shown in table 57.

Table 57 - Projected Titanium and Titanium Dioxide Production and Employment, Columbia-North Pacific Region, 1970, 1980, 2000 and 2020

Year	Titanium Dioxide (Tons)	Employment 1/	Titanium Sponge (Tons)	Employment 2/
1970	10,000	125	2,000	300
1980	20,000	250	20,000	1,200
2000	45,000	560	60,000	2,400
2020	50,000	625	66,000	2,640

1/ Eight tons per employee.
2/ Productivity changes from 6.6 in 1970 to 25 tons per employee in 2020.
Source: Fulkerson, Frank B., and Jerry J. Gray, The Titanium Industries and Their Relation to the Pacific Northwest, report prepared for Bonneville Power Administration, Portland, Oregon, 1965.

The figures shown in table 57 do not contain productivity gains in the titanium dioxide figures because that particular industry was considered to be a mature industry and any further drastic changes in technology would be considered unlikely.

In the past, the titanium metal reduction process has required 0.15 persons per annual ton. Considering that titanium reduction is a young industry and the earlier stages of a new industry enjoy a rather large increase in productivity in the first decade or so, a ratio of 0.15 persons per annual ton of production was used to establish total employment in 1970, but by the year 1980 the ratio was changed to 0.06, and by 2000 and beyond the ratio 0.04 was used.

Magnesium

Historically, magnesium ingot consumption has been outside the area due to concentration in the Midwest of aluminum rolling mills and extruding foundries where magnesium is used as an alloy (19).

National consumption of primary magnesium was estimated to reach 350,000 tons by 1985, three times the current domestic capacity. This was mainly based on continued expansion that has been projected in the aluminum industry. Factors that would lead to production of magnesium in the Columbia-North Pacific Region would have to be classified as changes in the industry. If more competition develops from domestic and foreign sources the price of magnesium may possibly drop, which would encourage consumption. In addition to price, other factors, such as greater consumer acceptance, growth of the economy, and the development of new uses, eventually should cause greater consumption of magnesium.

There are now no magnesium plants in the region; by 1970 one is projected to begin producing 15,000 tons annually. The assumption for this was that certain of the forthcoming increases in national magnesium plant capacity would be placed in the Columbia-North Pacific Region. The Pacific Northwest is considered to represent approximately 12 percent of the national market.

Magnesium production in the region with growth through 2020 is shown in table 58.

Table 58 - Projected Magnesium Production and Employment, Columbia-North Pacific Region, 1970, 1980, 2000 and 2020

Year	Tonnages	Employment
1970	15,000	375
1980	60,000	1,800
2000	155,000	3,000
2020	175,000	3,000

Production beyond 1985 was assumed to level off gradually at a steadily decreasing rate. The rates of growth between the periods 1970-80, 1980-2000, and 2000-2020 were assigned the following average annual growth rates: 1970-80, 15 percent; 1980-2000, 4.75 percent; 2000-2020, 0.75 percent.

Aluminum

Aluminum production in the Pacific Northwest has a very high potential for growth and stability (9) (17). Conditions for the expansion of the regional aluminum industry have been favorable; increased investments in existing plants and equipment and the entrance of new firms into the area substantiate this. The aluminum capacity of plants in the Pacific Northwest in 1965 was 802,500 tons (table 59).

By 1972 the capacity currently in the early construction or advanced planning stage should be in place; at that time the area's rated capacity should approach 1.5 million tons. The unprecedented expansion of the regional aluminum industry certainly is not without justification. Comparative cost is one of the important conditions in this expansion; the other is the growth of aluminum use by consuming industries in the western states, export markets, and the nation as a whole. In studies by the Bureau of Mines and the recently published aluminum report done for Bonneville Power Administration by Ivan Bloch and Associates (9), comparative costs indicated that regional plants will continue to compete effectively with those in the Ohio Valley.

Forecasts indicate national aluminum consumption could exceed 8.0 million tons by 1975 (9). This is twice that of the 1965 level, or an average annual growth rate of 8 percent -- the historical national rate for the industry. The 1965 capacity in the Pacific Northwest was 802,500 tons. Using an average annual growth rate of 8 percent would result in a 1975 capacity of 1.7 million tons. If the Pacific Northwest maintained the 31 percent national capacity, rated capacity would reach a 1975 level of 2.6 million tons. An average measure of these two figures, or the midpoint of the range, would be the more likely possibility -- 2.2 million tons by 1975. This is an average annual growth rate of between 10 and 11 percent. The further expansion of the aluminum industry in the Pacific Northwest is not expected to continue at that rate; the period from 1975 to 2020 will experience a growth rate below the national historical rate of 8 percent. Assuming the increase in the next decade would result in a 1980 capacity figure of 2.8 million tons and a 1985 capacity figure of 3.8 million tons (9), an average annual rate between 5 and 6 percent would be required. A study by Resources for the Future, Inc., in the publication, Resources in America's Future, Patterns of Requirements and Availabilities, 1960-2000, shows an average growth rate of 5.375 percent for the high projection of primary aluminum requirements between 1980 and 2000.

Table 59 - Primary Aluminum Ingot Capacity, by Company and Location, Columbia-North Pacific Region and United States, 1965 and 1972

Company and Location	1965 (tons)	Percent of Region in 1965	Under construction or scheduled	1972 (tons)	Subregion	Percent of Region in 1972
Aluminum Company of America						
Vancouver, Washington	100,000	12.5	-	100,000	8	6.7
Wenatchee, Washington	125,000	15.6	50,000	175,000	2	11.8
Reynolds Metals Co.						
Longview, Washington	65,000	8.1	120,000	185,000	8	12.4
Troutdale, Oregon	91,500	11.4	40,000	131,500	9	8.8
Kaiser Aluminum & Chemical Corp.						
Mead, Washington	193,000	24.0	-	193,000	1	13.0
Tacoma, Washington	41,000	5.1	41,000	82,000	11	5.5
Anaconda Aluminum Co.						
Columbia Falls, Montana	100,000	12.5	75,000	175,000	1	11.8
Intalco Aluminum Corp.						
Bellingham, Washington	-	-	228,000	228,000	11	15.3
Harvey Aluminum Co.						
The Dalles, Oregon	87,000	10.8	-	87,000	7	5.9
Northwest Aluminum Co.						
Warrenton, Oregon	-	-	130,000	130,000	10	8.7
Pacific Northwest Total	802,500		684,000	1,486,500		
United States total	2,772,000					
Percent of U.S. Total	29					

A more conservative estimate of 4 percent average annual growth from 1985 to 2000 and 2.5 percent from 2000 to 2020 would result in the following capacity figures for reduction plants in the Columbia-North Pacific Region: 1985, 3.8 million tons, 2000, 6.8 million tons; 2020, 11.0 million tons.

Employment as a function of production is a compromise between the employment by reduction plants as a direct ratio with production and the influence of a nominal gain in productivity. Projections of employment to the years 2000 and 2020 (table 60) are based on the gain in capacity less an estimated increased average annual productivity assumed to be between 2.5 and 3.0 percent.

Table 60 - Primary Aluminum Industry, Capacity and Employment, 1965, Pacific Northwest, with Projections to 1980, 1985, 2000, and 2020.

Year	Capacity (tons)	Employment
1965	802,500	9,100
1980	2,800,000	17,100
1985	3,800,000	21,100
2000	6,800,000	25,000
2020	11,000,000	25,000

Source: Bloch, Ivan, and Samuel Moment. The Aluminum Industry of the Pacific Northwest, report prepared by Ivan Bloch and Associates for Bonneville Power Administration, Portland, Oregon, 1967

The breakdown of direct employment in the regional aluminum industry into the subregions is shown in table 61. The allocation of workers up through 1975 was made using precentages of total employment that were equal to the percentage of installed capacity in each subregion. Beyond 1975, the assumption was made that the future expansion of the industry would most likely occur in those subregions with access to waterborne delivery of alumina by deep-draft freighter. For instance, the total share of employment in Subregions 8, 9, 10, and 11 increased from 37 percent in 1965 to 64 percent in 2020.

Table 61 - Employment in the Aluminum Industry, 1965, with Projections for 1980, 2000, and 2020, Columbia-North Pacific Region and Subregions

Year	Total capacity (short tons)	Columbia North Pacific	Employment 1/ Subregions 1	2	7	8	9	10	11
1965	802,500	9,100	3,300	1,400	1,000	1,850	1,050	-	500
1980	2,800,000	17,100	4,000	2,000	1,000	3,200	1,690	1,670	3,540
2000	6,800,000	25,000	5,000	2,500	1,500	5,000	3,000	4,000	4,000
2020	11,000,000	25,000	5,000	2,500	1,500	5,000	3,000	4,000	4,000

1/ From table 60; subregional employment allocated on basis of capacity

Subregion Projections for Major Commodities

Projections for the primary metals industries discussed in the previous pages have been presented on an industry basis. Table 62 shows the projected employment for each commodity allocated to the appropriate subregions (whenever confidentiality permits) which were assumed to be the locale for future growth.

Table 62 - Projected Employment for Major Commodities by Subregion, 1980, 2000 and 2020

Commodity	Subregion	1980	2000	2020
Copper, lead, zinc	1	1,773	1,220	845
	11	667	500	375
Total		2,440	1,720	1,220
Ferroalloys	1/	750	425	350
Steel	8	170	150	130
	9	1,770	1,940	1,830
	11	3,560	3,210	1,840
Total		5,500	5,300	3,800
Titanium	9	1,450	2,960	3,265
Magnesium	9 2/	1,800	3,000	3,000
Aluminum	1	4,000	5,000	5,000
	2	2,000	2,500	2,500
	7	1,000	1,500	1,500
	8	3,200	5,000	5,000
	9	1,690	3,000	3,000
	10	1,670	4,000	4,000
	11	3,540	4,000	4,000
Total		17,100	25,000	25,000
C-NP Total		29,040	38,405	36,635

1/ To insure confidentiality, cannot be allocated. Subregions represented include 1, 2, 4, 8, 9, and 10.

2/ The most likely subregions besides 9 for future growth will be 7 and 8.

Other Primary Metals Industries

Other primary metals industries include the production of primary non-ferrous shapes (rolling, drawing, extruding, casting), both ferrous and non-ferrous forgings, secondary smelting and refining of non-ferrous metals and miscellaneous minor activities. These industries comprise SIC classifications 334, 335, 336 and 339.

In 1966 these industries employed about 5,600 workers in the region (table 63). Employment has grown sharply in recent years. The annual rate of growth from 1960 through 1966 amounted to 7.0% per year (1960 estimated employment--3,750 workers).

Table 63 - Other Primary Metals Industries Employment, Columbia-North Pacific Region, 1966 1/

SIC	Industry	1966
334	Secondary smelting and refining non-ferrous metals	209
335	Rolling, drawing, extruding non-ferrous metals	3,777
336	Non-ferrous foundries	996
339	Miscellaneous primary metals	658
	Total	5,640

1/ Data estimated from state employment security agencies.

Two major factors in the location of these industries are markets and raw materials supplies. Markets are primarily in the metal products industries in population centers, and plants tend to locate near these markets. Plant locations are also influenced, however, by the location of the "basic" elements of the primary metals industry, SIC 331, 332, and 333, which supply their raw materials (ingots, billets, etc.). Their location in the region reflects these influences. Virtually all of present employment is located in Subregions 1, 8, 9 and 11 either near "basic" metals plants, such as aluminum refineries, or in the major regional population centers.

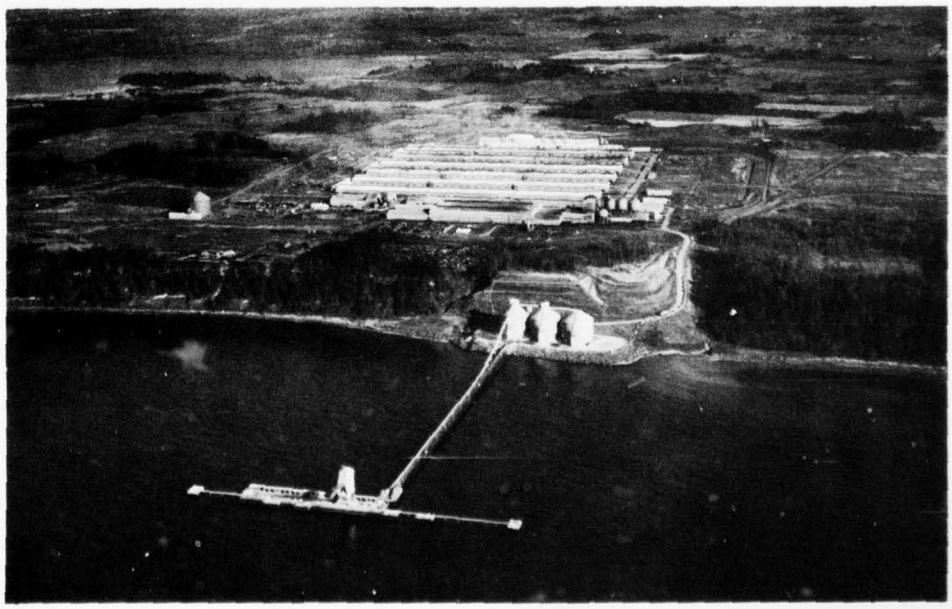
These industries are less well developed in the region than they are nationally, both in terms of their relationship

to the "basic" industries and in terms of their share of regional markets. Regional employment in 1966 amounted to about 24 percent of the whole regional primary metals industry compared with a share of about 30 percent nationally, and there were only 94 workers per 100,000 population in the region compared with 195 per 100,000 nationally.

Future growth in these industries may be expected to increasingly reflect the influence of markets and raw materials on their location. Based on this expectation, projections have been developed on the assumption that employment will tend to approach the national average relationship of employment to markets, and the national relationship of employment in these industries to the "basic" elements of the primary metals industry. Assuming that these industries will continue to represent about 30 percent of the national primary metals industries, and utilizing the national projections of the Office of Business Economics and Columbia-North Pacific projections of the "basic" elements in the region, employment is projected as follows: 1980, 10,200; 2000, 15,100; 2020, 16,400. Projections for subregions are presented in combined form in table 64.

Summary Projections

Projections of employment for the primary metals industry as a whole are presented in table 64. The figures include a subregion allocation of employment in ferroalloys and "other" primary metals industries as well as those shown in table 62.



Aluminum manufacturing, Bellingham, Washington. (Galen Biery photo)

Table 64 - Projected Employment in the Primary Metals Industries, Columbia-North Pacific Region and Subregions, 1980, 2000 and 2020

Subregion	1980	2000	2020
1	8,930	9,275	8,535
2	2,595	3,245	3,370
3	70	190	240
4	140	280	350
5	75	225	300
6	45	120	150
7	1,270	1,960	2,050
8	4,665	6,730	6,740
9	9,100	14,770	15,615
10	2,465	5,290	5,440
11	9,875	11,410	10,235
12	10	10	10
C-NP	39,240	53,505	53,035

OTHER MANUFACTURING INDUSTRIES

The manufacturing industries which have been treated in the earlier sections of this report comprise the water-using industries--those most significant in industrial water use in the region. They are, as a group, the largest employers and contribute a larger part of total production 1/ than the rest of the manufacturing industries. By coincidence, they are also the primary resource-using industries in the manufacturing group. The other manufacturing industries, less dependent on natural resources, have been later in their development, but they are now a substantial part of the manufacturing group, and the generally more rapid growth in these industries makes them increasingly important to the future economic development of the region. The "other" manufacturing industries employed about 180,000 workers in the region in 1960, and their total value added in manufacturing amounted to around $1.3 billion. Some information on the composition and importance of this group of industries is presented in table 65.

Employment in "other" manufacturing made up about 40% of the region's manufacturing employment in 1960. As shown in the table, the transportation equipment industry accounted for nearly half the employment in the group, and printing and publishing was another large employer. Three other industries accounted for most of the remainder: fabricated metals,

1/ Measured by value-added in manufacture.

Table 65 - Other Manufacturing Industries in the Columbia-North Pacific Region, 1960

SIC	Industry	1960 Employment	Percent of Other Manufacturing	Percent of Total Manufacturing	Location Quotient (US Base)
22	Textile mills	3,944	2.2	0.9	.134
23	Apparel	7,347	4.1	1.6	.203
27	Printing & publishing	27,320	15.2	6.1	.767
34	Fabricated metals[1/]	14,487	8.1	3.2	.360
35	Machinery	16,029	8.9	3.6	.329
36	Electrical equipment	9,354	5.2	2.1	.202
37	Transportation equipment	81,490	45.3	18.2	1.443
30,31,32, 38,39	Undistributed industries	19,868	11.0	4.4	.284
	Total for industries listed	179,839	100.0	40.2	.494
	Total manufacturing	447,025	--	100.0	.822

1/ Includes ordinance manufacturing, SIC 19.
Source: Compiled from 1960 Census of Population by Department of Commerce, Office of Business Economics.

machinery, and the undistributed group in which the stone, clay and glass industry is most important.

While the "other" manufacturing industries represented 40% of the region's manufacturing employment, these same industries in the nation as a whole represented 67% of national manufacturing employment. The underrepresentation of these industries in the region is demonstrated by the location quotients 1/ shown in the last column of the table. With the exception of the transportation equipment and printing and publishing industries, none of the industries had a location quotient greater than .36; a figure signifying roughly 1/3 of average representation in terms of the total employment size of the region.

Estimates of value added in these industries has been made for the years 1958 and 1963. Table 66 shows these estimates together with the proportion that they represented of national production (value added) in each industry.

The "other manufacturing industries represented a smaller proportion of manufacturing production than they did of employment. This is mainly due to the higher value added per employee of the capital intensive paper and chemicals industries in the heavy water-using category.

Value added in each industry was generally a very small part of national production, but in almost every case it increased substantially between the two years.

A better indication of the rapid regional development of these industries in recent years is presented in table 67. This table shows how employment has been expanding since 1950. Over the sixteen years covered by the data, regional growth in the group as a whole averaged well over six percent per year compared with a national average of two and a half to three percent. Moreover, growth was not confined to only one or two of the industries, but was quite evenly distributed among them. Every industry, with the exception of printing and publishing (and textiles in the most recent period) had regional growth rates significantly higher than the national rates of increase.

1/ A location quotient is the ratio of the percent that employment in an industry in an area is of national employment in that industry to the percent that total employment in the area is to total national employment. A ratio of 1.00 indicates that the region has an average proportion of employment in that industry; a ratio less than 1.00 shows underrepresentation of that industry in the region.

Table 66 - Value Added in Other Manufacturing Industries, Columbia-North Pacific Region, 1958 and 1963

SIC	Industry	Value Added 1958	Value Added 1963	Percent of Industry Total in US 1958	Percent of Industry Total in US 1963
		(Million Dollars)		(Percent)	
22	Textile mills	12.3	22.7	0.25	0.37
23	Apparel	33.2	48.4	0.55	0.61
27	Printing and publishing	133.4	163.8	1.67	1.56
30	Rubber and plastics	3.0	10.3	0.09	0.22
31	Leather and products	2.0	4.6	0.11	0.22
32	Stone, clay and glass	86.9	118.8	1.57	1.69
34	Fabricated Metals	116.3	142.3	1.23	1.21
35	Machinery, except electrical	99.6	148.4	0.80	0.86
36	Electrical equipment	41.2	85.6	0.39	0.50
37	Transportation equipment	665.9	1,114.3	4.35	4.89
38	Instruments, etc.	6.8	15.0	0.24	0.38
39	Miscellaneous manufacturing	18.8	29.1	0.70	0.82
	Total for industries listed	1,219.5	1,903.3	1.47	1.66
	Total manufacturing	3,716.5	5,066.1	2.63	2.64
	Industries listed as percent of total manufacturing	32.8%	37.6%		

Source: 1963 Census of Manufactures, Industry Statistics. Partially estimated from other materials.

Table 67 - Employment and Growth in Other Manufacturing Industries, Columbia-North Pacific Region, 1950-60 and 1960-66

SIC	Industry	1950-60 Period 1/ C-NP Region 1950	1960	Annual Rate of Growth C-NP	U.S.	1960-66 Period 2/ C-NP Region 1960	1966	Annual Rate of Growth C-NP	U.S.
22	Textile mills	4,108	3,944	-0.4	-2.4	3,100	2,900	-1.3	0.5
23	Apparel	4,746	7,347	4.5	1.2	6,600	7,600	2.6	2.1
27	Printing and publishing	20,915	27,320	2.7	3.3	15,600	17,600	2.1	2.1
34	Fabricated metals (incl. ord.)	8,951	14,487	4.9	4.7	12,900	15,700	3.4	2.9
35	Machinery	9,344	16,029	5.5	2.2	11,500	19,200	9.0	4.0
36	Electrical equipment	2,168	9,354	15.7	6.9	7,100	12,800	10.3	4.4
37	Transportation equipment	31,421	81,490	10.0	5.6	69,700	109,100	7.8	3.3
	Industries itemized below	13,486	19,868	4.0	1.6	14,500	18,200	3.9	2.1
30	Rubber, plastics	NA	NA	--	--	700	1,500	12.9	5.2
31	Leather and products	NA	NA	--	--	600	600	1.7	-0.3
32	Clay	NA	NA	--	--	8,600	9,900	2.6	1.0
38	Instruments, etc.	NA	NA	--	--	1,500	2,300	7.5	3.2
39	Miscellaneous	NA	NA	--	--	3,200	3,800	3.3	1.4
	Total for all industries listed	95,139	179,839	6.6	2.5	140,900	203,100	6.3	2.8
	Total manufacturing	338,905	447,025	2.8	2.1	395,200	475,700	3.2	2.2

1/ Compiled from Censuses of Population by Office of Business Economics.
2/ Estimated from information furnished by state employment security agencies. U.S. data calculated from 1967 Statistical Abstract, pp. 226-8.
NA = Not available

Developmental Influences

While special factors affecting individual industries have contributed to their growth in the region, the broad growth patterns which have characterized these industries as a group have been the result of more pervasive factors.

The prime example of a special industrial development has been that of the transportation equipment industry. This industry is dominated in the region by one aerospace manufacturer who has attained the position of principal supplier of commercial jet aircraft in the United States and much of the rest of the world. It is also an important defense industry supplier. Future growth in this industry depends largely on such factors as future company management, the federal government's decision on support for the supersonic transport and similar matters rather than on more predictable external factors.

Another example has appeared in the instruments industry where one manufacturer has become the principal national supplier of a specific kind of electronic measuring equipment. This firm again dominates its industry in the region, and its prospects depend more on the acumen of its management than on any external influences.

For other industries, however, (and to some degree for the industries mentioned above) development is heavily influenced by environmental factors--access to markets, raw materials, transportation, labor supply, etc.

The markets of these industries encompass a wide spectrum of the economy, but they are largely industrial and interregional rather than consumer and local in their composition. Information from an input-output study for the state of Washington shows, in table 68, the distribution of sales for "other" manufacturing in 1963.

The distribution is dominated by the transportation equipment industry which sells a large part of its production to governments. Excluding this industry, the distribution shows that the bulk of production goes to industry in the state and to markets (largely industrial) in the rest of the United States.

While part of the exports from the state of Washington to the rest of the United States go to adjacent states within the Columbia-North Pacific Region, a substantial part goes out of the region, particularly to California and other western states. The growth of western markets has been a significant influence on these industries. Population growth since 1940 has averaged

Table 68 - Markets for Other Manufacturing Industries, Washington State, 1963

Market	Percent of Total Sales	
	All "Other" Manufacturing	Excluding Transportation Equipment
Washington industries	15.4	43.1
Personal consumption and private investment	5.7	15.5
Government	44.0	5.7
Rest of United States	29.8	34.2
Foreign exports	5.1	1.5
Total	100.0	100.0

Source: Bourque, Philip J, et al, The Washington Economy: An Input-Output Study, University of Washington, 1967.

3.2% a year in the western states, and from 1950 to 1966 (excluding the war years) it averaged 3.1% a year. Growth has come nearly twice as fast as it has to the nation and industrial markets have grown even faster.

For some of these industries, especially machinery and equipment manufacturers, access to foreign markets is also important to their growth. The study referred to in table 68 (10) showed that for the state of Washington, foreign exports represented 8.2 percent of production in the transportation equipment industry, 4.2 percent in machinery and electrical equipment, and a substantial part of instruments production which was grouped in a miscellaneous category. A study for the Willamette Valley (15), the principal fraction of the Oregon economy, showed that about 14 percent of machinery and 20 percent of electrical equipment production goes abroad.

Related to the growth in markets has been a substantial reduction in transportation costs. Since 1940 costs per ton/mile for all kinds of domestic intercity freight traffic have fallen continuously relative to other costs. Taking average costs per ton/mile and deflating them by the wholesale price index for all commodities, transportation costs as shown in table 69 had fallen, by 1966, to only 62 percent of their 1940 levels.

This decline in shipping costs is uniquely important to the region as compared with other parts of the continental

Table 69 - Cost Per Ton/mile of Domestic Intercity Freight Traffic, United States, 1940-1966

Year	Current Cost per Ton/mile (cents)	Deflated Cost 1/ per Ton/mile (1940=100)
1940	0.90	100
1945	1.10	91
1950	1.34	74
1955	1.35	69
1960	1.40	67
1966	1.37	62

1/ Wholesale price index for all commodities used as deflator.
Source: Compiled from 1968 Statistical Abstract.

United States because the region lies the farthest from the major industrial centers of the nation. Reduced shipping costs have not only widened markets but also lowered delivered raw material costs.

As the regional economy has expanded the size of its internal markets, local production has expanded. Beyond this, however, the growth of local markets has led to more efficient production by permitting economies of scale in industrial operations. With many industrial processes, costs per unit diminish markedly as the size of plant is increased. Also, with increased size of the regional economy (and with increased size of a particular industry), reduced costs for services outside the firm, the so-called external economies, develop. A broader and cheaper range of services and facilities of all kinds become available. Social overhead, in terms of government services, transportation facilities, education and research facilities, etc., is increased.

Another factor which has contributed to the recent growth of these industries has been a tendency toward the decentralization of industry. The manufacturing industries have historically been heavily concentrated in the northeastern states, but in recent years a spreading out of industry has occurred which may be partly attributable to the reduction in relative transportation costs but must also be affected by changes in marketing techniques, improvements in technology, improved labor supplies, increased mobility, and other circumstances.

Lastly, the amenities of the region have had some affect on the growth of these industries. The region is one of unquestioned scenic grandeur, and offers unusually extensive

recreational opportunities to its residents. While the more heavily populated areas have less sunshine than the highly popular Florida and California areas, the climate is mild and fairly equable. Social and cultural amenities have achieved considerable stature in recent years although it could not be argued that they surpass those of the largest population centers. There is no doubt, however, that the region stands high in any ranking by "liveability" and with the growing mobility of the population, it will attract an increasing share of migrants.

Future Growth

These industries will continue to expand rapidly as markets improve and as industry decentralizes. Some slowing down of growth should occur over time as regional industries approach "proportional" representation in the area.

An indication of anticipated growth in production for these industries is presented in table 70. Projections of national production by Lundberg and others in Resources in America's Future (36) have been converted to a 1960 base and extrapolated from 2000 to 2020 on the basis of trends over the decade 1990-2000.

Table 70 - Projections of Production, Other Manufacturing Industries, United States, 1980, 2000 and 2020

SIC	Industry	Projections Index Numbers 1960=100 1980	2000	2020
22	Textile mills	158	244	388
23	Apparel	173	306	532
27	Printing and publishing	178	285	440
30	Rubber and plastics	139	195	269
31	Leather and products	299	738	1,831
32	Stone, clay, glass	213	445	992
34	Fabricated metals	222	480	1,076
35	Machinery, except electrical	296	764	1,941
36	Electrical equipment	264	635	1,512
37	Transportation equipment	333	956	2,760
38	Instruments, etc.	444	1,405	4,386
39	Miscellaneous	162	277	476
	All manufacturing	235	543	1,248

Source: Lundberg, H.H.,et al, Resources in America's Future, pp. 561ff. Adjusted here to 1960 base and extrapolated from the year 2000 to 2020 on basis of 1990-2000 trend.

Employment in the region will grow substantially, although somewhat less rapidly than production. Projections of employment for these industries are presented in table 71.

Table 71 - Employment in Other Manufacturing Industries, 1960, with Projections to 1980, 2000 and 2020, Columbia-North Pacific Region and United States

Year	Columbia-North Pacific Region	United States	Growth in C-NP as % of US Growth Rate
1960	179,839	12,744,625	--
1980	367,731	17,341,300	150
2000	534,622	21,689,600	116
2020	740,690	27,305,500	110

Source: Region projections by C-NP Economic Work Group; U.S. projections by U.S. Dept. of Commerce, Office of Business Economics, March 1968 projections.

NON COMMODITY PROD. IND.

NON-COMMODITY-PRODUCING INDUSTRIES

In terms of employment, the non-commodity-producing industries represent by far the largest part of the whole economy. They include all industries except agriculture, forestry, fishing, mining, and manufacturing. The non-commodity-producing industries with the exception of the construction industry do not produce physical goods but rather various kinds of services. The construction industry produces physical goods which are fixed-in-place and do not move in trade in the usual sense. The distinction between commodity producing and non-commodity-producing industries is primarily one of convenience for economic study purposes since the non-commodity-producing industries do not rely much on the resources of an area and the market for their products (services) is confined primarily to the regional economy. They are often called the "residentiary" industries because they are so closely tied to the local economy. They are also relatively low consumptive users of water resources.

CHARACTER OF THE NON-COMMODITY-PRODUCING INDUSTRIES

The non-commodity-producing industries of the region were 68 percent of total employment in 1960, a slightly higher proportion than the 65 percent that they represented nationally. There are six major industrial groups in the non-commodity-producing industries of which trade and services are the most important. The relative importance of these groups in the region and the nation is shown below:

Industry	Region	United States
Contract construction	9.6%	9.2%
Transportation, communication, and utilities	11.3	10.8
Wholesale and retail trade	29.0	28.6
Finance, insurance, and real estate	5.9	6.6
Services	32.3	32.8
Public administration and armed forces	11.9	11.9
All non-commodity-producing industries	100.0	100.0

Table 72 shows the distribution of employment in greater detail. It also shows the location quotients for industries in the region as related to the national composition of industry.

Table 72 - Detailed Distribution of Employment in the Non-commodity-producing Industries, Columbia-North Pacific Region and United States, 1960

Industry	Employment		Percent of Non-commodity Industries		Location Quotient for
	C-NP	U.S.	C-NP	U.S.	C-NP Region
All non-commodity-producing industries	1,352,875	42,983,462	100.0	100.0	1.06
Contract Construction	129,460	3,968,253	9.6	9.2	1.09
Transportation, Communications & Utilities	153,571	4,650,643	11.4	10.8	1.11
Transportation	98,154	2,859,973	7.3	6.6	1.15
Railroads	35,786	979,544	2.6	2.3	1.23
Trucking & warehousing	29,610	949,781	2.2	2.2	1.05
Other transportation	32,758	930,648	2.4	2.2	1.18
Communication	26,460	855,414	2.0	2.0	1.04
Utilities	28,957	935,256	2.1	2.2	1.04
Trade	392,179	12,287,854	29.0	28.6	1.07
Wholesale Trade	82,813	2,311,319	6.1	5.4	1.20
Retail Trade	309,366	9,976,535	22.9	23.2	1.04
Eating & drinking	63,498	1,878,561	4.7	4.4	1.13
Other retail	245,868	8,097,974	18.2	18.8	1.01
Finance, Insurance & Real Estate	79,937	2,820,517	5.9	6.6	.95
Services	436,369	14,123,667	32.3	32.9	1.04
Hotels, Lodgings	59,986	2,026,448	4.4	4.7	.99
Business & Repair	49,185	1,682,922	3.6	3.9	.98
Entertainment & Recreation	14,982	525,543	1.1	1.2	.96
Medical, Professional	259,688	7,896,155	19.2	18.4	1.10
Private Households	52,527	1,992,599	3.9	4.6	.88
Public Administration	98,861	3,341,911	7.3	7.8	.99
Armed Forces	62,498	1,790,617	4.6	4.2	1.17

Source: Compiled from Census of Population by Office of Business Economics.

As previously noted, the composition of these industries in the region differs in some respects from that of the nation but in general is quite similar. The amount of construction employment is influenced to a degree by the volume of dam construction and other water resource development work in the region. The proportion of construction employment in heavy construction (dam building, highways, waterworks, etc.) is 50 percent greater in the region than in the nation.

The region also has a significantly larger proportion of its employment in transportation, communication and utilities. The transportation industry accounts for most of this difference. The greater relative size of the transportation industry appears to be related to the greater distances and sparser population. Railroad employment is relatively heavy in the sparsely populated Subregions 1 and 4. The extent of waterborne commerce also contributes to the proportion of the transportation industry in the region.

The proportion of employment in the trade industries corresponds quite closely with the national average. However, wholesale trade is somewhat more important to the region.

The finance, insurance and real estate industries are slightly underrepresented in the region. Two elements of this group, finance and insurance, are not very strongly regionally oriented. The finance industry tends to be concentrated in the two principal financial centers, New York and San Francisco, and the insurance industry, while less concentrated, is not evenly distributed. The region has a number of insurance companies headquartered here but operating in all parts of the west and the United States.

The services industries represent a very broad range of activities and are the largest group among the non-commodity-producing industries. Overall representation of these industries in the region is fairly close to the national average, and although the region has a smaller proportion of its employment in lodgings, business and repair services and private households, it has a higher proportion in the medical and professional services.

Regional employment in public administration is almost precisely the same proportion of total regional employment as the national average as shown by its location quotient. The armed forces, however, are strongly represented.

The non-commodity-producing industries, when considered at the regional level, are much more evenly distributed than they are among the local areas. Table 73 shows by means of location

Table 73 - Location Quotients for Non-commodity-producing Industries, Columbia-North Pacific Region and Subregions, 1960 1/

Item	C-NP Region	Subregions 1	2	3	4	5	6	7	8	9	10	11	12
Total Employment in Subregion as Percent Region Total	*100.0*	*11.7*	3.8	3.5	5.4	4.8	3.8	4.4	4.5	20.7	6.9	30.1	0.4
	Location Quotients (C-NP Region Base)												
All Non-commodity-producing Industries	1.00	1.06	.98	.90	.98	1.00	.93	.96	.83	1.05	.84	1.03	.74
Contract Construction	*1.00*	.92	1.51	1.19	1.05	1.23	.83	1.19	.97	1.00	.84	.94	.82
Transportation	1.00	1.14	.82	.80	1.33	.78	.78	.95	1.03	1.10	.75	.99	.37
Communications and Utilities	1.00	1.05	1.41	.93	1.03	1.17	.62	.92	.86	1.12	.91	.92	.81
Wholesale Trade	1.00	1.01	.95	1.09	1.15	.95	.65	.77	.50	1.26	.59	1.00	.37
Retail Trade	1.00	1.10	.90	.94	1.05	1.01	1.01	1.05	.89	1.05	.98	.95	.79
Finance, Insurance and Real Estate	1.00	.98	.63	.66	.74	.89	.60	.63	.61	1.21	.68	1.19	.50
Services	1.00	1.08	.85	.90	.97	.92	1.24	1.03	.91	1.10	.91	.96	.83
Public Administration	1.00	1.01	.97	.76	.87	1.06	.71	1.01	.82	1.05	.77	1.10	.91
Armed Forces	1.00	1.21	1.58	.46	.14	1.26	.15	.09	.07	.16	.44	1.96	.88

1/ Prepared from data compiled from 1960 Census of Population by Office of Business Economics.

quotients how the distribution of these industries varies within subregions. These location quotients are based on the regional distribution; that is, an industry in a subregion with its employment the same proportion of total employment in the subregion as the regional industry's share of total regional employment, has a location quotient of 1.00. The first line of the table shows total employment in each subregion as a percentage of the regional total. In general, this table shows that most of these industries show some tendency to be concentrated in the major metropolitan centers which include Subregions 1, 9, and 11.

The tendency toward local agglomeration is particularly strong for wholesale trade, finance, insurance and real estate and public administration. The distributions for several industries, however, do not correspond well with this pattern. Reasons for the different distributions in contract construction and transportation were discussed above. The distributions for communication and utilities, and services may be explained by the location in outlying areas of special power facilities in the first case and a nuclear research facility in the second. The armed forces distribution, of course, represents the location of military bases. The distribution of retail trade cannot be fully explained. The distribution as it differs from a normal metropolitan agglomeration pattern, however, appears to be affected by the remoteness of a subregion from population centers.

Somewhat similar geographic patterns are shown in table 74 which presents sales volumes for wholesale and retail trade and selected services for the years 1958 and 1963. Density indexes (in terms of sales per capita) in this table show that for wholesale trade, per capita sales are greatest in Subregions 9 and 11, while per capita retail sales are much more evenly distributed. Gross income of selected services shows a fairly strong tendency to concentration in metropolitan areas. The high density index for selected services in Subregion 4 is attributable to the large atomic research facilities in the subregion.

FORCES OF CHANGE

As this nation's technology has advanced it has become possible to produce more and more with less and less employment in the commodity-producing industries. In consequence, an increasingly large proportion of the labor force in the economy has been made available for the activities of the non-commodity-producing industries. Since 1940 national growth in every one

Table 74 - Sales of Wholesale, Retail, and Selected Services Establishments, Columbia-North Pacific Region and Subregions, 1958 and 1963

Subregion	Wholesale Trade (Sales)			Retail Trade (Sales)			Selected Services 1/ (Gross Income)		
	1958	1963	1963 Density Index 3/	1958	1963	1963 Density Index 2/	1958	1963	1963 Density Index 2/
	(Thousand Dollars)			(Thousand Dollars)			(Thousand Dollars)		
1	767,639	762,568	.72	680,984	735,680	.93	80,027	96,716	.92
2	264,543	314,130	.85	232,792	267,912	.98	22,129	25,353	.69
3	243,986	263,639	.61	265,609	311,942	.97	26,525	34,421	.80
4	335,436	362,169	.67	347,559	416,254	1.03	37,747	68,967	1.28
5	291,094	354,099	.73	310,290	355,963	.99	34,503	42,375	.88
6	136,014	171,561	.57	183,585	208,119	.94	16,408	19,283	.65
7	192,241	250,513	.65	252,808	306,437	1.08	22,744	26,452	.69
8	117,952	128,688	.30	219,211	275,672	.86	17,630	23,165	.54
9	2,779,362	3,870,220	1.65	1,424,175	1,823,296	1.04	205,429	275,222	1.17
10	283,153	335,339	.46	424,986	27,900	.97	45,511	61,053	.84
11	2,994,340	3,708,541	1.08	2,145,771	2,598,449	1.02	301,503	376,535	1.10
12	4,795	7,602	.30	20,793	20,991	1.11	1,678	1,729	.68
C-NP	8,410,555	10,529,609	1.00	6,508,563	7,848,615	1.00	811,834	1,051,271	1.00

1/ Selected Services covered by the Census of Business include lodgings, personal service, miscellaneous business services, repair services, amusement and recreation. The principal exclusions are medical, educational and other professional services, non-profit organizations and private households.

2/ The density index shows sales volumes per capita in each subregion relative to the region-wide average. A density index of 1.00 indicates that sales in proportion to population in the subregion are equal to the region-wide average.

Source: 1963 Census of Business, vols. II, V, and VII.

of these industries except transportation has substantially exceeded the growth of the economy as a whole. Similar conditions have prevailed in the Columbia-North Pacific Region although growth has been somewhat faster than national rates. Non-commodity-producing industries in the region grew at the rate of 3.4% a year over the period 1940 through 1966 while regional employment in total grew about 2.6% a year.

In table 75 regional trends in these industries are shown for the two decades, 1940-50 and 1950-60, and the six year period from 1960 to 1966.

The table shows, in terms of employment, that these industries have generally grown considerably more rapidly than the commodity-producing industries. In the 1940-50 decade growth in almost all sectors was spurred by the war demands. Construction, transportation, and government(including military services) were particularly stimulated. Services lagged slightly due to labor force demands in other sectors. In the 1950-60 decade growth was much slower but still exhibited rates that averaged twice as great as those for the commodity-producing industries. Between 1960 and 1966 growth in the commodity-producing industries increased sharply owing to rapid growth in some of the manufacturing industries, but non-commodity growth was still higher.

Perhaps the most significant factor in the future development of the non-commodity-producing industries is the fantastic growth we are experiencing in per capita income. Since 1940 per capita income (in constant dollar terms) has grown from $1348 to $2325 by 1962. This was a near-doubling over those 22 years and by the year 2020, regional per capita income is expected to be more than five times greater than its 1962 level. A growing part of this increased income will be spent on various services, especially education and medical services. The demands of the business world for higher educational levels will increase prodigiously as the economy becomes more advanced, but also individual demand for non-business-related education will increase as financial capability increases. The expansion in medical services is also expected to continue without abatement as health improvement becomes more feasible. Other professional and business-related services are also anticipated to advance rapidly in accordance with the expanding needs of a richer society.

Higher income levels will undoubtedly encourage a great deal more travel and the outstanding recreational opportunities of the Columbia-North Pacific Region should encourage more than its share of this development.

Table 75 - Historical Employment Trends in the Non-commodity-producing Industries, Columbia-North Pacific Region, 1940-50, 1950-60, 1960-66

Item	Census of Population Data 1/			Annual Growth Rate		Employment Security Data 2/		Growth Rate
	1940	1950	1960	1940-50	1950-60	1960	1966	1960-66
Non-commodity-producing Industries	708,860	1,148,419	1,352,874	4.9	1.7	1,102,410	1,358,900	3.6
Contract Construction	67,915	132,391	129,460	6.9	-0.2	82,060	100,180	3.4
Transportation, Communications & Utilities	97,226	153,366	153,571	4.7	0.0	123,020	129,010	0.8
Trade	224,972	344,701	392,179	4.4	1.3	339,680	410,040	3.2
Finance, Insurance & Real Estate	37,085	58,132	79,937	4.6	3.2	66,090	85,440	4.4
Services	221,518	317,694	436,368	3.7	3.2	190,200	252,910	4.9
Government	60,144	142,135	161,359	9.0	1.3	301,360	381,320	4.0
Commodity-producing Industries 3/	486,237	578,953	625,881	1.8	0.8	405,300	487,780	3.2
Total Employment	1,192,097	1,727,372	1,987,756	3.8	1.4	1,507,710	1,846,680	3.4

1/ All employment including military as of late March for respective years. Government employment classified by industry activity.
2/ Annual average wage and salary employment. Excludes self-employed and military. Employment in government establishments all classified in government category. Estimates developed from data supplied by state employment security agencies.
3/ Includes agriculture, fishing, forestry, mining and manufacturing.
Source: Compiled from Censuses of Population by Office of Business Economics.

While transportation needs will increase with greater travel and more commodity movements, transportation employment is not anticipated to grow very much because of productivity gains in the industry. On the other hand, communications employment will probably grow with the burgeoning demands for timelier and more extensive communications. Finance and insurance will probably continue to grow at above average rates in comparison with the rest of the economy and probably the regional share of this growth will be greater than the national average. As communications improve, local access to financial markets will permit more localization of financial institutions to better serve local needs.

Federal government services are expected to decline relative to population increases in future years, however, rapidly growing state and local governments will tend to offset any Federal employment reductions.

PROJECTIONS OF EMPLOYMENT

As these industries continue their rapid expansion they will become an increasingly large proportion of total employment in the region. Projections of employment for all of these industries combined are shown in table 76.

Table 76 - Non-commodity Employment, 1960, with Projections to 1980, 2000, and 2020, Columbia-North Pacific Region and Subregion

Subregions	1960 1/	1980	2000	2020
1	140,704	210,628	291,781	388,557
2	47,289	73,188	107,096	144,929
3	48,739	69,798	98,305	133,896
4	65,399	98,770	140,047	190,721
5	64,220	101,280	143,369	192,479
6	35,288	51,626	69,343	89,754
7	47,724	70,343	94,650	122,663
8	44,060	65,849	89,760	117,966
9	309,900	502,960	728,365	1,005,332
10	75,893	109,918	145,035	184,795
11	470,847	722,832	1,020,164	1,382,597
12	2,811	3,321	3,461	3,781
C-NP	1,352,874	2,080,513	2,931,376	3,957,470

1/ Estimated from Census of Population and Office of Business Economics Data.

While projected employment figures are not presented for the individual industries, some indication of the changing composition of these industries is shown in table 77.

Table 77 - Projected Percentage Distribution of Employment in Non-commodity-producing Industries, Columbia-North Pacific Region, 1960 and 2020

Industry	1960	2020
Construction	9.6	8.2
Transportation, Communication & Utilities	11.3	4.6
Trade	29.0	21.9
Finance, Insurance & Real Estate	5.9	6.4
Services	32.3	48.5
Government	11.9	10.3
Total Non-commodity-producing Industries	100.0	100.0

Source: Adapted from Department of Commerce, Office of Business Economics, January 1969 Projections.

PROJECTIONS

P R O J E C T I O N S

POPULATION

In 1900 the population of the Columbia-North Pacific Region was slightly under 1.2 million (table 78). Between 1900 and 1940 the population trebled, and by 1965 it was nearly 5.9 million. Between 1940 and 1950 the population increase was 33 percent and, over the next decade, 18 percent as compared with national population increases of 14 percent and 19 percent for those two decades (figure 7). Between 1940 and 1960 the annual rate of growth was 2.2 percent for the region and 1.6 percent for the nation.

Population growth from 1940 to 1960 varied considerably between the 12 study subregions (table 78). The Puget Sound Subregion had the highest growth rate, 2.75 percent, and the Closed Basin the lowest, 0.56 percent.

Population densities vary from about 144 persons per square mile in the Puget Sound Subregion to only .8 person per square mile in the Closed Basin. The population of the region, like that of the nation, is becoming more concentrated in the urbanized areas. Whereas 23 percent of the region's population was classified as rural farm in 1940, only eight percent was so classified in 1960. Between 1940 and 1960 the population in the Coastal, Puget Sound, and Willamette Subregions increased from 56 to 61 percent of the total regional population.

The future growth in population is dependent upon the economic development of the region, and is projected to increase from 5.9 million in 1965 to 12.7 million in 2020 (table 78). At the same time, the nation's population is expected to increase from 194 million in 1965 to 398 million in 2020. These projections are an increase of 115 percent for the region, compared to 105 percent for the nation (figure 7).

As in the past, there will be differences in the population growth rates of the subregions. Those subregions which are projected to have annual rates of growth significantly greater than that of the region are the Willamette and the Puget Sound. The Closed Basin is expected to continue to have the lowest annual rate of growth.

By 2020, about 66 percent of the region's population is projected to be located in the Coastal, Puget Sound, and

Table 78 - Population, 1900-1965, with Projections to 1980, 2000, and 2020, United States, Columbia-North Pacific Region and Subregions

Subregion	Year 1900	1910	1920	1930	1940	1950	1960	1965	1980	2000	2020
	(Thousands)										
1	180.2	326.1	361.8	378.0	417.4	489.4	563.7	595.1	699.1	897.1	1,140.4
2	45.9	109.6	112.6	112.0	130.1	157.4	193.6	198.6	253.0	334.0	431.3
3	23.2	68.2	92.4	106.5	131.3	209.3	227.6	236.7	280.7	355.2	443.7
4	45.6	109.0	184.4	187.8	217.8	242.5	277.2	302.0	350.9	450.5	576.0
5	56.0	106.3	130.9	136.4	178.3	215.3	252.4	268.2	328.7	430.4	553.5
6	96.1	131.7	132.8	130.3	137.3	148.9	156.0	163.3	193.5	234.6	274.3
7	86.6	123.5	128.8	130.1	143.2	184.9	198.7	210.5	251.4	321.9	404.4
8	47.2	87.6	101.2	139.1	161.3	214.0	224.5	240.1	277.9	349.4	441.3
9	233.3	416.4	496.3	609.9	691.2	992.4	1,168.9	1,338.9	1,727.3	2,397.6	3,237.2
10	89.9	151.1	172.2	215.8	235.6	328.8	381.4	405.5	465.5	575.4	708.9
11	264.5	607.2	772.5	909.9	1,007.1	1,418.4	1,768.1	1,904.1	2,449.7	3,345.3	4,448.1
12	5.4	8.7	8.0	10.8	11.7	12.8	13.9	13.3	16.3	18.7	21.3
C-NP	1,174.0	2,245.3	2,693.9	3,066.4	3,462.3	4,614.0	5,426.1	5,876.1	7,293.9	9,710.1	12,680.3
	(Millions)										
U.S.	76.1	92.4	106.5	123.2	132.2	151.3	179.3	194.0	234.2	306.8	397.6

Source: 1900-1965 data estimated from Census of Population and Corps of Engineers data.

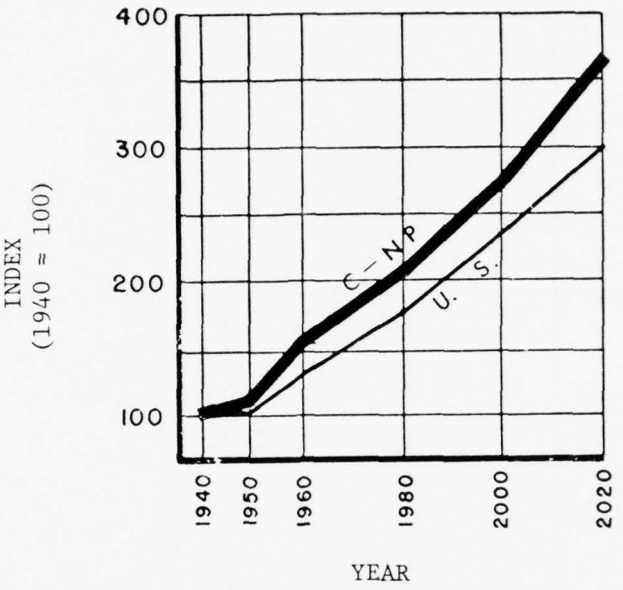


FIGURE 7. Index of Population Growth, United States and Columbia-North Pacific Region.

Willamette Subregions (figure 8). Two-thirds of the region's population will then be located in an area comprising only 18 percent of the total land area. As urbanization becomes more dominant, farm population will continue to decrease to about two percent of the total by 2020.

INCOME

In 1962 the sources of income in the region were wages and salaries (65 percent), proprietors (13 percent), property (13 percent), transfer payments (six percent), and other (three percent). Manufacturing is the major source of income in the form of wages and salaries, with government, services, and trade also important.

Total personal income in the region increased from $4.6 billion in 1940 to $13 billion in 1962, as measured in constant 1958 dollars. This increase of 180 percent over the period compares with a national increase of 144 percent, the difference being due largely to more rapid population growth. Total personal income for the region is expected to increase 4.4 percent annually during the projection period to about $154.4 billion in 2020. This rate of growth is slightly greater than

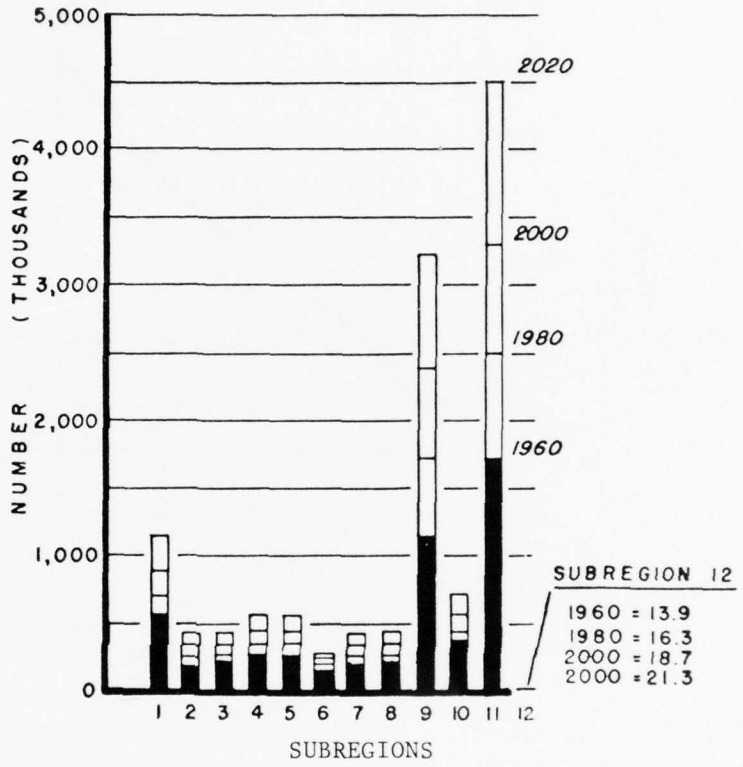


FIGURE 8. Population Growth by Subregion, Columbia-North Pacific Region.

the national rate.

In constant 1958 dollars, per capita income in the region has increased from $1,348 in 1940 to $2,325 in 1962, which is comparable to the national averages of $1,300 and $2,258 (table 79). The annual rate of growth during this period was about 2.5 percent for both the region and the nation. Per capita income is projected to be about $12,200 in 2020, an annual growth rate of about 2.9 percent.

EMPLOYMENT

The rate of growth in total employment has been greater for the region than the nation (figure 9). Total employment in the region has increased from about 1.2 million in 1940 to about 2.0 million in 1960 (table 80). This has been on

Table 79 - Per Capita Income, 1940-1962, with Projections to 1980, 2000 and 2020, United States, Columbia-North Pacific Region and Subregions

Subregion	1940	1950	1962	1980	2000	2020
			(1958 Dollars)			
1	1,369	1,795	2,057	3,947	6,814	11,611
2	1,227	2,040	2,271	4,112	7,161	12,411
3	1,213	1,851	2,230	3,950	6,863	11,994
4	916	1,531	1,938	3,468	6,010	10,517
5	1,102	1,602	2,080	3,844	6,767	11,852
6	1,002	1,816	2,032	3,770	6,629	11,897
7	1,275	1,996	2,237	4,134	7,228	12,528
8	1,192	1,850	2,165	4,012	7,022	12,287
9	1,417	1,946	2,328	4,175	7,096	12,287
10	1,188	1,905	2,034	3,550	6,258	10,995
11	1,574	2,093	2,633	4,358	7,447	12,659
12	1,570	2,479	2,459	4,243	7,467	12,878
C-NP	1,348	1,929	2,325	4,097	7,061	12,179
U.S.	1,300	1,805	2,258	4,112	7,161	12,411

Source: 1940-1962 data estimated from Census of Population and Office of Business Economics data.

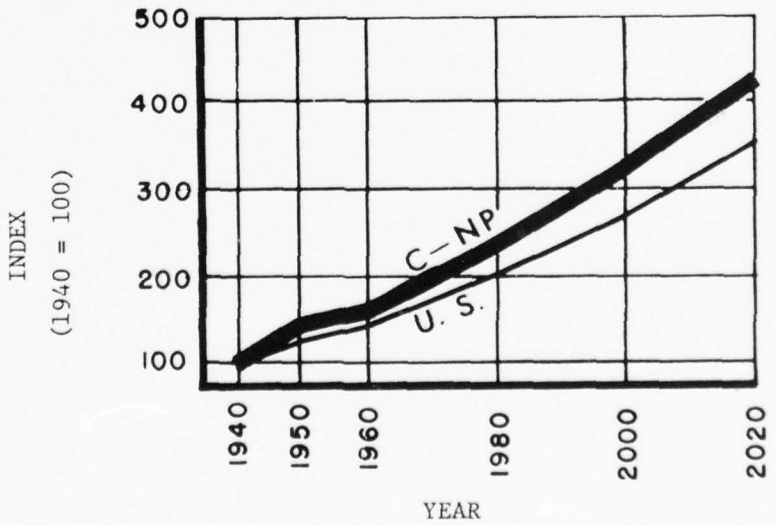


FIGURE 9. Index of Employment Growth, United States and Columbia-North Pacific Region

Table 80 - Employment 1940-1960, with Projections to 1980, 2000 and 2020, United States, Columbia-North Pacific Region and Subregions

Subregion	1940	1950	1960	1980	2000	2020
			(Thousands)			
1	139	177	194	269	355	459
2	45	59	71	99	134	173
3	42	72	79	104	135	173
4	65	84	98	133	177	230
5	58	79	94	135	179	231
6	45	54	56	73	93	114
7	52	70	74	101	129	162
8	54	75	78	108	139	175
9	247	378	431	680	949	1,280
10	82	124	132	182	232	289
11	359	550	668	979	1,338	1,773
12	5	5	6	7	8	9
C-NP	1,192	1,727	1,979	2,869	3,866	5,067
			(Millions)			
U.S.	45	57	66	93	123	159

Source: 1940-1960 data estimated from Census of Population and Office of Business Economics data.

an annual rate of increase of about 2.6 percent. During this same period, total employment in the nation increased at an annual rate of approximately 1.9 percent.

The annual rate of increase among industries, however, has been far from uniform. For example, employment in manufacturing has shown a relatively large increase of about 3.4 percent annually, retail trade about 2.6 percent, and professional services over five percent during this period. Agriculture and mining employment, on the other hand, exhibited substantial decreases in employment with significant increases in output. Employment in agriculture decreased by approximately 30 percent and mining 55 percent from 1940 to 1960.

In 1960, employment in the service and distributive industries accounted for approximately 63 percent of total employment, compared to about 54 percent in 1940. Manufacturing employment was about 19 percent of total employment in 1940, but increased to about 22 percent in 1960. During the same period employment in contract construction increased only about one percent relative to total employment. Agriculture employment

decreased from 18 percent of the total in 1940 to about seven percent in 1960.

Total employment for the region is estimated to increase from about 2.0 million in 1960 to 5.1 million in 2020 (table 80). Employment, like population, will tend to be concentrated in the western portion of the region. In 1960, 62 percent of all employment was located in three subregions -- Willamette, Puget Sound, and Coastal. By 2020, it is projected that 66 percent of the region's employment will be in these subregions (figure 10). Annual growth rates of employment will vary by subregion for the 1960-2020 period, ranging from 1.8 percent for the Willamette to 0.76 percent for the Closed Basin.

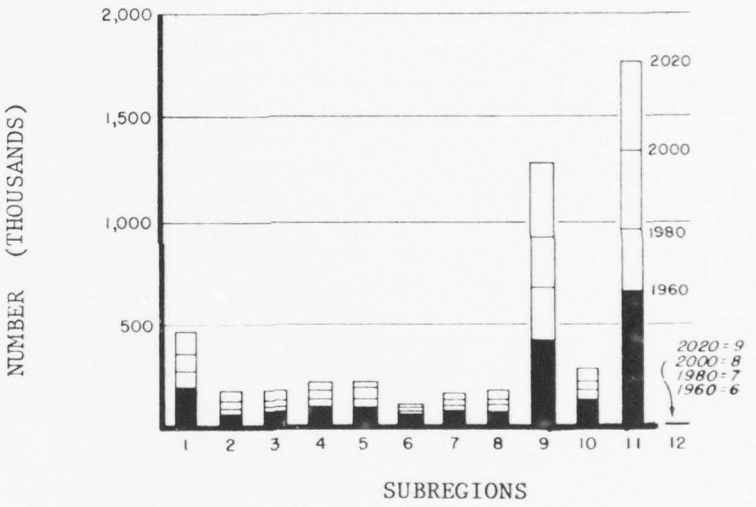


FIGURE 10. Employment Growth by Subregion, Columbia-North Pacific Region.

INDUSTRIES

The manufacture of forest products is the largest component of the region's manufacturing industry. In 1962, wood products employment (including pulp and paper) amounted to 154,000 workers. This was less than it had been in earlier years, but it was still nearly 35 percent of total manufacturing employment. In addition, another 17,500 workers were employed in forest management.

About three-quarters of the region's forest production comes from the Douglas-Fir area, encompassing the four

subregions lying west of the Cascades. Most of the remainder comes from Subregions 1, 4, and 7, but there is some forest production in each of the subregions.

Despite employment reduction, forest production has been expanding in recent years, and further expansion will occur. Projections, based upon consideration of the national demand for wood products and the relationship of regional supplies to those in other parts of the country, indicate that regional wood consumption by the forest industries will grow from about 3.5 billion cubic feet in 1962 to 5.3 billion in 2020. The increased timber harvest will be achieved not by enlarging the forests (forest land acreage will decrease slightly), but by more intensive forest management and better utilization of the trees.

Most of the growth in the manufacturing of forest products will be taken up by the pulp and paper industry, which will roughly treble in size. Consumption by the lumber and wood products industries is projected to be relatively unchanged, although great changes will likely take place in the types of products made and the methods of manufacture of these industries. Plywood will continue to take an increasing share of the market, and such products as fiberboard and particleboard and a broad range of user-oriented new products are replacing lumber as end products of the new industry.

Reflecting the increasing productivity of these industries, employment in lumber and wood products is projected to decline by about a third over the next 50 years, while pulp and paper, despite a threefold expansion in production, is expected to gain only a little more than 10 percent in employment. This intensification of forest management would increase employment in this category to nearly three times its 1962 level by 2020. The net result for employment in the forest industries taken together will mean a modest reduction in total employment despite the greatly expanded forest output.

Agriculture is an important industry in the region. In 1964 the value of agricultural production exceeded $1.5 billion and over 150,000 persons were employed in agriculture. About 60 percent of the value was from crops and 40 percent from livestock and poultry. The industry utilizes a significant proportion of the region's land and water resources for producing a great variety of agricultural commodities. Of the 21 million acres of cropland, about seven million acres are irrigated. Rangeland and forest land are also utilized by the livestock industry.

Agriculture is expected to continue as an important

industry within the region in the future, with output increasing nearly 2 1/2 times by the year 2020. Increases in output by subregions will range from two to threefold by 2020. Employment, on the other hand, will decrease substantially in the region and subregions by 2020. Farm incomes may be supplemented by recreational use of farm ponds and dude ranch operations.

Anticipated increases in agricultural output will be accompanied by changes in the structure of the agricultural industry. Substitution of capital and other inputs for labor and land, as well as shifts in the organization and use of resources, will continue. Further reductions in the numbers of farms are in prospect as smaller farms are consolidated into larger commercial farms. Increased productivity per worker and per acre will result primarily from additional resource development such as irrigation and drainage, new technology, and more extensive use of capital inputs.

Parts of the region are highly mineralized and, in several localities, mining activity is an important segment of the local economy. Subregion 1 is a leading production area in the United States for copper, lead, and zinc. Phosphate mining in Subregion 4 is also significant. The total value of mineral production in the region in 1965 amounted to about $388 million. Of this total, roughly half is derived from metals mining. Sand, gravel, and stone production, representing almost one-third of total mineral production, accounted for most of nonmetallic mineral production. Phosphate, lime, and pumice were also of importance.

Regional mineral production is projected to expanded in the future. A great variety of minerals is scattered throughout the region--many in large-scale deposits of economic significance--and these resources will be gradually developed in the future. Employment in the mining industry, however, is expected to decline slightly despite rising production levels.

The chemical industry of the region produces a wide range of products. The largest component of the industry in 1960 was the manufacture of plutonium at the Hanford Atomic Works. Other major components of the industry included producers of chlorine, caustic soda, elemental phosphorus and phosphate fertilizer, ammonia, paints, adhesives, and resins. Employment in the chemicals industry is projected to grow from 16,300 in 1960 to 39,300 in 2020. Petroleum refining, a relatively new industry in the region, is expected to expand substantially over the forecast period despite the absence of local petroleum reserves.

The processing of food is a major industry in the region. Some of the major activities are milk processing, grain milling

and canning and preserving of fruits, vegetables, and seafoods. In 1960, food processing employment was about 59,000, or about 13 percent of the total employment in manufacturing. Approximately 59 percent of the employment in food processing is located in the Willamette, Puget Sound, and Coastal Subregions. The primary food processing activities of these subregions are dairy products, grain milling, meat products, and canning and preserving. The Upper and Central Snake Subregions are important in the processing of dairy and meat products, sugar, and canning and preserving. Many of the commodities processed are consumed outside of the region.

Output of processed foods is projected to more than triple by 2020 for the region. Increases in output by subregions will vary from nearly two and a half to over five times the present output. Employment will decrease slightly due to increases in worker productivity.

The primary metals industry is partly engaged in processing regional mining products, but the larger part of its activities is based on imported raw materials or on local scrap metal supplies. The industry employed about 20,000 workers in 1960, mostly in steel, aluminum and copper, lead, and zinc smelting.

Prospects for future growth are favorable for virtually all elements of the industry. The steel industry, which now supplies about one-third of the regional steel market, should grow to serve an even larger part of this expanding market. Aluminum production, attracted to the region by low cost hydroelectric power and deep water harbors, is projected to grow very rapidly to meet the demand of national markets, growing at a projected rate of eight percent per year. Among the other components of the industry, the growth of titanium production is expected to be particularly strong, and magnesium processing may also develop. The part of the industry beyond the smelting stage--rolling, drawing, foundries, etc.--should also grow fairly rapidly from its present minor position relative to the basic smelting activities in the region. Primary metals employment is projected to reach over 50,000 by 2020.

Employment in the other manufacturing industries represented about two-fifths of manufacturing employment in 1960. Every one of the 20 major manufacturing industries, with the exception of tobacco, is represented in the region. Most of these industries are concerned in supplying national and international markets, and it is among these industries that the major manufacturing growth will likely occur over the next five or six decades. Employment in Pacific Northwest manufacturing is projected to double. Regional manufacturing growth over this period will be about one-third greater than the national

rate of growth, and the greatest part of this growth will come from the nonresource oriented activities.

Indicative of the strength of these industries, their total employment has grown more than five percent per year since 1960. Growth in machinery, electrical equipment, transportation equipment, and instruments, representing almost two-thirds of the employment in these industries, has exceeded seven percent per year since 1960.

By far the largest industry in this group is the transportation equipment industry. The Boeing Company, which dominates this industry, now produces about 65 percent of all commercial jet aircraft produced in the world. It is projected to retain its competitive position in a market predicted to quadruple by 1980.

Some of the other industries in this group have expectations no less buoyant, although their achievements to date have not been nearly so impressive. The increasing industrialization of the area, the growing tendency toward the uniformity of industrial mix, improved transportation, and the livability of the area are all factors encouraging the growth of these industries. In machinery, electrical and electronic equipment, and the instrument industry there are already a number of firms competing strongly in world markets, and these industries will grow at a rapid rate in the future as technological progress builds a more mechanized and automated economy.

National projections indicate that the noncommodity industries will grow from about 65 percent to 77 percent of the nation's total employment by 2020. In the region, similar changes are projected; noncommodity industries will rise from about 68 percent in 1960 to 77 percent of total employment in 2020.

The noncommodity industries include construction, transportation, communication and utilities, trade, finance and real estate, services, and government. These industries are growing faster, in terms of employment, than the commodity industries primarily because of the rapid gains in productivity in the commodity industries. Commodity production is expanding at rates comparable with the economy's growing income, but not as fast as product per worker, making an increasing proportion of the labor force available to the noncommodity industries.

A comparison of the composition of regional employment in 1940 with that of 1960 shows how the economy has been changing. All the noncommodity industries, except transportation and utilities, grew substantially in their share of total employment

over this period, and similar advances may be anticipated in the future.

Construction has been particularly strong in the Pacific Northwest historically, partly attributable to water resource development. The future rapid growth of the region will assure the continued high levels of activities in this industry.

As the economy has become more affluent and more efficient in production, increasing emphasis has been placed on trade and services, particularly the latter. It is in this area that the greatest expansion is likely to occur. Medical services have been increasing at a high rate in recent years and demand for better and more extensive medical services will grow as people are better able to afford them. Education is another area of strong growth as both the need for education and the ability to pay for it increase. All kinds of personal services and a multitude of business services are rapidly finding new demands.

Recreation will also be an important stimulus to these industries. Higher incomes, more leisure time, and greater mobility will greatly increase the demand for all kinds of recreation--touring, boating, fishing, hunting, skiing. This growth will cause increased demands for lodgings, restaurants, automobile services, equipment rentals, and a host of other activities.

Tables 81 through 94 present the present and projected economic characteristics for the United States, the Columbia-North Pacific Region and its 12 subregion.

The study projections are generally to be considered as conditional forecasts of the future. They are generally based upon extension of past relationships believed to have future relevance for the measure being projected. The reasoning underlying the extension of past relationships comprise the assumptions that make the projections conditional forecasts. If the assumptions are not correct or offsetting in their effect on the overall aggregates, the projections will not be realized.

The purpose of the projections is to enable decision makers to anticipate future economic conditions, identify developing and potential problem areas, and take such corrective action as may be warranted to solve the problems. The corrective actions, in and of themselves, may cause the actual situation in the future to be different than that projected.

Table 81 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, United States

Item	1960 1/	1980	2000	2020
Population	179,323,175	234,193,000	306,757,000	397,562,000
Participation Rate (empl/pop)	.3701	.3950	.3998	.4003
Total Employment	66,372,649	92,712,000	122,663,000	159,178,000
Agriculture, Forestry & Fishery 2/	4,469,625	3,271,000	2,505,000	1,897,000
Mining	674,662	607,000	589,000	577,000
Manufacturing	18,244,900	23,392,000	28,275,000	34,366,000
Paper & Allied Products	602,535	849,000	1,106,000	1,396,000
Petroleum	294,054	208,000	151,000	107,000
Chemicals & Allied Products	902,114	1,308,000	1,839,000	2,501,000
Food & Kindred Products	1,898,661	1,871,000	1,859,000	1,848,000
Primary Metals	1,272,286	1,467,000	1,600,000	1,750,000
Other Manufacturing	13,275,250	17,689,000	21,720,000	26,764,000
Non-commodity 2/	42,983,462	65,442,000	91,294,000	122,338,000
Total Personal Income (000 - 1958 dollars)	419,628,723	963,000,000	2,196,684,000	4,934,146,000
Per Capita Income (1958 dollars)	2,258	4,112	7,161	12,411
Total Earnings (000 - 1958 dollars)	340,680,000	749,158,000	1,670,268,000	3,718,754,000
Earnings per Worker (1958 dollars)	5,045	8,080	13,615	23,360

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.

2/ Includes some agricultural and forestry management.

Table 82 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Columbia-North Pacific Region

Item	1960 1/	1980	2000	2020
Population	5,426,108	7,293,880	9,710,083	12,680,299
Participation Rate (empl/pop)	.365	.393	.398	.400
Total Employment	1,978,756	2,868,894	3,866,015	5,067,045
Agriculture, Forestry & Fishery 2/	167,439	149,108	126,737	104,282
Agriculture	155,767	120,000	109,100	90,000
Mining	11,418	12,000	11,000	9,850
Manufacturing	447,025	627,273	796,902	995,443
Lumber & Wood Products	143,012	104,280	84,782	73,816
Paper & Allied Products	26,171	33,180	34,410	30,189
Petroleum	2,824	3,056	2,974	2,478
Chemicals & Allied Products	16,334	22,315	30,267	39,339
Food & Kindred Products	58,903	57,471	56,342	55,896
Primary Metals	19,942	39,240	53,505	53,035
Other Manufacturing	179,839	367,731	534,622	740,690
Non-commodity 2/	1,352,874	2,080,513	2,931,376	3,957,470
Total Personal Income (000 - 1958 dollars)	12,981,737	29,881,702	68,563,235	154,437,238
Per Capita Income (1958 dollars)	2,325	4,097	7,061	12,179
Total Earnings (000 - 1958 dollars)	9,558,311	23,263,268	51,681,849	114,560,277
Earnings per Worker (1958 dollars)	4,830	8,109	13,368	22,609

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.

2/ Includes some agricultural and forestry management.

Table 83 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 1

Item	1960 1/	1980	2000	2020
Population	563,748	699,096	897,048	1,140,364
Participation Rate (empl/pop)	.344	.385	.396	.402
Total Employment	193,867	268,921	354,822	458,553
Agriculture, Forestry & Fishery 2/	12,053	9,432	7,304	5,563
Agriculture	10,504	7,600	6,300	5,200
Mining	8,346	7,200	5,800	4,900
Manufacturing	32,764	41,661	49,937	59,533
Lumber & Wood Products	11,494	12,362	8,261	7,143
Paper & Allied Products	616	922	1,140	1,161
Petroleum	324	372	397	382
Chemicals & Allied Products	612	844	1,186	1,634
Food & Kindred Products	4,539	3,610	3,213	3,325
Primary Metals	7,709	8,930	9,275	8,535
Other Manufacturing	32	D	D	D
Non-commodity 2/	140,704	210,628	291,781	388,557
Total Personal Income (000 - 1958 dollars)	1,186,638	2,759,321	6,112,972	13,241,159
Per Capita Income (1958 dollars)	2,057	3,947	6,814	11,611
Total Earnings (000 - 1958 dollars)	878,636	2,112,749	4,635,154	9,955,028
Earnings per Worker (1958 dollars)	4,532	7,856	13,063	21,710

1/ Estimated from Census of Population and Office of Business Economics data. Data for income 1962 and earnings 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 84 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 2

Item	1960 1/	1980	2000	2020
Population	193,594	253,043	334,019	431,271
Participation Rate (empl/pop)	.364	.390	.400	.400
Total Employment	70,546	98,687	133,608	172,508
Agriculture, Forestry & Fishery 2/	14,713	14,374	12,948	11,114
Agriculture	14,411	12,300	11,900	10,400
Mining	289	260	220	200
Manufacturing	8,255	10,865	13,344	16,265
Lumber & Wood Products	3,325	3,003	2,469	2,055
Paper & Allied Products	193	83	76	79
Petroleum	---	---	---	---
Chemicals & Allied Products	481	615	767	919
Food & Kindred Products	1,022	1,386	1,404	1,478
Primary Metals	743	2,595	3,245	3,370
Other Manufacturing	8	D	D	D
Non-commodity 2/	47,289	73,188	107,096	144,929
Total Personal Income (000 - 1958 dollars)	446,751	1,040,513	2,391,910	5,352,504
Per Capita Income (1958 dollars)	2,271	4,112	7,161	12,411
Total Earnings (000 - 1958 dollars)	327,339	797,391	1,819,073	4,029,787
Earnings per Worker (1958 dollars)	4,640	8,080	13,615	23,360

1/ Estimated from Census of Population and Office of Business Economics data. Data for income 1962 and earnings 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 85 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 3

Item	1960 1/	1980	2000	2020
Population	227,649	280,732	355,204	443,728
Participation Rate (empl/pop)	.349	.371	.380	.390
Total Employment	79,496	104,239	134,978	173,054
Agriculture, Forestry & Fishery 2/	15,554	15,131	13,478	11,455
Agriculture	15,461	12,800	12,200	10,500
Mining	150	190	120	110
Manufacturing	15,053	19,120	23,075	27,593
Lumber & Wood Products	1,257	1,981	1,741	1,570
Paper & Allied Products	382	254	300	306
Petroleum	---	---	---	---
Chemicals & Allied Products	7,529	9,400	11,632	13,982
Food & Kindred Products	3,329	3,243	3,136	3,130
Primary Metals	34	70	190	240
Other Manufacturing	23	D	D	D
Non-commodity 2/	48,739	69,798	98,305	133,896
Total Personal Income (000 - 1958 dollars)	518,774	1,108,791	2,437,816	5,322,167
Per Capita Income (1958 dollars)	2,230	3,950	6,863	11,994
Total Earnings (000 - 1958 dollars)	371,434	882,040	1,874,325	3,989,604
Earnings per Worker (1958 dollars)	4,672	8,462	13,886	23,054

1/ Estimated from Census of Population and Office of Business Economics data. Data for income 1962 and earnings 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 86 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 4

Item	1960 1/	1980	2000	2020
Population	277,249	350,870	450,542	576,000
Participation Rate (empl/pop)	.353	.380	.393	.400
Total Employment	97,960	133,402	176,999	230,337
Agriculture, Forestry & Fishery 2/	22,218	19,885	16,934	13,945
Agriculture	21,910	16,600	15,300	12,800
Mining	174	530	670	670
Manufacturing	10,169	14,217	19,348	25,001
Lumber & Wood Products	355	297	240	200
Paper & Allied Products	101	76	227	454
Petroleum	23	D	D	D
Chemicals & Allied Products	2,426	3,653	4,337	6,359
Food & Kindred Products	4,773	6,105	6,111	5,769
Primary Metals	44	140	280	350
Other Manufacturing	36	D	D	D
Non-commodity 2/	65,399	98,770	140,047	190,721
Total Personal Income (000 - 1958 dollars)	541,700	1,216,921	2,707,857	6,057,552
Per Capita Income (1958 dollars)	1,938	3,468	6,010	10,517
Total Earnings (000 - 1958 dollars)	410,710	964,433	2,083,998	4,573,311
Earnings per Worker (1958 dollars)	4,193	7,230	11,774	19,855

1/ Estimated from Census of Population and Office of Business Economics data. Data for income 1962 and earnings 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 87 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 5

Item	1960 1/	1980	2000	2020
Population	252,430	328,695	430,400	553,476
Participation Rate (empl/pop)	.374	.409	.416	.417
Total Employment	94,350	134,551	178,868	230,721
Agriculture, Forestry & Fishery 2/	18,372	16,951	14,856	12,544
Agriculture	17,861	13,700	12,800	11,100
Mining	193	220	180	160
Manufacturing	11,565	16,100	20,463	25,538
Lumber & Wood Products	2,539	3,167	2,707	2,374
Paper & Allied Products	51	222	479	822
Petroleum	5	D	D	D
Chemicals & Allied Products	205	D	D	D
Food & Kindred Products	5,287	4,653	4,588	4,372
Primary Metals	80	75	225	300
Other Manufacturing	16	D	D	D
Non-commodity 2/	64,220	101,280	143,369	192,479
Total Personal Income (000 - 1958 dollars)	543,596	1,263,503	2,912,517	6,559,798
Per Capita Income (1958 dollars)	2,080	3,844	6,767	11,852
Total Earnings (000 - 1958 dollars)	394,086	1,016,299	2,262,511	4,997,503
Earnings per Worker (1958 dollars)	4,177	7,553	12,649	21,660

1/ Estimated from Census of Population and Office of Business Economics data. Data for income 1962 and earnings 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 88 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 6

Item	1960 1/	1980	2000	2020
Population	155,991	193,456	234,641	274,324
Participation Rate (empl/pop)	.356	.377	.390	.414
Total Employment	55,600	72,933	91,510	113,618
Agriculture, Forestry & Fishery 2/	10,750	8,579	6,687	5,140
Agriculture	10,229	7,400	6,100	4,900
Mining	251	480	420	360
Manufacturing	9,311	12,248	15,060	18,364
Lumber & Wood Products	6,095	5,094	3,824	2,865
Paper & Allied Products	979	841	784	752
Petroleum	---	---	---	---
Chemicals & Allied Products	92	D	D	D
Food & Kindred Products	1,040	1,002	979	892
Primary Metals	16	45	120	150
Other Manufacturing	9	D	D	D
Non-commodity 2/	35,288	51,626	69,343	89,754
Total Personal Income (000 - 1958 dollars)	325,720	729,348	1,555,513	3,263,627
Per Capita Income (1958 dollars)	2,032	3,770	6,629	11,897
Total Earnings (000 - 1958 dollars)	258,333	594,537	1,283,070	2,711,048
Earnings per Worker (1958 dollars)	4,646	8,152	14,021	23,861

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.
2/ Includes some agricultural and forestry management.
D = Too small to be projected but included in regional totals.

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COLUMBIA-NORTH PACIFIC REGION COMPREHENSIVE FRAMEWORK STUDY OF --ETC(U)
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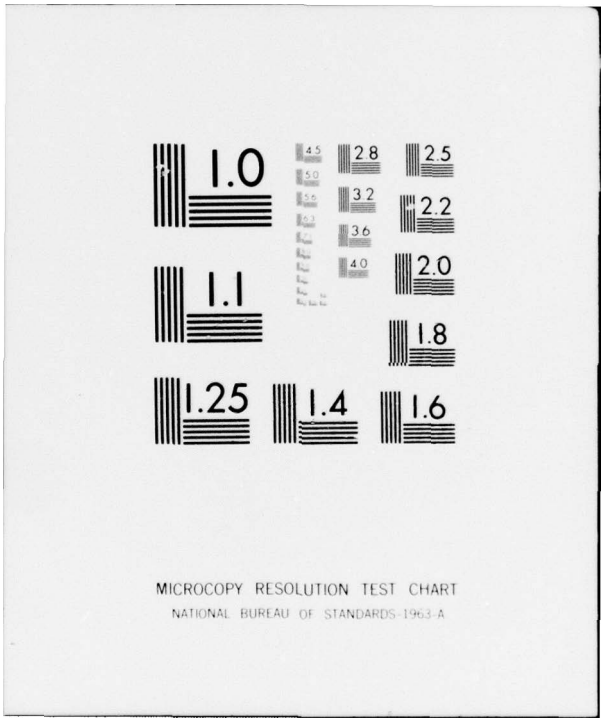
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Table 89 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 7

Item	1960 1/	1980	2000	2020
Population	198,665	251,430	321,868	404,373
Participation Rate (empl/pop)	.368	.400	.400	.400
Total Employment	73,054	100,572	128,747	161,749
Agriculture, Forestry & Fishery 2/	12,465	10,863	9,149	7,521
Agriculture	11,753	8,900	8,400	6,800
Mining	187	90	100	110
Manufacturing	12,678	19,276	24,848	31,455
Lumber & Wood Products	6,926	6,072	5,081	4,427
Paper & Allied Products	433	884	1,142	1,022
Petroleum	---	---	---	---
Chemicals & Allied Products	93	D	D	D
Food & Kindred Products	2,741	3,047	2,931	2,846
Primary Metals	505	1,270	1,960	2,050
Other Manufacturing	120	D	D	D
Non-commodity 2/	47,724	70,343	94,650	122,663
Total Personal Income (000 ~ 1958 dollars)	453,444	1,039,347	2,326,301	5,065,945
Per Capita Income (1958 dollars)	2,237	4,134	7,228	12,528
Total Earnings (000 ~ 1958 dollars)	359,722	832,331	1,816,824	3,890,979
Earnings per Worker (1958 dollars)	4,924	8,276	14,112	24,056

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.
2/ Includes some agricultural and forestry management.
D = Too small to be projected but included in regional totals.

Table 90 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 8

Item	1960 1/	1980	2000	2020
Population	224,486	277,906	349,369	441,324
Participation Rate (empl/pop)	.346	.390	.398	.398
Total Employment	77,736	108,295	139,027	175,440
Agriculture, Forestry & Fishery 2/	5,490	4,385	3,408	2,600
Agriculture	4,876	3,600	3,300	2,500
Mining	75	250	230	220
Manufacturing	28,111	37,811	45,629	54,654
Lumber & Wood Products	11,927	8,560	7,012	5,694
Paper & Allied Products	7,280	9,224	9,578	8,172
Petroleum	93	D	D	D
Chemicals & Allied Products	209	232	349	489
Food & Kindred Products	2,264	2,110	2,082	2,095
Primary Metals	1,630	4,665	6,730	6,740
Other Manufacturing	830	880	923	924
Non-commodity 2/	44,060	65,849	89,760	117,966
Total Personal Income (000 - 1958 dollars)	502,070	1,114,890	2,453,383	5,422,555
Per Capita Income (1958 dollars)	2,165	4,012	7,022	12,287
Total Earnings (000 - 1958 dollars)	360,216	883,496	1,925,386	4,114,192
Earnings per Worker (1958 dollars)	4,634	8,158	13,849	23,451

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 91 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 9

Item	1960 1/	1980	2000	2020
Population	1,168,899	1,727,266	2,397,552	3,237,150
Participation Rate (empl/pop)	.369	.393	.396	.395
Total Employment	431,094	679,650	949,329	1,279,940
Agriculture, Forestry & Fishery 2/	23,336	20,489	17,217	13,987
Agriculture	21,714	16,000	14,700	11,200
Mining	525	800	900	900
Manufacturing	97,333	155,401	202,847	259,721
Lumber & Wood Products	34,796	23,226	19,527	17,949
Paper & Allied Products	5,310	7,607	7,060	5,782
Petroleum	424	670	589	474
Chemicals & Allied Products	1,746	2,683	4,037	5,655
Food & Kindred Products	12,884	12,197	11,916	11,928
Primary Metals	4,634	9,100	14,770	15,615
Other Manufacturing	2,386	2,744	2,879	2,881
Non-commodity 2/	309,900	502,960	728,356	1,005,332
Total Personal Income (000 - 1958 dollars)	2,834,742	7,212,156	17,011,988	39,774,867
Per Capita Income (1958 dollars)	2,328	4,175	7,096	12,287
Total Earnings (000 - 1958 dollars)	2,084,525	5,733,281	13,278,835	29,635,678
Earnings per Worker (1958 dollars)	4,835	8,436	13,988	23,154

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.

2/ Includes some agricultural and forestry management.

Table 92 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 10

Item	1960 1/	1980	2000	2020
Population	381,384	465,482	575,416	708,879
Participation Rate (empl/pop)	.346	.391	.404	.408
Total Employment	131,780	182,129	232,242	289,106
Agriculture, Forestry & Fishery 2/	10,236	9,562	8,533	7,284
Agriculture	8,117	7,100	6,500	5,400
Mining	467	250	230	190
Manufacturing	45,184	62,399	78,444	96,837
Lumber & Wood Products	35,891	22,770	18,686	16,505
Paper & Allied Products	1,472	2,756	2,728	2,288
Petroleum	27	D	D	D
Chemicals & Allied Products	53	D	D	D
Food & Kindred Products	3,973	4,211	4,034	3,715
Primary Metals	214	2,465	5,290	5,440
Other Manufacturing	12	D	D	D
Non-commodity 2/	75,893	109,918	145,035	184,795
Total Personal Income (000 - 1958 dollars)	769,633	1,652,375	3,600,986	7,794,152
Per Capita Income (1958 dollars)	2,034	3,550	6,258	10,995
Total Earnings (000 - 1958 dollars)	608,942	1,307,079	2,787,999	5,924,586
Earnings per Worker (1958 dollars)	4,621	7,177	12,005	20,493

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

Table 93 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 11

Item	1960 1/	1980	2000	2020
Population	1,768,117	2,449,653	3,345,317	4,448,089
Participation Rate (empl/pop)	.378	.400	.400	.399
Total Employment	667,745	978,681	1,338,231	1,773,299
Agriculture, Forestry & Fishery 2/	20,973	18,242	15,069	12,116
Agriculture	17,824	13,000	10,700	8,400
Mining	681	1,700	2,100	2,000
Manufacturing	175,244	235,907	300,898	376,586
Lumber & Wood Products	27,198	16,944	14,670	12,601
Paper & Allied Products	9,348	10,311	10,896	9,351
Petroleum	1,928	1,661	1,625	1,290
Chemicals & Allied Products	2,888	4,110	5,745	7,591
Food & Kindred Products	16,994	15,907	15,913	16,311
Primary Metals	4,328	9,875	11,410	10,235
Other Manufacturing	472	585	672	721
Non-commodity 2/	470,847	722,832	1,020,164	1,382,597
Total Personal Income (000 - 1958 dollars)	4,826,380	10,675,588	24,912,576	56,308,358
Per Capita Income (1958 dollars)	2,633	4,358	7,447	12,659
Total Earnings (000 - 1958 dollars)	3,477,259	8,084,786	17,808,409	40,536,210
Earnings per Worker (1958 dollars)	5,207	8,261	13,307	22,859

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.
2/ Includes some agricultural and forestry management.

Table 94 - Economic Characteristics, 1960 with Projections to 1980, 2000 and 2020, Subregion 12

Item	1960 1/	1980	2000	2020
Population	13,902	16,250	18,670	21,320
Participation Rate (empl/pop)	.398	.421	.410	.409
Total Employment	5,528	6,834	7,654	8,720
Agriculture, Forestry & Fishery 2/	1,279	1,215	1,154	1,013
Agriculture	1,107	1,000	900	800
Mining	80	30	30	30
Manufacturing	1,358	2,268	3,009	3,896
Lumber & Wood Products	1,209	804	564	433
Paper & Allied Products	6	D	D	D
Petroleum	---	---	---	---
Chemicals & Allied Products	---	---	---	---
Food & Kindred Products	57	35	35	35
Primary Metals	5	10	10	10
Other Manufacturing	---	---	---	---
Non-commodity 2/	2,811	3,321	3,461	3,781
Total Personal Income (000 - 1958 dollars)	32,288	68,949	139,416	274,554
Per Capita Income (1958 dollars)	2,459	4,243	7,467	12,878
Total Earnings (000 - 1958 dollars)	27,109	54,846	106,265	202,351
Earnings per Worker (1958 dollars)	4,904	8,025	13,884	23,205

1/ Estimated from Census of Population and Office of Business Economics data. Data for income, 1962, and earnings, 1959.

2/ Includes some agricultural and forestry management.

D = Too small to be projected but included in regional totals.

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A D D E N D U M

COMPARISON OF THE ECONOMIC PROJECTIONS

The economic projections in this appendix--a "Type 1" study--are based on the projections which were transmitted by the Economics Committee, Water Resources Council, in March, 1968. The "Type 1" study projections were made by the Regional Economics Division, Office of Business Economics, and the Economic Research Service and Forest Service (OBERS). They differ to some degree from the economic projections for the Willamette Basin "Type 2" study, completed during August, 1966, and the Puget Sound and Adjacent Waters "Type 2" study, completed late in 1967.

A comparison of economic projections developed for the C-NP "Type 1" study and the Willamette and Puget Sound "Type 2" studies, in terms of their differences, assumptions and methodologies, were presented in the economic appendices of the "Type 2" studies. The following sections are based on the presentations from the "Type 2" economics appendices.

In both the "Type 1" and "Type 2" studies, it is recognized that regional growth will be dependent upon future national and regional economic opportunities. The level of future regional population will respond to these opportunities, or lack thereof. The "Type 1" and "Type 2" studies therefore, project regional employment opportunities, and then regional population. Other measures of economic growth were also included.

Willamette Basin Comparisons

The following tabulations present the differences between major economic parameters for the Willamette from the two studies:

	1960	1980	2000	2020
		Total Employment		
Willamette	455,606	652,700	803,300	1,306,600
OBERS	431,094	679,650	949,329	1,279,940
Difference	+24,512	-26,950	-66,029	+26,660
Percent of OBERS	+5.69	-3.97	-6.96	+2.08

	1960	1980	2000	2020
		Population		
Willamette	1,168,899	1,767,500	2,422,000	3,591,000
OBERS (prelim.)	1,168,899	1,727,267	2,397,553	3,237,150
Difference	--	+40,233	+24,447	+353,850
Percent of OBERS	--	+2.3	+1.0	+10.9
		Per Capita Income (1960 Dollars)		
Willamette	$2,357	$3,665	$5,665	$ 8,700
OBERS (prelim.)	1/	4,312	7,329	12,691
Difference	--	-647	-1,664	-3,991

Assumptions and Methodologies

The use of different data is one source of disparity between the two studies. The "Type 2" study measured employment using "establishment" data, tabulated geographically by the site of employing establishment. Data were obtained from the U. S. Bureau of Labor Statistics and State Departments of Employment and are annual averages; basin data and regional data, including Idaho, Oregon, Washington, and western Montana were used. The OBERS study used U.S. Bureau of Census "household" data, geographic data of worker residence as recorded for April 1 of decennial census years. Data used for the "Type 2" study had the advantage of giving more industrial detail for the area and subarea analysis; production data, relating to the "establishment" data, reinforced the analysis. Total employment as measured in this study exceeded that of the OBERS study by about 5.7 percent in 1960; presumably the projections are similarly affected.

Differences in methodology and assumptions also affect the results. In both studies, future levels of gross national product and national population are assumed (or separately derived) as important parameters of regional growth. The two studies assume closely comparable future levels of GNP, but their assumptions of national population growth differ. The assumed national population level for 2020 is about 17 percent higher in the "Type 2" study than the OBERS figure. The OBERS study assumes lower future fertility rates than the Willamette "Type 2" study. Employment projections of the "Type 2" study undoubtedly reflect the higher national population assumptions, but the differences in the two methodologies prevent a direct measure.

1/ Approximately the same as the Willamette E.B.S. figure: 1959-$2,281; 1962-$2,405 (both in 1960 dollars).

In the Willamette "Type 2" study, projections were made of production and employment for each of the "base" or commodity-producing industries studied. Employment projections were then made for the noncommodity-producing industries, and also for the federal government and armed forces. The "Type 1" study uses a variant of the "shift-share" analysis to make regional projections. The "Type 1" study first develops individual industry projections for the nation by breaking down GNP projections. Each industry's employment is then allocated to 167 subnational "economic areas" on the basis of the historical trends in the regional components of "shift-share" analysis. Residentiary industries are projected in the same way and are then adjusted to derive the national and local employment base. These data for "economic areas" are then allocated into the more than 200 water resource areas.

The methodological differences between the studies cannot be directly quantified; but the comparison of the employment projections indicated that the "Type 2" study method, given the differences in basic data and assumptions, resulted in somewhat lower results than would have been obtained under the OBERS procedures. The differences, however, are small considering the time period involved.

The population figures in each study were derived by applying labor-force-participation rates to employment projections. Disparate population projections occur because of differences in employment projections and differences in assumed participation rates.

Labor-force-participation trends were analyzed in each study, and future anticipated trends were projected. The "Type 2" study assumed modest progressive reduction in the civilian labor force participation rate throughout the study period. The OBERS study, on the other hand, assumed slight increases in labor-force-participation throughout the projection period. The OBERS assumption is based primarily upon a more recent Bureau of Labor Statistics study 1/, which forecasted rising participation rates traceable mainly to increasing employment rates of females.

Differences in per capita personal income projections are largely explainable in terms of projected national figures based on different assumptions. Differences in index years and projection methods also account for some of the differences.

In the "Type 2" study, per capita income is estimated to

1/ Cooper, Sophia and Denis F. Johnston, "Labor Force Projections for 1970-80", Monthly Labor Review, February 1965.

increase approximately 2.2 percent annually during the projection period. In the OBERS study, it is assumed that per capita personal income will increase at a more rapid rate--2.9 percent.

The OBERS study projected personal income by first projecting national totals in terms of GNP. Regional projections were then made by allocation methods similar to procedures used for employment. In the "Type 2" study national totals, obtained from Water Resources Council, were used, and per capita incomes were projected from national assumptions. In the "Type 2" study, population figures were then applied to develop total personal incomes.

Although the economic parameters projected by the two studies differ, particularly in the latter years, they are reasonably consistent in view of the projection period, and they may be considered as satisfactory for water resource planning purposes.

Puget Sound Comparisons

The following tabulations present the differences between major economic parameters for the Puget Sound and Adjacent Waters from the two studies:

	1980	2000	2020
		Total Employment	
PSAW	973,100	1,535,400	2,434,400
OBERS (prelim.)	978,681	1,338,231	1,773,299
Difference	-5,581	+197,169	+661,101
Percent of OBERS	-0.6	+14.7	+37.3
		Population	
PSAW	2,726,900	4,300,500	6,809,400
OBERS (prelim.)	2,449,700	3,345,300	4,448,100
Difference	+277,200	+955,200	+2,361,300
Percent of OBERS	+11.3	+28.6	+53.1

The projections are fairly similar for the period up to 1980. However, as they extend forward to the years 2000 and 2020, the projections for the "Type 2" study increase at a faster rate and the differences increase. By 2020, the "Type 2" projections indicate 37 percent more employment and 53 percent more population.

Assumptions and Methodologies

Generally, most of the assumptions made in the "Type 1" and "Type 2" studies are quite similar. However, there is a divergence in some major assumptions. The assumptions concerning population for the United States are presented in the following tabulation:

	1980	2000	2020
PSAW (000)	259,584	338,219	469,126
OBERS (000)	234,193	306,757	397,562
Percent of OBERS	+10.8	+10.3	+18.0

The directional effect of this assumption is to provide for higher population and employment projections in the "Type 2" study.

Another reason for the differences is the procedures utilized to estimate the future levels of economic activity. The procedures used by OBERS have already been discussed in the section on the Willamette Basin. The "Type 2" study for the Puget Sound utilized an interindustry input-output model to develop projections for the 1963 to 1980 period. The 1963 to 1980 growth rates were then extended to the years 2000 and 2020. The projected growth rate for the 1963 to 1980 period was substantially greater than the longer term growth rates used in OBERS. Consequently, the "Type 2" procedure results in substantially higher projections for the latter two projection years.

As in the Willamette Basin, sources of base data and base years for the two studies were different for some economic parameters. Disparate population projections also occur because of differences in employment projections and the differences in the assumed participation rates. In addition, both studies relied on "substantial judgement" for making modifications of the projections, especially for the years 2000 and 2020. All of these factors have contributed to the differences in the projections for the Puget Sound.

A more detailed discussion on the projections, assumptions, and procedures used for each of the aforementioned studies can be found in the economic appendices for the "Type 2" studies.

PARTICIPATING STATES AND AGENCIES

STATES

Idaho	Nevada	Utah	Wyoming
Montana	Oregon	Washington	

FEDERAL AGENCIES

Department of Agriculture
- Economic Research Service
- Forest Service
- Soil Conservation Service

Department of the Army
- Corps of Engineers

Department of Commerce
- Economic Development Adm.
- National Oceanic & Atmospheric Administration
  - National Weather Service
  - National Marine Fisheries Service

Department of Health, Education, & Welfare
- Public Health Service

Department of Housing & Urban Development

Department of Transportation

Department of the Interior
- Bonneville Power Adm.
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Mines
- Bureau of Outdoor Recreation
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- National Park Service

Department of Labor

Environmental Protection Agency

Federal Power Commission