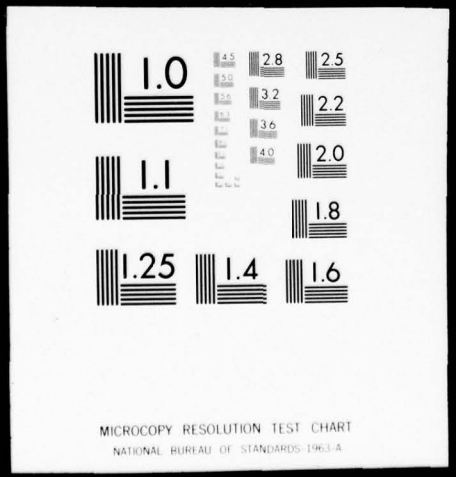
AD-A036 748 PACIFIC NORTHWEST RIVER BASINS COMMISSION VANCOUVER WASH F/G 8/6
THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED L--ETC(U)
1969

UNCLASSIFIED NL

1 OF 3
ADA036748

1 OF 3

AD-A036 748



AD A036748

WILLAMETTE BASIN
COMPREHENSIVE STUDY
Water and Related Land Resources

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

APPENDIX C

ECONOMIC BASE

DDC
MAR 11 1977
C

WILLAMETTE BASIN TASK FORCE - PACIFIC NORTHWEST RIVER BASINS COMMISSION

1969

ORIGINAL CONTAINS COLOR PLATES: ALL DDC
REPRODUCTIONS WILL BE IN BLACK AND WHITE

(1)

(6)

The WILLAMETTE BASIN

COMPREHENSIVE STUDY of

Water and Related Land Resources

DDC
RECEIVED
MAR 11 1977
C

APPENDIX C

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

ECONOMIC BASE

410 072

WILLAMETTE BASIN TASK FORCE - PACIFIC NORTHWEST RIVER BASINS COMMISSION

(11) 1969

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

(12) 285 p.

CREDITS

This is one of a series of appendices to the Willamette Basin Comprehensive Study main report. Each appendix deals with a particular aspect of the study. The main report is a summary of information contained in the appendices plus the findings, conclusions, and recommendations of the investigation.

This appendix was prepared by the Economic Base Committee under the general supervision of the Willamette Basin Task Force. The committee was chaired by the Corps of Engineers and included representation from the following agencies:

Federal Water Pollution Control Administration

Bureau of Outdoor Recreation

Bonneville Power Administration

Bureau of Mines

Bureau of Sport Fisheries and Wildlife

Bureau of Commercial Fisheries

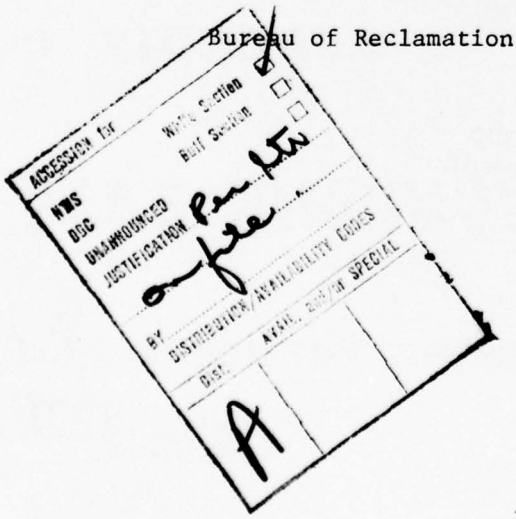
Economic Research Service

Department of Agricultural Economics
Oregon State University

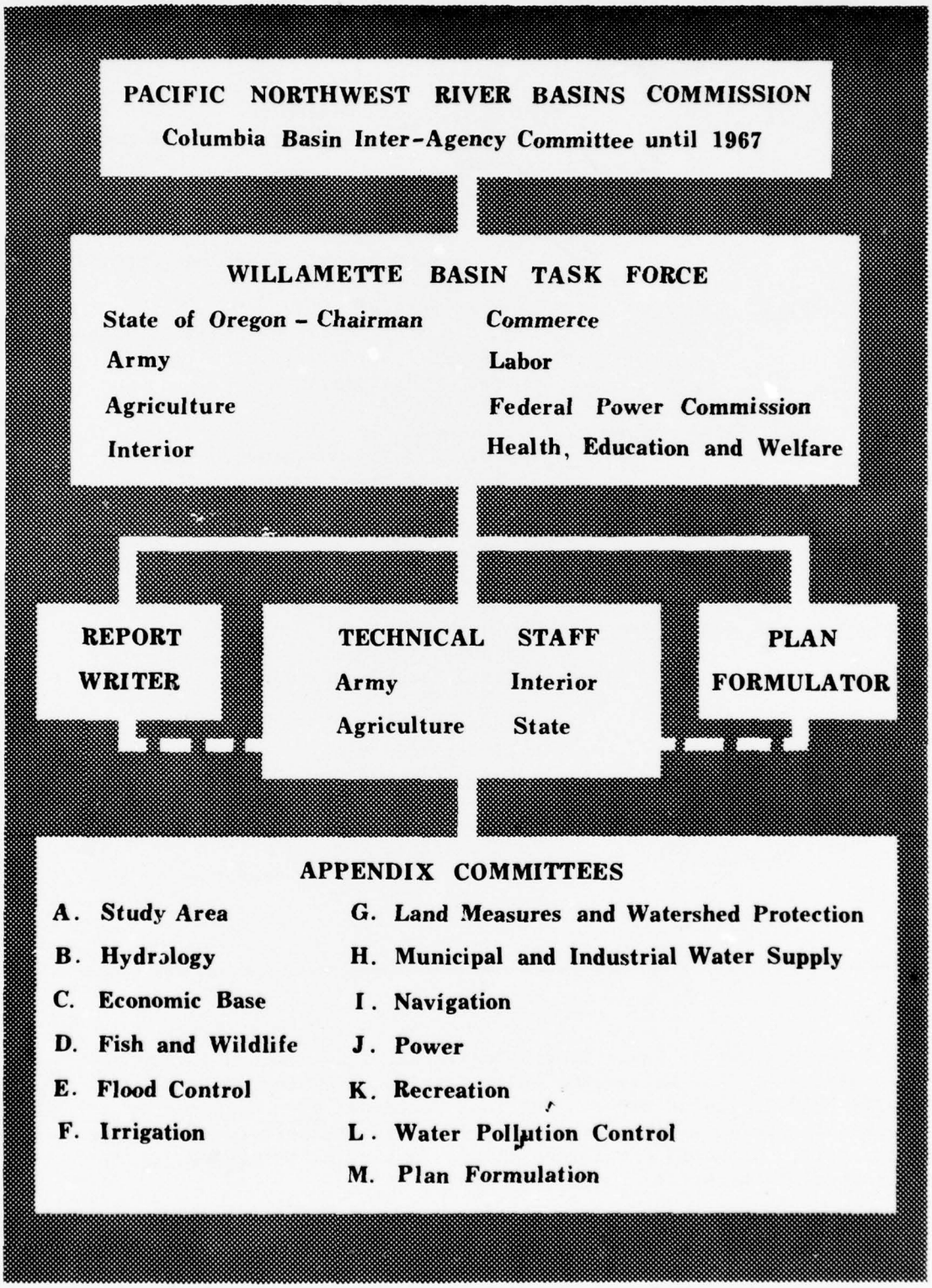
Forest Service

Department of Economics
University of Oregon

Bureau of Reclamation



ORGANIZATION



WILLAMETTE BASIN TASK FORCE

State of Oregon	Donel J. Lane, Chairman Director, Oregon State Water Resources Board
Department of Army	Henry Stewart Chief, Planning Branch U. S. Army Engineers, Portland District
Department of Interior	John F. Mangan Area Engineer, Lower Columbia Development Office Bureau of Reclamation
Department of Agriculture	Oke Eckholm Assistant State Conservationist Soil Conservation Service
Department of Commerce	David J. Bauman Hydrologist, Weather Bureau Forecast Center
Federal Power Commission	Gordon N. Boyer Hydraulic Engineer Federal Power Commission
Department of Labor	Horace Harding Regional Economist Bureau of Employment Security
Department of Health, Education & Welfare	Francis L. Nelson Public Health Service Water Supply and Sea Resources Program

The Willamette Basin Comprehensive Study has been directed and coordinated by the Willamette Basin Task Force, whose membership as of April 1969 is listed above. The Task Force has been assisted by a technical staff, a plan formulator, and a report writer - Executive Secretary. Appendix committees listed on the following page carried out specific technical investigations.

APPENDIX COMMITTEES

Appendix-Subject		
A - Study Area	OSWRB - Chairman:	FWPCA, USBPA, USBLM, USBM, USBOR, USBR, USBSF&WL, USCE, USERS, USFS, USGS, USNFS, USSCS, OSDC, OSDF, OSDG&MI, OSS&WCC, OSU
B - Hydrology	USGS - Chairman:	FWPCA, USBPA, USBR, USCE, USSCS, USWB, OSE, OSWRB
C - Economic Base	USCE - Chairman:	FWPCA, USBPA, USBCF, USBM, USBOR, USBR, USBSF&WL, USDL, USERS, USFS, OSDC, OSU, UO, PSC-PR&C
D - Fish & Wildlife	USBSF&WL - Chairman:	FWPCA, USBCF, USBLM, USBOR, USCE, USDA, USFS, USGS, USSCS, OSFC, OSGC, OSWRB, USHEW
E - Flood Control	USCE - Chairman:	FWPCA, USBR, USDA, USGS, USSCS, USWB, OSDC, OSE, OSWRB, UO
F - Irrigation	USBR - Chairman:	USSCS, OSDC, OSWRB, OSU
G - Land Measures and Watershed Protection	USSCS - Chairman:	FWPCA, USBCF, USBLM, USBOR, USBR, USBSF&WL, USFS, OSU
H - M&I Water Supply	FWPCA - Chairman:	USBR, USBSF&WL, USGS, USSCS, OSBH, OSDC, OSWRB, USHEW
I - Navigation	USCE - Chairman:	OSDC, OSMB, POP, OSU
J - Power	USBPA - Chairman:	FPC, FWPCA, USBCF, USBR, USCE, USFS, USGS, OSE, OSWRB
K - Recreation	USBOR - Chairman:	FPC, FWPCA, USBLM, USBSF&WL, USCE, USFS, USNPS, USSCS, OSBH, OSDC, OSFC, OSGC, OSHD-PD, OSMB, OSWRB, LCPD, OCPA, USHEW
L - Water Pollution Control	FWPCA - Chairman:	USBCF, USBLM, USBOR, USBR, USBSF&WL, USGS, USSCS, OSBH, OSE, OSFC, OSGC, OSWRB, OSU, USHEW
M - Plan Formulation	Plan Formulator - Chairman:	USCE, USDA, USDI, OSWRB

FPC	- Federal Power Commission
FWPCA	- Federal Water Pollution Control Administration
USBPA	- Bonneville Power Administration
USBCF	- Bureau of Commercial Fisheries
USBLM	- Bureau of Land Management
USBM	- Bureau of Mines
USBOR	- Bureau of Outdoor Recreation
USBR	- Bureau of Reclamation
USBSF&WL	- Bureau of Sport Fisheries and Wildlife
USCE	- Corps of Engineers
USDA	- Department of Agriculture
USHEW	- Department of Health, Education and Welfare
USDI	- Department of Interior
USDL	- Department of Labor
USERS	- Economic Research Service
USFS	- Forest Service
USGS	- Geological Survey
USNPS	- National Park Service
USSCS	- Soil Conservation Service
USWB	- Weather Bureau
OSBH	- Oregon State Board of Health
OSDC	- Oregon State Department of Commerce
OSDF	- Oregon State Department of Forestry
OSDG&MI	- Oregon State Department of Geology and Mineral Industries
OSE	- Oregon State Engineer
OSFC	- Fish Commission of Oregon
OSGC	- Oregon State Game Commission
OSHD-PD	- Oregon State Highway Department - Parks Division
OSMB	- Oregon State Marine Board
OSS&WCC	- Oregon State Soil and Water Conservation Committee
OSWRB	- Oregon State Water Resources Board
OSU	- Oregon State University
PSC-PR&C	- Portland State College - Center for Population Research and Census Service
UO	- University of Oregon
LCPD	- Land County Parks Department
OCPA	- Oregon County Parks Association
POP	- Port of Portland

BASIN DESCRIPTION

Between the crests of the Cascade and Coast Ranges in northwestern Oregon lies an area of 12,045 square miles drained by Willamette and Sandy Rivers--the Willamette Basin. Both Willamette and Sandy Rivers are part of the Columbia River system, each lying south of lower Columbia River.

With a 1965 population of 1.34 million, the basin accounted for 68 percent of the population of the State of Oregon. The State's largest cities, Portland, Salem, and Eugene, are within the basin boundaries. Forty-one percent of Oregon's population is concentrated in the lower basin subarea, which includes the Portland metropolitan area.

The basin is roughly rectangular, with a north-south dimension of about 150 miles and an average width of 75 miles. It is bounded on the east by the Cascade Range, on the south by the Calapooya Mountains, and on the west by the Coast Range. Columbia River, from Bonneville Dam to St. Helens, forms a northern boundary. Elevations range from less than 10 feet (mean sea level) along the Columbia, to 450 feet on the valley floor at Eugene, and over 10,000 feet in the Cascade Range. The Coast Range attains elevations of slightly over 4,000 feet.

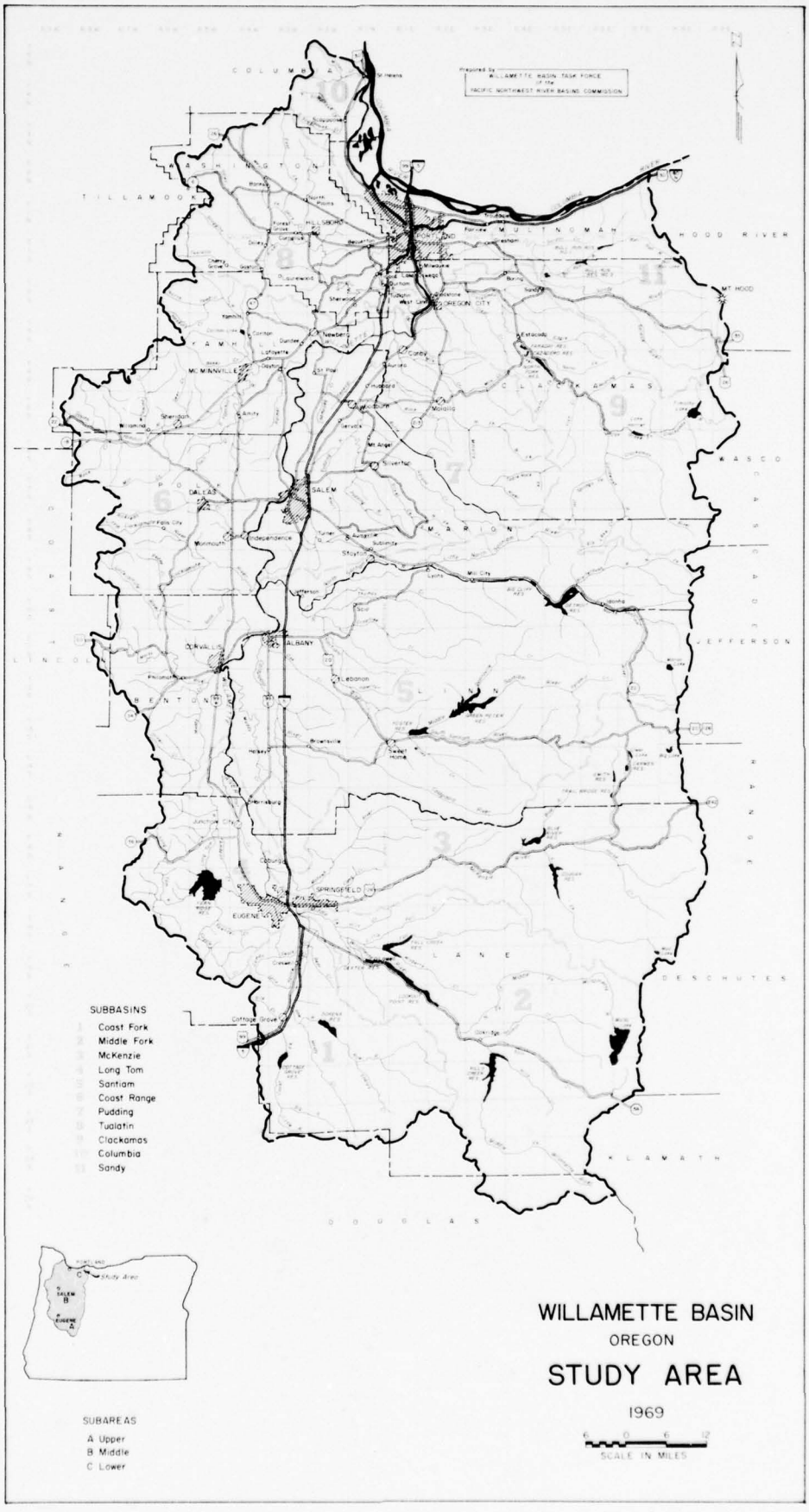
The Willamette Valley floor, about 30 miles wide, is approximately 3,500 square miles in extent and lies below an elevation of 500 feet. It is nearly level in many places, gently rolling in others, and broken by several groups of hills and scattered buttes.

Willamette River forms at the confluence of its Coast and Middle Forks near Springfield. It has a total length of approximately 187 miles, and in its upper 133 miles flows northward in a braided, meandering channel. Through most of the remaining 54 miles, it flows between higher and more well defined banks unhindered by falls or rapids, except for Willamette Falls at Oregon City. The stretch below the falls is subject to ocean tidal effects which are transmitted through Columbia River.

Most of the major tributaries of Willamette River rise in the Cascade Range at elevations of 6,000 feet or higher and enter the main stream from the east. Coast Fork Willamette River rises in the Calapooya Mountains, and numerous smaller tributaries rising in the Coast Range enter the main stream from the west.

In this study, the basin is divided into three major sections, referred to as the Upper, Middle, and Lower Subareas (see map opposite). The Upper Subarea is bounded on the south by the Calapooya Mountains and on the north by the divide between the McKenzie River drainage and the Calapooia and Santiam drainages east of the valley floor and by the Long Tom-Marys River divide west of it. The Middle Subarea includes all lands which drain into Willamette River between the mouth of Long Tom River and Fish Eddy, a point three miles below the mouth of Molalla River. The Lower Subarea includes all lands which drain either into Willamette River from Fish Eddy to its mouth or directly into Columbia River between Bonneville and St. Helens; Sandy River is the only major basin stream which does not drain directly into the Willamette.

For detailed study, the three subareas are further divided into 11 subbasins as shown on the map.


Prepared by
WILLAMETTE BASIN TASK FORCE
of the
PACIFIC NORTHWEST RIVER BASINS COMMISSION
SUBBASINS
Coast Fork
Middle Fork
McKenzie
Long Tom
Santiam
Coast Range
Pudding
Tualatin
Clackamas
Columbia
Sandy
SUBAREAS
A Upper
B Middle
C Lower
WILLAMETTE BASIN
OREGON
STUDY AREA
1969
SCALE IN MILES
MBF-0-100884-L

SUMMARY

This report contains an analysis of the economic base of the Willamette Basin--including economic characteristics, economic history, present state of economic development, and projections of the future. The economy is studied in light of national and regional setting to determine prospective changes for the years 1980, 2000, and 2020. Studies were made of the basin, its people, and their incomes, its employment structure, and its industries. The basin's employment growth was analyzed using an "economic base" or "export" model.

The basin is noted for products associated with its natural resource base. Principal commodity-producing industries are forest products and food processing which, combined account for over half the 104,000 employed in manufacturing. Of the 530,400 persons employed in the basin in 1965, one out of every five was employed in the resource-based industries--forest products, agriculture, food processing, and mining and related products.

Two-thirds of the land in the basin is forested. Timber stands contain 140 billion board feet, 10 percent of all softwood timber in the nation. Several of the nation's largest forest products manufacturers are located here. Forest products output of the basin supplies a significant part of the nation's demand; over 90 percent of this output is shipped to national and world markets. In the future, forest products industries will continue to be significant to the basin's economy. Projected decreases in lumber output will be offset by increases in pulp, paper, and plywood. Changes in output and gains in productivity are expected to reduce employment in these industries from 45,000 in 1965 to about 23,000 by 2020.

About one-third of the basin's land is in farms. The value of agricultural production is about $180 million annually. Principal export products are grass seeds, vegetables, berries, hops, mint, and turkeys. Agriculture will continue to be important to the basin's economy, with output valued at about 2-1/2 times the present level by 2020. Anticipated gains in productivity will offset shifts of farmlands to other uses. Employment is expected to decrease.

Food processing, a major industry in the basin, consists of nearly 400 firms and has an output valued at nearly $300 million annually. Canned and frozen fruits and vegetables are the most important export products. Employment in this industry approximates 14,000, with peak summer employment reaching 22,000. Significant increases in production are expected; however, employment is expected to decline to 11,000 by 2020.

Mineral, primary metal, and chemical producers, together employ 7,500 with an annual output of $130,000. Mineral extraction, limited almost entirely to nonmetallics, will expand modestly with future population; significant increases are expected for both primary metals and chemicals in the next 50 years.

In recent years, a more diversified industrial base has emerged to supply an increasing share of local and regional markets. New industries have experienced the most rapid rates of growth. The "balance" of manufacturing industries now developing is characteristic of growth areas. The more important expanding industries are machinery, fabricated metals, transportation equipment, and printing and publishing; these industries are more dependent upon the area's markets than upon resources. Value added by manufacture from these industries approximated $450 million in 1965, with employment of 40,000. As demands from local and regional markets increase, the basin will produce manufactured goods in greater variety, with employment in the market-oriented manufacturing industries projected to increase to 63,000 by 1980, and to 113,000 by the turn of the century.

The basin's most rapidly expanding industries are those which provide various services in the basin and adjacent areas. These industries are: wholesale and retail trade; business and personal services; self-employed and miscellaneous; transportation, communications and utilities; government; construction; and finance, insurance and real estate. Tourism and recreation services are also provided by this group. These industries employed 383,000 in 1965 and will continue to be important in the future expansion of the basin's economy; by 2000, the number employed is projected to almost double.

Most of the industrial activity and settlement is located on the valley floor. Of the one million who live in urbanized areas, over 900,000 reside within 10 miles of the Willamette River. The three major centers of population are Portland, Eugene, and Salem.

Population in the Willamette Basin increased from 416,000 in 1910 to 1,338,900 in 1965. The long-run population growth rate has exceeded those of the Pacific Northwest and of the nation. Only during the fifties was its growth rate less than the nation, but it re-accelerated from 1960 to 1965.

During the 1940-1965 period, total personal income in the basin increased more rapidly than in the nation. In 1960-1961, personal income averaged $2.8 billion annually. Personal per capita income in the basin ($2,357 in 1960) is expected to reach $8,700 by 2020.

The future economy of the Willamette Basin will have:

1. *Increased production and income*

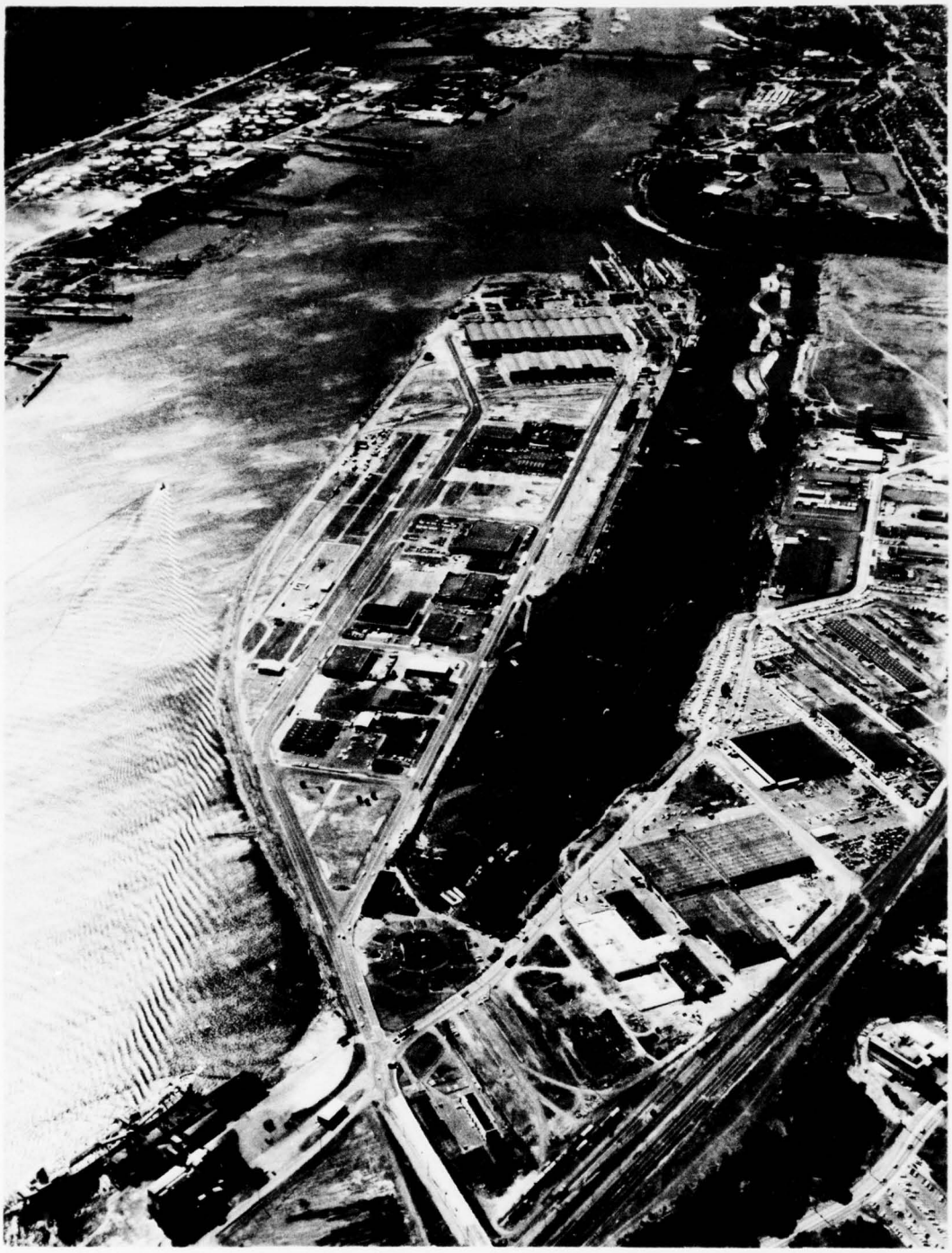
   Total personal income will increase from $2,792,000,000 in 1960-1961 to $31,240,000,000 by 2020.

2. *More jobs*

   Employment will increase from 530,430 in 1965 to almost 650,000 in 1980, to more than 880,000 in 2000, and to more than 1,300,000 by 2020.

3. *An increased population*

   From 1,338,900 in 1965 to 2,422,000 in 2000 and 3,591,000 in 2020.



Just upstream from where the Willamette River joins the Columbia is the Port and City of Portland--hub of the basin's population, its financial and industrial center, and its gateway to world trade. (Delano for Port of Portland Photo)

TABLE OF CONTENTS

	Page
TITLE PAGE	i-1
CREDITS	i-2
ORGANIZATION	i-3
WILLAMETTE BASIN TASK FORCE	i-4
APPENDIX COMMITTEES	i-5
BASIN DESCRIPTION	i-6
FRONTISPIECE	i-6a
SUMMARY	i-7
TABLE OF CONTENTS	i-11
TABLES	i-16
FIGURES	i-22
MAPS	i-24
PHOTOS	i-25

PART I - INTRODUCTION

STUDY OBJECTIVES	Divider
RELATIONSHIP TO OTHER PARTS OF THE REPORT	I-1
ASSUMPTIONS	I-2
METHOD OF ANALYSIS	I-5
Nature and Pattern of Economic Change	I-5
Projection Techniques	I-6
STUDY AREA DESCRIPTION	I-8
Physiography	I-8
Economic Setting	I-9
Delineation of Economic Study Area Boundaries	I-10

Page

PART II - PRESENT STATUS

POPULATION II-1
National II-1
Regional II-2
Willamette Basin II-2
Willamette Subareas II-6
Migration II-9
Age-Sex Composition II-12

PERSONAL INCOME II-15
National Trends II-15
Regional Trends II-17
Trends in Oregon II-18
Willamette Basin Trends II-20

EMPLOYMENT ANALYSIS II-23
Present Employment, by Industry II-23
Comparative Specialization II-23
Relative Growth by Industry, 1958-1964 . . . . . II-25
Employment Trends in Subareas II-28
Lower Subarea II-28
Middle Subarea II-32
Upper Subarea II-34

PART III - INDUSTRY STUDIES

AGRICULTURAL ECONOMY III-2
Characteristics of Agriculture III-2
Land Use III-3
Farm Characteristics III-5
Number and Size of Farms III-5
Economic Classes of Farms III-6
Farm Ownership III-7
Farm Sales III-7
Farm Population and Employment III-8
Mechanization and Technology in Farming III-10
Agricultural Land Resources III-13
Agricultural Land Base III-13
Quality and Use of Agricultural Land Base III-13
Reduction of Agricultural Land Base III-15
Agricultural Projections III-17
National Projections III-18
Willamette Basin Projections III-18
Crop Production and Acreage III-20
Livestock Production III-22
Value of Farm Production III-22
Land Use III-24
Farm Employment and Number of Farms III-24

	Page
FOOD PROCESSING	III-27
Type of Processing	III-27
Employment	III-29
Markets for Processed Output	III-31
Output Projections	III-31
Employment Projections	III-33
FOREST PRODUCTS INDUSTRIES	III-35
Timber Resources	III-35
Present Forest Industry	III-36
Log Production	III-36
Manufacturing Output	III-38
Employment	III-49
Projected Future Development	III-49
Consumption of Logs	III-50
Future Employment	III-54
THE MINING AND MINERAL INDUSTRIES	III-56
Mineral Resources and Industries	III-58
Nonmetals	III-58
Metals	III-62
Fuels	III-63
Industrial Minerals Demand	III-63
Outlook and Employment Projections	III-64
PRIMARY METALS	III-66
National Trends	III-66
Regional Trends	III-66
Basin Trends	III-67
Comparative Trends	III-71
Silicon Metal and Ferroalloys	III-72
Steel	III-73
Primary Aluminum	III-74
"Exotic" Metals	III-74
Projections	III-75
CHEMICAL PRODUCTS INDUSTRY	III-76
Comparative Development	III-80
National Output Projections	III-81
Location of Plants	III-81
Chemical Outlook	III-84
"ALL OTHER" MANUFACTURING INDUSTRIES	III-87
National Aspects	III-88
Relative Development in Basin and Region	III-88
Production Trends	III-91
Employment Trends	III-94
Future Outlook	III-96

Page

PART IV - PROJECTIONS

EMPLOYMENT PROJECTIONS. IV-1
Basic Industries IV-1
Agriculture IV-1
Mining. IV-1
Manufacturing IV-1
Food and Kindred Products. IV-1
Lumber and Wood Products IV-2
Paper and Allied Products. IV-2
Chemical and Allied Products IV-2
Primary Metals IV-2
"All Other" Manufacturing. IV-2
Federal Government. IV-3
Residentiary Industries. IV-3

POPULATION PROJECTIONS. IV-8

PERSONAL INCOME ESTIMATES IV-11

ADDENDA

ADDENDUM A — Detail of Economic Base Model Method of Analysis

ADDENDUM B — Detail of Employment Shift Analysis

ADDENDUM C — Employment Trends, 1940-1960

ADDENDUM D — Employment Data
Willamette Basin Study Area and Subareas, 1958-1967, Tables D-1 through D-10
Oregon State Employment, 1947-1967, Tables D-11 through D-15
Pacific Northwest Employment, 1947-1966, Tables D-16 through D-20
United States Employment, 1947-1966, Tables D-21 through D-25

ADDENDUM E — Projection Methodology

ADDENDUM F — An Alternative Procedure for Projecting Employment

ADDENDUM G — Comparative Population Projections

ADDENDUM H — Population Projections, Willamette Basin, by Tributary Basin, 1960-2020

ADDENDUM I — Comparison of Willamette Basin Economic Base Study Projections with Study Projections by Office of Business Economics

ADDENDUM J — Definitions of Industry Groups

ADDENDUM K — Supporting Studies

TABLES

No.		Page
I-1	Comparative economic data, Willamette Basin	I-10
II-1	Population of Willamette Basin, and subareas, Pacific Northwest, and United States, 1910-1964	II-7
II-2	Estimated population growth due to net in-migration and natural increase, Willamette Basin and subareas, 1940-64	II-8
II-3	Population growth due to net in-migration and natural increase, Willamette Basin and subareas, 1940-64	II-9
II-4	Percent change in population due to net in-migration and natural increase, Willamette Basin and subareas, 1940-50, 1950-60, 1960-64, 1940-64	II-10
II-5	Population distribution by age and sex, Willamette Basin Study Area and Subareas, 1960 and 1964	II-14
II-6	National trends in personal income, 1940-64	II-16
II-7	Comparative trends in total personal income, divisions of the United States, 1940-64	II-17
II-8	Personal income and income per employee, 1964, Oregon and United States	II-19
II-9	Comparative trends in total personal income, Willamette Basin, Pacific Northwest, and United States, 1950-51 to 1960-61	II-20
II-10	Comparative trends in personal income by major sources, Willamette Basin Study Area, Pacific Northwest, United States, 1950-51 to 1960-61	II-20a
II-11	Trends in personal income by major sources, Willamette Basin Subareas - 1950-51 to 1960-61	II-20b
II-12	Comparative trends in per capita income, Willamette Basin, Pacific Northwest and United States 1950-51 to 1960-61	II-22
II-13	Employment trends, Lower Subarea, 1958-64	II-31
II-14	Employment trends, Middle Subarea, 1958-64	II-33
II-15	Employment trends, Upper Subarea, 1958-64	II-35
III-1	Use of farmland, Willamette Basin, 1964	III-3

No.		Page
III-2	Acreage and distribution of cropland use, Willamette Basin, 1939, 1949, 1959, and 1964	III-4
III-3	Farms: Class and sales level, Willamette Basin, 1964	III-6
III-4	Commercial classification of tenure classes of farms, Willamette Basin, 1964	III-7
III-5	Farm products: Sales, by percentage of distribution, Willamette Basin, 1939, 1949, 1959, and 1964	III-8
III-6	Farm population and employment, Willamette Basin, 1930-1960	III-8
III-7	Indexes of change: Farm production, employment, and efficiency indicators, Willamette Basin, 1949-1959	III-12
III-8	Use of agricultural land base, by land capability class: Willamette Basin, 1958	III-14
III-9	Estimated urban and builtup areas, Willamette Basin	III-16
III-10	Present and projected 1980 agricultural land base, Willamette Basin	III-16
III-11	Average production of food products, United States	III-18
III-12	Estimated crop production, Willamette Basin	III-20
III-13	Crop yields per acre harvested, 1959-1961, and projected indexes of change, Willamette Basin (1959-61 = 100)	III-21
III-14	Estimated harvested cropland, Willamette Basin	III-21
III-15	Production of livestock products, Willamette Basin	III-22
III-16	Annual farm value of agricultural production, Willamette Basin	III-23
III-17	Use of agricultural land base, Willamette Basin	III-24
III-18	Agricultural employment, Willamette Basin	III-25

No.		Page
III-19	Number of farms, Willamette Basin	III-25
III-20	Processing firms operating in Willamette Basin, 1965-66, showing annual and seasonal employment	III-28
III-21	Distribution of food manufacturing firms, by number of employees per firm, Willamette Basin, 1966	III-29
III-22	Distribution of employment in food processing firms according to the market area served, Willamette Basin, 1966	III-31
III-23	Production of food and kindred products, Willamette Basin	III-32
III-24	Estimated food and kindred products employment, Willamette Basin	III-33
III-25	Volume of growing stock on commercial forest land in Willamette Basin, 1963	III-36
III-26	Annual log production, by owner class, Willamette Basin, 1950-1963	III-37
III-27	Production of timber products, Willamette Basin, 1963	III-40
III-28	Plant locations, sawmills, Willamette Basin, 1965	III-42a
III-29	Plant locations, plywood & veneer manufacturers, Willamette Basin, 1965	III-45
III-30	Plant locations, wood composition-board plants (1965) and wood pulp mills (1966), Willamette Basin	III-47
III-31	Employment and wage payments in forest product industries, Willamette Basin, 1964	III-49
III-32	Estimated consumption of roundwood for lumber and wood products, Willamette Basin, 1965-2020	III-51
III-33	Estimated consumption of wood fiber by the pulp and paper industries, Willamette Basin, 1965-2020	III-52
III-34	Estimated production of forest products, Willamette Basin, 1963-2020	III-54
III-35	Employment in forest product industries, Willamette Basin	III-55

No.		Page
III-36	Sand and gravel, and stone production, Willamette Basin, 1959-64	III-59
III-37	Estimated cement consumption	III-61
III-38	Estimated lime consumption	III-61
III-39	Value of metals production, Willamette Basin, 1900-1963	III-62
III-40	Estimates of the major industrial mineral raw materials shipped into the Willamette Basin for consumption, 1963	III-64
III-41	Average employment in mining, Willamette Basin	III-65
III-42	Number of plants, employment, and payroll in major primary metal categories, Willamette Basin, 1964	III-67
III-43	Primary metal plant locations, Willamette Basin, 1963	III-69
III-44	Net shipments of primary metal products, railroads and waterborne commerce, Willamette Basin, 1962 and 1964	III-71
III-45	*Silicon metal and ferroalloy* production, and raw materials consumed, Willamette Basin, 1980-2020	III-73
III-46	Steel production and raw material consumption, Willamette Basin, 1980-2020	III-74
III-47	Employment in primary metals manufacturing industries, Willamette Basin and Subareas	III-75
III-48	Net shipments of chemical products by railroads and waterborne commerce, Willamette Basin, 1962 and 1964	III-77
III-49	National demand for chemical and allied products, by major source	III-78
III-50	Percent employment by major chemical category Willamette Basin, Pacific Northwest, United States, 1964	III-80

No.		Page
III-51	Chemical plant locations, Willamette Basin (20 or more employees)	III-83
III-52	Trends in production, chemical and allied industries, Willamette Basin, Pacific Northwest, United States	III-85
III-53	Index of national chemical output projections 1960-2020	III-85
III-54	Output and employment of chemical and allied products industries, Willamette Basin and subareas	III-86
III-55	Index of relative development, "All Other" manufacturing industries, Willamette Basin, 1963	III-87
III-56	Net shipments of products of "All Other" manufacturing industries by railroad and waterborne commerce, Willamette Basin, 1962 and 1964	III-89
III-57	Value added by manufacture for "All Other" manufacturing industries, Willamette Basin, 1958 and 1963	III-90
III-58	Comparative trends in production of "All Other" manufacturing industries, Willamette Basin, Pacific Northwest, United States, 1958 to 1963	III-92
III-59	Number employed, percent change and distribution, "All Other" manufacturing industries, Willamette Basin Subareas, 1958 and 1964	III-95
III-60	Major national demand components, "All Other" manufacturing industries	III-97
III-61	Index of national output of "All Other" manufacturing industries	III-99
III-62	Comparative production trends and projections, "All Other" manufacturing industries, Willamette Basin, Pacific Northwest, United States	III-100
III-63	Value added and employment of "All Other" manufacturing industries, Willamette Basin and Subareas	III-101

No.		Page
IV-1	Employment and labor force, Willamette Basin	IV-4
IV-2	Employment and labor force, Lower Subarea	IV-5
IV-3	Employment and labor force, Middle Subarea	IV-6
IV-4	Employment and labor force, Upper Subarea	IV-7
IV-5	Population, Willamette Basin and subareas	IV-8
IV-6	Population by age and sex, Willamette Basin and subareas, 1980	IV-9
IV-7	Estimated percentage distribution of population by age and sex, Willamette Basin, 2000 and 2020	IV-10
IV-8	Per capita and total personal income, Willamette Basin	IV-11

FIGURES

No.		Page
I-1	Assumptions compared	I-4
II-1	Distribution of national population increase, divisions of the United States, 1910-1964 (measured as percent of U. S. increase for each period)	II-1
II-2	Comparative population growth rates, divisions of the United States and Willamette Basin, 1910-64 (by average percent increase)	II-3
II-3	Comparative population trends, United States, Pacific Northwest, and Willamette Basin, 1910-64	II-4
II-4	Net in-migration of population, Willamette Basin and subareas, 1940-64	II-11
II-5	Comparative distribution of population by age and sex, Willamette Basin, Pacific Northwest, and United States, 1965	II-13
II-6	Relative differences among geographic divisions in per capita personal income, 1930-1964	II-18
II-7	Comparative employment rank of major industries, Willamette Basin, Pacific Northwest, and United States, 1964	II-24
II-8	Percentage changes in employment, by major industrial categories, Willamette Basin, Pacific Northwest, and United States, 1958-1964	II-26
II-9	Comparative growth in employment by major manufacturing categories, Willamette Basin, Pacific Northwest, and United States, 1958-1964	II-27
III-1	Farms: Number and size, Willamette Basin, 1919-64	III-5
III-2	Farms: Distribution by size class and change in number, Willamette Basin, 1945-64	III-5
III-3	Willamette Basin crop production as a proportion of Oregon's production, 1959-61 average	III-19
III-4	Willamette Basin livestock production as a proportion of Oregon's production, 1959-61 average	III-19
III-5	Distribution of lumber from Willamette Basin, 1963-65	III-38
III-6	Distribution of plywood from Willamette Basin, 1963-65	III-39

No.		Page
III-7	Distribution of pulp, paper, and paperboard from Willamette Basin, 1960-62	III-39
III-8	Sand and gravel, and stone production, Willamette Basin, 1940-65	III-58

MAPS

No.		Page
I-1	Economic Subarea Boundaries, Willamette Basin	I-11
III-1	Plant Locations, Sawmills, Willamette Basin, 1965	III-42
III-2	Plant Locations, Softwood, Plywood and Veneer Plants, Willamette Basin, 1965	III-44
III-3	Plant Locations, Wood Composition-Board Plants (1965) and Wood Pulp Mills (1966), Willamette Basin	III-46
III-4	Mineral Resources, Willamette Basin	III-57
III-5	Primary Metal Plant Locations, Willamette Basin	III-68
III-6	Chemical Plant Locations, Willamette Basin, 1964	III-82

PHOTOS

No.		Page
	Port of Portland	i-10
I-1	City of Portland	I-8
I-2	Diversified economic activity	I-12
II-1	Population contrast - Portland vs. rural area	II-5
II-2	Portland suburban area	II-10
II-3	Rail transport facilities	II-15
II-4	Retail purchasing	II-22
II-5	Metropolitan Portland	II-29
II-6	City of Salem	II-34
II-7	Cities of Eugene and Springfield	II-36
III-1	Basin agriculture	III-1
III-2	Marion County, cropland and woodland	III-4
III-3	School girl berry pickers	III-9
III-4	Sprinkler irrigation	III-11
III-5	Bush bean picking machine	III-11
III-6	Pastureland in Linn County	III-13
III-7	Salem cannery, inspection line	III-26
III-8	Salem cannery	III-30
III-9	Balloon logging	III-34
III-10	Horse logging	III-37
III-11	Sawmill	III-41
III-12	Plywood being loaded into a railroad car	III-43
III-13	Wood products in building	III-48
III-14	Log raft and wood chip barge	III-53
III-15	Metal smelter	III-56

No.		Page
III-16	Sand and gravel dredging	III-59
III-17	Metal fabricator	III-65
III-18	Blast furnace	III-70
III-19	Chemical plant	III-76
III-20	Cement plant	III-79
III-21	Manufacturing Plant	III-88
III-22	Industrial park, Portland	III-93
III-23	Light industry, Portland	III-93
III-24	Fabricated metals	III-98
IV-1	People, our basic resource	IV-11

INTRODUCTION

INTRODUCTION

STUDY OBJECTIVES

The Economic Base Study of Willamette Basin is a specialized study of the basin's economy designed to serve as a guide to water and related land resources development planning.

An expanding economy requires more resources or more intensive resource utilization. As demands for resources increase, the increase in their supply can often be attained only by developing more costly sources or by utilizing resources more intensively. In particular, future demand for water looms large. Assuring that demands for resources will be satisfied in the best manner requires comprehensive development plans. These plans should in turn be based on the character and growth of the basin's economy.

The objective of the Economic Base Study is to provide the basis for determining the scale, sequence, and timing of water and related land resources development. These determinations are based on estimates of future economic activity within the basin and the characteristics and size of its population. In estimating the basin's future economic activity, regional, national, and foreign trade in goods and services are recognized. Exports of basin products enhance the economic growth of the basin.

The economic parameters projected in this study may be used in determining the need for each of the resource planning objectives. Useful economic parameters include (1) population and its characteristics--age, sex, and per capita income--for estimates of visitor-day use in fish and wildlife, and recreation studies; (2) output of industries using large quantities of water and power, for estimates of municipal and industrial water and power requirements; and (3) changes in urban, industrial, and agricultural development, for studies of navigation, irrigation, land measures, flood control, and water pollution control.

RELATIONSHIP TO OTHER PARTS OF THE REPORT

The data, analyses, and conclusions contained in this appendix serve together with Appendix A - Study Area, and Appendix B - Hydrology, to support resource development aspects delineated in the functional appendices. The projection of population, employment, personal income, overall economic development, and social desires of the people all have an important bearing on multipurpose development of water and related land resources. This appendix provides the economic setting and background for the recommended plan and the entire report. It is in this setting that needs are determined and the means of satisfying these needs are developed as a comprehensive plan.

A S S U M P T I O N S

Certain assumptions must necessarily be adopted for general guidance in any projection. These anticipated conditions set the broad framework of economic development of subnational areas. While all assumptions may not be fully realized, their identification will permit adjustments to be made as economic conditions change.

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.

5. Conterminous United States population will expand to:

1960	178,464,000
1980	259,584,000
2000	336,800,000
2020	467,700,000

6. Employment at approximately 96 percent of civilian labor force will prevail nationally throughout the forecast period.

7. United States gross national product (1960 dollars) will reach:

1960	$ 505 billion
1980	$1,130 billion
2000	$2,472 billion
2020	$5,402 billion

8. Development of technological processes, together with expansion of worker skills and capital formation, will increase productivity per man-hour approximately 2.9 percent per year.

The general direction and magnitude of the projected national economic growth are considered reasonably accurate even though the exact population, employment, output, and other elements of growth may occur either earlier or later than projected. Effort was made to assure that the specific projected measures were based on the best available data and judgment.

Projections of the national economy indicate what regional changes may occur. The population and economy of the nation will continue to grow during the projection period--from the present to the year 2020. Population is expected to increase at a lesser rate after 1980 as fertility rates fall. Labor force participation rates are expected to decline slightly as the period of training is envisioned to increase and the age of retirement to decline. The employment rate is expected to be maintained at near full employment levels. Hours worked probably will continue to decrease in response to pressures for greater leisure. Output per man-hour is expected to increase, reflecting advances in management and technology. The net result is that the economy will continue to grow, possibly at a more rapid rate than in recent years. Total output of goods and services is expected to increase approximately 4.0 percent annually during the projection period, as compared to 3.9 percent for the 1940-1960 period. This would more than double the output of the economy during each 20-year period. National real income per person is expected to double that of today by 2000 and to triple by 2020.

The national assumptions used for this study for the period to 1980 were those adopted by Bonneville Power Administration in their current Economic Base Study of the Pacific Northwest. Assumptions adopted for projection years after 1980 were those made by the Economic Task Group of the Ad Hoc Water Resources Council Staff, dated July 1963. Later projections by the U. S. Department of Commerce, Office of Business Economics, were not available at the time this study was in progress. Figure I-1, Assumptions Compared, is an analysis of the national economic changes up to 2020 adopted for this study, earlier projections by the Ad Hoc Water Resources Council Staff, and historic trends.

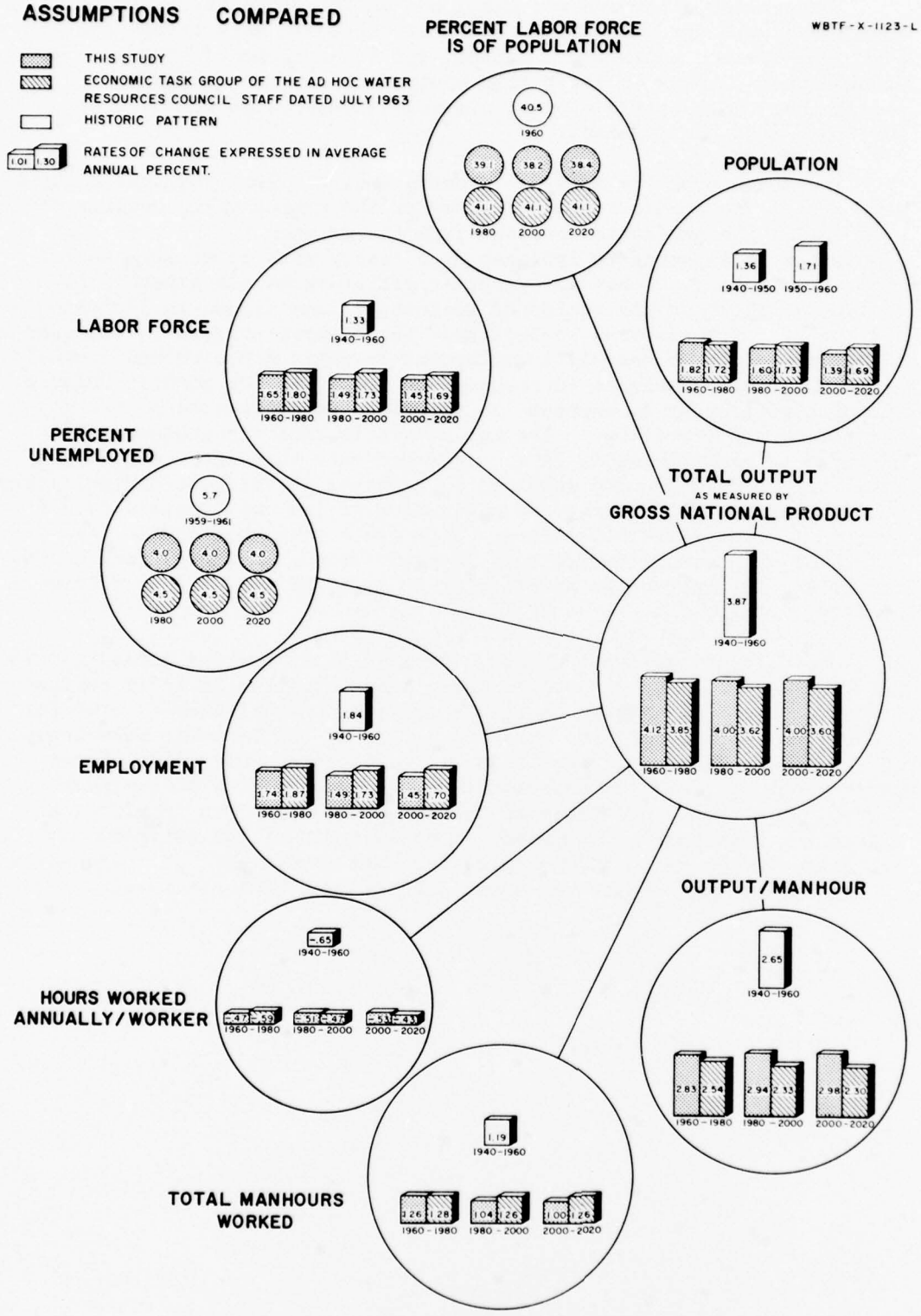


Figure I-1. - Assumptions Compared

METHOD OF ANALYSIS

NATURE AND PATTERN OF ECONOMIC CHANGE

A procedure for estimating future trends and levels of economic growth must recognize changes and factors that have influenced these trends in the past and must appraise forces likely to be operating in the future. A general review of these forces is helpful in understanding the value and limitations of economic projections.

The pattern and rate of economic growth varies markedly among regions and river basins in the United States. The national population increase of 17 percent between 1950 and 1960 was uneven. Many counties in excess of 100,000 doubled, while about half the counties in the nation lost population; generally, the metropolitan areas gained while small towns and rural areas declined. Along with shifts in population numbers and characteristics were changes in industrial employment, output, income, and land use. These variable growth rates largely reflect geographic or employment shifts in three industries--agriculture, mining, and manufacturing.

Forces affecting national economic development also affect regional development. As the national population increases and family incomes rise, the demand for goods and services expands. Changes in consumer tastes and in relative price relationships affect the demand for goods and services differently. Regions vary in industrial pattern and ability to supply the changing demand.

As demand and supply conditions change, an area's ability to produce and distribute in relation to other areas also changes. Some areas have access to raw or semi-processed materials, enjoy other basic cost advantages, and are located near markets. Others are not so well situated. Differential economic growth among regions of the nation is therefore largely explainable in terms of their comparative advantages for production and distribution. Exceptions are areas which attract retired persons or tourists and specialize in meeting their needs.

Other things being equal, firms try to locate where combined production and distribution costs are at a minimum. If costs of production are the more critical, access to the basic factors of production may dominate the decision regarding location, whereas market access may be relatively more important to other firms. To some, neither may be dominant. In general, extractive industries are oriented to resource inputs, fabricating industries, to either certain material, to labor inputs or to markets, and service industries primarily to markets. Since many factors of production are mobile or can be readily substituted, most kinds of firms are not locationally confined by a given factor.

A region with relatively low population density and limited markets does not attract market-oriented industries, which can produce economically only on a large scale. As a region grows and its market expands, plants geared to large-scale production will be attracted and other firms which provide specialized products and services for these plants will follow. The agglomeration economies thus generated tend to stimulate further development. An area's rate of growth and its industrial pattern constantly change as its ability to compete with other areas varies over time in response to changing requirements of individual industries.

Industries which can be projected with some confidence are those tied to national rather than to local markets and which require few raw material inputs that make up a large part of the total cost of production. Industries relatively "foot-loose" and/or dependent upon the future size of the local market are more difficult to project because they have considerable freedom of choice in locating within a general market area; for these, an analyst must resort to the use of general trends and relationships, supplemented with considerable judgment.

PROJECTION TECHNIQUES

Appraising future economic development is an essential part of planning. Given the limitations inherent in all projections, estimates developed in this study are thought to be a reasonable indication of the direction and magnitude of economic expansion in Willamette Basin throughout the period of analysis. Observations by the Economic Task Group of the ad hoc Water Resources Council about the nature and limitations of long-run economic projections are appropriate to the projections of this study:

> "Long-run economic growth reflects the whole gamut of forces influencing economic activity. None of these forces can be considered as given or determined outside the entire system of cause and effect. The history of economic development amply demonstrates that major implementors of economic growth vary from one period of history to another. Accordingly, models of economic growth greatly oversimplify the problems of economic projections. New data, improved economic theory, and much more sophisticated statistical techniques will provide better analyses of the influence of demand changes and the contribution of labor, capital, and technology to potential economic growth. But, the future is uncertain and will continue so. Despite limitations in predicting the future, long-run appraisals will continue to be made. Long-run decisions require judgment about the future and often these decisions are based on fragmentary supporting analyses. Fortunately, many decisions involving long-run commitments require only a general judgment about economic growth.

"A general economic projection for a period as long as 50 years can be little more than an assumed point of reference. These limitations, in both our ability to project and on the use of projections, should be recognized and made known to users."

The principal methodology adopted for projecting employment and population growth in Willamette Basin is known as the "economic base" or "export" model. It rests on two main principles: (1) Population is distributed essentially on the basis of economic opportunity. If favorable employment opportunities exist, in-migration will bolster local population; if relatively better opportunities exist elsewhere, out-migration will result. (2) Industries engaged in export trade are the most dynamic elements in economic development because no region can be self-sufficient in a competitive society; exports are necessary to sustain the imports which a region requires. Sales of the commodities and/or services of these industries bolster the area's economy with increased income and employment which, in turn, have a multiplier effect on the industries geared to the local market. Therefore, a reasonable differentiation must be made between (a) industries which cater to the export market, and (b) those which serve mainly the local population.

In the model, the procedure is to dichotomize and analyze industires, showing relationships between industries which are "basic" (export market oriented) and those which are "residentiary" (local market oriented). For this analysis, employment data were selected as the primary measuring device. Detailed income data by industrial origin are perhaps more meaningful for multiplier analysis; however, they are not available. Employment does have the advantage that it is closely geared to the location of industry and value added. This methodology is described in Addendum A.

STUDY AREA DESCRIPTION

PHYSIOGRAPHY

The Study Area includes the Willamette and Sandy River drainages in northwest Oregon. The area is roughly rectangular in shape, approximately 75 miles wide and 150 miles long, with a total area of 12,045 square miles--12.4 percent of the area of Oregon. The basin is ringed by mountains with elevations of 2,000 to more than 10,000 feet tapering to near sea level at the Columbia River on the northern boundary. The area below the 1,000-foot elevation comprises nearly one-half of the total area. The climate, influenced by the maritime air mass which moderates extremes in temperature, is characterized by dry, moderately warm summers and wet, mild winters. Over three-fourths of the precipitation occurs from October through March; snowmelt, however, moderates the fluctuation in streamflows. The dominant natural resources are the agricultural lands, timber stands, and abundant water supply.

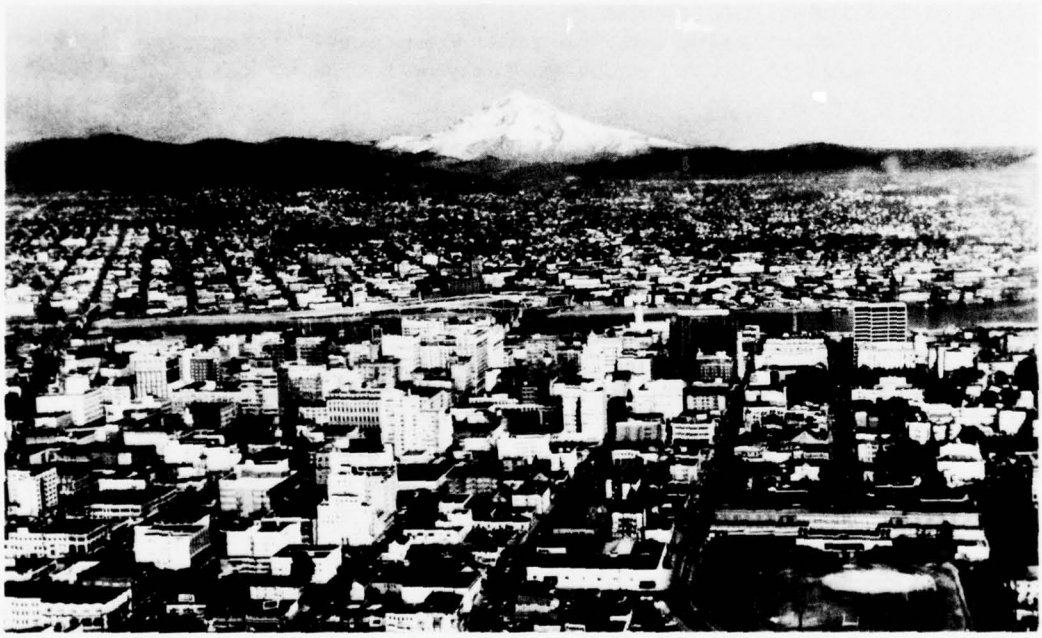


Photo I-1. Looking east across the City of Portland, elevation near sea level, toward Oregon's highest peak, Mt. Hood, elevation 11,245 feet. (Oregon State Highway Photo)

ECONOMIC SETTING

Since the basin's early settlement in the 1830's, the population has increased to 1.3 million persons--68 percent of Oregon's population in 1965. The long-term average annual population increase in the Economic Study Area has well exceeded that of the Pacific Northwest and nation. Most of the industrial activity and settlement is along a strip down the center of the basin. Of the one million who live in urbanized areas, over 900,000 reside within 10 miles of Willamette River. The three major centers of population, all classified as Standard Metropolitan Statistical Areas, are Portland, Salem, and Eugene. Although the industrial base is becoming diversified, industries related to forest products remain paramount.

The comparative geographic isolation of the basin from the large population centers and markets of the nation has not been a restrictive factor to development. Portland, at the north end of the basin, is open to deep-draft navigation. Approximately 1,650 ships, handling about 10 million tons annually, call from national and world ports. Commodity shipment by barge on Columbia River as far east as Pasco, Washington, rafted log shipments on Willamette and Columbia Rivers, and internal commodity movements on the Willamette, add an additional nine million tons. Major railroads, all tying in with the national railroad network, serve many of the principal cities and towns in the basin. A highway system, with high-speed, limited-access freeways, and airline service complete the excellent passenger and commodity transportation system.

DELINEATION OF ECONOMIC STUDY AREA BOUNDARIES

For purposes of analysis and projections, several levels of geographic breakdown are necessary--region, state, basin, subareas, and subbasins. The region, the Pacific Northwest, includes the States of Oregon, Washington, and Idaho, and the 11 counties of Montana west of the Continental Divide.

Economic Study Area boundaries must of necessity coincide with the geographic areas for which requisite economic and demographic data are available, *i.e.*, the counties. County boundaries closely match the periphery of the basin, as shown on Map I-1. The only significant departure from a "close fit" between county boundaries and drainage area boundaries occurs in Lane County. However, only six percent of the population of Lane County is in the western part of the county lying outside Willamette Basin. Adjustments are made for Lane County where there is a significant effect from including the western part as, for example, in land area and land use. The nine counties that comprise the major portion of the basin are Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington, and Yamhill. These are defined as the Economic Study Area.

In this appendix, the term "Willamette Basin" normally refers to the Economic Study Area. In those tables where the data refer to the hydrologic basin, appropriate footnotes are shown.

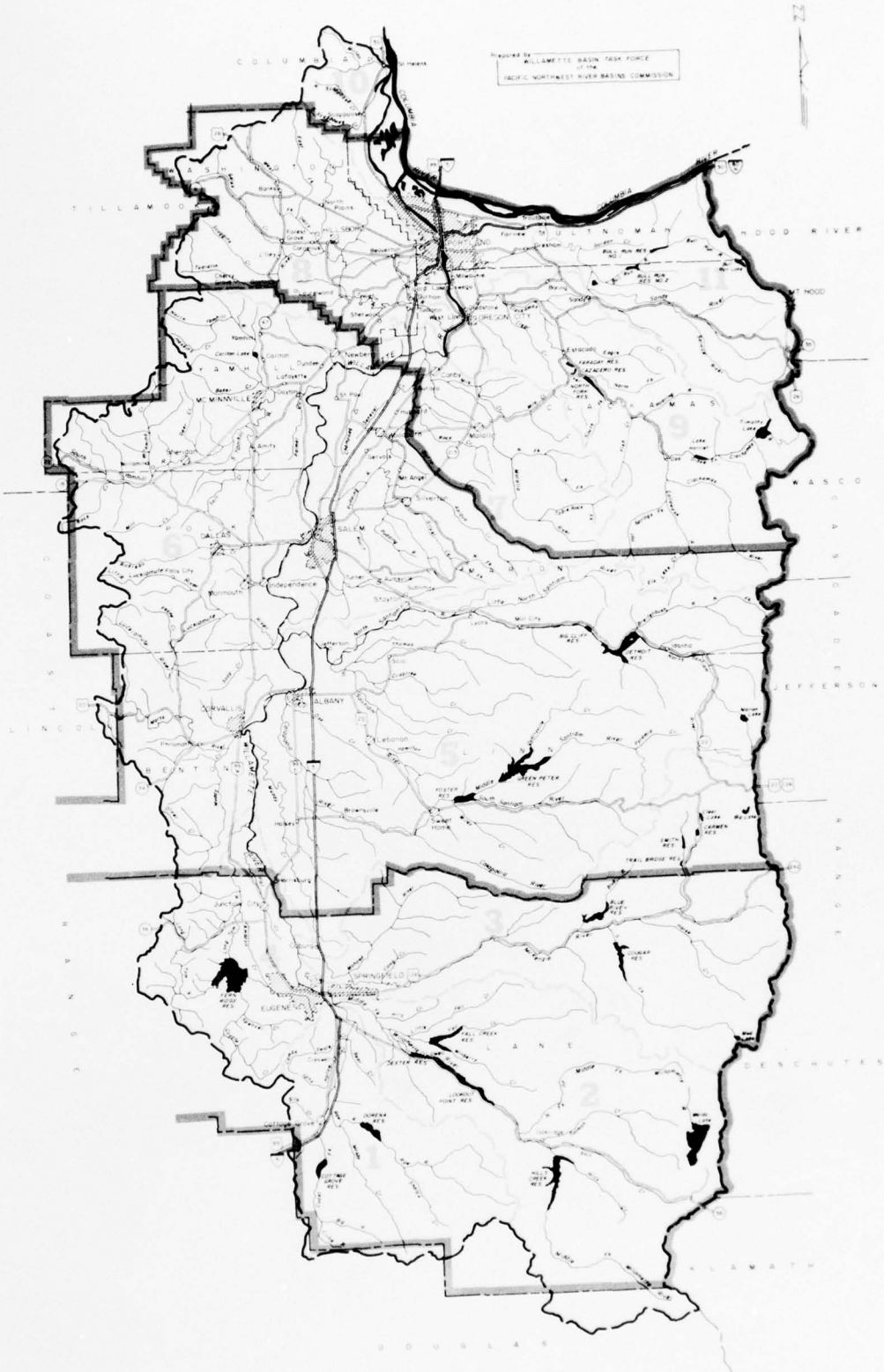
The Study Area is further subdivided into three subareas: the Upper - Lane County; the Middle - Benton, Linn, Marion, Polk, and Yamhill Counties; and the Lower - Clackamas, Multnomah, and Washington Counties.

Table I-1
Comparative economic data, Willamette Basin 1/

	Year	Lower Subarea	Middle Subarea	Upper Subarea	Total Study Area
Population	1964	779,676	319,452	190,072	1,289,200
Population Growth Rate (annual)	1950-64	1.7%	1.8%	2.9%	1.9%
Population Density Persons/Sq. Mile	1964	258	57	42	98
Area in Sq. Miles		3,027	5,577	4,560	13,164
Manufacturing Employment Share	1964	18.2%	19.4%	27.0%	19.7%
Value Added by Manufacture 2/ (Million dollars)	1958	$496.7	$162.6	$121.1	$780.4
	1963	$638.0	$218.7	$183.6	$1,040.4
Per Capita Income	1960-61	$2,644	$1,828	$1,967	$2,351

1/ *These data are for the Economic Study Area, which does not coincide with the Hydrologic Study Area.*

2/ *Value Added by Manufacture is a measure of output derived by subtracting the cost of inputs from the value of shipments and adjusting for the net change in finished goods and work-in-process inventory, and is measured in constant 1963 dollars.*


Prepared by
WILLAMETTE BASIN TASK FORCE
of the
PACIFIC NORTHWEST RIVER BASINS COMMISSION
N
COLUMBIA
TILLAMOOK
WASHINGTON
MULTNOMAH
HOOD RIVER
CLACKAMAS
CLARK
YAMHILL
MCMINNVILLE
PORTLAND
OREGON CITY
WASCO
SHERMAN
GILLIAM
MORROW
UMATILLA
SALEM
POLK
MARION
LINN
ALBANY
CORVALLIS
LEBANON
JEFFERSON
CROOK
BENTON
LINCOLN
SPRINGFIELD
EUGENE
LANE
DESCHUTES
KLAMATH
DOUGLAS
COOS
CURRY
Study Area
SALEM
B
EUGENE
A
SUBAREAS
A Upper
B Middle
C Lower
MAP I-1
WILLAMETTE BASIN STUDY
OREGON
ECONOMIC SUBAREA BOUNDARIES
1967

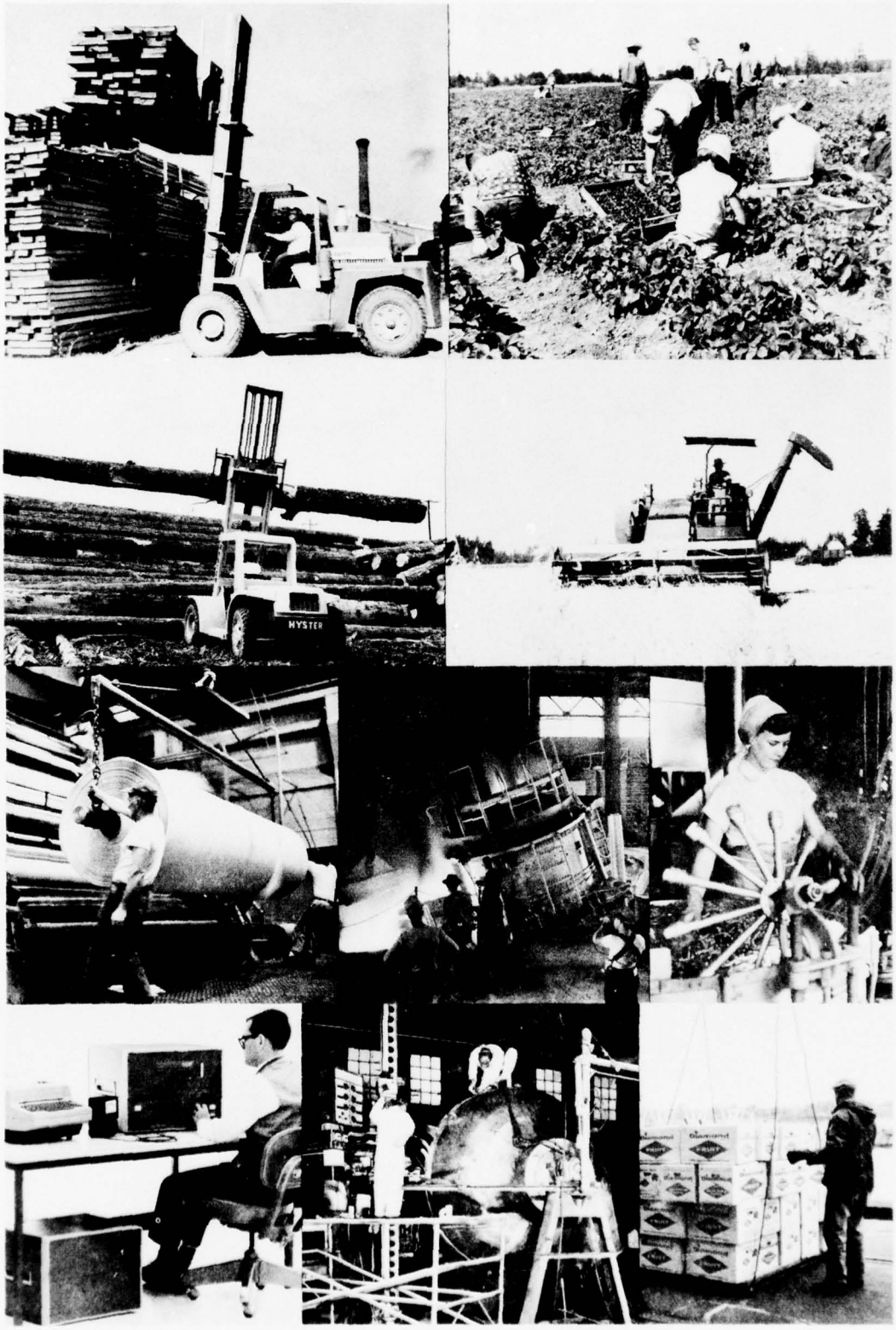


Photo II-3. Economic activity takes many forms in the basin.

PRESENT STATUS

PRESENT STATUS

POPULATION

NATIONAL

Although the rate of national population growth in earlier years was greater, the absolute increases in the 1940's and 1950's have not been exceeded. Between 1940 and 1964, the population of the United States increased by 60 million - from approximately 130 million to 190 million. The greatest increase occurred during the second half of the 1950's when population growth averaged 3 million annually. Since 1960, however, this level of expansion has diminished, being slightly less than 2.5 million during 1964-1965. In spite of this curtailed growth, the increase between 1964-1965 was 43 percent greater than the average annual increase during any decade prior to 1940.

Population growth varies geographically. The total increase east of the Mississippi continues to exceed that of the faster-growing West. Of the 60 million increase between 1940 and 1964, approximately 35 million were in the East. The most populous sections generally showed the greatest population increase (see Figure II-1). The growth rate, however, of the area west of the Mississippi River is greater. The

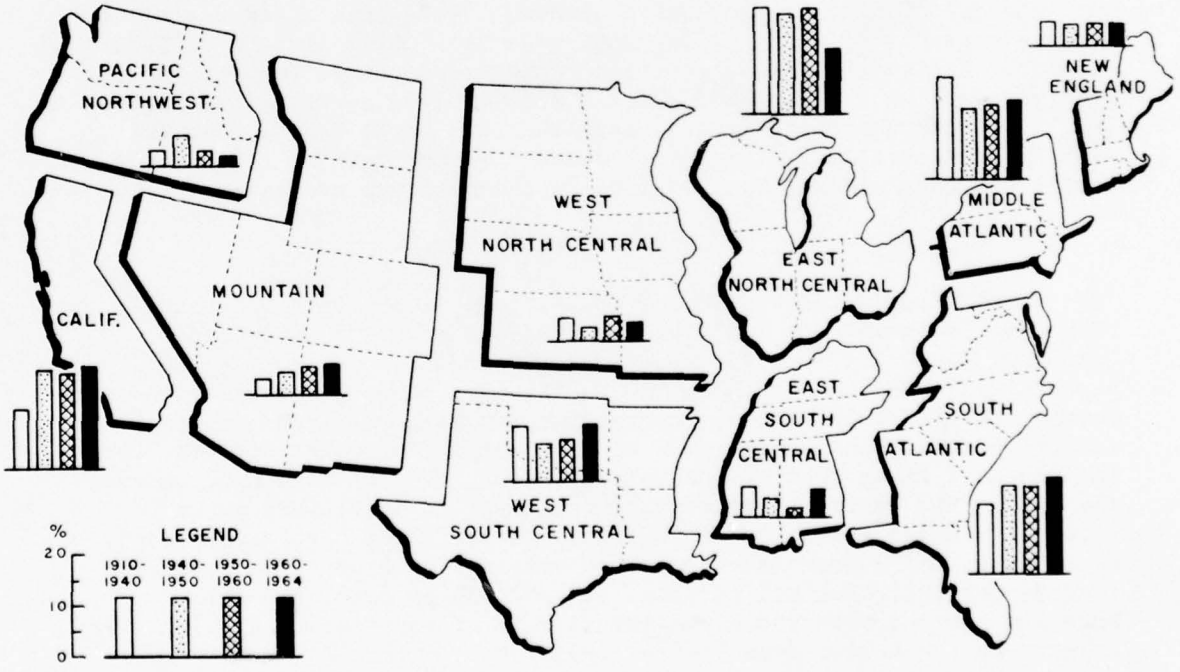


Figure II-1. - Distribution of National Population Increase, Divisions of the United States, 1910-64 (Measured as percent of U. S. increase for each period).

proportion of the national population in the West has increased steadily from 33.3 percent during the 1910-1940 period to 42.5 percent during 1960-1964.

Among the 10 geographic divisions of the nation, only three--California, the Mountain States, and the South Atlantic States--exceeded the national rate of expansion for all four study periods (see Figure II-2). California led all divisions, with an annual rate twice the national average during each period. The Mountain States were second to California, except during the 1940's.

The divisions are those established by the U. S. Bureau of Census with the exception of California and the Mountain States. To permit comparison between the Pacific Northwest and other divisions, the States of Oregon and Washington were withdrawn from the Pacific Division, and Idaho and Western Montana from the Mountain Division.

REGIONAL

Population growth in the Pacific Northwest fluctuated greatly from 1910 to 1964, during which time it increased from approximately 2.3 million to over 5.7 million. Between 1910 and 1940, the average annual rate of population increase was 1.46 percent, compared with the national rate of 1.21 percent; it was exceeded only by California and the Mountain States. Between 1940 and 1950, the rate of increase jumped to more than twice that of the nation; only California's rate was greater. During the following decade, the Pacific Northwest's average annual rate was 1.62 percent, below the national rate of 1.71 percent. During 1960-1964, its rate of growth declined further to 1.05 percent, well below the national rate of 1.54 percent (see Figure II-2). During these four years, only the East North Central and the West North Central divisions experienced a slower rate of growth; the latter has consistently been well below the national average.

WILLAMETTE BASIN

Population in the Willamette Basin Study Area increased steadily from 416,356 in 1910 to 1,338,900 in 1965--more than a threefold increase. From 1910 to 1940, the average annual growth rate (1.70 percent) exceeded that of both the Pacific Northwest and the nation. During the 1940-1950 period, the average annual growth rate increased to 3.68 percent, well above that of the Pacific Northwest and over two and one-half times that of the United States. In the following decade, the basin, the Pacific Northwest, and the United States had growth rates of similar magnitude--1.65, 1.62, and 1.71 percent, respectively. Since 1960, the average annual growth rate in the Study Area increased to 2.34 percent. For all periods, except 1950 to 1960, the Study Area has shown growth rates similar to some of the fastest growing regions of the nation (see Figure II-3).

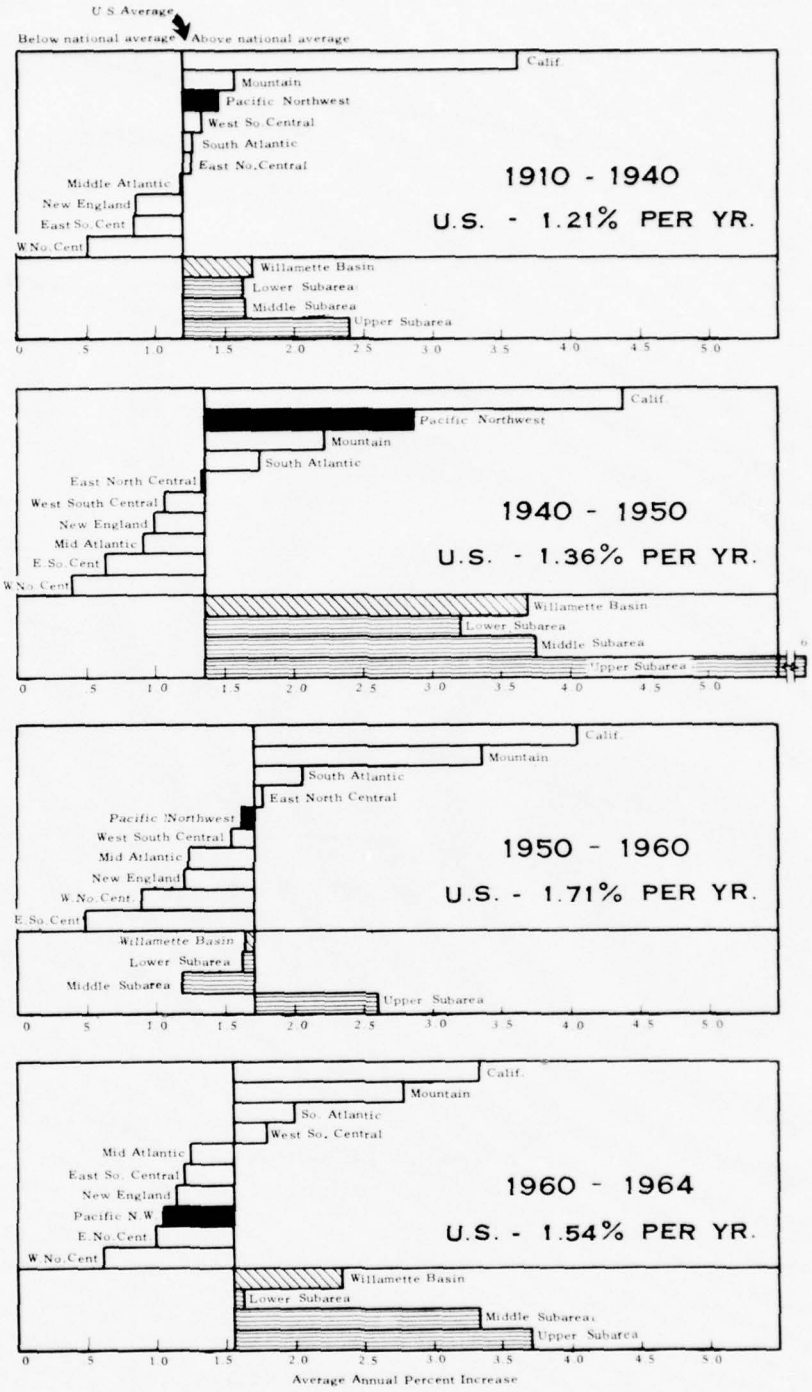


Figure II-2. - Comparative Population Growth Rates, Divisions of the United States and Willamette Basin, 1910-64 (by average annual increase).

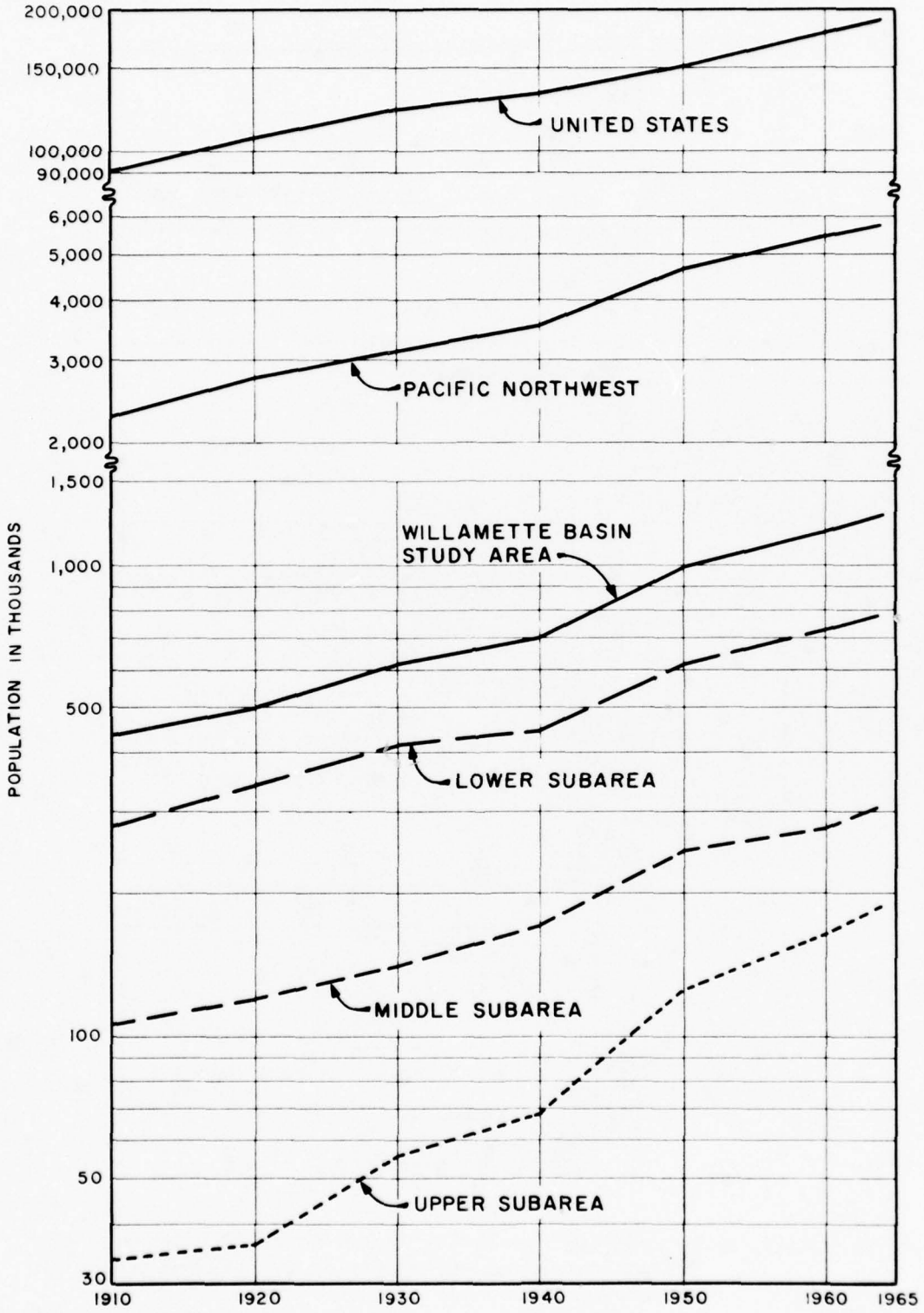


Figure II-3. - Comparative Population Trends, United States, Pacific Northwest, and Willamette Basin, 1910-1964.

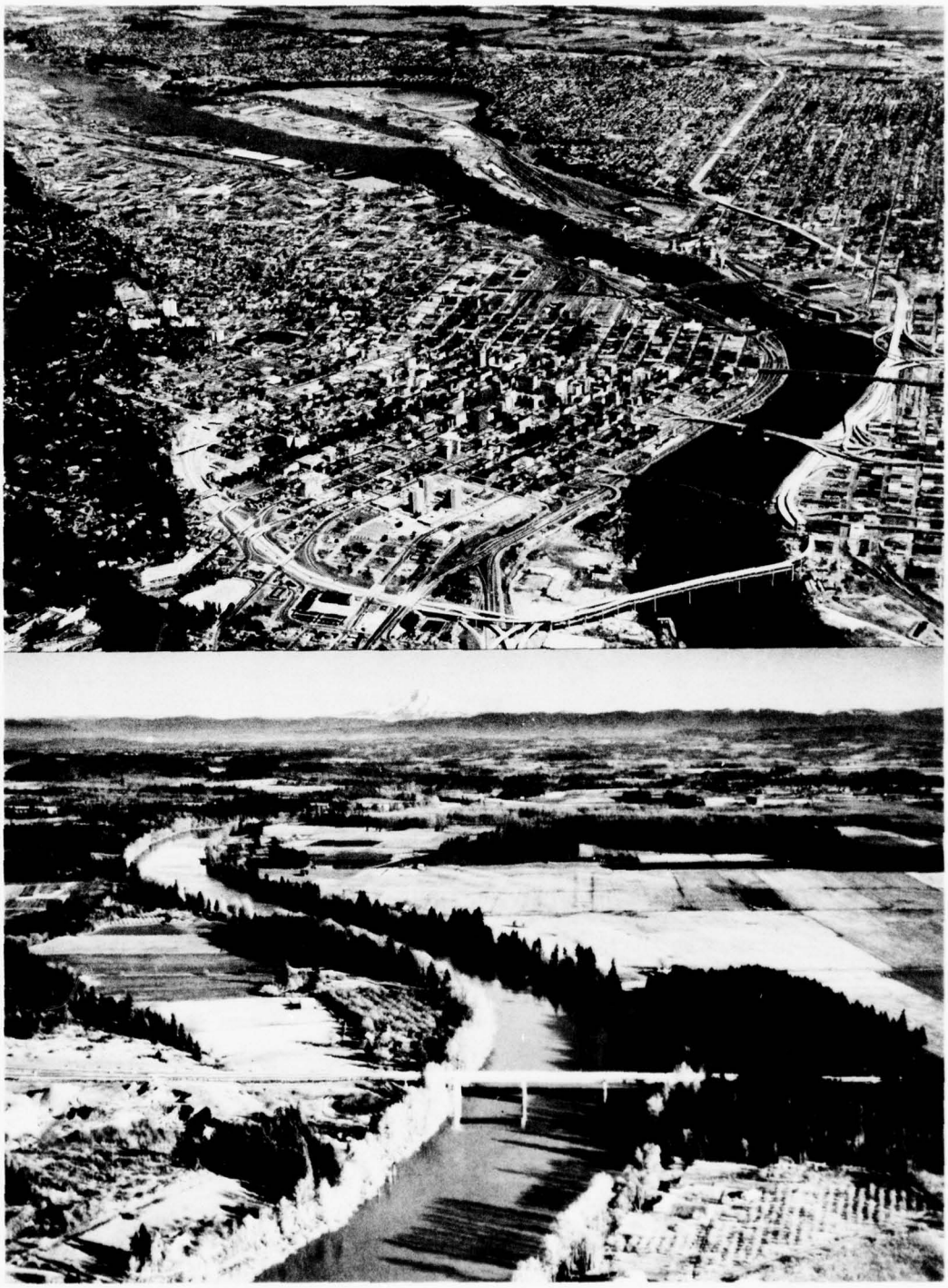


Photo II-1. Contrast: Portland's central area and the rural hinterland 25 miles up Willamette River. (Oregon State Highway Department Photo)

WILLAMETTE SUBAREAS

Each of the subareas in the basin has followed the general population trend of the Willamette Economic Study Area (see Table II-1). Except for the 1950's, all subareas have exceeded the growth rate of both the Pacific Northwest and the nation.

The three counties forming the Lower Subarea are in the Portland Standard Metropolitan Statistical Area (SMSA), and contain the greatest population concentration in Oregon as well as in the Study Area. In 1964, the population of the Lower Subarea was 779,676, about 85 percent urban. The Lower Subarea's annual rate of increase has been constant (about 1.6 percent), except for the 1940-1950 decade when it soared to 3.21 percent. Of the 19 SMSA's in the nation of comparable size, only two exceeded the growth rate of the Portland SMSA during the 1940-1950 period.

The Middle Subarea had a population of 319,452 in 1964, about one-half urban. Its center of population is Salem which was designated as an SMSA in 1964. The Middle Subarea's rate of growth was slow between 1950 and 1960, but during the previous decade and then again from 1960 to 1964, the increase was over twice the national rate.

The Upper Subarea's population increased from 69,096 in 1940 to 190,072 in 1964, or about 175 percent. Between 1910 and 1964, the Upper Subarea (Lane County) substantially exceeded the regional and national population growth rates. Between 1940 and 1950, and again from 1960 to 1964, its rate of increase was greater than that of California, the fastest growing area in the nation (see Figure II-2). Lane County is among the fastest growing counties in the nation. Over half the population lives in the urbanized Eugene-Springfield area.

Populations in 1950 and 1960 were estimated for the 11 subbasins within the Economic Study Area, as shown in Table II-2. There is a wide variation in population size and rates of change among the subbasins. The subbasins with a larger proportion of their area at higher elevations and in non-private land ownership had the least population growth; e.g., Coast Fork Subbasin increased less than one percent. In contrast, Tualatin Subbasin increased over 55 percent during this period.

Table II-1
Population of Willamette Basin, and Subareas, Pacific Northwest, and United States 1/
1910 - 1964

	1910	1940	1950	1960	1964
Willamette Economic Study Area	416,356	691,204	992,387	1,168,899	1,289,200
Lower Subarea	277,714	451,423	619,522	728,088	779,676
Clackamas	29,931	57,130	86,716	113,038	126,044
Multnomah	226,261	355,009	471,537	522,813	541,386
Washington	21,522	39,194	61,269	92,237	112,246
Middle Subarea	104,859	170,685	247,089	277,921	319,452
Benton	10,663	18,629	31,570	39,165	45,666
Linn	22,662	30,485	54,317	58,867	64,029
Marion	39,780	75,246	101,401	120,888	139,301
Polk	13,469	19,989	26,317	26,523	33,007
Yamhill	18,285	26,336	33,484	32,478	37,449
Upper Subarea (Lane County only)	33,783	69,096	125,776	162,890	190,072
Pacific Northwest (000)	2,280	3,524	4,675	5,490	5,739
United States (000)	91,972	131,669	150,697	178,464	190,413

1/ Resident population of conterminous United States. Alaska, Hawaii, and armed forces overseas are excluded. 1910 data is of April 15; 1940, 1950, 1960, April 1; and 1964, July 1.

Source: 1964 population for counties; State of Oregon, Center for Population Research and Census; decennial censuses and estimates for states of Pacific Northwest and United States: U. S. Bureau of Census.

Table II-2
Estimated population and percentage change
Willamette Basin, by Subbasins,
1950 and 1960

	1950	1960	Percentage Change 1950-60
Upper Subarea	118,800	156,250	31.5
1. Coast Fork	16,850	17,000	.9
2. Middle Fork	8,700	9,400	8.0
3. McKenzie	18,900	21,500	13.8
4. Long Tom	74,350	108,350	45.7
Middle Subarea	257,000	289,950	12.8
5. Santiam	61,350	65,200	6.3
6. Coast Range	88,950	96,950	9.0
7. Pudding	106,700	127,800	19.8
Lower Subarea	613,600	721,650	17.6
8. Tualatin	73,500	114,000	55.1
9. Clackamas	27,900	35,700	28.0
10. Columbia	503,400	562,250	11.2
11. Sandy	8,800	9,700	10.2
Willamette Basin	989,400	1,167,850	18.0

Source: *U. S. Bureau of Census, Number of Inhabitants, Oregon, 1950 & 1960. Computations were based on data tabulated by census divisions, census tracts, and enumeration districts. Where these recording units had to be apportioned between two or more subbasins, Oregon State Highway Department maps showing location of residences were used.*

Note: *The differences between the figures in Table II-2 and comparable figures in Table II-1 are due to differences in the hydrologic and economic study area boundaries. For explanation, see the section Delineation of Economic Study Area Boundaries, beginning on page I-9.*

MIGRATION

In-migration is a significant factor in the growth of Willamette Basin. From 1940 to 1964, population increased from 691,204 to 1,289,200. Of this increase, 318,196 or 53 percent resulted from in-migration (see Table II-3). The influx was greatest during the 1940's when net in-migration added nearly 215,000 to the population. The net inflow declined markedly during the succeeding decade, but has increased again in recent years. The increased population resulting from net in-migration was approximately 36,600 for the period 1950-1960 and 67,300 between 1960 and 1964.

Table II-3

Population growth due to net in-migration and natural increase Willamette Basin and Subareas, 1940-64 1/

	Lower Subarea	Middle Subarea	Upper Subarea	Will. Basin Study Area
1940 Population	451,423	170,685	69,096	691,204
1940-50 Natural Increase	50,996	23,264	12,645	86,905
1940-50 Net In-migration	117,103	53,140	44,035	214,278
1950 Population	619,522	247,089	125,776	992,387
1950-60 Natural Increase	77,585	36,305	26,050	139,940
1950-60 Net In-migration	30,981	-5,473	11,064	36,572
1960 Population	728,088	277,921	162,890	1,168,899
1960-64 Natural Increase	28,493	13,160	11,302	52,955
1960-64 Net In-migration	23,095	28,371	15,880	67,346
1964 Population	779,676	319,452	190,072	1,289,200
1940-64 Natural Increase	157,074	72,729	49,997	279,800
1940-64 Net In-migration	171,179	76,038	70,979	318,196

1/ The 1960-64 period is from 1 April 1960 to 1 July 1964.

Source: 1940-60 computed from data supplied by Oregon State Board of Health. Data for 1960-64 furnished by State of Oregon, Center of Population Research and Census.

Since 1940, the components of population increase--in-migration and natural increase--have had different relative impacts on the growth of Willamette Basin. During the 1940-50 decade, population expansion attributable to in-migration was more than double the natural increase for each of the subareas (see Table II-4). Migration flows diminished drastically in the 1950-1960 period, when the increase due to in-migration was less than half that of natural increase in the Lower and Upper Subareas, and when net out-migration occurred in the Middle Subarea (see Figure II-4). However, again during the 1960-1964 period, net in-migration accounted for the major part of the estimated population increase in both the Middle and Upper Subareas, while the Lower Subarea was fairly evenly divided.

Table II-4

Percent change in population due to net in-migration and natural increase Willamette Basin and Subareas 1940-50, 1950-60, 1960-64, 1940-64

	1940-50	1950-60	1960-64	1940-64
Lower Subarea				
Population	37.2	17.5	7.1	72.7
Natural Increase	11.3	12.5	3.9	34.8
Net In-migration	25.9	5.0	3.2	37.9
Middle Subarea				
Population	44.8	12.5	14.9	87.2
Natural Increase	13.6	14.7	4.7	42.6
Net In-migration	31.2	-2.2	10.2	44.6
Upper Subarea				
Population	82.0	29.5	16.7	175.1
Natural Increase	18.3	20.7	6.9	72.4
Net In-migration	63.7	8.8	9.8	102.7
Total Study Area				
Population	43.6	17.8	10.3	86.5
Natural Increase	12.6	14.1	4.5	40.5
Net In-migration	31.0	3.7	5.8	46.0

Source: Same as Table II-3.

Photo II-2. Expanding suburban area in northeast Portland. (Oregon State Highway Department Photo)

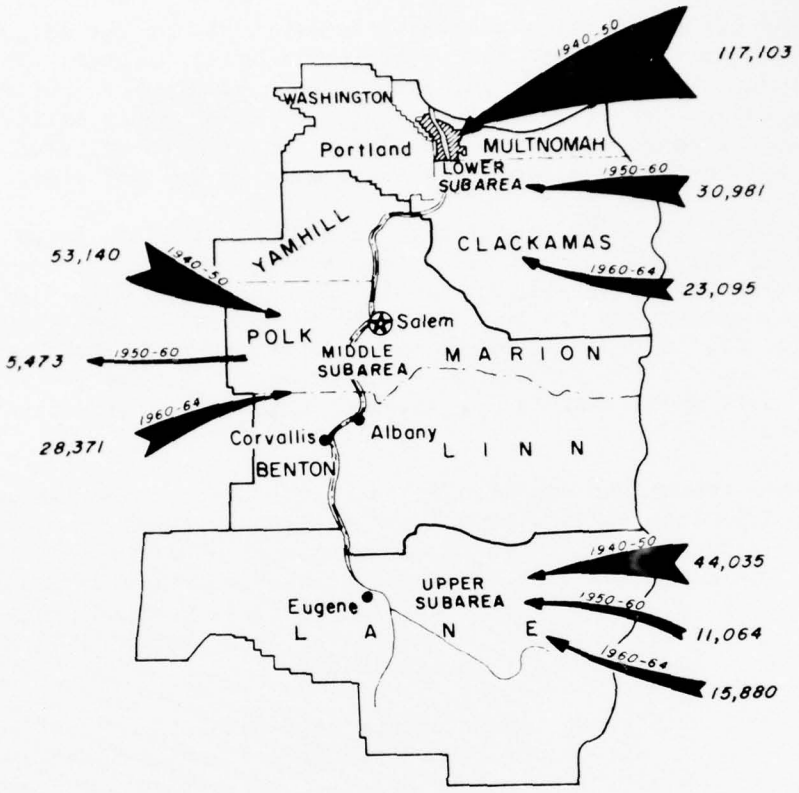


Figure II-4. - Net Migration of Population, Willamette Basin and Subareas, 1940-64.

For the entire 1940-1964 period, population growth resulting from migration exceeded that due to natural increase for each of the subareas. Since the rate of natural increase in the basin has been about the same as for the region and the nation, net migration trends indicate that economic expansion, with concomitant increase in job opportunities, has been favorable in the basin.

AGE-SEX COMPOSITION

Age and sex composition are major determinants of the natural increase in population and of labor-force participation rates. The most meaningful age categories for purposes of this study are: children - 0-14 years of age; young adults - 15-24; parents of young children - 25-44; middle aged residents who typically do not have children at home - 45-64; and retired residents - 65 years of age and over.

The proportion of the population in 1965 in each age group was comparatively uniform between Willamette Basin, the Pacific Northwest, and the nation (see Figure II-5). The age group 0-14 years is the largest, accounting for approximately 30 percent of the total population. The smallest is the 65-years-and-over category, which comprises about 10 percent of the population. The other age groups 15-24, 25-44, and 45-64, have approximately 15, 25, and 20 percent, respectively (see Table II-5).

Trends between 1960 and 1965 in the proportion of population in each age group were similar for all six geographic areas shown in Figure II-5. The proportion in three age groups--0-14, 45-64, and 65-and-over--remained relatively unchanged. The proportion of population in the 15-24 age group increased, and in the 25-44 group decreased. These shifts were the result of a high birth rate between 1945 and 1950 and a low birth rate between 1935 and 1940.

In the 0-14 age group, males outnumber females in each of the six geographic areas. This is not true of other age groups because of differences in sex mortality rates, and in age-sex migration rates. The proportion of males vs. females for the three major areas--Willamette Basin, the Pacific Northwest, and the U. S.--is about the same for the three age groups between 15 and 64. In the oldest age category, there are significantly more females.

The age-sex population distribution varies more among the subareas than among the larger areas. The major differences among the subareas occur in the 15-24 and 65-and-over age groups. One of the factors causing variation in the 15-24 age group is the result of relative differences in college and institutional population. In the other age groups, 25-44 and 45-64, there is little variation. Unique cultural, environmental, and economic factors are more influential in areas with smaller populations.

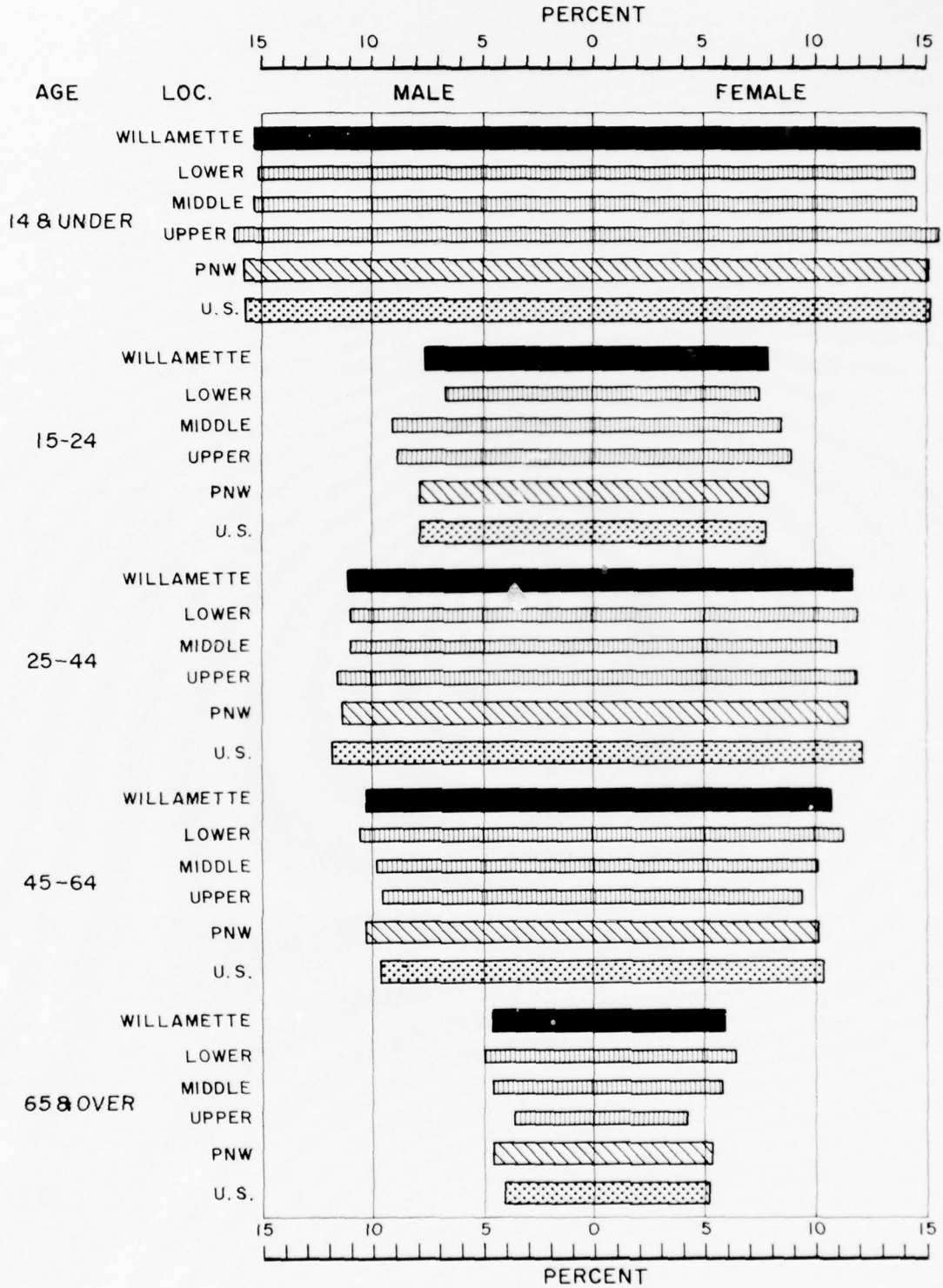


Figure II-5. - Comparative Distribution of Population by Age and Sex, Willamette Basin, Pacific Northwest, and United States, 1965.

Table II-5
Population distribution by age and sex, Willamette Basin Study Area and Subareas, 1960 and 1964

Willamette Basin

Age Group	1960 Total	1960 Male	1960 Female	1964 Total	1964 Male	1964 Female
0-14	353,218	179,656	173,562	387,360	198,260	189,100
15-24	152,051	73,259	78,792	195,020	95,207	99,813
25-44	290,369	141,187	149,182	298,449	145,972	152,477
45-64	247,070	122,105	124,965	270,140	132,653	137,487
65 & over	126,191	58,015	68,176	138,231	61,961	76,270
Total	1,168,899	574,222	594,677	1,289,200	634,053	655,147

Lower Subarea

0-14	215,592	109,542	106,050	230,810	117,980	112,830
15-24	85,554	39,781	45,773	107,311	50,293	57,018
25-44	182,319	87,653	94,666	181,690	87,730	93,960
45-64	160,932	78,786	82,146	170,748	82,813	87,935
65 & over	83,691	37,960	45,731	89,117	39,327	49,790
Total	728,088	353,722	374,366	779,676	378,143	401,533

Middle Subarea

0-14	84,880	43,238	41,642	96,008	49,330	46,678
15-24	41,723	21,434	20,289	54,637	28,440	26,197
25-44	66,013	32,714	33,299	71,236	35,672	35,564
45-64	55,542	27,627	27,915	63,567	31,655	31,912
65 & over	29,763	13,961	15,802	34,004	15,587	18,417
Total	277,921	138,974	138,947	319,452	160,684	158,768

Upper Subarea

0-14	52,746	26,876	25,870	60,542	30,950	29,592
15-24	24,774	12,044	12,730	33,072	16,474	16,598
25-44	42,037	20,820	21,217	45,523	22,570	22,953
45-64	30,596	15,692	14,904	35,825	18,185	17,640
65 & over	12,737	6,094	6,643	15,110	7,047	8,063
Total	163,890	81,526	81,364	190,072	95,226	94,846

PERSONAL INCOME

Economic development centers on the level of economic activity and its composition and trends. Economic activity can be measured in terms of employment--employment characteristics and change--or in terms of the accomplishments of the employed. Accomplishments, in turn, can be measured by output of goods and services or by income paid to contributors of this output. Since there are regional and industrial differences in the "economic contribution" of each participant, income is regarded as a better measure of economic activity than employment. Personal income is probably the most comprehensive measure for regional analysis, because it is a gauge of both economic activity and purchasing power.

Differences in per capita income result from differences in industrial composition, relative efficiencies of production within a given industry, non-income incentives, labor-force participation rates, and monetary price of goods. Differences in wage levels tend to be self leveling, particularly in labor-oriented industries such as apparel. But this is not so true for industries where costs of transportation or access to raw materials are major considerations.

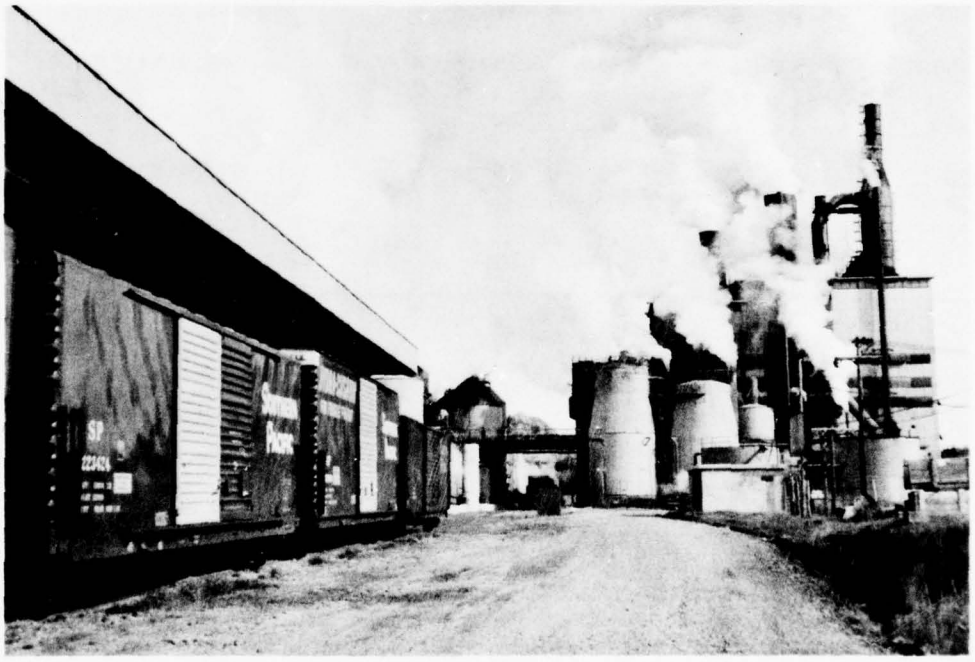


Photo II-3 Many pulp and paper industries in the Willamette Basin are dependent upon rail transportation both to bring the raw material to their mills and moving their paper products to users all over the nation. (Southern Pacific Photo)

NATIONAL TRENDS

Trends in total personal income reflect changes in the number of people, amount of goods and services produced, and value of the monetary unit. Between 1940 and 1964, a period of no major depression, total personal income of the nation increased at an average annual rate of 4.4 percent, adjusted for a dollar of constant value. At this rate, total real income doubles every 16 years. During the same period, per-capita personal income of the nation increased from $1,316 to $2,568, in terms of a constant value dollar. At this rate, real per capita income doubles every 25 years (see Table II-6).

Table II-6
National trends in personal income
1940 - 1964

	Total Personal Income				Per Capita Personal Income	
	Current Dollars (billions)	Percent 1/ Increase	1964 2/ Dollars (billions)	Percent 1/ Increase	1964 2/ Dollars	Percent 1/ Increase
1940	78.7		174.3		1,316	
		11.2		5.3		3.8
1950	228.5		292.5		1,926	
		6.0		3.7		2.0
1960	401.3		420.8		2,338	
		5.2		4.0		2.3
1964	491.4		491.4		2,568	
1940-1964		7.9		4.4		2.8

1/ *Annual average percent increase*
2/ *Deflator: consumer price index*

Source: Council of Economic Advisors, Economic Report of the President, 1965, p 205 & 244

REGIONAL TRENDS

Increases in personal income have progressed unevenly among the 10 geographic divisions of the nation. During the 1940's and 1950's, the most rapidly expanding division increased at nearly twice the rate of the slowest-growing division. Between 1960 and 1964, this disparity decreased somewhat (see Table II-7). There was a close correlation between population rates of growth and personal income between 1950 and 1964. The correlation was weaker during the 1940-1950 decade.

Table II-7
Comparative trends in total personal income
Divisions of the United States, 1940-1964
(Measured in Percent Change in Current Dollars)

1940-1950		1950-1960		1960-1964	
Division	Percent Increase	Division	Percent Increase	Division	Percent Increase
W. S. Central	247	California	120	California	30.0
Pac. Northwest	245	Mountain	110	So. Atlantic	29.5
California	236	So. Atlantic	87	Mountain	26.5
Mountain	235	United States	(76)	E. So. Central	26.4
E. So. Central	226	W. So. Central	75	W. So. Central	23.4
So. Atlantic	211	New England	71	United States	(23.0)
W. No. Central	205	E. No. Central	70	New England	22.5
United States	(187)	E. So. Central	69	Mid Atlantic	20.3
E. No. Central	185	Mid Atlantic	66	Pac. Northwest	20.1
Mid Atlantic	147	Pac. Northwest	62	E. No. Central	19.9
New England	137	W. No. Central	62	W. No. Central	17.8

Per capita income among the divisions is also markedly unequal, but the disparity is lessening. Between the two extreme divisions (see Figure II-6), the ratio was 3:1 in 1930 and in 1940, 2:1 by 1950, and even less between 1960 and 1964. The tendency for per capita income to shift toward the national norm was less pronounced in some regions from 1950 to 1964. In 1964, the extremes in per capita income were $1,745 in the East South Central states and $3,103 in California, while the national average was $2,568. The tendency for per capita income in the various geographic divisions to shift toward the national norm will likely continue.

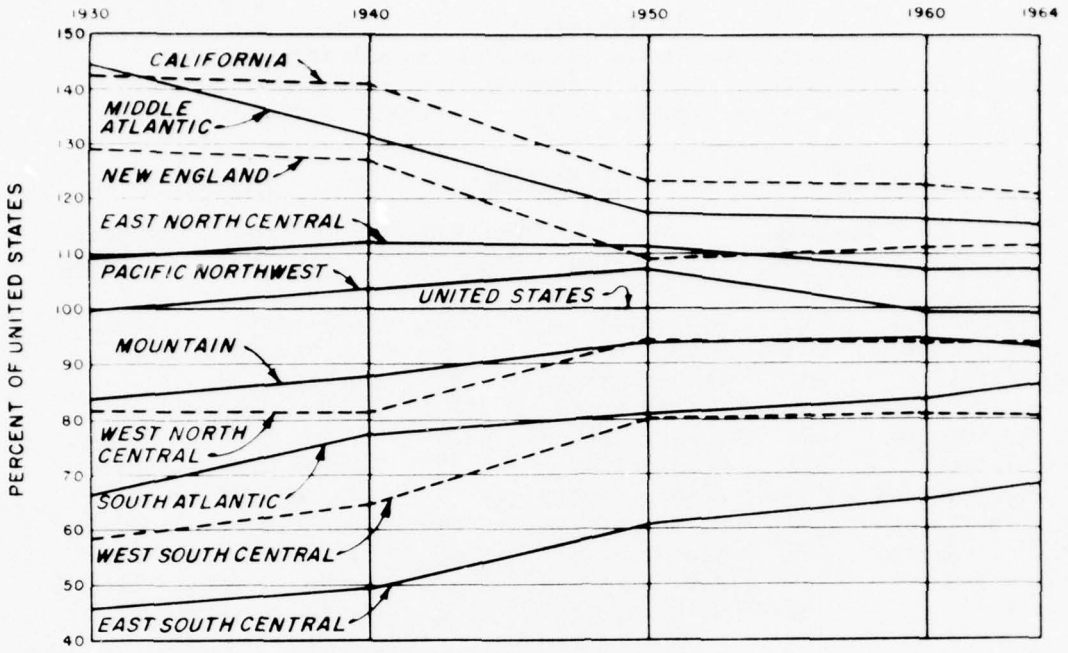


Figure II-6. - Relative Differences among Geographic Divisions in Per Capita Personal Income, 1930-1964.

From 1940 to 1950, total personal income in the Pacific Northwest increased by 245 percent, the second-highest rate in the nation. In recent years, its growth rate dropped to among the lowest, as the result of lower-than-average growth in employment and a relative decline in per capita income. In 1950, per capita income in the Pacific Northwest was 7.5 percent above the national average, but in 1960 and 1964 it was nearly one percent below.

TRENDS IN OREGON

Oregon's 1964 per capita income of $2,606 was slightly above the national average of $2,568. Pay rates in Oregon are below the national average, probably because of a lower proportion of higher-salaried employees. Total wage and salary payments per employee in 1964 averaged $4,380 in Oregon, and $5,050 in the nation--a meaningful difference. In manufacturing, construction, and trade, Oregon's pay per employee is about the same as the nation's, but in finance, transportation, utilities, and government, it is below the national scale (Table II-8).

In income other than wages and salaries, Oregon compares well with the nation. Farm and property incomes are both only slightly less than the national average. The State receives significant transfer payments and non-farm proprietor income. In the latter, Oregon receives $190 million more than its population share. This more than makes up the deficiency in farm proprietor and property income.

Table II-8

Personal income and income per employee
Oregon and United States, 1964

	Oregon		United States	
	Personal Income 1/	Income per Employee	Personal Income 1/	Income per Employee
Wages and Salaries	$3,195	$4,380	$332,151	$5,050
Farms	61		2,766	
Mining	9		3,951	6,300
Contract Construction	210	6,250	19,467	6,280
Manufacturing	907	6,030	104,494	6,010
Wholesale and Retail Trade	654	5,200	59,788	4,920
Finance, Insurance, Real Estate	132	5,100	16,069	5,470
Transportation and Utilities	302	6,170	25,078	6,500
Services	310	3,920	37,480	4,380
Federal Government, Civilian	152	6,600	16,599	7,150
Federal Government, Military	38		9,681	
State and Local	414	4,700	35,063	7,350
Other	7		715	
Other Labor Income	124		14,100	
Farm Proprietors	103		12,079	
Nonfarm Proprietors	570		38,953	
Property	643		68,239	
Transfer Payments	388		38,125	
Total	$4,876		$491,004	

1/ *Total - millions of dollars*

WILLAMETTE BASIN TRENDS

Trends in personal income in the Economic Study Area can be compared to the Pacific Northwest and the nation for the years 1950 to 1961. Total personal income in the Study Area increased 61.8 percent as compared to 57.3 percent for the region and 70.1 percent for the nation (Table II-9). Only the Upper Subarea, with an increase of 70.9 percent exceeded the national growth rate. Tables II-10 and -11 illustrate major income differences.

Table II-9
Comparative trends in total personal income
Willamette Basin, Pacific Northwest, and United States
1950-51 to 1960-61 1/
(Measured in current dollars)

	Percent Increase 1950-51 to 1960-61
United States	70.1
Pacific Northwest	57.3
Willamette Economic Study Area	61.8
Lower Subarea	65.2
Middle Subarea	45.9
Upper Subarea	70.9

1/ A two-year average was taken for the terminal periods in order to reduce the influence of marked fluctuations in income components associated with small areas.

Source: U. S. Office of Business Economics and U. S. Bonneville Power Administration

Total personal income in the Study Area averaged approximately $2.8 billion annually in 1960-61 (Table II-11). Major income sources over $100 million are briefly described below as they compare to the nation in respect to their growth rates and their relative importance to the economy. These sources are listed in order of growth rate between 1950 and 1961.

Table II-10

Comparative trends in personal income by major sources, Willamette Basin Study Area, Pacific Northwest, United St 1950-51 to 1960-61

	Income* Willamette Basin Study Area		Percent Change 1950-1	1960-1		Percen WB	
	1950-1	1960-1	WB	PNW	U.S.	1950-1	1960-1
Total Personal Income	1725.38	2792.26	61.8	57.3	70.1	100.0	100.0
Farm	92.67	43.86	-52.7	-16.8	-11.6	5.4	1.6
Wage & Salary	23.63	25.51	8.0	7.6	7.1	1.4	0.9
Proprietary	69.07	18.35	-73.4	-24.4	-15.2	4.0	0.7
Mining	3.58	3.30	- 7.8	-12.7	12.3	0.2	0.1
Contract Construction	75.78	119.07	57.1	51.6	78.0	4.4	4.3
Manufacturing	315.95	487.59	54.3	67.4	62.5	18.3	17.5
Wholesale & Retail Trade	250.14	411.38	64.5	64.9	72.9	14.5	14.7
Finance, Insurance & Real Estate	43.75	88.35	101.9	103.1	113.8	2.5	3.2
Banking & Other Finance	16.96	39.10	130.5	130.2	142.3	1.0	1.4
Insurance & Real Estate	26.81	49.26	83.7	88.4	96.3	1.6	1.8
Transportation	99.24	128.33	29.3	26.8	37.9	5.8	4.6
Railroads	48.27	53.99	11.8	58.3	- 3.8	2.8	1.9
Highway Freight, Warehousing & Other Transportation	50.99	74.36	45.8	50.0	84.7	3.0	2.7
Communications & Public Utilities	39.58	65.31	65.0	57.4	87.4	2.3	2.3
Services	101.75	190.70	87.4	81.8	103.0	5.9	6.8
Hotels & Other Lodging Places	5.84	11.16	91.1	55.2	59.2	0.3	0.4
Personal Service & Private Households	29.50	38.09	29.1	29.0	44.0	1.7	1.4
Business & Repair Services	12.88	31.55	145.0	148.8	188.6	0.7	1.1
Amusement & Recreation	8.04	9.36	16.4	25.0	62.7	0.5	0.3
Professional, Social & Related Services	45.52	100.29	120.3	110.8	140.6	2.6	3.6
Government	145.97	326.80	123.9	80.2	102.5	8.5	11.7
Federal, Civilian	51.77	88.51	71.0	44.6	76.9	3.0	3.2
Federal, Military	7.55	14.76	95.5	39.1	56.2	0.4	0.5
State & Local	86.66	223.54	158.0	131.7	142.3	5.0	8.0
Other Industries & Income	27.00	71.19	163.7	161.6	154.6	1.6	2.5
Proprietors - Non-Farm	263.79	346.18	31.2	30.3	45.8	15.3	12.4
Property	189.79	363.47	91.5	84.4	84.9	11.0	13.0
Net Transfer Payments	76.52	146.88	92.0	101.2	108.5	4.4	5.3

* *Income is expressed in millions of current dollars.*

Source: Data for Willamette Basin and Pacific Northwest from Maxwell, Personal Income; for U. S. fro

Totals may not add due to rounding.

Table II-10

in personal income by major sources,
by Area, Pacific Northwest, United States,
1950-51 to 1960-61

nt Change 1 1960-1		Percent of Total Income						Index			
		WB		PNW		U.S.		WB / PNW		WB / U.S.	
PNW	U.S.	1950-1	1960-1	1950-1	1960-1	1950-1	1960-1	1950-1	1960-1	1950-1	1960-1
57.3	70.1	100.0	100.0	100.0	100.0	100.0	100.0				
-16.8	-11.6	5.4	1.6	9.6	5.1	7.3	3.8	56	31	74	41
7.6	7.1	1.4	0.9	2.0	1.4	1.2	0.7	70	64	116	123
-24.4	-15.2	4.0	0.7	7.6	3.7	6.1	3.1	53	19	65	22
-12.7	12.3	0.2	0.1	0.9	0.5	1.4	0.9	22	20	15	13
51.6	78.0	4.4	4.3	4.4	4.3	3.7	3.9	100	100	119	110
67.4	62.5	18.3	17.5	17.0	18.1	22.5	21.5	108	97	81	81
64.9	72.9	14.5	14.7	12.1	12.7	12.0	12.2	120	116	121	121
103.1	113.8	2.5	3.2	2.0	2.6	2.5	3.2	125	123	100	99
130.2	142.3	1.0	1.4	0.8	1.2	1.0	1.4	13	117	102	102
88.4	96.3	1.6	1.8	1.2	1.4	1.6	1.8	133	129	98	97
26.8	37.9	5.8	4.6	5.1	4.0	4.4	3.6	114	115	131	129
58.3	- 3.8	2.8	1.9	2.6	1.8	2.3	1.3	108	106	121	147
50.0	84.7	3.0	2.7	2.5	2.2	2.1	2.3	120	123	143	119
57.4	87.4	2.3	2.3	1.9	1.9	1.8	2.0	121	121	124	115
81.8	103.0	5.9	6.8	5.0	5.8	6.0	7.1	118	117	99	96
55.2	59.2	0.3	0.4	0.4	0.4	0.4	0.4	75	100	83	105
29.0	44.0	1.7	1.4	1.4	1.1	1.9	1.6	121	127	89	83
148.8	188.6	0.7	1.1	0.5	0.9	0.8	1.3	140	12	98	87
25.0	62.7	0.5	0.3	0.4	0.3	0.5	0.5	125	100	87	67
110.8	140.6	2.6	3.6	2.3	3.1	2.3	3.3	113	116	113	109
80.2	102.5	8.5	11.7	12.2	13.9	9.9	11.7	70	84	86	100
44.6	76.9	3.0	3.2	4.2	3.8	3.2	3.3	71	84	95	97
39.1	56.2	0.4	0.5	2.8	2.4	2.2	2.0	143	21	20	26
131.7	142.3	5.0	8.0	5.2	7.7	4.5	6.5	96	104	111	124
161.6	154.6	1.6	2.5	0.3	0.2	1.9	2.9	53	125	80	88
30.3	45.8	15.3	12.4	12.4	10.3	10.0	8.5	123	120	154	145
84.4	84.9	11.0	13.0	10.5	12.3	12.1	13.2	105	106	91	99
101.2	108.5	4.4	5.3	6.5	8.4	4.4	5.4	68	63	100	97

ell, Personal Income; for U. S. from Office of Business Economics.

Table II-11

Trends in personal income by major sources, Willamette Basin subareas, 1950-51 to 1960-61

	LOWER SUBAREA						MIDDLE SUBAREA				
	Income		Percent Change 1951-1961	Percent of Total Income		Index	Income		Percent Change 1951-1961	Percent of Total Income	
	1951	1961		1951	1961	1961	1951	1961		1951	19
Total Personal Income	1171.77	1935.50	65.2	100.0	100.0		356.81	520.52	45.9	100.0	100
Farm	31.43	14.09	-55.2	2.7	0.7	19	55.65	26.50	-52.4	15.6	5
Wage-Salary	8.51	8.96	5.3	0.7	0.5	62	12.53	14.19	13.2	3.5	2
Proprietary	22.93	5.13	-77.6	2.0	0.3	9	43.13	12.31	-71.5	12.1	2
Mining	1.18	1.29	9.3	0.1	0.1	8	.97	0.64	-34.0	0.3	0
Contract Construction	48.38	82.70	70.9	4.1	4.3	110	14.06	17.17	22.1	3.9	3
Manufacturing	184.40	305.66	65.8	15.7	15.8	74	77.46	95.96	23.9	21.7	18
Wholesale & Retail Trade	197.17	323.36	64.0	16.8	16.7	137	31.67	49.00	54.7	8.9	9
Finance, Insurance & Real Estate	38.16	73.11	91.6	3.3	3.8	118	3.82	11.57	202.9	1.1	
Banking & Other Finance	13.68	32.63	138.5	1.2	1.7	123	2.12	4.21	98.6	0.6	
Insurance & Real Estate	24.49	40.49	65.3	2.1	2.1	115	1.70	7.36	332.9	0.5	
Transportation	81.96	105.12	28.3	7.0	5.4	153	6.93	8.88	28.1	1.9	
Railroads	35.34	38.20	8.1	3.0	2.0	150	4.59	4.85	5.7	1.3	
Highway Freight, Warehousing & Other Transportation	46.63	66.92	43.5	4.0	3.5	154	2.34	4.04	72.6	0.7	
Communications & Public Utilities	31.25	51.50	64.8	2.7	2.7	130	5.61	8.58	52.9	1.6	
Services	80.58	144.61	54.6	6.9	7.5	105	11.89	27.54	131.6	3.3	
Hotels & Other Lodging Places	4.71	9.08	92.8	0.4	0.5	124	0.51	1.04	103.9	0.1	
Personal Service & Private Households	22.37	28.04	25.4	1.9	1.5	88	4.03	6.13	52.1	1.1	
Business & Repair Services	10.54	25.88	145.5	0.9	1.3	103	1.13	3.33	194.7	0.3	
Amusement & Recreation	6.35	7.63	20.2	0.5	0.4	76	1.12	1.09	- 2.7	0.3	
Professional, Social & Related Services	36.61	73.99	102.1	3.1	3.8	116	5.11	15.95	212.1	1.4	
Government	94.48	197.40	108.9	8.1	10.2	87	39.28	95.84	144.0	11.0	
Federal, Civilian	45.08	72.98	61.9	3.9	3.8	115	4.49	9.69	115.8	1.3	
Federal, Military	4.92	10.42	111.8	0.4	0.5	27	2.17	3.68	69.6	0.6	
State & Local	44.48	114.00	156.3	3.8	5.9	91	32.63	82.47	152.7	0.9	
Other Industries & Income	17.38	47.03	170.6	1.5	2.4	84	5.93	14.32	141.5	1.7	
Proprietors, Non-Farm	181.76	238.83	31.4	15.5	12.3	144	49.84	63.17	26.8	14.0	
Property	131.83	254.51	85.5	11.2	13.1	100	36.27	68.02	87.5	10.2	
Net Transfer Payments	51.88	96.35	85.7	4.4	5.0	92	17.46	33.39	91.2	4.9	

* *Data indicated in the columns for 1951 and 1961 is the average of 1950-1951 and 1960-1961, respectively.*

Table II-11
nal income by major sources,
tte Basin subareas,
0-51 to 1960-61

	MIDDLE SUBAREA						UPPER SUBAREA					
dex	Income		Percent Change 1951-	Percent of Total Income		Index	Income		Percent Change 1951-	Percent of Total Income		Index
961	1951	1961	1961	1951	1961	1961	1951	1961	1961	1951	1961	1961
	356.81	520.52	45.9	100.0	100.0		196.80	336.24	70.9	100.0	100.0	
19	55.65	26.50	-52.4	15.6	5.1	134	5.59	3.27	-41.5	2.8	1.0	26
62	12.53	14.19	13.2	3.5	2.7	369	2.59	2.36	- 8.9	1.3	0.7	95
9	43.13	12.31	-71.5	12.1	2.4	77	3.01	.91	-69.8	1.5	0.3	9
8	.97	0.64	-34.0	0.3	0.1	13	1.43	1.37	- 4.2	0.7	0.4	47
110	14.06	17.17	22.1	3.9	3.3	85	13.34	19.20	43.9	6.8	5.7	148
74	77.46	95.96	23.9	21.7	18.4	86	54.09	85.97	58.9	27.5	25.6	119
137	31.67	49.00	54.7	8.9	9.4	77	21.30	39.02	83.2	10.8	11.6	95
118	3.82	11.57	202.9	1.1	2.2	70	1.77	3.67	107.3	0.9	1.1	34
123	2.12	4.21	98.6	0.6	.8	59	1.16	2.26	94.8	0.6	0.7	49
115	1.70	7.36	332.9	0.5	1.4	77	0.62	1.41	127.4	0.3	0.4	23
153	6.93	8.88	28.1	1.9	1.7	48	10.35	14.33	38.4	5.3	4.3	120
150	4.59	4.85	5.7	1.3	0.9	71	8.34	10.94	31.2	4.2	3.2	248
154	2.34	4.04	72.6	0.7	0.8	35	2.02	3.40	68.3	1.0	1.0	45
130	5.61	8.58	52.9	1.6	1.6	81	2.72	5.23	92.3	1.4	1.6	76
105	11.89	27.54	131.6	3.3	5.3	74	9.28	18.55	99.9	4.7	5.5	77
12/	0.51	1.04	103.9	0.1	0.2	53	0.62	1.04	67.7	0.3	0.3	82
88	4.03	6.13	52.1	1.1	1.2	72	3.10	3.92	26.4	1.6	1.2	71
103	1.13	3.33	194.7	0.3	0.6	49	1.21	2.34	93.4	0.6	0.7	54
76	1.12	1.09	- 2.7	0.3	0.2	41	0.57	.91	77.2	0.3	0.3	53
116	5.11	15.95	212.1	1.4	3.1	93	3.80	10.35	172.4	1.9	3.1	93
87	39.28	95.84	144.0	11.0	18.4	157	12.21	33.56	174.9	6.2	10.0	85
115	4.49	9.69	115.8	1.3	1.9	57	2.20	5.84	165.4	1.1	1.7	53
27	2.17	3.68	69.6	0.6	0.7	36	0.46	0.66	43.5	0.2	0.2	10
91	32.63	82.47	152.7	0.9	15.8	245	9.55	27.07	183.5	4.8	8.0	124
84	5.93	14.32	141.5	1.7	2.7	95	3.69	9.84	166.7	1.9	2.9	101
144	49.84	63.17	26.8	14.0	12.1	142	32.19	44.18	37.2	16.4	13.1	154
100	36.27	68.02	87.5	10.2	13.1	99	21.69	40.94	88.8	11.0	12.2	92
92	17.46	33.39	91.2	4.9	6.4	118	7.18	17.14	138.7	3.6	5.1	94

50-1951 and 1960-1961, respectively.

Manufacturing - This was the largest single source of income - $488 million. However, both its growth rate and its proportional contribution to total income were less than the national average.

Wholesale and retail trade - With a total income of $411 million, wholesale and retail trade was second only to manufacturing as the largest source of income. Its importance as an income generator is evidenced by the fact that it is 21 percent higher than the national average.

Property income - Income from property, more than $363 million, exceeded the national rate of growth. However, the ratio of property income to total income coincides with that of the nation.

Proprietor's income (non-farm) - With a total of $346 million, proprietary income was well above the national average in relative importance. However, nationally the rate of growth of proprietary income was greater.

Government - Wages and salaries paid by all levels of government totaled $327 million. Although the rate of increase in the basin exceeded the national rate, the proportion of income derived from this source is the same as the nation. Federal payroll was relatively lower, and state and local government payrolls higher.

Services - Income from the five subcategories (listed in Table II-10), some of which are indicators of the impact of tourism, totaled $191 million. The rate of increase was less than the national rate. The proportion of total income was slightly below the national average.

Net transfer payments - This source, which includes government transfer payments, less personal contributions for social insurance, amounted to $147 million. The rate of increase was below that of the nation, but its relative importance was approximately the same.

Transportation - Wage and salary income, $128 million, increased only 29 percent, less than half the rate of total income. Its relative importance was well above the national average.

Contract construction - Income from this source totaled $119 million. Its rate of increase was below that of the nation but it remains a relatively large contributor to the economy.

Per capita income in the basin exceeded the national average during the 1950-1961 period, but it increased at a less rapid rate. The Lower Subarea was 17 percent above the national norm, while both the Middle and Upper Subareas were well below (Table II-12).

Table II-12

Comparative trends in per capita income
Willamette Basin, Pacific Northwest and United States
1950-51 to 1960-61
(measured in current dollars)

	1950-51		1960-61	
	Average Annual Per Capita Income	Percent of U.S.	Average Annual Per Capita Income	Percent of U.S.
Willamette Study Area	$1,715	109	$2,357	105
Lower Subarea	1,870	119	2,640	117
Middle Subarea	1,429	91	1,837	82
Upper Subarea	1,515	97	1,999	89
Pacific Northwest	1,667	106	2,227	99
United States	1,569	100	2,249	100

Photo II-4. Retail purchasing at a Portland department store. (Meier & Frank Photo)

EMPLOYMENT ANALYSIS

The first step in the following analysis of employment is to describe its present distribution among the major industries in the Willamette Study Area. Sources for data used in this chapter are identified in Addendum C, page C-12. The next step is to compare the pattern of employment in the Study Area with that of the Pacific Northwest and of the United States as a whole, showing which industries are relatively more or less important. The third step is to examine changes in employment, by industry, during recent years. These changes, particularly when related to changes taking place in the national labor force during the same period, show which industries are growing significantly. Finally, the fourth step is to describe in more detail the composition and recent changes in the labor force in each of the Willamette's three subareas.

PRESENT EMPLOYMENT, BY INDUSTRY

Employment by industry, in Willamette Basin and subareas in 1964 is shown in Table D-7, Addendum D. In terms of the particular classification adopted in that table, manufacturing provides about one-fifth of total employment in the Willamette Study Area. Slightly less than one-fifth are in each of the classifications "Trade" and "Government." Most of the remaining employment is in other service industries. Only about five percent of total employment in the Willamette Study Area is in agriculture.

COMPARATIVE SPECIALIZATION

Figure II-7 shows the relative importance of the major industry groups, as measured by their percentage of total employment, in the Study Area, the Pacific Northwest, and the United States. Manufacturing is the largest group in all three areas, though its relative size in the Willamette is below the national average. On the other hand, the Study Area is above the national average in the proportion of its labor force in "Self-employed" and "State and Local Government."

A more detailed analysis of the Study Area's labor force, as compared to the relative distribution in the nation, is contained in Addendum B. There it is shown that within the "manufacturing" classification, there are wide disparities between the distribution in the Willamette Study Area and the national average. "Lumber and Wood Products" alone has about a third of all manufacturing employment in the Willamette Study Area, compared with only three percent in the United States. In the United States as a whole, no single group, in terms of the classification used in Addendum B, has more than 10 percent of total manufacturing employment. This indicates a much less highly specialized pattern than the Willamette's great concentration on "Lumber and Wood Products."

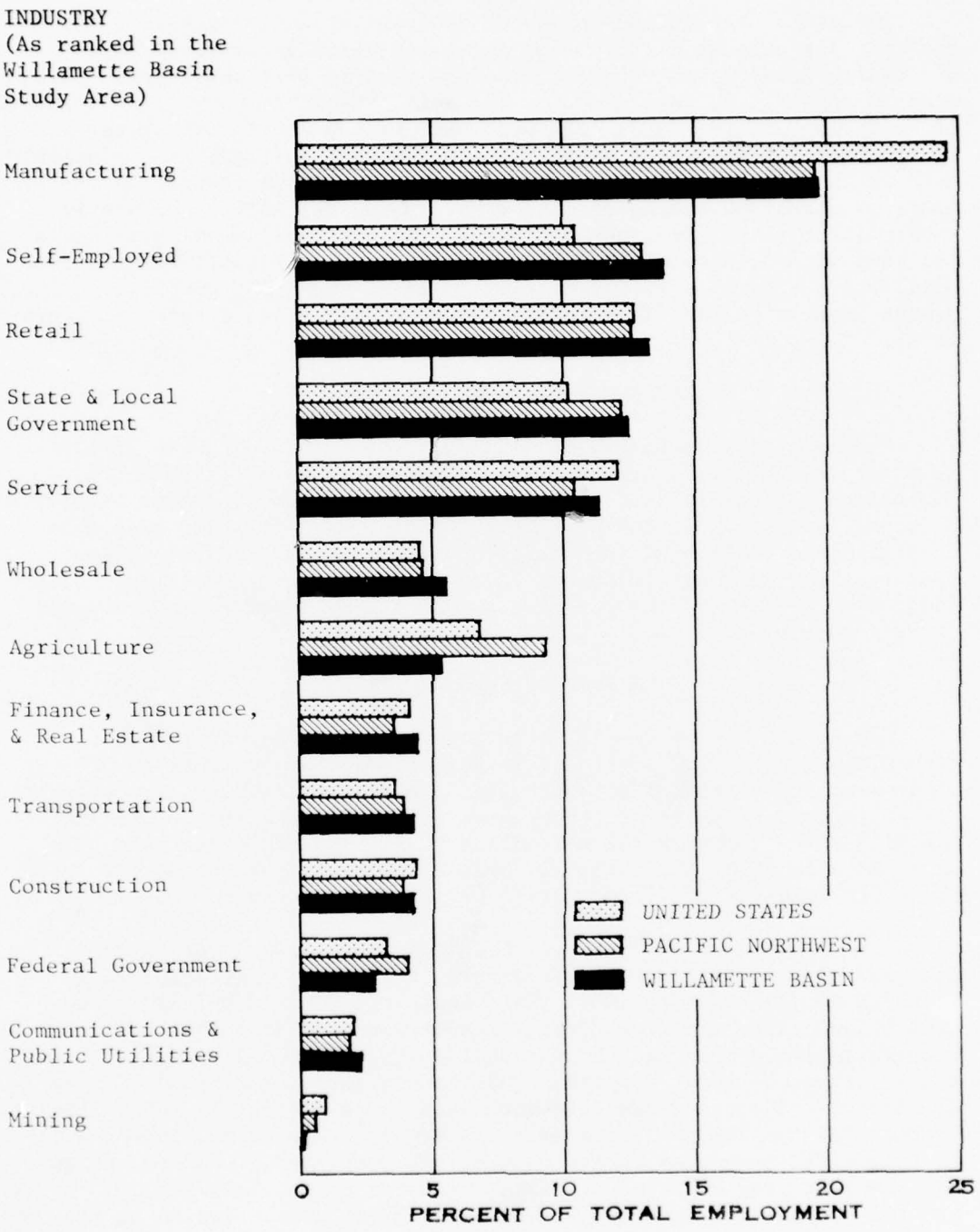


Figure II-7. Comparative Employment Rank of Major Industries, Willamette Basin, Pacific Northwest, and United States, 1964.

RELATIVE GROWTH BY INDUSTRY, 1958-1964 1/

The structure of the basin's economy and the relative growth rates of individual industries reflect its competitive advantages -- access to both raw materials and other productive factors and to markets. Therefore, these structural characteristics and changes give some indication of the basin's future growth potential and future employment.

As is discussed more fully in Addenda B and C, the growth rate in the Study Area in recent years has exceeded the rates in both the Pacific Northwest Region and the nation, not only for total employment but also for employment in most of the 32 industrial categories compared. During the 1958-64 period, total employment increased 17.6 percent, compared with 8.2 percent for the region and 10.0 percent for the nation. Comparative changes in employment for all major industrial categories are shown in Figure II-8, and a detailed breakdown of manufacturing is shown in Figure II-9.

Among the 13 major industrial categories shown in Figure II-8, the increase in the basin exceeded that of the region in all but agriculture. The Study Area exceeded the nation in all but agriculture and transportation. The percentage increase in total manufacturing employment was nearly four times the region's and twice the nation's. Wholesale trade and total government also increased at greater rates in the basin than in the nation, though they did not keep pace with total employment growth in the basin. Mining experienced a large rate of growth, though in absolute terms it is a minor industry in the Willamette. Industries oriented principally to local markets, and hence related closely to population size, expanded at rates similar to total employment.

Comparative growth in most of the manufacturing categories was also relatively strong in the Study Area. In 10 of the 19 manufacturing categories shown in Figure II-9, the basin's rate of growth exceeded that of both the region and nation. Many of the smaller, more recently established industries in the basin have grown rapidly in recent years. Those increasing 20 percent or more in employment between 1958 and 1964 include chemicals, rubber and miscellaneous plastics, stone-clay-glass, fabricated metal products, machinery, electrical machinery (which includes electronics), transportation equipment, and miscellaneous manufacturing.

1/ *For the general long-run employment trends, the period 1940-1960 was used (see Addendum C). For specific industry analysis, the period 1958-64 was used. The latter period was considered representative of the long-run employment growth trends because during both 1940-1960 and 1958-64, total employment in the basin increased at an annual average rate of 2.8 percent.*

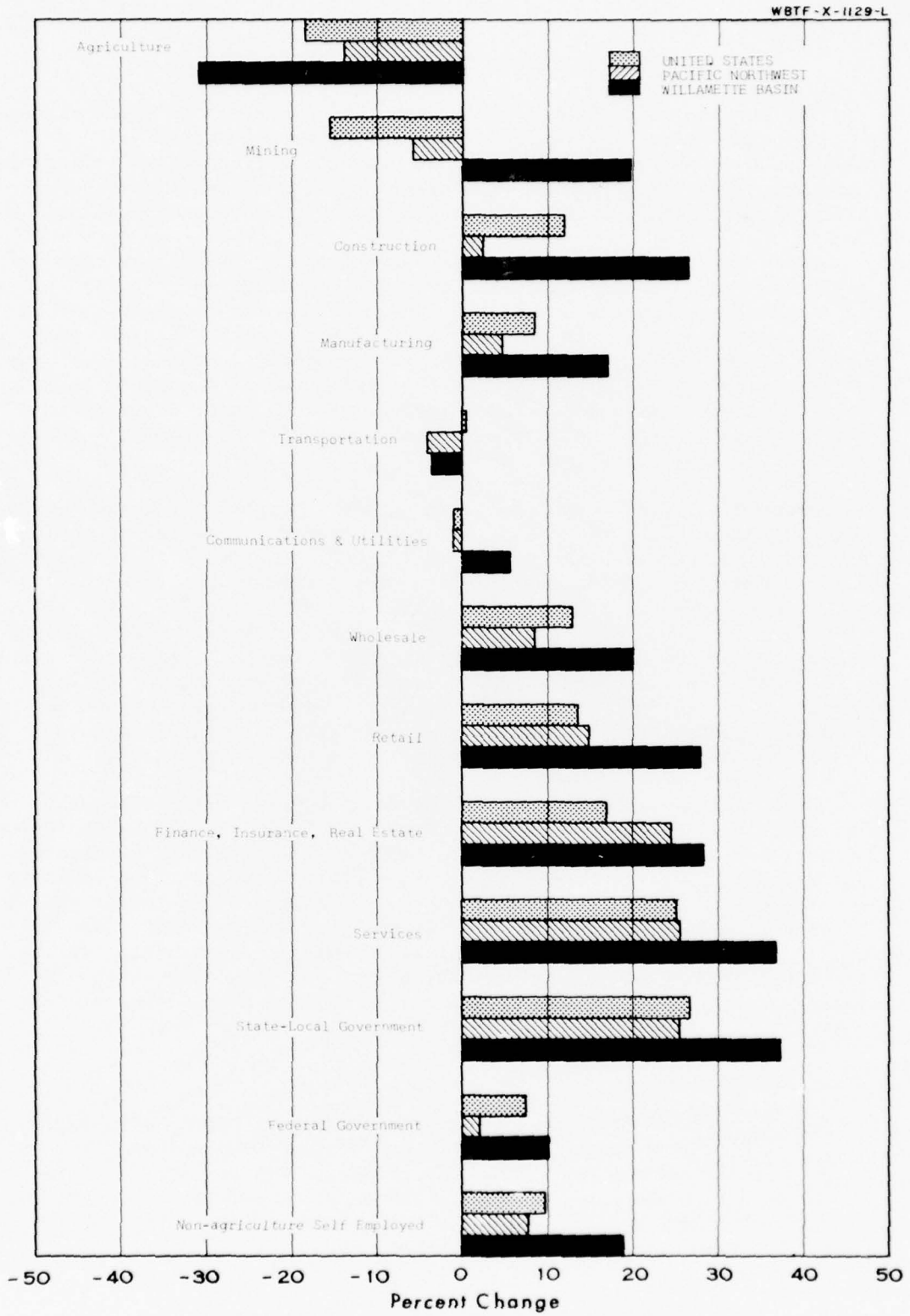


Figure II-8. Percentage Changes in Employment, by Major Industrial Categories, Willamette Basin, Pacific Northwest, and United States, 1958-1964.

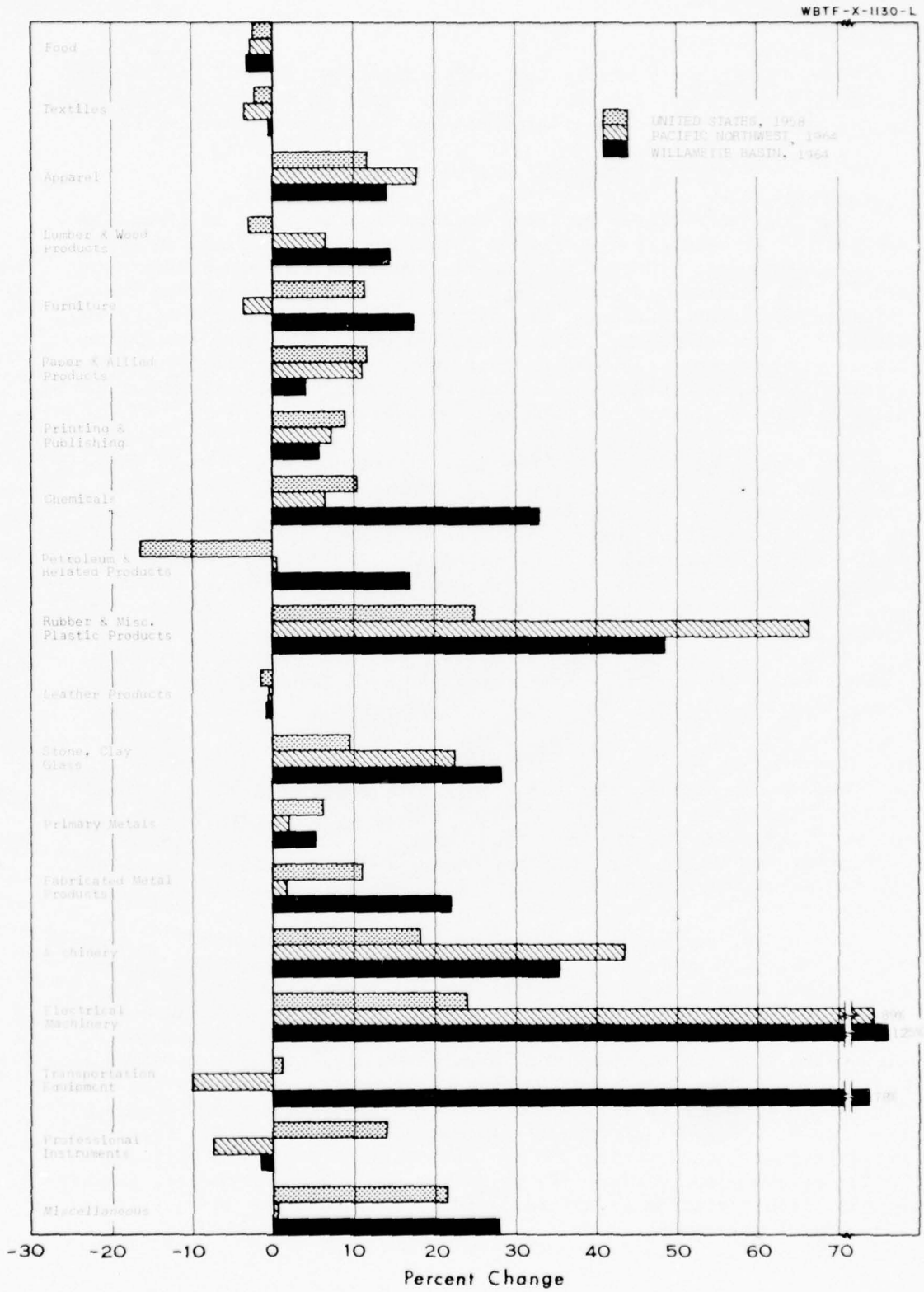


Figure II-9. Comparative Growth in Employment, by Major Manufacturing Categories, Willamette Basin, Pacific Northwest, and United States, 1958-1964.

Even though the basin is not self-sufficient in 16 of the 19 manufacturing categories, its superior growth rates in most categories attest to the vigor and continued diversification of the manufacturing base.

EMPLOYMENT TRENDS IN SUBAREAS

The dominance of the Portland metropolitan area has an impact on the pattern of economic development throughout the basin and in parts of the region. It provides many specialized services and products to surrounding areas. Portland's influence is readily apparent in the differences in the industrial employment structure among the three subareas. Employment in the Lower Subarea is proportionately greater in trade, finance, services, and most of the noncommodity producing industries. Its manufacturing base, although proportionately a smaller part of its total employment, is much more diversified.

The Middle and Upper Subareas have a greater porportion of their employment in the commodity producing industries--agriculture, mining, manufacturing, and construction. These two subareas are specialized in three manufacturing industries (food products, lumber and wood products, and paper and allied products) which are also dominant in the Pacific Northwest. These industries account for over 80 percent of the manufacturing employment in the Middle Subarea and 90 percent in the Upper Subarea. The smaller proportion of employment in trade, services, and finance, and the lack of diversified manufacturing reflect the dependence of the central and southern parts of the basin upon the Portland metropolitan area.

Lower Subarea

Two-thirds of the total employment in the basin is in the Lower Subarea. In 1964, employment in 23 of the 26 industry groups exceeded the combined total for the other two subareas. The only exceptions were those industries typically not associated with metropolitan areas--agriculture, mining, and the manufacturing of lumber and wood products.

Employment increased 16.8 percent between 1958 and 1964. A changed employment structure also evolved, as the result of disparate industrial growth rates. Agricultural employment dropped 36 percent, from 17,000 to 10,900, the largest decline for any industry. Among the nonmanufacturing industries, only transportation and mining declined in employment. In the manufacturing group, the only significant decrease was in the processing of food and kindred products, which was the leading manufacturing industry in 1958; it declined nearly nine percent, from 9,300 to 8,477. Employment in several other categories remained relatively unchanged during the period--textile, paper and allied products, printing and publishing, petroleum and related products, primary metals, transportation except railroads, communications and utilities, and Federal government.

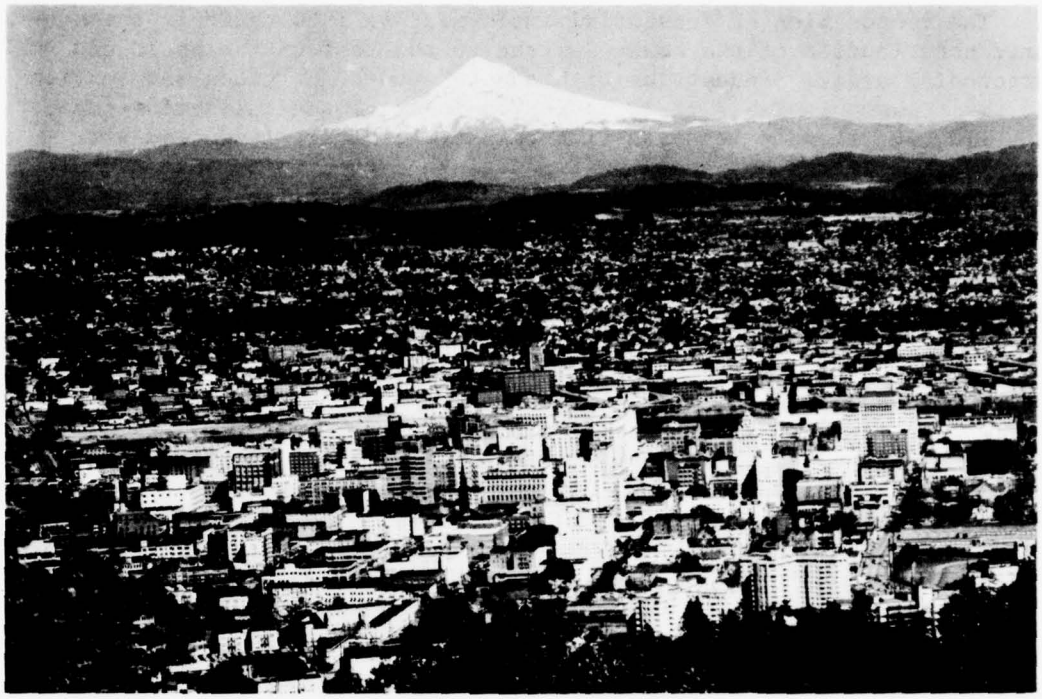


Photo II-5. Metropolitan Portland straddles lower Willamette River. (Oregon State Highway Department Photo)

Expansion has been greatest in trade, services, and State and local government-which are also the national growth industries. Employment in trade increased by nearly 12,800, approximately three-fourths of which was in retail trade. Services and State and local government raised employment by an additional 10,587 and 8,522, respectively. Much of the increase in the latter resulted from expansion of school enrollment. The number of nonagricultural self-employed increased by 9,400 between 1958 and 1965. Although the specific industrial category of this group is not ascertainable, nearly all are in construction, service, trade, and real estate. Total manufacturing employment advanced by 8,165. Over 50 percent of the net increase in manufacturing employment was due to the rapid rise in the fabrication of machinery, which, in 1964, became the leading manufacturing industry in the Lower Subarea. Machinery ranked second nationally as as a growth industry. The four leading manufacturing industries in 1964 were machinery (including electrical), food, lumber and wood products, and fabricated metal products, in that order. These were also the top four in 1958, but in a different order.

The composition of industrial employment in 1964 reflects the economic contribution of the Lower Subarea to the rest of the basin and surrounding areas. Industries with a net "export" of goods and services are those shown in Table II-13 having an index of specialization greater than 1.0. Portland's location with respect to water, land, and air shipping facilities has been instrumental in establishing and maintaining the Lower Subarea as a distribution center as well as a center of finance, trade, and services. The proportion of its labor force employed in transportation is greater than the other subareas, the region or the nation. It is also highly specialized in wholesale trade, communications and utilities, and finance; the Middle and Upper Subareas are largely dependent on the Lower Subarea for these services. Employment in retail trade and services, which has a low variability among subnational areas, is less specialized. Although the share of the total labor force employed in manufacturing is less than in the other subareas, as well as in the region and nation, the Lower Subarea does specialize in three subcategories of manufacturing: lumber and wood products, paper and allied products, and food and kindred products. The subarea has, however, become less under-specialized in many of the other manufacturing categories. This trend is consistent with observations stated earlier that as local markets increase, production of a greater variety of items becomes economically feasible.

The industries in which the Lower Subarea is markedly underspecialized, aside from manufacturing, are those previously noted as not typical of highly urbanized areas--agriculture and mining. Employment in Federal government, State and local government, and construction, is at the "expected" level.

Table II-13

Employment trends, Lower Subarea
1958-1964

	Employment 1958	Employment 1964	% Change	% Ea. is of Total 1964	Index of Specialization 1964 2/
Total Employment	279,936	327,027	16.8		
Nonagr. Self-Emp.	36,400	45,800	25.8	14.0	1.33
Agriculture	17,100	10,900	-36.3	3.3	.49
Mining	325	238	-26.8	.1	.08
Construction	12,000	13,533	12.8	4.1	.94
Manufacturing	51,336	59,501	15.9	18.2	.74
Food	9,300	8,477	-8.8	2.6	1.05
Textile, Mill Prod.	2,000	1,948	-2.6	.6	.47
Lumber & Wood Prod.	6,996	7,547	7.9	2.3	2.72
Paper & Allied Prod.	3,710	3,705	-.1	1.1	1.26
Printing and Publishing	3,280	3,212	-2.1	1.0	.73
Chemicals & Allied Prod.	1,180	1,430	21.2	.4	.35
Petroleum & Related Prod.	314	329	4.8	.1	.37
Stone, Clay, Glass	1,245	1,486	19.4	.5	.51
Primary Metals	4,111	4,036	-1.8	1.2	.71
Fabricated Metals	4,200	4,914	17.0	1.5	.88
Machinery (incl. elect.)	5,920	10,035	69.5	3.1	.68
Other 1/	9,080	12,382	36.4	3.8	.51
Transp., Comm., Util.	27,000	26,100	-3.3	8.0	1.41
Railroads	7,300	5,919	-18.9	1.8	1.68
Transp., ex. RR	11,224	11,624	3.6	3.6	1.42
Comm. & Util.	8,476	8,557	1.0	2.6	1.27
Trade	57,000	69,793	22.4	21.3	1.23
Wholesale	21,000	24,565	17.0	7.5	1.64
Retail	36,000	45,228	25.6	13.8	1.08
Finance, Ins., Real Estate	13,500	16,300	20.7	5.0	1.19
Services	31,475	42,062	33.6	12.9	1.06
Total Govt.	33,800	42,800	26.6	13.1	.97
Federal	10,400	10,878	4.6	3.3	1.00
State, Local	23,400	31,922	36.4	9.8	.96

1/ Includes nondisclosed industries
2/ Index of Specialization defined in Addendum A, page 2

Middle Subarea

Employment increased 12.8 percent from 1958 (95,240) to 1964 (107,430). Only two of the 26 industries compared decreased--agriculture declined 30 percent (from 18,110 to 12,700), and transportation (except railroads) declined slightly. The largest absolute growth during the 1958-1964 period was shown by trade with an increase of 3,840, followed by State and local government with 3,376, services 3,039, manufacturing 1,970, and construction 1,680; these five categories represented two-thirds of the total employment in the subarea in 1964.

The Middle Subarea is specialized in only a few industries and markedly dependent in many others (see Table II-14). It is specialized in three manufacturing categories--lumber and wood products, food and kindred products, and paper and allied products--which comprise 80 percent of the total manufacturing employment in the subarea. Proportionately, State and local government employment is nearly twice the national average, largely attributable to the State offices, medical and penal institutions, and an institution of higher learning. An abundance of truck and livestock farms has resulted in a specialization in agricultural employment greater than in the other subareas, the region, or the nation.

Photo II-6. City of Salem - financial center of the Middle Subarea. (Oregon State Highway Department Photo)

Table II-14
Employment trends, Middle Subarea
1958-1964

	Employment 1958	Employment 1964	% Change	% Ea. is of Total 1964	Index of Specialization 1964 2/
Total Employment	95,240	107,430	12.8		
Nonagr. Self-Emp.	12,750	14,080	10.4	13.1	1.25
Agriculture	18,110	12,700	-29.9	11.8	1.75
Mining	131	202	54.2	.2	.21
Construction	2,810	4,490	59.8	4.2	1.70
Manufacturing	18,880	20,850	10.4	19.4	.79
Food	4,280	4,485	4.8	4.2	1.70
Textile, Mill Prod.	153	201	31.4	.2	.15
Lumber & Wood Prod.	10,621	11,040	3.9	10.3	12.09
Paper & Allied Prod.	1,017	1,230	20.9	1.1	1.27
Printing and Publishing	695	864	24.3	.8	.59
Chemicals & Allied Prod.	42	70	66.7	.1	.06
Petroleum & Related Prod.	0	D	D	D	D
Stone, Clay, Glass	367	438	19.3	.4	.47
Primary Metals	D	D	D	D	D
Fabricated Metals	214	288	34.6	.3	.16
Machinery (incl. elect.)	653	1,085	66.2	1.0	.23
Other 1/	838	1,149	37.1	1.1	.11
Transp., Comm., Util.	3,160	3,430	8.5	3.2	.56
Railroads	460	508	10.4	.5	.44
Transp., ex. RR	1,200	1,131	-5.8	1.1	.42
Comm. & Util.	1,500	1,791	19.4	1.7	.81
Trade	10,910	14,750	35.2	13.7	.79
Wholesale	1,400	1,800	28.6	1.7	.37
Retail	9,510	12,950	36.2	12.1	.95
Finance, Ins., Real Estate	2,700	4,120	52.6	3.8	.92
Services	6,329	9,368	48.0	8.7	.72
Total Govt.	19,460	23,440	20.4	21.8	1.62
Federal	1,250	1,854	48.3	1.7	.52
State, Local	18,210	21,586	18.5	20.1	1.98

1/ Includes nondisclosed industries
2/ Index of Specialization defined in Addendum A, page 2.

D: Disclosure rule, not available for publication

Industries relatively underdeveloped, for which the Middle Subarea depends on the Lower Subarea, include services, finance, wholesale trade, transportation, communications, and utilities. The Middle Subarea is essentially self-sufficient in retail trade and construction. In general, the deviation in the employment distribution has narrowed during the 1958-1964 period.

Upper Subarea

Employment grew rapidly between 1958 and 1964, increasing by 30.5 percent from 52,740 to 68,810. This rate of increase was approximately twice that of the other two subareas, three times that of the nation, and four times that of the region. The largest numerical increases occurred in manufacturing with 4,360; trade 3,770; state and local government 3,420; and services 1,823. These four categories comprised two-thirds of total employment in 1964. Some industries, although contributing less to total growth, had a higher growth rate (see Table II-15). Increases in excess of 50 percent occurred in finance, trade, construction, railroad transportation and mining.

Photo II-7. Eugene - Springfield - financial center of the Upper Subarea. (Delano Photo)

Table II-15
Employment trends, Upper Subarea
1958-1964

	Employment 1958	Employment 1964	% Change	% Ea. is of Total 1964	Index of Specialization 1964 2/
Total Employment	52,740	68,810	30.5		
Nonagr. Self-Emp.	9,180	9,580	4.4	13.9	1.32
Agriculture	4,290	3,700	-13.8	5.4	.79
Mining	154	291	89.0	.4	.47
Construction	2,170	3,460	59.4	5.0	1.14
Manufacturing	14,230	18,590	30.6	27.0	1.10
Food	1,320	1,460	10.6	2.1	.86
Textile, Mill. Prod.	0	0	-	-	-
Lumber & Wood Prod.	11,740	15,080	28.4	21.9	25.79
Paper & Allied Prod.	300	302	.7	.4	.49
Printing and Publishing	340	486	42.9	.7	.53
Chemicals & Allied Prod.	6	133	*	.2	.15
Petroleum & Related Prod.	0	D	D	D	D
Stone, Clay, Glass	103	276	168.0	.4	.45
Primary Metals	D	D	D	D	D
Fabricated Metals	110	324	194.5	.5	.28
Machinery (incl. elect.)	189	368	94.7	.5	.12
Other 1/	122	161	32.0	.2	.02
Transp., Comm., Util.	3,020	3,490	15.6	5.1	.90
Railroads	568	1,504	164.8	2.2	2.03
Transp., ex. RR	1,600	896	-44.0	1.3	.52
Comm. & Util.	852	1,090	27.9	1.6	.76
Trade	7,120	10,890	52.9	15.8	.91
Wholesale	1,260	2,040	61.9	3.0	.65
Retail	5,860	8,850	51.0	12.9	1.01
Finance, Ins., Real Estate	1,440	2,220	54.2	3.2	.77
Services	4,286	6,109	42.5	8.9	.73
Total Govt.	6,850	10,480	53.0	15.2	1.13
Federal	920	1,130	22.8	1.6	.49
State, Local	5,930	9,350	57.7	13.6	1.34

1/ Includes nondisclosed industries
2/ Index of Specialization defined in Addendum A, page 2

D: Disclosure rule, not available for publication
**: Not meaningful*

The rate of increase in manufacturing employment has coincided with growth in total employment. The two largest manufacturing industries--lumber and wood products, and agriculture and related products--increased at a lesser rate than total employment. Some of the newly established industries--chemicals; fabricated metals; stone, clay and glass products; machinery; and printing and publishing--have had the greatest rates of increase, although they had less than 500 employees each. Employment declines were experienced in agriculture and transportation (except railroads).

Industries in which the Upper Subarea specialized remained essentially unchanged between 1958 and 1964. Employment in railroad transportation increased from 568 in 1958 to 1,800 in 1959 because railroad repair facilities were shifted to Eugene, but the number employed subsequently decreased to 1,504 in 1964. The declining trend is national in scope, resulting largely from changes in regulations regarding the size of operating crews and improvements in labor productivity. The proportion of local government employment is greater than normal, largely due to increased requirements for educational services because of a higher than typical school age population and the University of Oregon. The degree of specialization in nonagricultural self-employed remains high, but has decreased during the period as the proportion of those in small retail and service establishments, as well as gyppo logging, declined. The rapid growth of the area is reflected in the high level of construction employment. Manufacturing specialization is due to one industry--lumber and wood products--which accounted for 15,080 of the 18,590 employed in manufacturing.

The Upper Subarea is dependent upon the Portland metropolitan area primarily in wholesale trade, finance and services, but this degree of dependency has lessened during the study period. The trend is now toward more self-sufficiency in noncommodity producing industries. This is characteristic of areas with a high proportion of the population in expanding metropolitan centers. Growth of these industries can be expected to continue to exceed the rate of other industries as local markets develop. The Upper Subarea has attained self-sufficiency in retail trade.

PART III

INDUSTRY STUDIES

INDUSTRY STUDIES

Industries basic to an economy are those whose products serve a regional or national market. These industries exist in an area because of unique natural or social advantages. Without these industries, and the area's advantages which give rise to them, there would be little reason to settle the area. Income from sales of the exported products of basic industries flows back into an area and enriches it.

Settlement in the Willamette Basin to the present day can be traced in large part to exports of the forest products and agriculture-food industries. These industries provide significant export incomes today but the economy has diversified into many other basic lines of production.

In this appendix, recreation has not been evaluated as a separate economic activity. The "recreational industry" ranks third in importance after wood products and agriculture-food industries in Oregon's economy. Recreation, however, is an activity rather than a good or service, and thus cannot be classified in the traditional way. The traditional classification of industries is based on the type of good or service provided without regard to the motive which gives rise to the purchase. In a sense, recreation is consumed by engaging in an activity such as camping or hiking, but it is not produced. Although recreation is not defined as an industry in this study, its importance as a motive for consumer spending is great--in fact, most of the industries evaluated in this study are affected to some extent by spending for the greater employment of recreational pursuits.

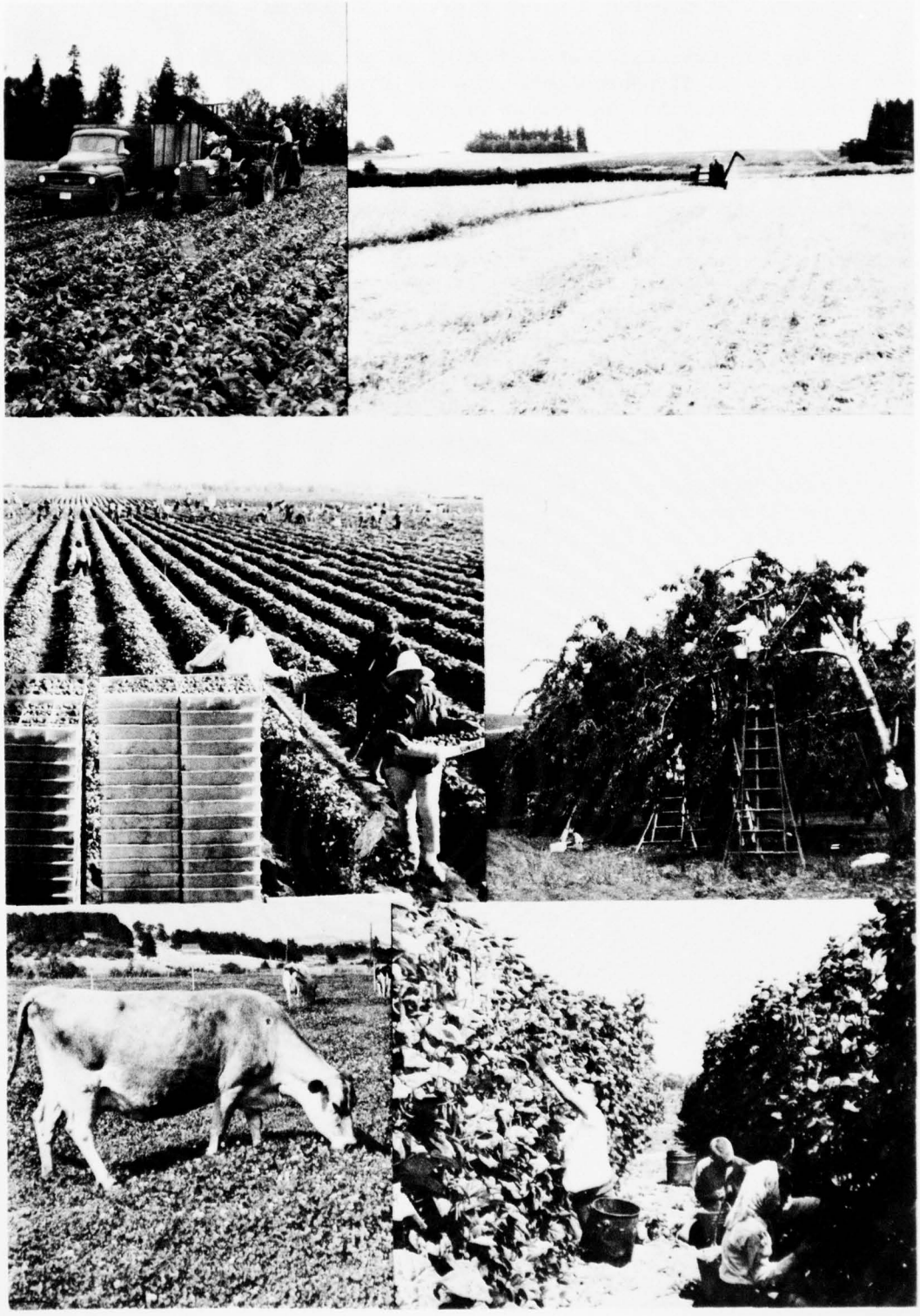


Photo III-1. Agriculture in the basin takes a variety of forms.

AGRICULTURAL ECONOMY

One of the most noticeable changes in agriculture in the basin has been a decline in farm population and employment. Land in farms and land in use as cropland have also declined slightly. An implication easily drawn from these changes is that agriculture is a declining industry. This conclusion is not supported in view of the significant increases in agricultural production and value of production. The decreases in labor and land inputs might instead be viewed as a result of evolutionary changes in the way of farming. While labor use has declined, the inputs of machinery, fertilizer and various forms of technology have increased. This shift in kinds of inputs (to nonlabor and nonland) leads to the generation of larger incomes in nonfarm sectors which sell the machinery, fertilizer, pesticides, etc., to farmers. Thus, while farm labor has declined, other sectors which serve farming have enjoyed larger sales.

CHARACTERISTICS OF AGRICULTURE

Several Willamette Basin crops are important nationally. In 1959, 99 percent of the nation's ryegrass seed was grown in this area, as were 22 percent of the mint, 23 percent of the snapbeans, 19 percent of the hops, and 17 percent of the strawberries. Willamette Basin accounted for 79 percent of Oregon's production of horticultural specialties. These specialties, together with caneberries, cherries, filberts, and turkeys, normally make up the exportable commodities.

In livestock and livestock products, Willamette Basin does not rank nationally; some meat products must be imported to meet local demand. The basin is self-sufficient in sheep, lambs, chickens, and eggs, but deficient in cattle, hogs, milk, feed grain, hay, and potatoes.

Land Use

About 2.4 million acres, or one-third of the Study Area, are used for agricultural purposes. The major uses of agricultural land in 1964 were for harvested cropland, wooded and nonwooded pasture, and nonpastured woodland (Table III-1). There were about 188,300 acres reported as irrigated in the 1964 Census of Agriculture.

Table III-1
Use of farmland, Willamette Basin 1/, 1964

Land Use	Area		Percentage of Farmland	
	1,000 acres		Percent	
Cropland		1,306.2		53.9
Harvested	931.0		38.4	
Pasture	217.2		9.0	
Other 2/	158.0		6.5	
Woodland		630.5		26.0
Pasture	398.0		16.4	
Nonpasture	232.5		9.6	
Other Pasture		368.1		15.2
Other Nonpasture		118.9		4.9
Total farmland		2,423.7		100.0

1/ In this and most subsequent tables in this section, the geographic area is the nine-county Economic Study Area.

2/ Includes summer fallow, acres in soil improvement areas, idle land, and crop failure.

Source: Bureau of the Census, U. S. Census of Agriculture, Oregon, 1964, Washington, D. C.

Major crops are small grains, grass seed, hay, fruits and nuts, and vegetables. The percentage of total cropland of the various crop categories are shown for the period 1939-1964 in Table III-2. Small grains and "other crops" declined in acreage; grass seed and vegetables increased; and hay, fruits and nuts, and "other cropland" fluctuated. Cropland pasture has remained relatively stable at about 17 percent of cropland. Total cropland has declined slightly since 1949.

Table III-2
Acreage and distribution of cropland use, Willamette Basin, 1939, 1949, 1959 and 1964

Crop	Year							
	1939		1949		1959		1964	
	1,000 acres:	Pct.	1,000 acres:	Pct.	1,000 acres:	Pct.	1,000 acres:	Pct.
Small grains	431	31	421	30	363	27	250	19
Hay cut	274	20	181	13	164	12	200	15
Grass seed 1/	-	-	136	10	227	17	281	22
Fruits and nuts	100	7	111	8	83	6	86	7
Vegetables	19	1	36	3	39	3	57	4
Other crops	222	16	136	9	117	9	57	4
Cropland pasture	240	17	233	16	222	16	217	17
Other cropland	94	7	150	11	146	11	158	12
Total 2/	1,379	100	1,403	100	1,362	100	1,306	100

1/ Included with other crops in 1939.
2/ May not add due to rounding

Source: U. S. Census of Agriculture, Oregon

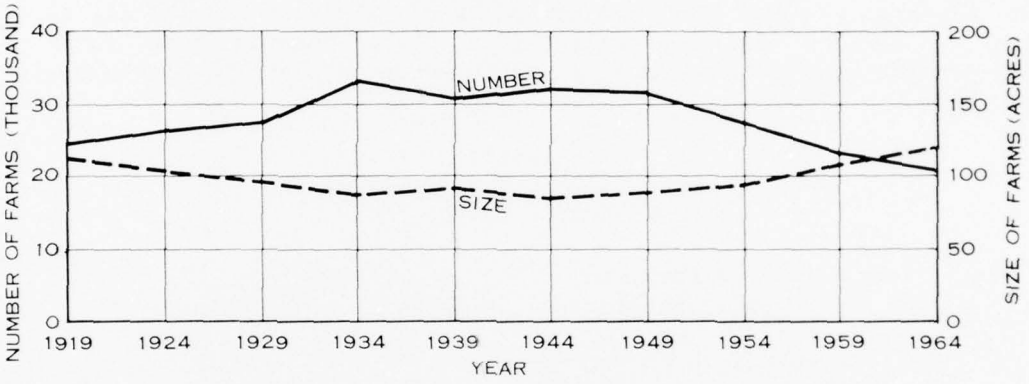
Photo III-2. Collage of cropland and woodland in Marion County. (Soil Conservation Service Photo)

Farm Characteristics

Number and Size of Farms

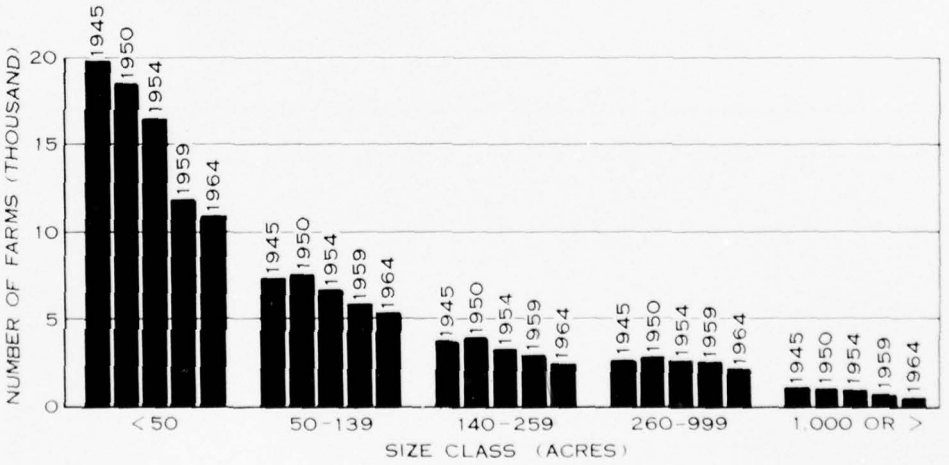
In 1964, there were some 20,400 farms in Willamette Basin, with an average size of about 119 acres. From the early days of settlement, until about 1934, the number of farms in the basin increased to 33,000 and then declined to the present number. The average size of farm has increased consistently since 1944 (see Figures III-1 and -2).

The largest number of farms contained less than 50 acres in 1959, but the number of farms in this group has declined rapidly. In 1964 there were 10,980 farms of less than 50 acres; 227 farms were larger than 1,000 acres. In contrast to many other farming areas, recent increases in the average size of farms resulted from a decline in the number of small farms. The land previously in small farms has either been shifted to nonfarm uses or consolidated into larger farm units.



Source: U. S. Census of Agriculture, Oregon

Figure III-1. Farms: Number and Size, Willamette Basin, 1919-1964.



Source: U. S. Census of Agriculture, Oregon

Figure III-2. Farms: Distribution by Size Class and Change in Number, Willamette Basin, 1945-1964.

Most farmland is in units larger than 50 acres in size. Although 53 percent of the farms were less than 50 acres in size in 1964, they contained only 9 percent of the land. Farms of 50 or more acres contained the remaining 91 percent. Farms of 260 or more acres (11 percent of the farms) contained 54 percent of the land.

Economic Classes of Farms

About 52 percent of the farms in the basin are classed as noncommercial and 48 percent as commercial (Table III-3). Almost one-fifth of the "commercial" farms had sales of less than $2,500 in 1964, hardly adequate to meet living expenses. Noncommercial part-time farms, nearly as numerous as commercial ones, are those farms with less than $2,500 annual sales where the farm operator either works off the farm more than 100 days or has nonfarm income greater than farm income. The farms with less than $2,500 sales could be characterized as (1) small in acreage, (2) poor in land quality, (3) farmed in low-value crops and pasture, or (4) farms on which the operator works off the farm and farming is less a business and more a way of life. "Other" noncommercial farms (13 percent of all farms) are primarily those on which the operator is retired.

Table III-3
Farms: Class and sales level, Willamette Basin, 1964

Type of Farm and Sales Level	Farms	
	Number	Percent
Commercial		
Greater than $2,500	8,016	39.4
Less than $2,500	1,801	8.8
Part-time	7,896	38.8
Other	2,653	13.0
Total	20,366	100.0

Source: U. S. Census of Agriculture, Oregon, 1964

Farm Ownership

Seventy-seven percent of the farms are owner-operated. Table III-4 shows the relationship of commercial to noncommercial farms by ownership. About 48 percent of the commercial farmers rent all or part of their land; they rely to a considerable extent on the rental market to gain control of land for farming.

Table III-4

Commercial classification of tenure classes of farms, Willamette Basin, 1964

Tenure Class	Number of Farms		
	Commercial	Noncommercial	Total
	Number	Number	
Full owner	6,298	9,338	15,636
Part owner	2,762	706	3,468
Full tenant	701	485	1,186
Manager	56	20	76

Source: U. S. Census of Agriculture, Oregon, 1964

Farm Sales

Sales of farm products in Willamette Basin in 1964 totaled $176.5 million. About 54 percent was from crops, 36 percent from livestock and livestock products, and the remainder from forest products and horticultural specialties (Table III-5). Since 1939, trends in value of farm products sold indicate an increasing share of sales in crops and horticulture and a decreasing share in livestock products. Average product sales per farm in 1964 were about $8,676.

Table III-5

Farm Products: Sales, by percentage of distribution Willamette Basin, 1939, 1949, 1959 and 1964

Product	Percentage of Total Sales 1/			
	1939	1949	1959	1964
	Percent	Percent	Percent	Percent
Crops	45.8	48.4	52.5	54.4
Livestock and products	48.8	43.6	37.6	35.8
Forest	1.3	2.6	2.4	1.3
Horticultural specialties	4.1	5.4	7.5	8.5
Total	100.0	100.0	100.0	100.0

1/ Current prices used for comparisons. Actual sales have increased in all categories

Source: U. S. Census of Agriculture, Oregon

Farm Population and Employment

In 1960, farm population was about 69,000 or six percent of the total population in Willamette Basin (Table III-6). The farm population has been declining; in 1940 it was 129,300, or 19 percent of the total. This has followed the national trend as mechanization, technological improvements, and other factors have lessened the need for farm labor. Much of the farm population has migrated to urban areas.

The labor force in agriculture has also been declining. Fewer farmers start farming each year, and many retiring farmers sell or lease their holdings to those still farming. Labor requirements are highly seasonal with summer hired labor particularly needed.

Table III-6

Farm population, Willamette Basin 1930-1960

Year	Farm Population
1930	110,800
1940	129,300
1950	116,500
1960	68,900
Decline 1940-60	60,400

U. S. Census of Population, U. S. Bureau of the Census, 1930-1960. U. S. Government Printing Office, Washington, D. C.

Photo III-3. School girl berry pickers. (Oregon State Department of Labor Photo)

For 1960, average farm employment (including summer employment) was estimated to be about 33,440. Some 14,000 of these were hired; the remainder were self-employed or family labor. In the above estimate, seasonal workers under the age of 14 years and some part-time farmers are excluded. The labor force may be about 5,000 larger if those under 14 years are included. These young workers constitute 40 percent of the seasonal labor force for strawberries and about 30 percent for snapbeans, according to the Oregon State Department of Employment. Hired farm employment may be as high as 80,000 in June during the strawberry harvest, and averages 25,000 to 30,000 during the six months of May through October. July and August are other months of high peak labor requirements when caneberries and snapbeans ripen and largely require harvesting by hand.

Mechanization has reduced summer farm employment as well as the number of regular hired workers. For example, a shift in snapbeans from pole to bush varieties is reducing employment needs since bush beans are planted and harvested mechanically.

Summer farm labor requirements in the basin are met largely by local persons, although about 20 percent of the labor force come from outside the state. With the expiration of Public Law 78, which permitted foreign farm laborers to enter the U. S., it is expected that more domestic migratory workers will remain in the Southwest where farm wages have increased, and fewer will be available for labor requirements here. This may mean that more of the seasonal labor requirement in Willamette Basin must be met with local labor.

Mechanization and Technology in Farming

Development and adoption of technology in agriculture has been a major factor in increased agricultural output in the past three decades. Adoption of improved technology in agriculture, nationally, has been responsible in large part for output increases as large or larger than needed for increased population and export demands, while land and labor inputs have declined. Forms which technology has taken include improved crop varieties, better methods for control of weeds and insects, improved management of soil and water resources, higher levels of fertilization, improved marketing facilities, better machines and improved breeds of livestock and other improvements. The development and adoption of these improvements have been made possible by research, education, and extension services as well as availability of capital.

Agricultural production in Willamette Basin is largely mechanized except for some harvest operations. The crops grown generally do not require large amounts of hand or stoop labor in production, and the practice has been to reduce what is required. Forage harvesting provides an example. The Census of Agriculture for 1964 shows that there were 2,759 pick-up balers and 1,179 field forage harvesters compared with 1,363 and 671, respectively, in 1954. During the same period, swathers and hay conditioners have replaced mowers to permit curing a better quality of hay in spite of sometimes adverse weather conditions.

In the more intensive fruit, vegetable, and specialty crops that are occupying a growing percentage of cropland, mechanical picking equipment has been adapted or developed for sweet corn, bush beans, carrots, beets, potatoes, peas, some caneberries, mint and hops.

Another significant change in technology has taken place in the increased use of chemicals. Chemical fertilizers were used on 759,330 acres in 1964, compared with 746,124 in 1959 and 598,463 acres in 1954. There were 124,120 tons of fertilizer used in 1964, in 1959 it was 96,690 tons, and in 1954 it was 76,760 tons. Use of chemical herbicides and insecticides has also shown a substantial gain. These increases in mechanization and use of chemicals have been associated with production of both historically important and newly important crops.

The growth in irrigation provides another noteworthy change in technology. In 1949, 76,900 acres were irrigated. This has increased to 188,300 acres, according to the 1964 Census of Agriculture. The 1964 Census of Agriculture states that 24 percent of the farms reported irrigation, nearly all of which were irrigated by sprinklers. Sprinkler irrigation tends to use water more efficiently, but requires large quantities of capital and labor. Irrigated farming generally links a high degree of mechanization with the use of chemical fertilizers and pesticides.

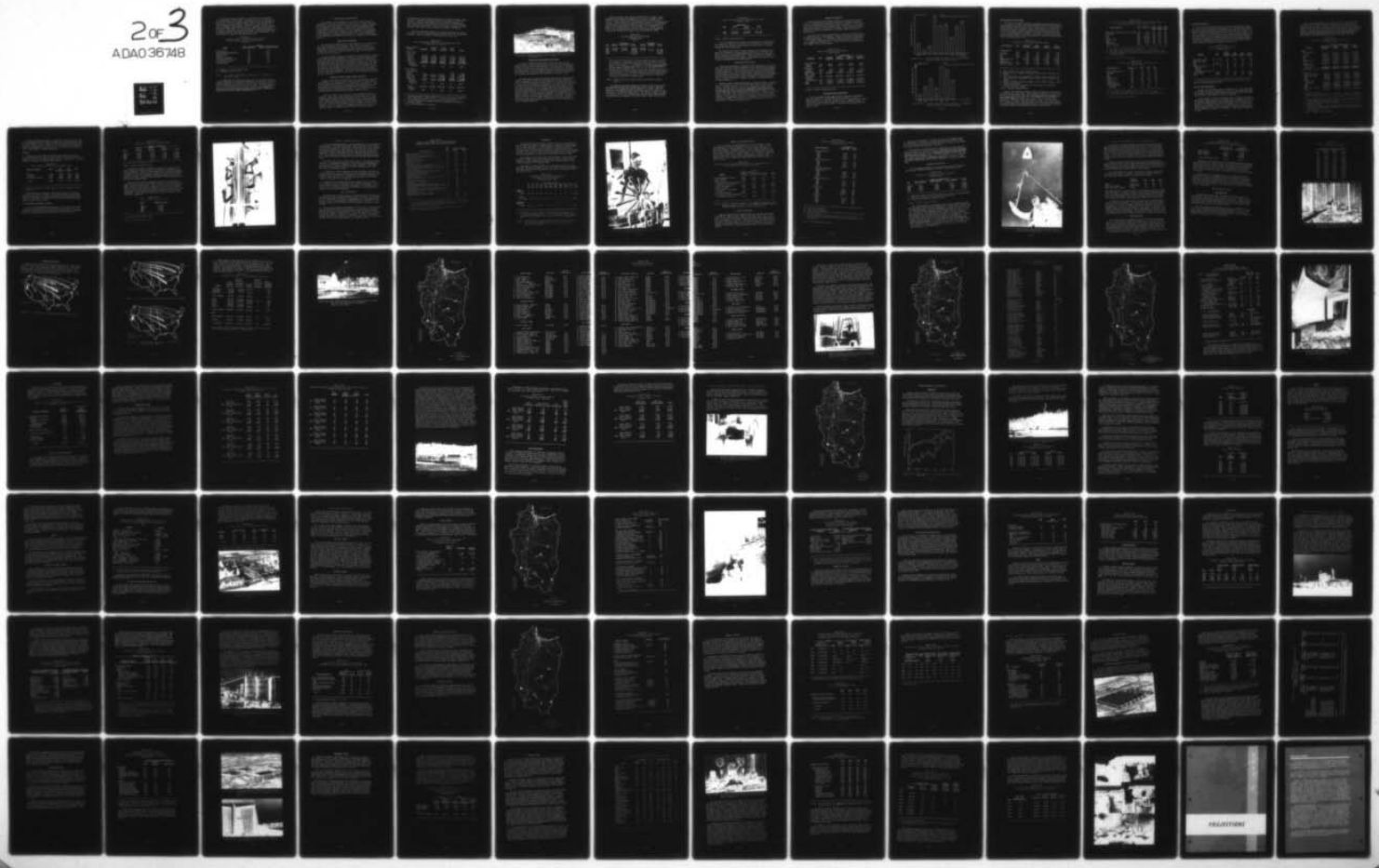
Photo III-4. Corn field under sprinkler irrigation. (Soil Conservation Service Photo)

Photo III-5. Bush bean picker; new machinery and new plant strains are combined to reduce hand labor. (Del Monte Foods Photo)

AD-A036 748 PACIFIC NORTHWEST RIVER BASINS COMMISSION VANCOUVER WASH F/G 8/6
THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED L--ETC(U)
1969

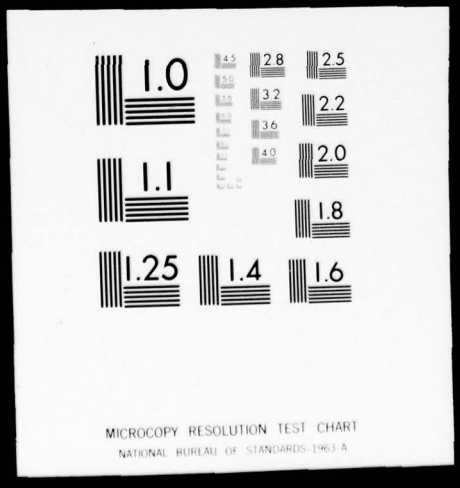
UNCLASSIFIED NL

2 OF 3
ADA036748



2 OF 3

AD A036748



In Willamette Basin, production is estimated to have increased by 38 percent from 1949 to 1959. Production per acre of cropland increased 42 percent and production per employee 119 percent during this same period. A major, although unknown, part of this increase was from technological improvements. Some part, however, was also due to a shift to higher valued products such as vegetables, fruits, and nuts. Agricultural employment, land in farms and farm cropland declined by 37 percent, eight percent, and three percent, respectively (Table III-7). A significant factor in increased productivity was, undoubtedly, also the increase in irrigated land during the period.

Table III-7

Indexes of change: Farm production, employment, and efficiency indicators, Willamette Basin, 1949-1959

Index	Change	
	Index (1949=100)	Annual change (percent
Production 1/	138	3.2
Agricultural employment 2/	63	-3.3
Land in farms	92	-0.8
Cropland	97	-0.2
Production/employee	219	8.2
Production/land in farms	150	4.1
Production/cropland	142	3.5
Acres/employee	146	3.9

1/ Expressed in constant 1949 dollars
2/ Change from 1950 to 1960

Source: U. S. Census of Agriculture, Oregon, and U. S. Census of Population, Oregon

By comparison, it has been estimated that for the three states of Oregon, Washington, and California, production increased by 33 percent, production per man hour (employee) by 68 percent and production per acre of cropland by 34 percent from 1949 to 1959. For more information see the U. S. Department of Agriculture report entitled Changes in Farm Production and Efficiency, A Summary Report, 1965. Statistical Bulletin No. 233, July, 1965, Washington, D. C.

AGRICULTURAL LAND RESOURCES

The availability and productivity of land for agriculture are important to the future of farming. Future levels of farm output may be limited by the availability of land for farming. However, judgment of the adequacy of the quantity of land cannot be made without also considering the productivity of the land. Any expected increase in productivity of land for farming is a major element in the Irrigation, Land Measures and Watershed Protection, and Flood Control Appendices. In this appendix, a broad brush is applied to the twin considerations of the supply and the productivity of land for farming in the Willamette Basin.

Agricultural Land Base

The agricultural land base may be described by use of information from the Conservation Needs Inventory (CNI) conducted by the U. S. Department of Agriculture in 1957-58. These data with appropriate adjustments for the more recent 1964 Census of Agriculture and other sources are considered to be sufficiently accurate for the purpose of this section of the report.

The agricultural land base is defined as the rural land in private, State, city and county ownership. It does not include Federally held land, land used for urban and builtup purposes and small water areas. The agricultural land base area thus defined is about 4.6 million acres and represents about 55 percent of the Economic Study Area. This base includes 2.43 million acres of land defined in the 1964 Census as land in farms but also includes about 1.95 million acres of rural, private land owned by non-farmers and .20 million acres of rural land owned by State and local governments. Most of the land owned by non-farmers is used to provide resources for the lumber and wood products industries, and for recreation.

Quality and Use of Agricultural Land Base

A general indication of the quality of the agricultural land base is provided by the "land capability classification" of soils used by the Soil Conservation Service, U. S. Department of Agriculture. Soils are classified as suitable for plowing and cropping because of favorable physical characteristics and situations or as unsuitable for cropping because of limitations of slope, soil material or some other factor which would cause soil deterioration under cropping.

Lands in Classes I, II, III, and IV are considered suitable for cropping. These soils totaled about 2.4 million acres in the nine-county economic study area in 1958 (Table III-8). Fifty-six percent of the Class I through IV soils suitable for cropping were actually used for cropland, seven percent for pasture-range or native pasture, 33 percent for forest and woodland, and four percent for other uses. Acreages of Class I through IV cropland soils which are not in cropland use--about 1.1 million acres in 1958--are potential sources

for meeting future cropland requirements even though investment inputs required for drainage, clearing, and other developmental costs will increase. Moreover, agriculture is not the only use competing for this land--currently the large majority of the area in urban development, industrial development, parks, transportation systems, and other nonagricultural uses is land of capability Classes I through IV.

Lands not considered suitable for sustained cropland use, Classes V, VI, VII, and VIII, were used primarily (95 percent) for forests and woodlands. Only one percent of these lands was in crop use.

Table III-8
Use of agricultural land base by land capability class
Willamette Basin, 1958 1/

Land Capability Class	Cropland	Pasture-range	Forest-woodland	Other land	Total
Suitable for crop use:					
Class I	150,300	8,200	24,200	17,000	199,700
Class II	568,900	34,000	180,600	47,600	831,100
Class III	332,000	69,400	72,200	26,300	699,900
Class IV	314,800	66,200	321,600	14,200	716,800
Subtotal	1,366,000	177,800	798,600	105,100	2,447,500 2/
Percent of Subtotal	(56)	(7)	(33)	(4)	(100)
Not suitable for crop use:					
Class V	-	-	-	1,800	1,800
Class VI	20,500	40,100	882,800	7,500	950,900
Class VII	4,200	13,100	1,144,600	7,600	1,169,500
Class VIII	-	-	1,600	10,400	12,000
Subtotal	24,700	53,200	2,029,000	27,300	2,134,200
Percent of Subtotal	(1)	(3)	(95)	(1)	(100)
Total	1,390,700	231,000	2,827,600	132,400	4,581,700
Percent of Total	(30)	(5)	(62)	(3)	(100)

1/ *Excludes land under Federal ownership unless leased, and rural builtup areas larger than 10 acres in size. Includes some 200,000 acres of rural land owned by the State, counties and municipalities.*
2/ *See Land Measures and Watershed Protection Appendix for hydrologic boundary subtotal.*
Source: Conservation Needs Inventory

Photo III-6. Permanent pasture in Linn County. (Soil Conservation Service Photo)

Reduction of Agricultural Land Base

A review of changes in land use in Willamette Basin and of studies in other areas indicated urban and builtup land uses were increasing while most other uses were not. Since the future increase in the area of urban and builtup land uses can be expected to come from land principally in rural private ownerships, projections of urban and builtup land uses to the year 2020 were made as a basis for measuring the decrease in the agricultural land base of Willamette Basin.

Projected areas of urban and builtup land use were based on past trends in population density of urban and builtup areas, trends in place of residence and population projections. The population density in urban areas was assumed to change little; the proportion of the population living in urban areas was assumed to increase as in the past. Although the quantity of rural private land may be affected in other ways, the major reductions will likely result from an increased area of urban and builtup use. The assumption made here about population density in urban and builtup areas is essentially an extension of the present density. In the Irrigation Appendix, an increase in population density of about 50 percent was assumed by the year 2020. The net result is that by the year 2000, 175,000 more acres are estimated to shift from rural uses to urban and builtup uses in this appendix than in the Irrigation Appendix.

Urban and builtup land uses were 318,648 acres in 1960. Total urban and builtup uses are projected to increase to 528,900 by 1980, 743,000 acres by 2000 and 1,152,000 acres by the year 2020 (Table III-9). If these projections are approximately correct, the agricultural land base will be reduced by 210,300 acres by 1980 and by some 800,000 acres by 2020, and the agricultural land base would consequently be reduced to 4,157,000 acres by the year 2000, and 3,748,000 acres by 2020. Thus, the agricultural land base is projected to decrease due to urban and builtup use by nearly one-fifth by the year 2020.

Table III-9
Estimated urban and builtup areas
Willamette Basin
(acres)

	Land Area			Increase		
Year	Urban 1/	Builtup 2/	Total	Urban	Builtup	Total
1960	178,048	140,600	318,648	103,936	-	-
1980	314,600	214,300	528,900	136,600	73,700	210,300
2000	-	-	743,000	-	-	214,100
2020	-	-	1,152,000	-	-	409,000

1/ *Urban land areas are defined as areas occupied by towns and cities and contiguous Census County Divisions with a density of 1,000 or more persons per square mile adjacent to Portland, Salem, or Eugene. Bureau of the Census, U. S. Department of Commerce Area Measurement Reports, Areas of Oregon 1960, GE-20, No. 39, Washington, D. C.*

2/ *Builtup land is defined as areas of more than 10 acres and used for industrial sites, railroad yards, cemeteries, airports, golf courses, shooting ranges, etc., and institutional and public administrative sites and similar types of areas. The area devoted to roads and railroads was included in builtup areas.*

Source: Oregon Conservation Needs Inventory and Economic Research Service.

The classes of land that might be utilized for urban and builtup area expansion between 1960 and 1980 were also projected, using projections in the Conservation Needs Inventory as a guide. About 80 percent of the increase in urban and builtup uses is projected to come from Class I through IV cropland soils. This being the case, the quantity of Class I to IV land available for cropland use in 1980 would be 2,278,000 acres as compared to 2,447,500 acres in 1960 (Table III-10).

Table III-10
Present and projected 1980 agricultural land base, Willamette Basin

Year	Land Class I-IV	Land Class V-VIII	Total
	acres		
1960	2,447,500	2,134,200	4,581,700
1980	2,278,000	2,093,400	4,371,400

Source: Economic Research Service

If it is assumed that 80 percent of the reduction in the agricultural land base continued to come from cropland soils of Classes I-IV, the acreage of these soils would decline to 2,106,700 and 1,779,500 in 2000 and 2020, respectively.

The quantity and quality of land available for agricultural uses gives one indication of the potential for production. However, production per acre has increased significantly in the past, resulting in greater production from fewer acres. Larger quantities of nonland inputs and technological developments in farming have reduced the role of land in meeting production requirements.

AGRICULTURAL PROJECTIONS

The projected changes in Willamette Basin agriculture for the years 1980, 2000, and 2020 include estimates of crop production and acreage, livestock production, value of farm production, land use, farm numbers, and farm employment. In these estimates, the effects of domestic and foreign markets, population, income, product substitutions, technology, and the comparative advantage of the basin's agriculture are considered. Agricultural commodities are classed according to the market served; that is, whether the basin is surplus, deficient, or self-sufficient in their production.

Recent studies provided information on expected changes in demands for farm commodities in the Pacific Northwest region and the United States. One such study was by the U. S. Department of Agriculture, Economic Research Service, entitled Agricultural Production and Food Processing in the Pacific Northwest, 1960-1985, Administrative report to the Bonneville Power Administration, Department of Interior, Corvallis, Oregon, July 1964. Also, the Water Resources Council is sponsoring a program of study entitled "Economic and Statistical Analyses and Projections for Comprehensive River Basin Planning," from which preliminary results were drawn. This program is being carried out by the U. S. Departments of Commerce and Agriculture.

National Projections

Future demand for agricultural products is determined by several forces. Because demand is relatively inelastic, population growth is of primary importance in making the national projections. Also significant are per capita income, consumer tastes, industrial use, livestock feeding efficiencies, and imports and exports. National projections of products of particular importance to Willamette Basin are shown in Table III-11.

Allocations of national requirements to regions are based largely on historical roles of the regions. Trends are the major criteria used in making projections. The Willamette Basin projections are based on U. S. economic assumptions, and on the likelihood that the basin will play essentially the same role as it has in the past in providing food for regional and national markets.

Table III-11
Average production of food products, United States

Commodity	Unit	1959-61	Projections 1980	2000	2020
		(million)	(million)	(million)	(million)
Feed grains & wheat	Tons	186.4	277.4	376.6	513.5
Potatoes	Cwt	282.1	347.1	483.7	670.6
Noncitrus fruits	Tons	10.0	12.1	16.6	23.1
Vegetables	Cwt	363.5	635.4	876.2	1,215.1
Beef & veal	Lbs.	28,882.1	47,520.0	65,519.0	90,879.0
Milk & milk products	Lbs.	123,360.0	145,289.0	200,291.0	277,814.0
Poultry & poultry pds.	Lbs.	9,057.4	15,726.0	21,680.0	30,071.0
Eggs	No.	64,832.0	75,778.0	103,944.0	144,172.0
Pork	Lbs.	20,216.6	23,959.0	33,034.0	45,821.0

Source: Economic Research Service.

Willamette Basin Projections

The relationship between agricultural production in Willamette Basin and Oregon for the 1959-1961 period is shown for crops in Figure III-3 and for livestock in Figure III-4. Although land in farms in the basin is only about 12 percent of land in farms in Oregon, 41 percent of Oregon's value of sales of farm products originated in the basin in 1964.

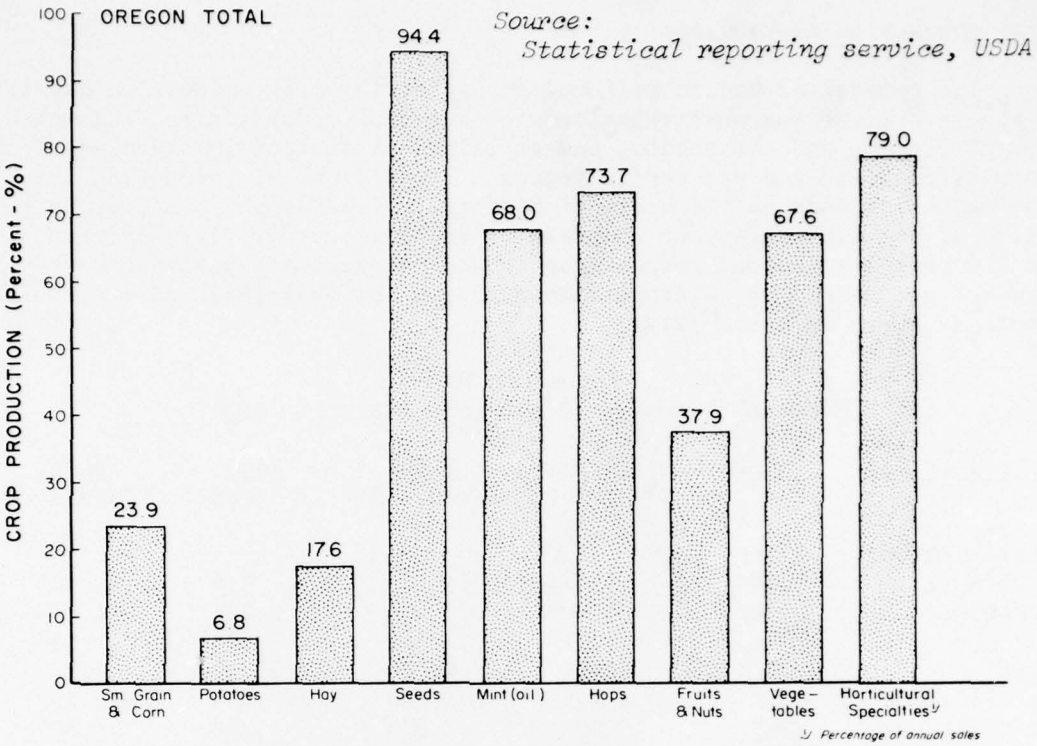


Figure III-3. Willamette Basin Crop Production as a Proportion of Oregon's Production, 1959-61 Average.

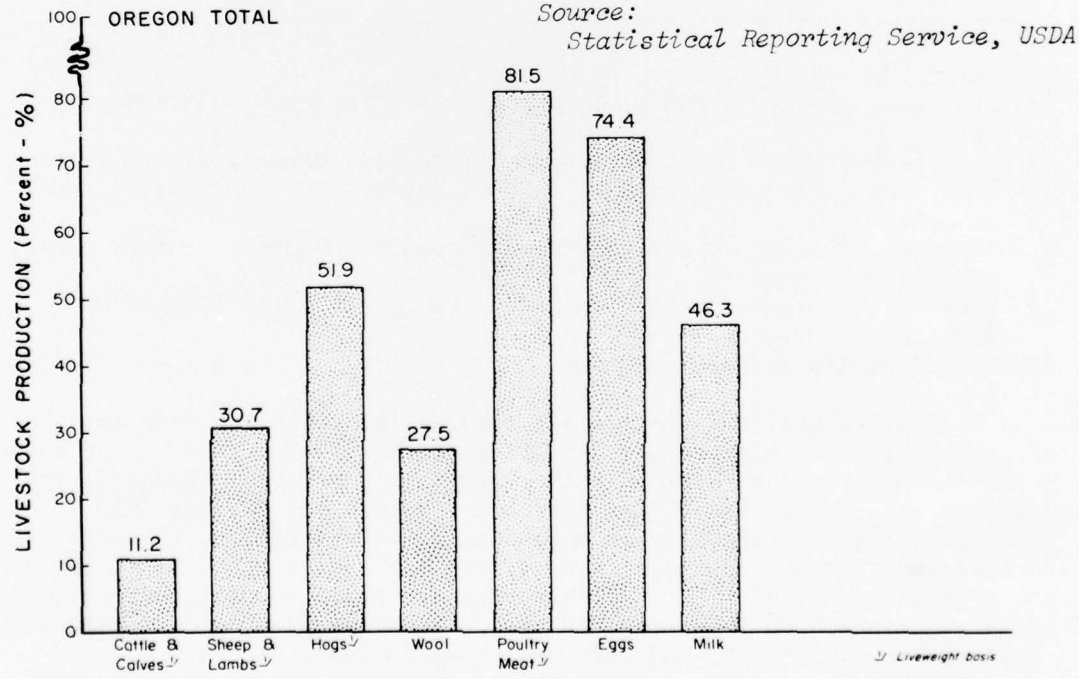


Figure III-4. Willamette Basin Livestock Production as a Proportion of Oregon's Production, 1959-61 Average

Crop Production and Acreage

The general procedure followed in projecting crop production was to evaluate present and past relationships between production in Willamette Basin, Oregon, and the nation, and to relate production in these areas to population size, and per capita income. Projections of production for the basin are made on the basis of historical relationships and projections of the market served. Degrees of relative comparative advantage in the past are assumed to continue in the future. Production for crop product groups and major crops within groups for 1959-1961 and projection years is shown in Table III-12.

Table III-12
Estimated crop production, Willamette Basin

Crop Product	Unit	1959-61 5/ (Thousand)	1980 (Thousand)	2000 (Thousand)	2020 (Thousand)
Small grains & corn 1/	Tons	337	533	736	965
Potatoes	Cwt	590	924	1,276	1,673
Hay	Tons	331	462	638	837
Hops	Lbs.	4,158	4,160	5,740	7,530
Forage seeds 2/	"	205,259	193,800	267,444	350,778
Mint oil	"	625	875	1,208	1,584
Vegetables 3/	Cwt	6,614	14,552	20,081	27,794
Fruits & nuts 4/	Tons	112	190	262	343

1/ *Wheat, barley, rye, oats, and field corn.*
2/ *Ryegrass, clover, fescues, bentgrass, Austrian peas, bluegrass, and vetch.*
3/ *Snap beans, sweet corn, asparagus, broccoli, carrots, lettuce, cabbage, cauliflower, cucumbers, onions, celery, beets, tomatoes, and squash.*
4/ *Berries, filberts, applies, cherries, pears, peaches, prunes, plums, grapes, and walnuts.*
5/ *Statistical Reporting Service, USDA and Oregon State Extension Service, Corvallis, Oregon*
Source: Economic Research Service

Changes in cropland use reflect changes in production, composition of product groups, and yields. Yield estimates (Table III-13) are based primarily on work done by Adon Poli, Long-term Production Prospects for Western Agriculture, ERS, USDA, Agr. Econ. Report No. 33, May 1963. Some modifications were made to more nearly reflect Willamette Basin agriculture. The yield projections differ for some crops from those in the Irrigation Appendix. The differences are based on different methods and assumptions used in making the projections. Projections of harvested cropland for 1980, 2000, and 2020 are shown in Table III-14.

Table III-13

Crop yields per acre harvested, 1959-61, and projected indexes of change, Willamette Basin (1959-61 = 100)

Crop Product 1/	Unit	1959-61 2/	1980 Index	2000 Index	2020 Index
Small grains and corn (incl. silage)	Tons	.85	178	270	400
Potatoes	Cwt.	147.50	157	216	378
Hay	Tons	1.97	140	208	310
Hops	Lbs.	1,386.00	150	207	272
Forage seeds	Lbs.	743.69	115	170	251
Mint	Lbs.	62.50	140	215	317
Vegetables	Cwt.	143.78	125	184	276
Fruits and nuts	Tons	1.40	148	223	326

1/ See Table III-12 footnotes for commodities in each group.

2/ Base period data are from the Statistical Reporting Service, USDA, Portland, Oregon and the Extension Service, Oregon State University, Corvallis, Oregon.

Source: Economic Research Service

Table III-14

Estimated harvested cropland, Willamette Basin (thousand acres)

Crop Product 1/	1959-61 2/	1980	2000	2020
Small grains & corn	396	353	320	284
Potatoes	4	4	4	3
Hay	168	168	156	137
Hops	3	2	2	2
Forage Seeds	276	227	212	188
Mint	10	10	9	8
Vegetables	46	81	76	70
Fruits and nuts	80	92	84	75
Total harvested cropland	983	937	863	767

1/ See Table III-12 footnotes for commodities in each group.

2/ Statistical Reporting Service and Oregon State Extension Service

Source: Economic Research Service

Livestock Production

The procedure followed in projecting livestock production is similar to that used in projecting crop production. Relationships between production, and population and income were also examined to obtain estimates of whether the products were surplus or deficit in the basin. The basin is deficient in production of all livestock products except turkeys and mutton. Since the basin does not produce as much livestock and livestock products as it consumes, production projections are made on the basis of population increases for the basin and estimated changes in per capita consumption. Estimated base period (1959-1961) and projected livestock production is shown in Table III-15.

Table III-15
Production of livestock products, Willamette Basin

Product	Unit	Base 1959-61 (mill.)	1980 (mill.)	2000 (mill.)	2020 (mill.)
Cattle and calves	Lbs. lv. wt.	47	94	130	193
Sheep and lambs	" "	16	17	24	35
Wool	Lbs.	2	2	3	5
Hogs	Lbs. lv. wt.	30	40	56	82
Poultry products:	" "	64	123	169	250
Broilers	" "	31	-	-	-
Turkeys	" "	24	-	-	-
Chickens (ex. brlrs.)	" "	9	-	-	-
Chicken eggs	Number	447	581	796	1,181
Milk	Lbs.	521	677	937	1,390

1/ Statistical Reporting Service and Oregon State Extension Service
Source: Economic Research Service

Value of Farm Production

Fruits, nuts and berries had the highest value of any crop group in 1959-1961, and this is expected to continue in the projection years. The estimate of $26.5 million in 1959 is 28 percent of all crop value, and the value of $45 million in 1980 is 31 percent.

Next in order of value of production, in all periods, are vegetables, small grains and corn, and forage seeds. Estimated value of the two highest ranked groups--fruits-nuts-berries and vegetables--is 49 percent of the value of all crops in 1959-1961, and it is projected to increase to 58 percent by 1980. The production of all crops, in constant dollars, is projected to increase by 57 percent from the base period (1959-1961) to 1980, by 116 percent to 2000, and by 188 percent to 2020.

Values of farm production for the years 1959-61, and projections for 1980, 2000, and 2020 are shown in Table III-16. Average and normalized prices were used. Prices for 1959-1961 were obtained from the Extension Service, OSU, and Statistical Reporting Service, USDA, Portland, Oregon. Normalized prices were based, in part, on data in Interim Price Standards for Planning and Evaluating Water and Land Resources, Water Resources Council, Washington, D. C., April 1966, and a supplement (Adv. WS-22) by the Soil Conservation Service of August 19, 1966.

Table III-16
Annual farm value of agricultural production, Willamette Basin

Product	Value of Production 1/ 1959-1961 2/ ($1,000)	1980 ($1,000)	2000 ($1,000)	2020 ($1,000)
Crops:				
Small grains & corn	17,213.77	24,598.8	33,946.3	44,523.8
Potatoes	1,500.75	2,347.0	3,241.0	4,249.4
Hay	7,710.95	10,769.2	14,871.8	19,510.5
Hops	1,987.38	1,988.5	2,743.7	3,599.3
Forage seeds	16,318.26	17,577.7	24,257.2	31,815.6
Mint	2,788.21	3,901.6	5,386.5	7,063.1
Vegetables	19,243.42	39.897.3	55,018.3	76,163.9
Fruits, nuts & berries	26,496.00	44,982.5	61,985.9	81,193.4
Total value of crops	93,258.74	146,062.6	201.450.7	268,119.0
Livestock:				
Cattle and calves	9,480.00	18,800.0	26,000.0	38,600.0
Sheep and lambs	2,672.00	2,822.0	3,984.0	5,810.0
Wool	949.20	936.0	1,404.0	2,340.0
Hogs	4,650.80	6,628.0	9,279.2	13,587.4
Poultry meat products	11,596.36	20,664.0	28,392.0	42,000.0
Eggs	13,270.00	18,011.0	24,676.0	36,611.0
Milk	21,817.33	29,991.0	41,509.1	61,577.0
Total value of livestock	64,435.69	97,852.0	155,244.3	200,525.4
Total value of crop & livestock production	157,694.43	243,914.6	336,695.0	468,644.4

1/ Average 1959-61 prices used for base period and average or normalized prices used for projection years.
2/ Based on data from Statistical Reporting Service and Oregon State Extension Service.
3/ Figures not adjusted for feed and hay fed to livestock. Value of feed and hay fed estimated to be $19-22 in 1959-61 and $30-40 million in 1980.
Source: Economic Research Service

Value of livestock production in 1959-1961 was led by poultry products including broilers, turkeys, chickens, and chicken eggs, followed by dairy products. Next in order of value were cattle and calves, hogs and sheep, lambs and wool. Production of all livestock, in constant dollars, is projected to increase by 52, 141, and 211 percent from 1959-1961 to 1980, 2000, and 2020, respectively.

Land Use

Land used for agricultural cropland is projected to decline by about 246,000 acres from 1964 to the year 2020. Harvested cropland is projected to decrease by 164,000 acres during the same period. Projected changes in land use are shown in Table III-17.

Table III-17
Use of agricultural land base, Willamette Basin

Land Use Category	1964 1/	1980	2000	2020
	(thousands of acres)			
Cropland	1,306	1,290	1,190	1,060
Harvested	(931)	(937)	(863)	(767)
Other Agr. land base	3,276	3,080	2,967	2,688
Total	4,582	4,372	4,157	3,748

1/ *Census of Agriculture, Oregon, 1964 and Oregon Conservation Needs Inventory*

Rural land use is expected to decline as other uses, especially urban and builtup land, increase. Rural nonfarm uses, such as those mentioned previously, may also be expected to bid land away from agriculture. Projections of cropland are consistent with projected crop production and yields per acre.

Farm Employment and Number of Farms

One of the outstanding characteristics of post-World War II agriculture, both nationally and in Willamette Basin, has been that farm production increased while the farm labor force declined. A continued decline in agricultural employment is projected (Table III-18).

Table III-18
Agricultural employment, Willamette Basin

Year	Number of Employees			
	Lower Subarea	Middle Subarea	Upper Subarea	Total
1964 1/	10,900	12,700	3,700	27,300
1980	7,480	8,790	2,430	18,700
2000	5,680	6,670	1,850	14,200
2020	4,400	5,170	1,430	11,000

1/ Oregon State Employment Service

Source: Economic Research Service

Employment on farms is projected to decline by 32 percent from 1964 to 1980 and to decline further throughout the remainder of the projection period. Rates of future change in agricultural employment are based on projected increases in production and expected changes in output per worker. The assumed percentage increases in output per employee are five percent per year from 1960 to 1980 and three percent per year from 1980 to 2020.

Projections are that the number of farms will not decline as rapidly as in the past 15 years (Table III-19); from 1949 to 1964 this number declined by 35 percent. More than one-half of the projected decline of about 6,500 farms by 1980 may be from farms less than 50 acres in size. Small farms are likely to continue to drop out of farming because of low income and the opportunities afforded by nonfarm employment. Large farms are expected to continue to increase in efficiency of production.

Table III-19
Number of farms, Willamette Basin

Year	Number of Farms
1964 1/	20,366
1980	13,900
2000	10,500
2020	8,200

1/ Census of Agriculture, Oregon

Source: Economic Research Service

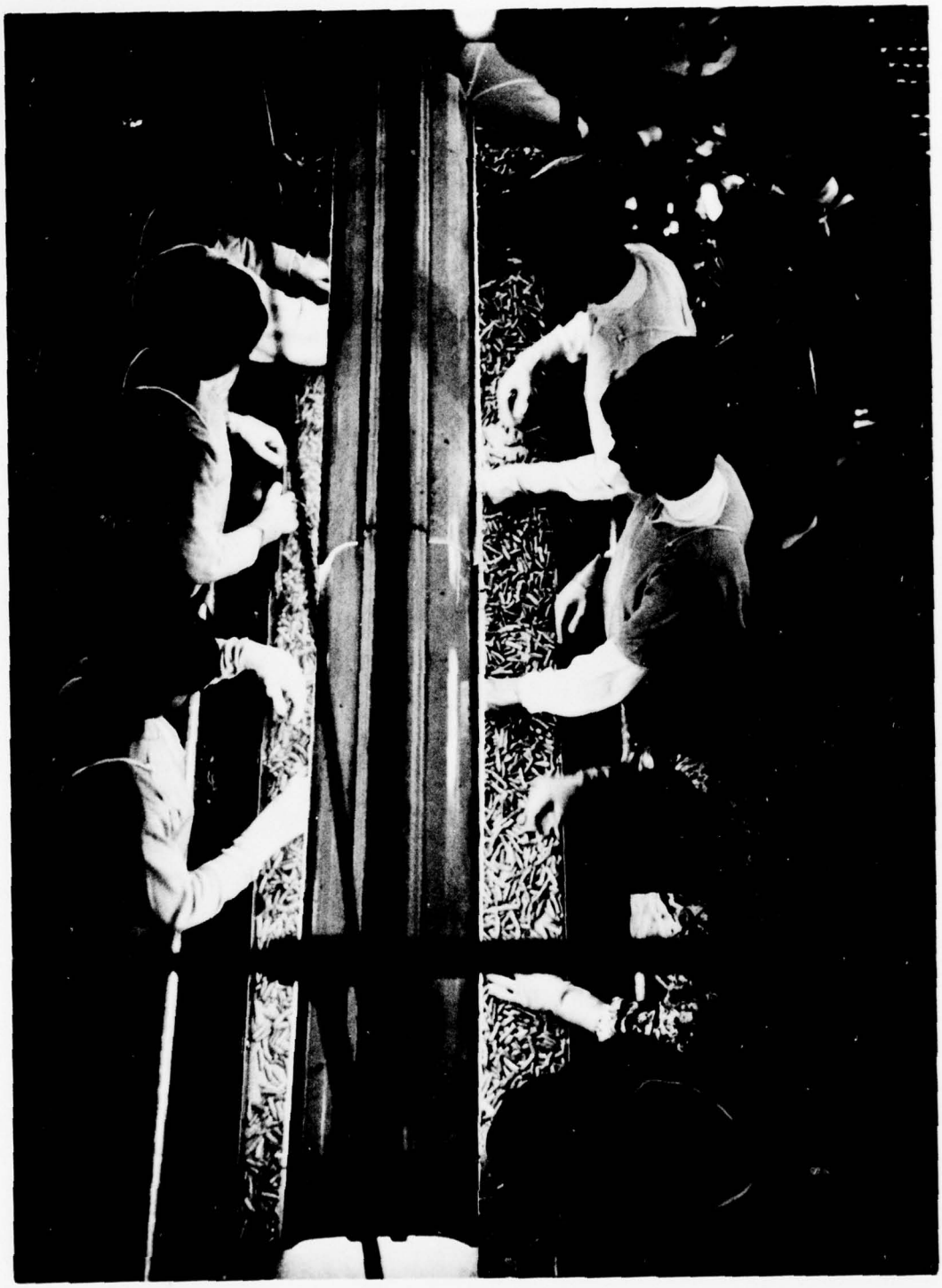


Photo III-7. Green bean inspection line in a Salem cannery. (Del Monte Foods Photo)

FOOD PROCESSING

The food processing industry is an important part of the Willamette Basin economy. This industry employed about 15 percent of all workers in manufacturing, and was second only to lumber and wood products among manufacturing industries. Approximately one-third of the food processing employees work in canning, freezing, and preserving fruits and vegetables. Another 28 percent work in processing meat and dairy products, 18 percent work in bakery products, and the remainder in grain mill, sugar, confectionary, beverage, and miscellaneous products industries.

Willamette Basin farms provide major inputs to the food processing industry. A considerable quantity of fresh fruits and vegetables are sold on the local market in addition to those processed. Willamette Basin farms also provide products to dairies, bakeries, grain mills, and other food processing firms.

In addition to direct employment in food processing, many jobs in related industries, such as those in supplies, equipment, services, and transportation, are provided. Although this additional employment is related to the existence of the food processing industry, it is discussed in other parts of this appendix.

Although food processing output has expanded rapidly in recent years, employment has declined since 1958. Annual increases of two to four percent in output per employee are common in this industry. The trend to fewer and larger plants has contributed to increasing labor productivity and other efficiencies.

TYPE OF PROCESSING

An Oregon State University survey in 1966 enumerated 365 manufacturing firms processing food and kindred products. Of these, four handled fish and 20 bottled soft drinks or carbonated water; the remainder manufactured food or feed products from agricultural raw materials. Firms primarily engaged in distribution, either wholesale or retail, were not included.

The type of processing and location of firms reflect the particular agricultural characteristics of the basin. Fifty-three of the plants engage primarily in seed cleaning and processing, providing an outlet for the seed industry (Table III-20). Fruits and vegetables are canned, dehydrated, pickled, or frozen by a complex of 79 firms. Livestock provides important raw materials for 103 processing firms and constitutes a market for 36 firms preparing feeds for animals and fowl.

Table III-20

Processing firms operating in Willamette Basin, 1965-66, showing annual and seasonal employment

Product or Service	Number of Firms	Number of Employees	
		Annual 2/	Seasonal
Agricultural services, not elsewhere classified 1/	53	397	259
Meat packing plants	44	1,277	-
Sausages and other prepared meat products	16	574	-
Poultry and small game dressing and packing, wholesale	15	767	307
Creamery butter	4	44	-
Condensed and evaporated milk	2	14	5
Ice cream and frozen desserts	3	120	-
Fluid milk	19	1,465	50
Canned and cured seafoods	2	73	37
Canned specialties	2	14	-
Canned fruits, vegetables, preserves, jams and jellies	30	1,583	9,679
Dried and dehydrated fruits and vegetables	18	193	627
Pickled fruits and vegetables, vegetable sauces and seasonings, salad dressings	6	226	271
Fresh and frozen packaged fish	2	28	-
Frozen fruits, fruit juices, vegetables, and specialties	25	687	7,150
Flour and other grain mill products	2	200	-
Prepared feeds for animals and fowl	36	549	190
Cereal preparations	1	19	-
Blended and prepared flour	1	15	-
Bread and other bakery products, except biscuit, crackers and pretzels	25	1,474	-
Biscuit, crackers and pretzels	7	1,033	-
Candy and other confectionary products	8	118	60
Malt liquors	1	225	35
Wines, brandy and brandy spirits	1	8	-
Bottled and canned soft drinks and carbonated waters	20	598	-
Flavoring extracts and flavoring syrups, not elsewhere classified	3	26	10
Grease and tallow	4	69	-
Animal and marine fats and oils, except grease and tallow	3	213	-
Shortening, table oils, margarine and other edible fats and oils, not elsewhere classified	1	14	-
Manufactured ice	3	9	-
Macaroni, spaghetti, vermicelli, and noodles	4	62	-
Food preparations, not elsewhere classified	4	380	95
Total	365	12,474	18,853

1/ Firms listed in this category all have seed cleaning and processing as their primary activity. Firms in this category are classified under agricultural services by the Bureau of the Budget, but are included here because they are a part of the Oregon seed industry.

2/ Number of employees hired on a full year basis.

Unpublished data resulting from a survey of business firms by the Department of Agricultural Economics. Oregon State University, Corvallis.

EMPLOYMENT

The processing firms employed a total of 12,474 annual employees and an additional 18,853 at seasonal peaks in 1965-66. Seasonal employment is about equivalent to 2,000 employees working full-time for one year and is an important source of income for part-time employees. The availability of this seasonal labor is crucial to the food processing industry. The payroll for all food processing employees covered under the Oregon Department of Employment law was $83.2 million in 1965.

Meat packing, fluid milk, fruit and vegetables, canning and freezing, and the baking firms employ the greatest number of year-around employees. Firms canning and freezing fruits and vegetables utilize a high percentage of the seasonal labor.

The number of annual employees per firm ranges from two to more than 500. Although 45 percent of the firms hired fewer than 11 employees, 28 firms hired more than 100 employees; of these, two hired more than 500 (Table III-21).

Table III-21
Distribution of food manufacturing firms by number of employees per firm, Willamette Basin, 1966

	Employees per Firm										
	0-10	11-20	21-30	31-50	51-100	101-200	201-300	301-400	401-500	501-+	Total
Annual:											
No. of firms	144	48	36	29	37	20	4	2	0	2	322 1/
Percent of firms	45	15	11	9	11	6	1	1	0	1	100
Seasonal:											
No. of firms	250	7	8	13	13	8	6	4	2	0	311

1/ *This number does not include the 53 firms primarily engaged in cleaning and processing seed. It does include four firms engaged in processing of seafoods that have a total annual employment of 101.*

Source: Unpublished data resulting from a survey of business firms by the Department of Agricultural Economics, Oregon State University, Corvallis.

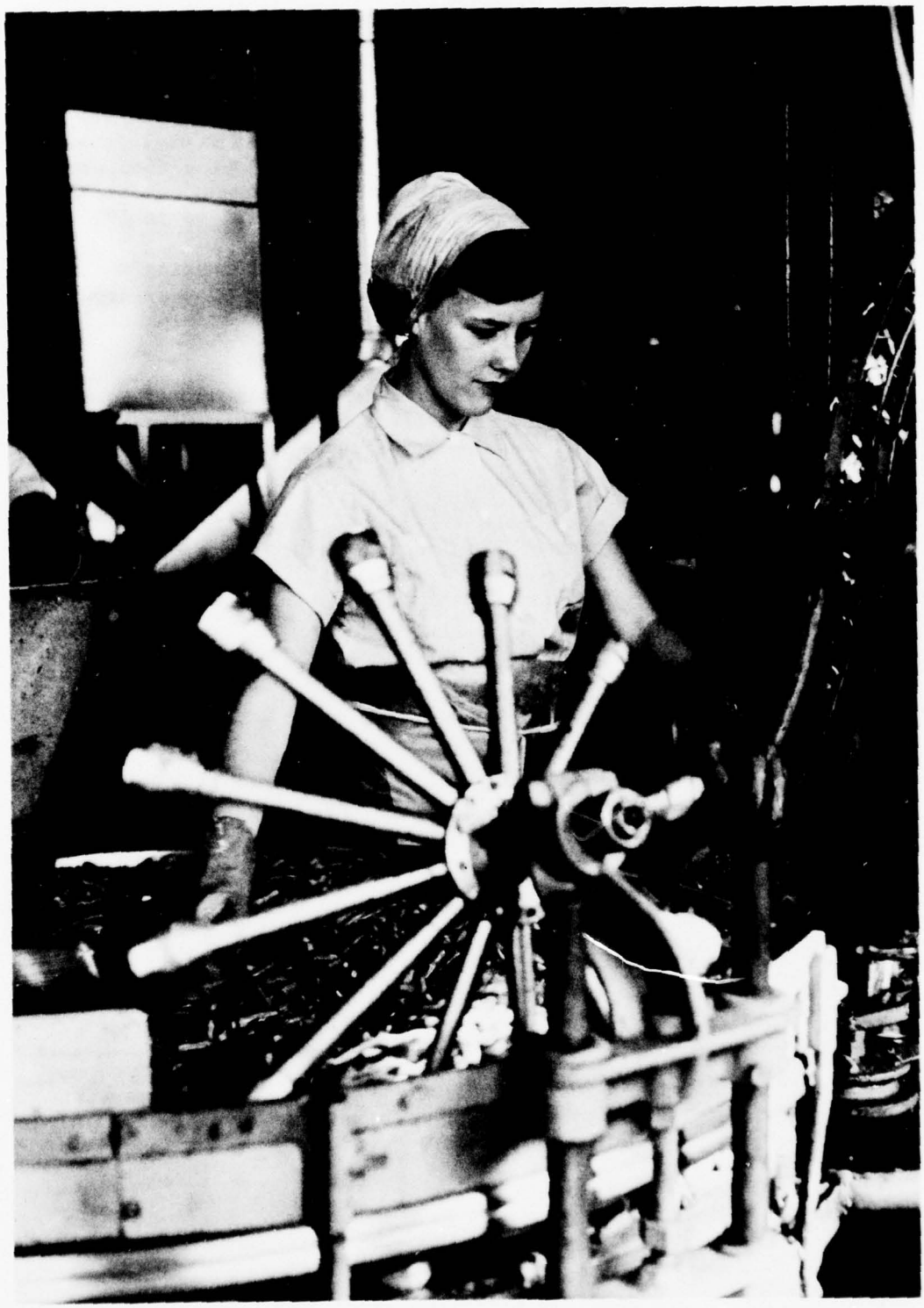


Photo III-8 *Green beans being processed in a Salem cannery.*
(Del Monte Foods Photo)

MARKETS FOR PROCESSED OUTPUT

About 61 percent of the employment in food and kindred products manufacturing is to serve markets in Willamette Basin (Table III-22). Nearly 90 percent of the employment is for the Oregon, Washington or California markets. Markets for dairy, bakery, confectionery and related and beverage products are mostly local. The canning and preserving firms export a large part of their output out of the basin. Grain mill products also have a large amount of employment for export output. These exports inject income from areas outside the basin area into the basin economy.

Table III-22

Distribution of employment in food processing firms according to the market area served, Willamette Basin, 1966

Product	Willamette Basin	Other Oregon and Washington	California	Other
Food and kindred products	60.8	20.6	7.7	10.9
Meat products	71.2	22.9	2.3	3.6
Dairy products	82.5	17.4	0.2	-
Canning and preserving fruits, vegetables and seafoods	10.2	14.9	32.7	42.2
Grain mill products	41.1	15.5	19.0	24.4
Bakery products	72.3	25.2	0.3	2.2
Confectionery and related products	73.2	6.2	2.1	19.6
Beverage industries	80.3	17.3	0.5	1.9
Miscellaneous food preparations and kindred products	51.3	36.8	0.3	11.6

Source: Donald H. Farness and Gordon Sitton, Economic Prospects for the Willamette Valley, Department of Agricultural Economics, Oregon State University, Corvallis, Oregon, 1968, page 18.

OUTPUT PROJECTIONS

Canning, preserving and freezing output is projected to increase 73 percent by 1980 and nearly three and one-half times by 2020. This sector of the food processing industry has significant export markets that are projected to continue. Production in all other industries is projected to increase also, but at a rate determined primarily by basin population growth and changes in per capita consumption. Projected changes in production of food and kindred products are shown in Table III-23.

Table III-23
Production of food and kindred products
Willamette Basin

Sector and Year	Production	
	Mill. lbs.	Index
Meat products 1/:		
1963	400.7	100
1980	628.5	157
2000	863.2	215
2020	1,191.6	297
Dairy products 2/:		
1963	476.0	100
1980	580.5	122
2000	801.4	168
2020	1,106.4	232
Canning, preserving, freezing 3/:		
1963	500.8	100
1980	866.4	173
2000	1,252.0	250
2020	1,737.8	347
Bakery products 2/:		
1963	343.5	100
1980	443.5	129
2000	612.3	178
2020	845.3	246
Grain mill:		
1963	886.7	100
1980	1,329.9	150
2000	1,836.2	207
2020	2,535.0	286
Other 4/:		
1963	234.8	100
1980	363.0	155
2000	513.3	219
2020	708.7	302

1/ Liveweight equivalent.
2/ Weight of final product.
3/ Input weight excluding canned and frozen specialties, some preserves, jams and jellies.
4/ Confectionery and related items, beer, wines and soft drinks. Does not include miscellaneous food products such as manufactured ice, macaroni, etc.

Source: Economic Research Service

The study area's share of the national output of processed fruit and vegetables is projected to increase somewhat between 1960 and 1980. For other products, the projected production levels reflect little change in the past competitive position of the basin.

For estimates of regional and State projections and other information on prospects for food processing see Agriculture and Food Processing, Bonneville Power Administration; Long-Run Projections of Food Processing and Marketing in the West, Dale G. Stallings, Economic Research Service, USDA, Agricultural Economics Report No. 78, Washington, D. C., June 1965; and Oregon's Agriculture is Everybody's Business, G. E. Korzan, Oregon Agricultural Experiment Station Special Report 183, Corvallis, December 1964.

EMPLOYMENT PROJECTIONS

Food processing employment is projected to decline from 13,864 in 1963 to about 12,600 in 1980 and to 11,700 in 2020 (Table III-24).

Table III-24

Estimated food and kindred products employment
Willamette Basin

Year	Number of Employees 1/			
	Upper Subarea	Middle Subarea	Lower Subarea	Total
1963 2/	1,293	4,346	8,225	13,864
1980	1,200	3,800	7,600	12,600
2000	1,100	3,600	7,300	12,000
2020	1,100	3,500	7,100	11,700

1/ Excludes employment in canned and frozen specialties, some preserves, jams, and jellies, and miscellaneous food products.
2/ Oregon State Employment Service, Salem.

Source: Economic Research Service

The slight declines in employment result from an assumed continuation of postwar trends in labor productivity to 1980, then a reduced rate of change thereafter. Output per employee is assumed to increase by two to 3.5 percent annually for the 1963-1980 period and by 1.25 to 2.5 percent annually for the 1980-2020 period. Higher rates of increase in labor productivity are projected for the meat and canning-freezing-preserving sectors than for the other sectors of the industry. Information on labor productivity in food processing is published in W. H. Waldorf, "Output per Man Hour in Food Manufacturing," Marketing and Transportation Situation, U. S. Department of Agriculture, ERS, February 1965. The distribution of employment among subareas is assumed to remain unchanged for the projection period, because it was relatively stable during the 1940-1964 period.

Photo III-9. Balloon logging research aimed at reducing damage to surrounding area during harvest. (U. S. Forest Service)

FOREST PRODUCTS INDUSTRIES

The economic development engendered by the forest resources is of major significance to both Willamette Basin and the Pacific Northwest. Timber processing has historically been and still is the leading manufacturing industry in both the basin and the region. In 1964, employment in lumber and wood products, and paper and allied products was 40 percent of the total manufacturing employment in both the basin and the region. This compares to 7 percent in the nation. Timber processing creates needs for supporting services such as transportation, sales and finance.

Projected changes in the basin's forest products industries are based on national and regional supply and demand estimates made by the U.S. Forest Service. Growth of the industry in the basin will be limited by the economically available supply of timber, hence a larger national growth would have only a minor effect on this industry.

Per capita demands for timber products have changed in the recent past and are expected to continue. The future per capita demand for the three major forest products is projected as follows:

	Units of Measure	1962	1980	2000
Lumber	Board feet	200	180	165
Plywood and Veneer	Square feet	64	91	97
Paper and Allied Products	Pounds	454	575	711

These demands assume a continued shift to plywood and paper and a shift away from lumber. A change in demand to more highly fabricated products or to less fabricated products, such as logs for export, would greatly modify these projections. Since the total demand for wood is rising, it is likely that future basin supplies of timber will be fully used.

The Forest Service reports for Willamette Basin include Columbia County in the Lower Subarea. All data in this section on forest product industries, unless otherwise stipulated, follow the Forest Service delineation. In the Lower Subarea, as defined by the Forest Service, Columbia County's output is 40 percent of the lumber, 13 percent of the plywood and veneer, 20 percent of the miscellaneous wood products, and 33 percent of the pulp and paper. These factors can be used to reconcile differences of future projections caused by unlike area definitions.

TIMBER RESOURCES

Vast timber stands are dominant features of the basin landscape. Of the 7.7 million acres, about 5.0 million acres--two-thirds of the land area--are classed as commercial forest land. Timber stands in the basin contain 146 billion board-feet of sawtimber--about 10 percent of all softwood timber in the nation--with Douglas fir (69 percent) and western hemlock (15 percent) the dominant species (see Table III-25). In spite of the large volume of timber cut during the past decades, most of the commercial forest area is well stocked.

Table III-25

Volume of growing stock and sawtimber on commercial forest land in Willamette Basin, 1963

	Growing Stock Million Cu. Ft.	Sawtimber Million Bd. Ft.
Lower Subarea	6,165	33,999
Middle Subarea	8,814	50,326
Upper Subarea	10,541	61,792
Total Willamette Basin	25,520	146,117

Ownership of forest land is evenly divided between public and private, although public lands presently have 80 percent of the sawtimber. During the first half of this century, cutting was confined to private lands because public lands were remote and relatively inaccessible. The majority of old-growth timber is now harvested from the public lands, and the private lands are now producing second- and third-generation crops.

Competitors in the southern pine region (southeastern United States) have locational advantage over both the basin and the Pacific Northwest in access to many markets. However, forests of Willamette Basin yield excellent structural material. Second-growth Douglas fir has better structural qualities than the three or four species commonly referred to as "southern pine"; this factor helps the Douglas fir industry stay competitive.

PRESENT FOREST INDUSTRY

Log Production

Log production in the basin has remained relatively stable in recent years. From 1950 to 1963, inclusive, the cut averaged 3.4 billion board-feet annually (international 1/4-inch rule). Timber harvest from private land has been decreasing while that from public land has been increasing. In 1963, 56 percent of the cut was from public land compared to 24 percent in 1950 (Table III-26).

Log harvest during the 14-year period shifted southward, with the cut in both the Lower and Middle Subareas decreasing. In 1963, 50 percent of the log harvest was in the Upper Subarea, 34 percent in the Middle Subarea, and 16 percent in the Lower Subarea. The corresponding figures in 1950 were 41, 41, and 18 percent.

Table III-26
Annual log production, by owner class, Willamette Basin, 1950-1963

Year	Log Production in Million Board Feet		
	Private Land	Public Land	Total
1950	2,896	893	3,789
1951	2,988	890	3,878
1952	3,117	952	4,069
1953	2,431	1,135	3,566
1954	2,294	1,173	3,467
1955	2,191	1,157	3,348
1956	2,351	1,107	3,458
1957	1,736	1,059	2,795
1958	1,567	1,298	2,865
1959	1,424	1,710	3,134
1960	1,645	1,423	3,068
1961	1,744	1,491	3,235
1962	1,734	1,963	3,697
1963	1,637	2,080	3,717

Photo III-10. Horse logging replaces heavy equipment logging in young growth forests (U.S. Forest Service Photo)

Manufacturing Output

Lumber, veneer, plywood, wood pulp, and paper are the basin's most important forest products, and are significant nationally. See Figures III-5, -6, and -7 for distribution outside the basin. In 1963 the basin produced 9 percent of the nation's lumber, 34 percent of its softwood veneer and plywood, and 3 percent of the wood pulp. In 1964, the total value of output exceeded $500 million.

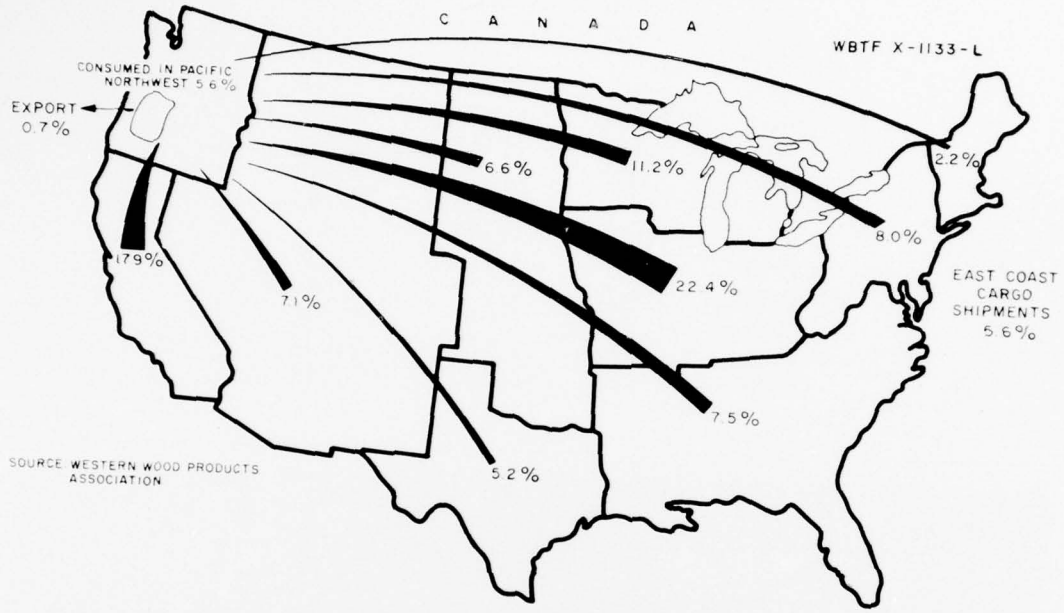


Figure III-5. Distribution of Lumber from Willamette Basin, 1963-65.

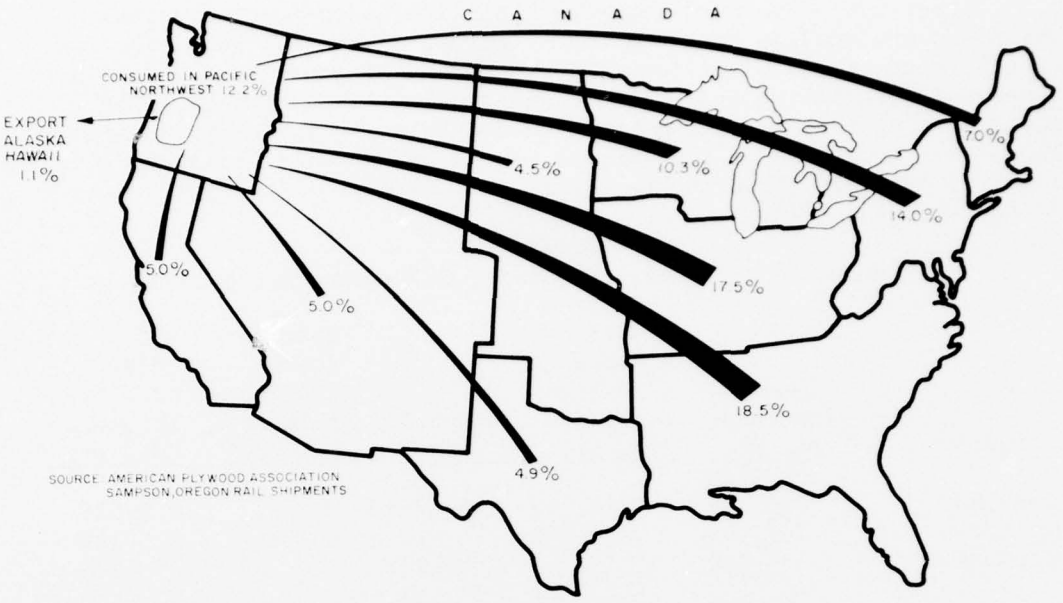


Figure III-6. Distribution of Plywood from Willamette Basin, 1963-65.

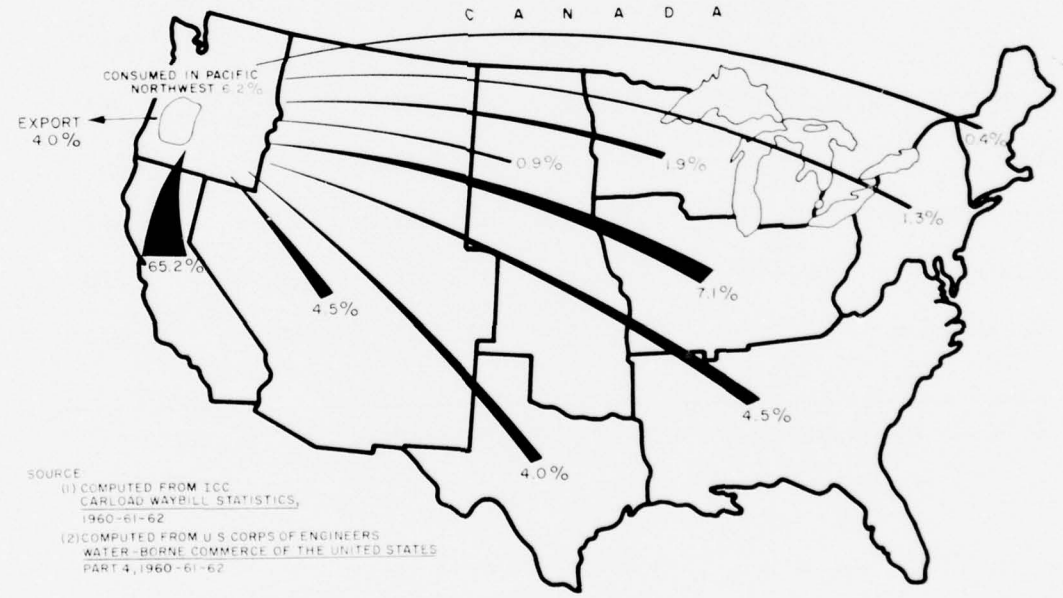


Figure III-7. Distribution of Pulp, Paper, and Paperboard from Willamette Basin, 1960-62.

Lumber output in 1963 exceeded 3 billion board-feet, over half of which was produced in Lane and Linn Counties (Table III-26). The combined output of all other counties, except Washington County, was in excess of 100 million board-feet. The general dispersion of lumber manufacturing throughout the basin is indicated by the distribution of sawmills. Locations of the largest of the 293 sawmills existing in the basin in 1965 are shown on Map III-1. The largest sawmills are also listed on Table III-28.

Table III-27

Production of timber products, Willamette Basin, 1963

County	Lumber Thousands Bd. Ft.	Veneer & Plywood (3/8 Inch) Thousands Sq. Ft.	Woodpulp Tons	Particle Board (3/4 Inch) Millions Sq. Ft.	Misc. Products Thousands Cu. Ft.
Clackamas	195,778	80,000	307,728	-	1,833
Multnomah	141,099	296,000	-	-	153
Washington	66,962	-	36,927	-	134
Lower Subarea	403,839	376,000	344,655	-	2,120
Benton	290,768	251,000	24,618	-	723
Linn	467,775	1,086,000	110,782	60	3,340
Marion	120,970	-	49,236	-	731
Polk	200,896	289,000	-	-	857
Yamhill	117,976	107,846	49,236	-	115
Middle Subarea	1,198,385	1,753,846	233,872	60	5,766
*Lane					
Upper Subarea	1,240,432	1,348,000	123,091	22	8,442
Columbia	266,705	55,800	172,327	-	520
Total Basin	3,109,361	3,513,646	873,945	82	16,848

* *Lane County figures represent the Upper Subarea.*

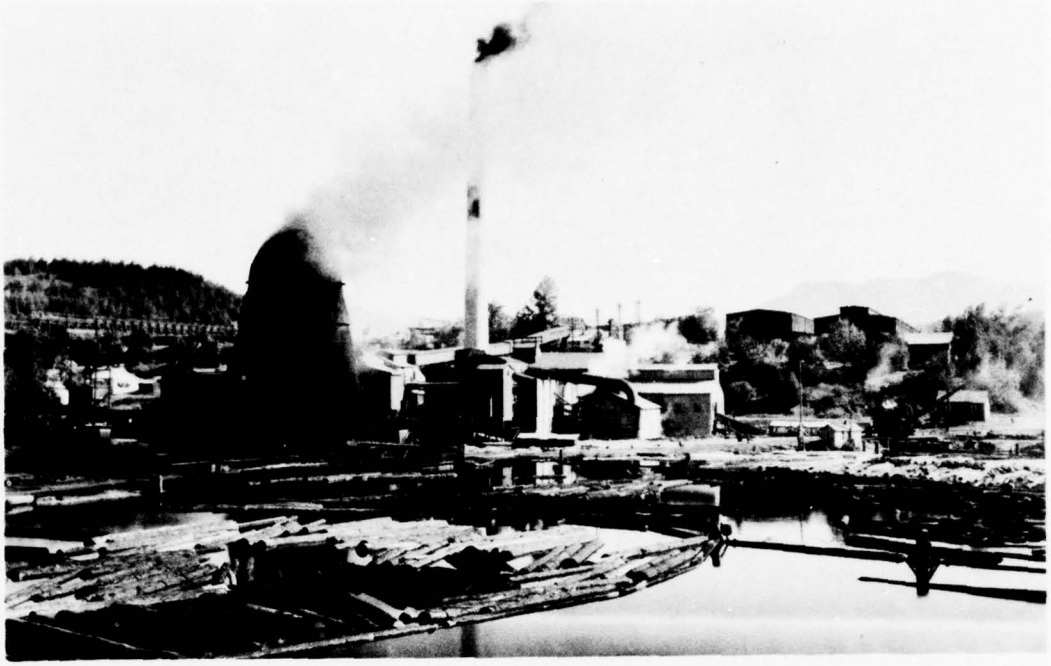
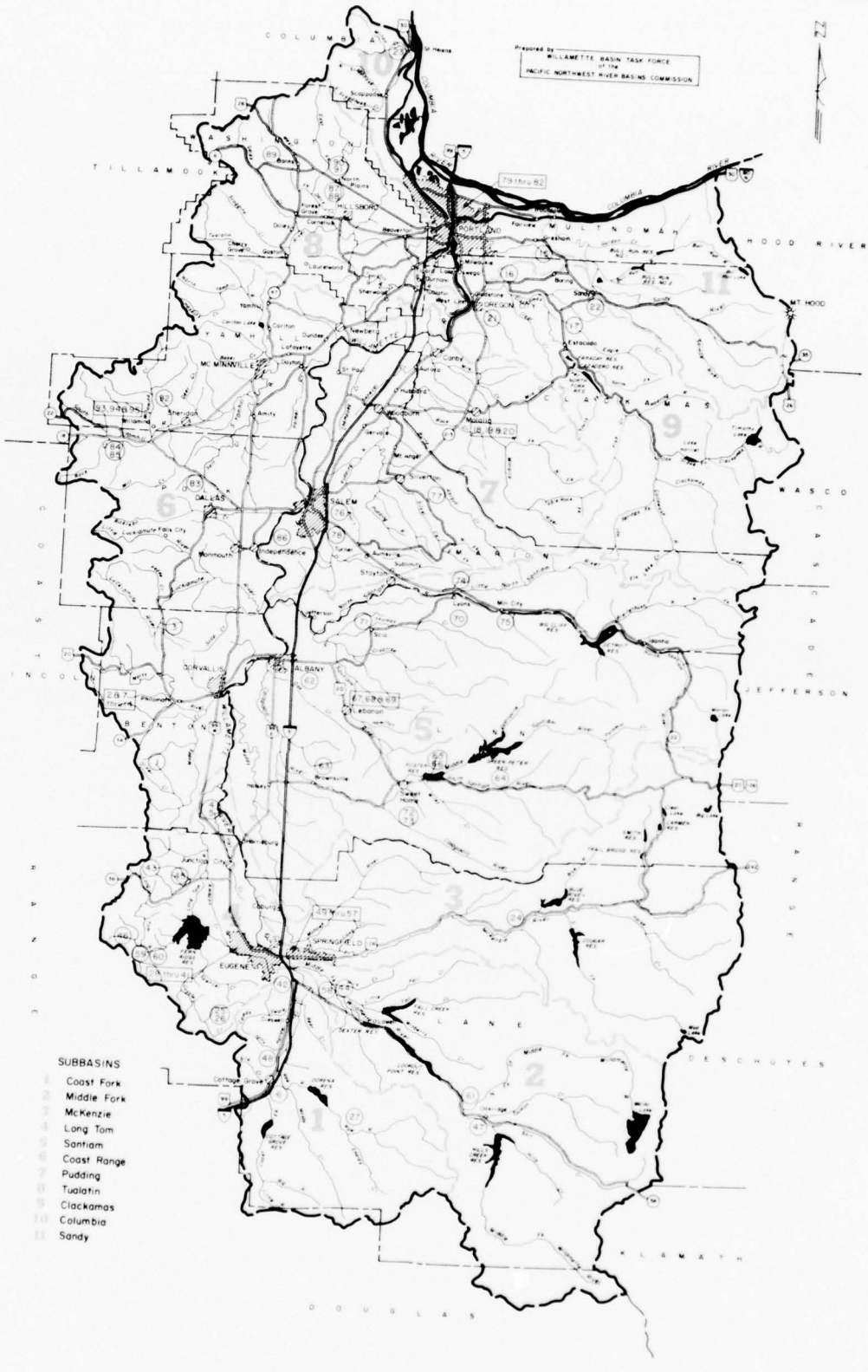


Photo III-11. Many sawmills operate in the Willamette Basin, furnishing lumber and other basic wood products. (Forest Service Photo)



WBTF-0-III8-1

Source: Directory of the Forest Products Industry

MAP III-1
WILLAMETTE BASIN STUDY
OREGON

PLANT LOCATIONS, SAWMILLS 1965

1967

	BENTON COUNTY	LOCATION	CAPACITY M FBM PER DAY
1	Alsea Lumber Co.	Alsea	75 M
2	Larson Lumber Co.	Philomath	100 M
3	Moser Lumber Co.	Kings Valley	50 M
4	Hull-Oakes Lumber Co.	Monroe	75 M
5	Miller, I. P. Lumber Co.	Monroe	80 M
7	Clemens Forest Products, Inc.	Philomath	215 M
8	Ellis, Ben Lumber Co.	Philomath	100 M
9	Flynn Lumber Co.	Philomath	40 M
10	Hoskins Lumber Co.	Philomath	45 M
11	Mid Willamette Lumber Corp.	Philomath	100 M
12	North Side Lumber Co.	Philomath	60 M
13	Red Fir Lumber Co.	Philomath	75 M
14	Tayler-Hart Lumber Co.	Philomath	40 M
	CLACKAMAS COUNTY		
96	Koch, Walter E. Lumber Co.	Sandy	100 M
15	Valberg Timber Corp.	Boring	75 M
16	Rollin Lumber Co.	Carver	50 M
17	Park Lumber Co.	Estacada	115 M
18	Avison Lumber Co.	Molalla	125 M
19	Krofp Lumber Co.	Molalla	40 M
20	Low, J. T. Lumber Co.	Molalla	40 M
21	Samuels Lumber Co.	Oregon City	40 M
22	Oja, Olaf M.	Sandy	50 M
	COLUMBIA COUNTY		
23	Pope & Talbot, Inc.	St. Helens	335 M
	LANE COUNTY		
6	Georgia Pacific Corporation	Mosby Creek	--
24	McKenzie River Lumber Co.	Blue River	60 M
25	R & R Timber Products Co.	Cottage Grove	45 M
26	Weyerhaeuser Co.	Cottage Grove	180 M
27	Bohemia Lumber Co.	Culp Creek	110 M
28	Barker-Willamette Lumber Co.	Eugene	100 M
29	Beckley Lumber Co.	Eugene	45 M
30	Bethel Planing Co.	Eugene	100 M
31	Cascadian Co., Inc.	Eugene	70 M
32	Central Manufacturing Corp.	Eugene	45 M
33	Cuddeback Lumber Co., Inc.	Eugene	140 M
34	Eugene Stud & Veneer, Inc.	Eugene	45 M
35	Giustina Bros. Lumber Co.	Eugene	40 M

	LANE COUNT
36	Olympic Harbor
37	Seneca Sawmill
38	Snellstrom Lum
39	Star Lumber Co
40	Tangfeldt Lumb
41	Zip-O-Log Mill
42	Cone Lumber Co
43	Hult Lumber &
44	Hills Creek Lu
45	Larsen, Clark
46	Swanson Bros.
47	Pope & Talbot
48	Rickini Lumber
49	Armstrong Lumb
50	Gem Studs, Inc
51	Huntington Shi
52	Mt. June Lumbe
53	Rasboro Lumber
54	Springfield Li
55	Swance Stud &
56	Westlane Mill
57	Weyerhaeuser
58	Kimball Bros.
59	International
60	Johnson, Ralp
61	Hines, Edward
	LINN COUNT
62	Edwards Bros.
63	Schneider Lum
64	Tomco Inc.
65	Bauman Sawmil
66	Willamette Na
67	Bauman Lumber
68	Santiam Lumbe
69	Timber Owners
70	Freres Forest
71	Lulay Bros. I
72	Clear Lumber
73	Santiam Lumbe

Table III-28
Plant locations, sawmills, Willamette Basin, 1965

CAPACITY M FBM PER DAY		LANE COUNTY (CONT'D)	LOCATION
75 M	36	Olympic Harbor Lumber Co.	Eugene
100 M	37	Seneca Sawmill Co.	Eugene
50 M	38	Snellstrom Lumber Co.	Eugene
75 M	39	Star Lumber Co.	Eugene
80 M	40	Tangfeldt Lumber Co.	Eugene
215 M	41	Zip-O-Log Mills, Inc.	Eugene
100 M	42	Cone Lumber Co.	Goshen
40 M	43	Hult Lumber & Plywood Co.	Horton
45 M	44	Hills Creek Lumber Co.	Jasper
100 M	45	Larsen, Clark & Powell	Junction City
60 M	46	Swanson Bros. Lumber Co.	Noti
75 M	47	Pope & Talbot Co.	Oakridge
40 M	48	Rickini Lumber Co., Inc.	Saginaw
	49	Armstrong Lumber Co.	Springfield
	50	Gem Studs, Inc.	Springfield
	51	Huntington Shingle Co.	Springfield
100 M	52	Mt. June Lumber Co.	Springfield
75 M	53	Rasboro Lumber Co.	Springfield
50 M	54	Springfield Lbr. Mills, Inc.	Springfield
115 M	55	Swance Stud & Veneer	Springfield
125 M	56	Westlane Mill Co.	Springfield
40 M	57	Weyerhaeuser Co.	Springfield
40 M	58	Kimball Bros. Lumber Co.	Trent
40 M	59	International Paper Co.	Vaughn
50 M	60	Johnson, Ralph Lumber Co.	Veneta
	61	Hines, Edward Lumber Co.	Westfir
		LINN COUNTY	
335 M			
	62	Edwards Bros. Construction Co.	Albany
	63	Schneider Lumber Co.	Brownsville
	64	Tomco Inc.	Cascadia
--	65	Bauman Sawmills, Inc.	Foster
60 M	66	Willamette National Lbr. Co.	Foster
45 M	67	Bauman Lumber Co.	Lebanon
180 M	68	Santiam Lumber Co.	Lebanon
110 M	69	Timber Owners Lumber Co.	Lebanon
100 M	70	Freres Forest Products Co.	Lyons
45 M	71	Lulay Bros. Lumber Co.	Scio
100 M	72	Clear Lumber Co.	Sweet Home
70 M	73	Santiam Lumber Co.	Sweet Home
45 M			
140 M			
45 M			
40 M			

CAPACITY M FBM PER DAY		MARION
40 M	97	Gervais Lumb
70 M	74	Frank Lumbe
100 M	75	Stout Creek
120 M	76	Capitol Lum
80 M	77	Johnson Bro
70 M	78	Burkland Lu
190 M		
80 M		MULTNOM
80 M		
70 M	98	Western Coo
65 M	79	Dwyer Lumbe
330 M	80	Jones Lumbe
80 M	81	Kingsley Lu
75 M	82	Portland Lu
70 M		
45 M		POLK C
150 M		
216 M	83	Willamette
80 M/shift	84	Fort Hill L
40 M	85	Oregon Amer
75 M	86	Mountain Fi
350 M		
60 M		WASHING
--		
60 M	87	Forest Grov
200 M	88	Stimson Lum
	89	Whiteman Lu
	90	North Plai
	91	Sunset Lum
100 M		
100 M		YAMHILL
55 M		
80 M	92	Taylor Lum
165 M	93	Garrabrant
300 M	94	Oregon Ald
100 M	95	Willamina
75 M		
55 M		
100 M		
80 M		
400 M		

8
awmills,
, 1965

LOCATION	CAPACITY M FBM PER DAY
igene	40 M
igene	70 M
igene	100 M
igene	120 M
igene	80 M
igene	70 M
shen	190 M
rton	80 M
asper	80 M
nction City	70 M
ti	65 M
akridge	330 M
aginaw	80 M
pringfield	75 M
pringfield	70 M
pringfield	45 M
pringfield	150 M
pringfield	216 M
pringfield	80 M/shift
pringfield	40 M
pringfield	75 M
pringfield	350 M
rent	60 M
aughn	--
eneta	60 M
estfir	200 M
lbany	100 M
ownsville	100 M
scadia	55 M
ster	80 M
ster	165 M
banon	300 M
banon	100 M
banon	75 M
ons	55 M
io	100 M
eet Home	80 M
eet Home	400 M

MARION COUNTY	LOCATION	CAPACITY M FBM PER DAY
97 Gervais Lumber Co., Inc.	Gervais	40 M
74 Frank Lumber Co.	Mill City	2002M
75 Stout Creek Lumber Co.	Mehama	40 M
76 Capitol Lumber Co.	Salem	120 M
77 Johnson Bros. Lumber Co.	Silverton	45 M
78 Burkland Lumber Co.	Turner	220 M
MULTNOMAH COUNTY		
98 Western Cooperage Co.	Portland	100 M
79 Dwyer Lumber & Plywood Co.	Portland	250 M
80 Jones Lumber Corp.	Portland	150 M
81 Kingsley Lumber Co.	Portland	75 M
82 Portland Lumber Mills	Portland	185 M
POLK COUNTY		
83 Willamette Valley Lumber Co.	Dallas	170 M
84 Fort Hill Lumber Co.	Grand Ronde	70 M
85 Oregon American Studs, Inc.	Grand Ronde	100 M
86 Mountain Fir Lumber Co.	Independence	90 M
WASHINGTON COUNTY		
87 Forest Grove Lumber Co.	Forest Grove	100 M
88 Stimson Lumber Co.	Forest Grove	80 M
89 Whiteman Lumber Co.	Manning	80 M
90 North Plains Lumber Co.	North Plains	150 M
91 Sunset Lumber Products	North Plains	130 M
YAMHILL COUNTY		
92 Taylor Lumber Co.	Sheridan	80 M
93 Garrabrant Lbr. & Invest. Co.	Willamina	90 M
94 Oregon Alder-Maple Co.	Willamina	75 M
95 Willamina Lumber Co.	Willamina	100 M

3

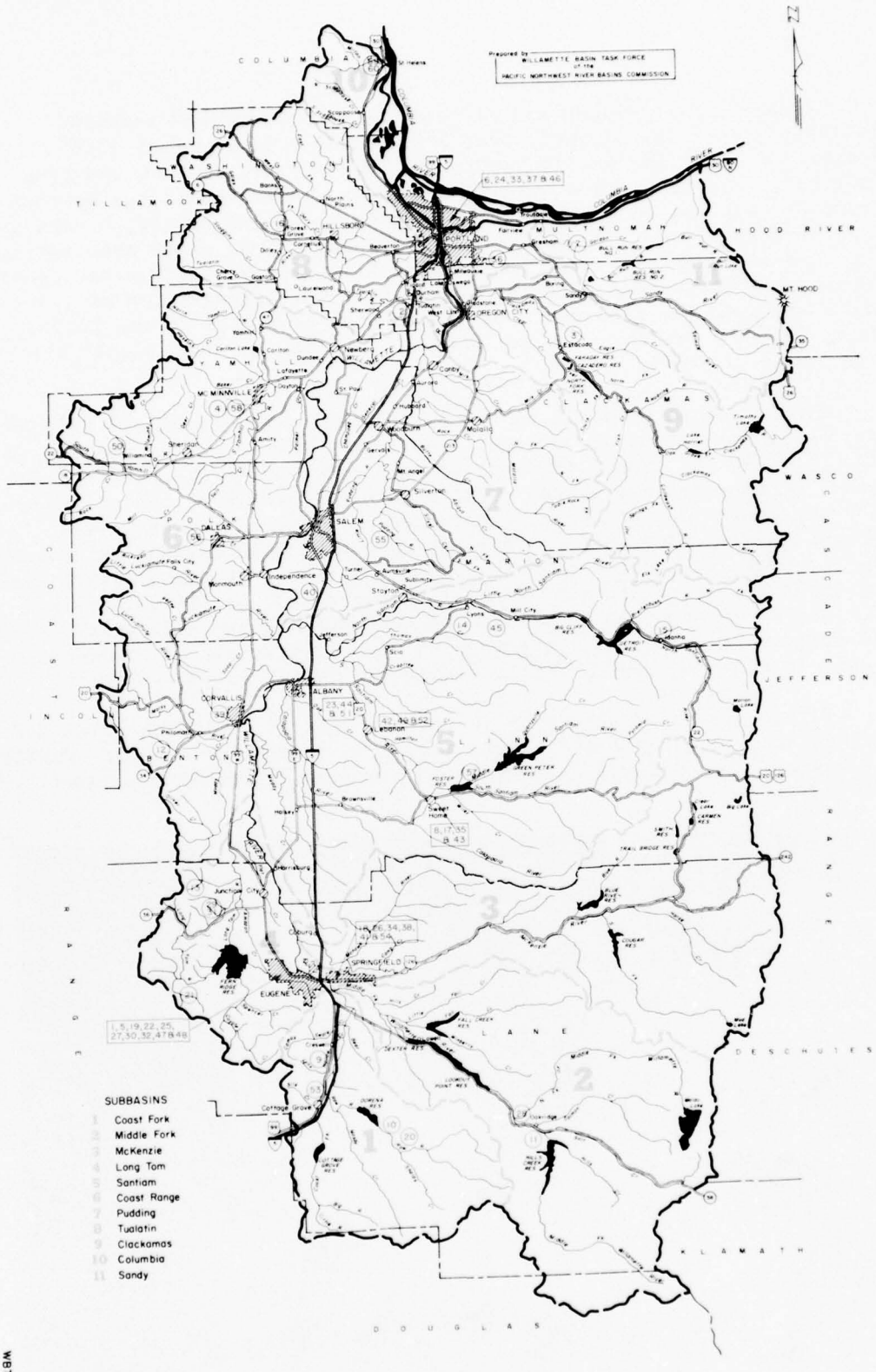
2

Production of veneer and plywood has shown a marked increase. In 1963, output was slightly over 3-1/2 billion square feet (3/8" basis). As with lumber, production is concentrated in Lane and Linn Counties. The value of a mix of logs can be maximized if the optimum grade of each can be realized. This tends to pull sawmills, veneer and plywood plants and other wood conversion plants into close association. The concentration of veneer and plywood plants in the Middle and Upper Subareas is thus related to the log supply and concentration of sawmills in these two subareas. Of the 76 plywood plants in the basin, the major ones are shown on Map III-2. The major plywood plants are also listed on Table III-29.

Production of woodpulp in the basin totaled approximately 874,000 tons in 1963. Output was concentrated in the Lower Subarea where site advantages--water transportation, water supply, waste disposal and market access--are available. Most plants engaged in secondary production and conversion of paper, paperboard, etc., are located in the Portland metropolitan area. In 1963, 49 plants were engaged in primary and secondary production of pulp, paper and allied products. Particleboard plants, which produced 82 million board feet in 1963, likewise are located principally in the Middle and Upper Subareas in response to the pull of raw material. Location of pulp, paper, and particle-board plants is shown on Map III-3; the plants are listed in Table III-30.

Forest resources also provide other products, including poles and piling, fuelwood, Christmas trees, greens, and logs for export. Within the basin these products have historically been of relatively minor significance.

Photo III-12. Plywood, produced in the basin, is loaded in a freight car to start a cross-country journey to the consumer. (Topline Equipment Company Photo)



Source: Pacific Northwest Forest Experiment Station
Prospective Economic Developments Based on the
Timber Resources of the Pacific Northwest

MAP III - 2
WILLAMETTE BASIN STUDY
OREGON
PLANT LOCATIONS, SOFTWOOD,
PLYWOOD & VENEER PLANTS 1965
1967

WBTF-O-1119-L

Table III-29

Plant locations, softwood plywood & veneer manufacturers, Willamette Basin, 1965

			ANNUAL CAPACITY 1/8" Basis (Million) 1/8" Basis	
SOFTWOOD VENEER PLANTS				
1	Camas Veneer, Inc.	Eugene	260	Sq. Ft.
2	Conrad Veneers, Inc.	Tualatin	-	
3	Diamond Lumber Co.	Estacada	220	"
4	D. L. Veneer Co.	McMinnville	25	"
5	Eugene Stud & Veneer Co.	Eugene	120	"
6	Evans Products Co.	Portland	200	"
7	Olympic Manufacturing Co.	Gresham	30	"
8	Oregon Plywood Co.	Sweet Home	180	"
9	Plywood Products Corp.	Creswell	180	"
10	Plywood Products Corp.	Dorena	225	"
11	Pope & Talbot, Inc.	Oak Ridge	240	"
12	Rex Veneer Co.	Philomath	200	"
13	Rult Lumber & Plywood Co.	Horton	125	"
14	Freres Veneer Co.	Lyons	240	"
15	Simpson Timber Co.	Idanha	200	"
16	Stimpson Lumber Co.	Forest Grove	190	"
17	Sweet Home Veneer, Inc.	Sweet Home	90	"
18	Vancouver Plywood Co.	Springfield	215	"
19	Zip-O-By Veneer, Inc.	Eugene	140	"
60	Crown Zellerbach Corp.	St. Helens	430	"
			3/8" Basis (Million)	
SOFTWOOD PLYWOOD PLANTS				
20	Bohema Lumber Co.	Culp Creek	-	
21	International Paper Co.	Vaughn	75	Sq. Ft.
22	Camas Veneer Inc.	Eugene	60	"
23	Coquille Valley Lumber Co.	Albany	70	"
24	Dwyer Lumber & Plywood Co.	Portland	50	"
25	Eugene Plywood Co.	Eugene	120	"
26	Georgia Pacific Corp.	Springfield	255	"
27	Guistina Veneer Co.	Eugene	80	"
28	Edward Hines Lumber Co.	Westfir	60	"
29	Hult Lumber & Plywood Co.	Junction City	55	"
30	Jones Veneer & Plywood Co.	Eugene	155	"
31	Jones Veneer & Plywood Co.	Junction City	55	"
32	Lane Plywood Inc.	Eugene	150	"
33	Linnton Plywood Assoc.	Portland	70	"
34	McKenzie River Plywood Corp.	Springfield	50	"
35	Mid-Plywood Inc.	Sweet Home	50	"
36	Milwaukie Plywood Corp.	Milwaukie	75	"
37	Multnomah Plywood Corp.	Portland	95	"
38	Natron Plywood Co.	Springfield	100	"
39	Plywood Products Corp.	Corvallis	340	"
40	Plywood Products Corp.	Independence	120	"
41	Rosboro Lumber Co.	Springfield	50	"
42	Santiam Lumber Co.	Lebanon	65	"
43	Santiam Lumber Co.	Sweet Home	70	"
44	Simpson Timber Co.	Albany	60	"
45	Simpson Timber Co.	Lyons	90	"
46	Simpson Timber Co.	Portland	80	"
47	Snellstrom Lumber Co.	Eugene	80	"
48	U. S. Plywood Corp.	Eugene	70	"
49	U. S. Plywood Corp.	Lebanon	160	"
50	U. S. Plywood Corp.	Willamina	70	"
51	Vancouver Plywood Co.	Albany	250	"
52	Western Veneer & Plywood Co.	Lebanon	90	"
53	Weyerhaeuser Co.	Cottage Grove	75	"
54	Weyerhaeuser Co.	Springfield	80	"
55	Willamette Plywood Corp.	Aumsville	85	"
56	Willamette Valley Lumber Co.	Dalles	110	"
57	Willamette Valley Lumber Co.	Foster	110	"
58	Yamhill Plywood Co.	McMinnville	45	"
59	Crown Zellerbach Corp.	St. Helens	45	"

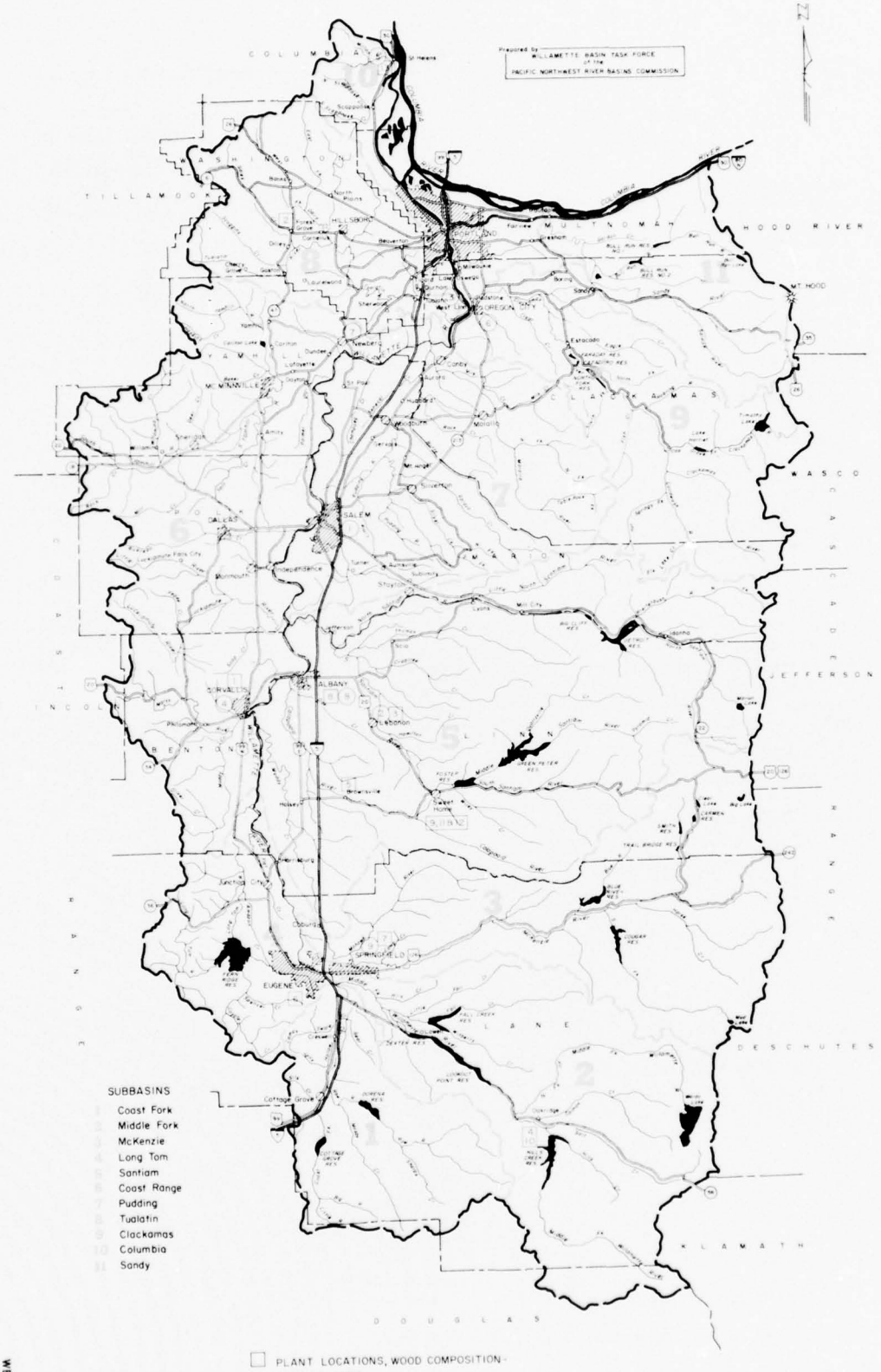

Prepared by
WILLAMETTE BASIN TASK FORCE
of the
PACIFIC NORTHWEST RIVER BASINS COMMISSION
N
SUBBASINS
1 Coast Fork
2 Middle Fork
3 McKenzie
4 Long Tom
5 Santiam
6 Coast Range
7 Pudding
8 Tualatin
9 Clackamas
10 Columbia
11 Sandy
PLANT LOCATIONS, WOOD COMPOSITION-BOARD PLANTS
PLANT LOCATIONS, WOOD PULP MILLS
Source: a) Oregon Directory of Manufacturers
b) Directory of Forest Products Industry
c) Pacific Northwest Forest Experiment Station, Prospective Economic Developments Based on the Timber Resources of the Pacific Northwest
MAP III - 3
WILLAMETTE BASIN STUDY
OREGON
PLANT LOCATIONS, WOOD COMPOSITION-BOARD PLANTS (1965), WOOD PULP MILLS (1966)
1967
WBTF-O-1201-L

Table III-30
Plant Locations,
Wood Composition-Board Plants (1965)
and Wood Pulp Mills (1966), Willamette Basin

	□ 1/ Wood Composition-Board Plants			Ann. Cap. MM Sq Ft	Basis
1	Evans Products Co.	Corvallis	65 empl.	40	1/8"
2	Forest Fiber Products Co.	Forest Grove (Gaston)	115 "	66	1/8"
3	U. S. Plywood	Lebanon	100+ "	120	1/8"
4	Pope & Talbot, Inc. (hardboard)	Oakridge	40 "	-	-
5	Brownsville Particleboard & Assoc. Products, Inc.	Brownsville	51 "	72	3/4"
6	Cascade Fiber Co.	Eugene	65 "	36	3/4"
7	Clear Fir Products of Oregon, Ltd.	Springfield	20 "	10	1/4"
8	Duraflake Company	Albany	70 "	85	3/4"
9	Lester Cedar Products, Inc.	Sweet Home	25 "	7	1/2"
10	Pope & Talbot, Inc. (particleboard)	Oakridge	50 "	24	3/4"
11	Standard Board Products, Inc.	Sweet Home	10 "	24	3/8"
12	Clad Wood Co.	Sweet Home	10 "	6	5/8"
13	Kaiser Gypsum Co.	St. Helens	290 "	120	1/2"

	○ 1/ Wood Pulp Mills			Tons/Day	
1	Boise Cascade Corp.	Salem	493 "	220	Sulfite
2	Crown Zellerbach Corp.	Lebanon	118 "	95	"
3	Crown Zellerbach Corp.	West Linn	1,250 "	710	"
				385	Groundwood
4	Evans Products Co.	Corvallis		30	Sulfite
				40	Misc.
5	Boise Cascade Corp.	St. Helens	630 "	385	Sulphate
6	Publisher's Paper Co.	Oregon City	640 "	350	Groundwood
7	Publisher's Paper Co.	Newberg	140 "	150	Sulfite
8	Western Kraft Corp.	Albany	245 "	500	Sulphate
9	Weyerhaeuser Co.	Springfield	265 "	450	"

1/ Symbols shown on Map III-3

Value added by manufacture of lumber and wood products in the basin increased from $250 million in 1958 to an estimated $309 million in 1964 (constant 1964 dollars). During the same period, output of pulp and paper products increased from $72 million to $91 million. The total for both in 1964, approximately $400 million, amounted to 36 percent of the value added by all manufacturing in the basin.

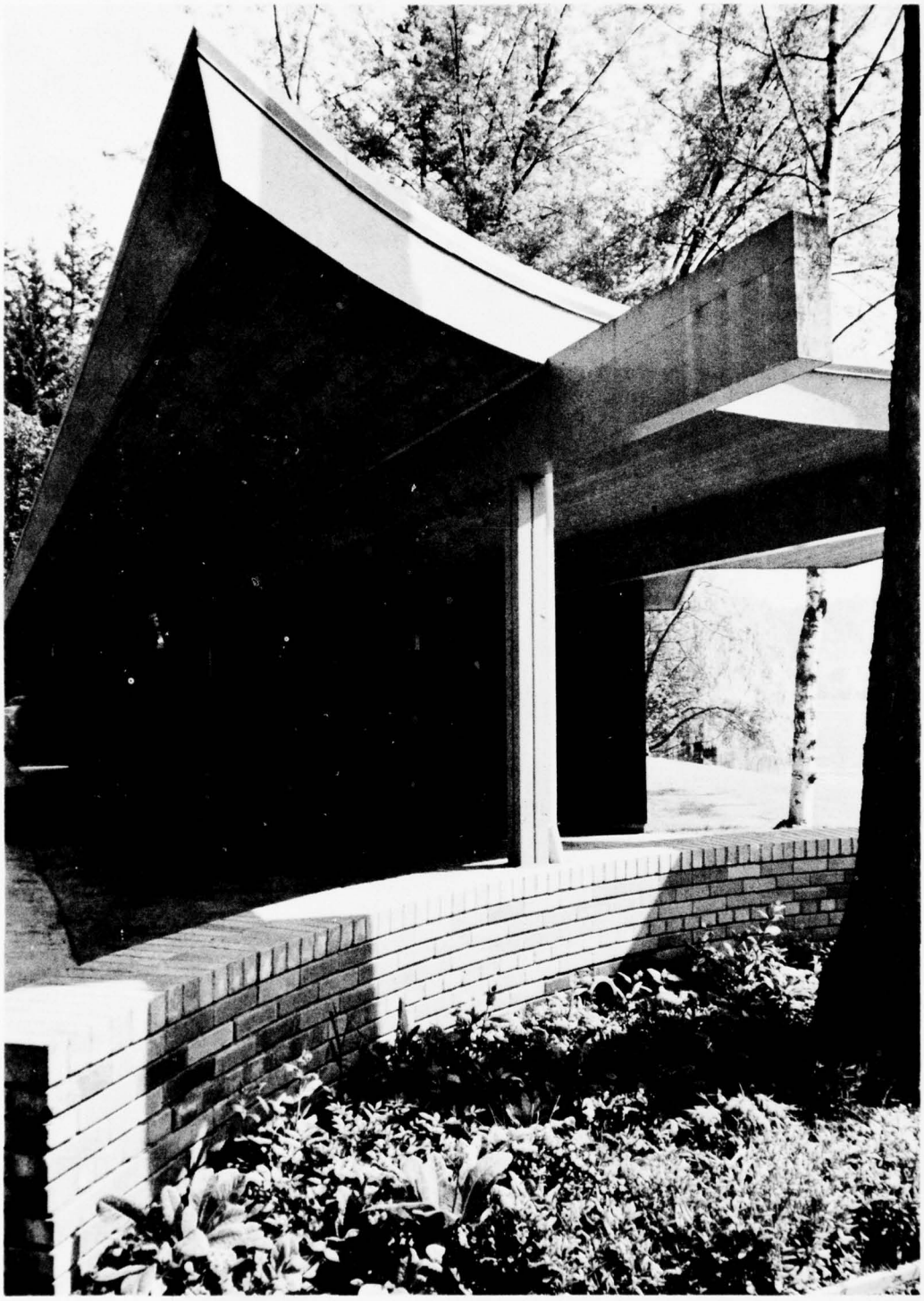


Photo III-13. Willamette Basin wood products--ceiling and siding of hemlock; beams, posts, and soffit of Douglas fir. (Western Wood Products Association Photo)

Employment

In recent years, the number of workers employed in processing timber resources varied between 35,000 and 39,000. In 1964, the industry employed 40 percent of manufacturing employees. Employment and wage payments in each of the major industry subcategories in the basin in 1964 are shown in Table III-31. Nearly two-thirds are employed in sawmills and veneer and plywood plants. Wage payments were approximately $245,000,000.

Table III-31

Employment and wage payments in forest product industries, Willamette Basin, 1964

Industrial Category	Number Employed	Total Annual Wage Payment (In thousands)
Lumber and Wood Products	33,667	$208,645
Logging	5,406	33,634
Sawmills, Planing Mills	10,375	62,395
Millwork	16,002	102,711
Veneer and Plywood	(13,530)	(87,625)
Wood Containers	357	1,419
Miscellaneous	1,518	8,383
Paper and Allied Products	5,237	36,327
Pulp Mills and Paper Mills	2,917	20,361
Paper Board	557	4,389
Converted Paper	1,060	7,128
Boxes, Cartons	703	4,448
Total	38,904	$244,972

PROJECTED FUTURE DEVELOPMENT

The quantity of future raw materials is a function of present volume of growing trees, regeneration, net growth, future cut, and utilization standards. More intensive utilization is expected, principally in the form of increased and better use of small logs and increased use of logging waste and processing residue. More intensive forest management will reduce tree mortality and increase growth and yields.

Output of forest products will be limited by wood supplies throughout the projection period. Timber inventories are expected to decrease markedly after 1990, and a reduced harvest on private land is expected until inventories are rebuilt. The downward trend in annual cut on private lands will be arrested and may be reversed after 2000. Although some timber may be cut prematurely, net and total growth will increase. Nevertheless, the reduced cut on private lands combined with the more-or-less fixed cut on public lands will result in a decline in total cut by about 2000. By the year 2020, the total cut is expected to be 82 percent of the 1963 level.

Consumption of Logs

Estimated future log consumption is shown in Tables III-32 and III-33. Table III-32 shows consumption of roundwood for lumber and wood products and Table III-33 shows wood fiber consumption for pulp and paper production.

Consumption of roundwood for lumber and wood products is expected to remain relatively constant, at approximately 5 billion board feet annually, until after 1980. By 2000, roundwood consumption is projected to decline to 4.0 billion board feet and to decrease further to 3.8 billion by 2020. The product mix will change; the volume of roundwood used for lumber is expected to decline steadily throughout the projection period, while that used for veneer and plywood is projected to increase until 1985 and to decline thereafter. In spite of the decline after 1985, consumption of veneer logs is projected to be 20 percent greater in 2020 than in 1965. Consumption of logs for miscellaneous wood products is anticipated to remain a minor part of consumption--about four percent.

Consumption of wood fiber for paper and allied products will increase from the present to 1985, and thereafter will remain constant. During the period of expanding production, the two sources of wood fiber--round pulpwood and wood chips--are expected to retain their relative magnitude with wood chips supplying approximately 60 percent of the total raw material need. After 1985 roundwood consumption will continue to increase while residue use declines. This decline in the use of residue will result from a reduction in total log consumption and from fuller utilization of logs.

Table III-32

Estimated consumption of roundwood for lumber and wood products, Willamette Basin, 1965-2020

		Upper Subarea	Middle Subarea	Lower Subarea	Total
		(in million bd.-ft. int. 1/4" rule)			
	Saw Logs	1,061	1,023	445	2,529
	Veneer Logs	862	1,109	276	2,247
1965	Misc. Wood Products	103	71	32	206
	Total	2,026	2,203	753	4,982
	Saw Logs	954	921	400	2,275
	Veneer Logs	969	1,246	310	2,525
1970	Misc. Wood Products	103	71	32	206
	Total	2,026	2,238	742	5,006
	Saw Logs	891	860	373	2,124
	Veneer Logs	1,030	1,324	329	2,683
1975	Misc. Wood Products	116	77	39	232
	Total	2,037	2,261	741	5,039
	Saw Logs	827	798	347	1,972
	Veneer Logs	1,089	1,400	348	2,837
1980	Misc. Wood Products	116	77	39	232
	Total	2,032	2,275	734	5,041
	Saw Logs	785	757	329	1,871
	Veneer Logs	1,146	1,474	367	2,987
1985	Misc. Wood Products	116	77	39	232
	Total	2,047	2,308	735	5,090
	Saw Logs	462	440	198	1,100
	Veneer Logs	1,068	1,343	329	2,740
2000	Misc. Wood Products	100	66	34	200
	Total	1,630	1,849	561	4,040
	Saw Logs	378	360	162	900
	Veneer Logs	1,068	1,343	329	2,740
2020	Misc. Wood Products	80	53	27	160
	Total	1,526	1,756	518	3,800

Table III-33

Estimated consumption of wood fiber by the pulp and paper industries, Willamette Basin, 1965-2020

		Upper Subarea	Middle Subarea	Lower Subarea	Total
		(million cubic ft.)			
	Round Pulpwood	8	14	31	53
1965	Pulpwood Chips	13	24	52	89
	Total	21	38	83	142
	Round Pulpwood	9	18	40	67
1970	Pulpwood Chips	16	29	65	110
	Total	25	47	105	177
	Round Pulpwood	11	21	46	78
1975	Pulpwood Chips	18	33	73	124
	Total	29	54	119	202
	Round Pulpwood	12	24	53	89
1980	Pulpwood Chips	20	38	84	142
	Total	32	62	137	231
	Round Pulpwood	14	26	59	99
1985	Pulpwood Chips	23	43	94	160
	Total	37	69	153	259
	Round Pulpwood	16	28	66	110
2000	Pulpwood Chips	21	39	90	150
	Total	37	67	156	260
	Round Pulpwood	18	32	75	125
2020	Pulpwood Chips	19	35	81	135
	Total	37	67	156	260

Log production and use are assumed to have the same subarea pattern during the projection period as existed in 1963. Although some factors influencing plant location, such as a change in timber supply location, change through time, other factors tend to resist shifts of production facilities. Among the latter are: high sunk capital costs, economies gained by increasing capacity at existing plants, economies of integrated production, availability of labor supply, and know-how. Furthermore, differences in transportation costs from log sources anywhere in the basin are not an appreciable part of total costs. In addition there is a scarcity of plant sites which are as well situated with respect to water supply, waste disposal, and transportation facilities as are present facilities. It is reasonable, therefore, to assume that the relative distribution of the manufacturing processes among areas in the future would remain essentially unchanged. Subarea projections of log and residue consumption shown in Tables III-32 and 33 also are based on this assumption. In the future, as now, the Lower Subarea will specialize in the production of paper and allied products and the Upper and Middle Subareas will specialize in lumber and wood products. Approximately 15 percent of future consumption for lumber and wood products is expected to be in the Lower Subarea, and the remaining 85 percent is split nearly evenly between the other two subareas. Approximately 60 percent of future estimated consumption by the pulp and paper industries will occur in the Lower Subarea compared to 25 and 15 percent in the Middle and Upper Subareas, respectively.

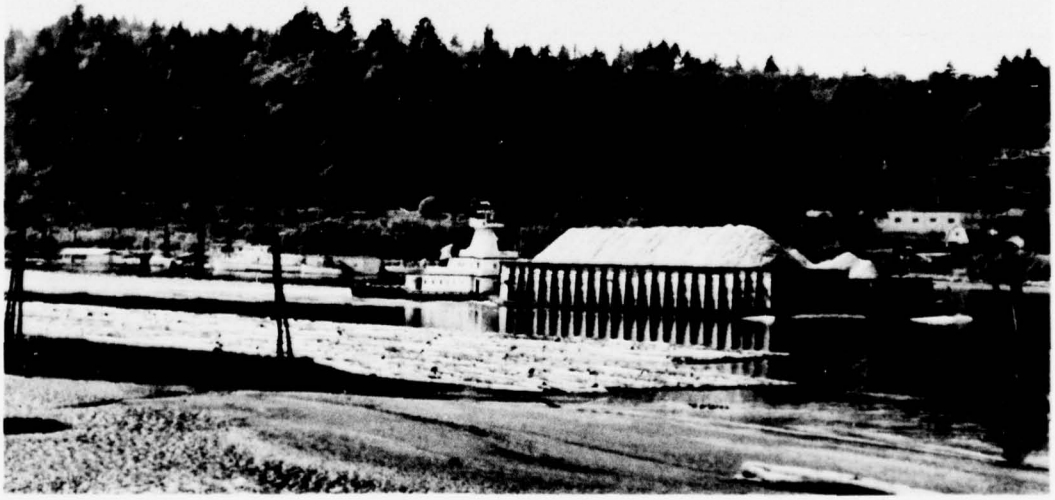


Photo III-14. Log rafts and wood chip barges are commonly seen plying the lower reaches of Willamette River. (Corps of Engineers Photo)

Consumption of timber materials cited above is equivalent to the level of output in the major product categories. Table III-34 converts the consumption units into output units.

Table III-34
Estimated production of forest products, Willamette Basin, 1963-2020

		Lumber Mil. bd.-ft.	Plywood Veneer Mil. sq. ft., 3/8"	Misc. Mil. bd.-ft.	Pulp & Paper 1,000 Tons
	Lower Subarea	671	432	34	517
	Middle Subarea	1,198	1,734	66	234
1963	Upper Subarea	1,240	1,348	100	123
	Total	3,109	3,514	200	874
	Lower Subarea	347	650	39	945
	Middle Subarea	798	2,645	77	430
1980	Upper Subarea	827	2,105	116	225
	Total	1,972	5,400	232	1,600
	Lower Subarea	198	620	34	1,080
	Middle Subarea	440	2,550	66	450
2000	Upper Subarea	462	2,030	100	270
	Total	1,100	5,200	200	1,800
	Lower Subarea	162	620	27	1,080
	Middle Subarea	360	2,550	53	450
2020	Upper Subarea	378	2,030	80	270
	Total	900	5,200	160	1,800

Future Employment

Forest industry employment is a function of log supply, utilization and value added by manufacturing, and labor requirements per unit of output. Technological changes are expected to reduce future labor requirements, but additional fabrication, re-manufacturing, and new products will tend to increase labor requirements. Future levels of employment were derived by applying the estimated labor productivity of Western Oregon to projected log consumption.

Total future employment in all forest product subcategories is expected to decline steadily. An average annual net loss of nearly 400 jobs is expected to 2000. Thereafter, employment is expected to decline at an average of approximately 130 jobs annually. However, the industry will still be a major contributor in the economy of the basin in terms of both production and employment.

The greatest absolute as well as relative decrease in employment is projected to occur in the lumber and wood products industries, where a drop from 33,667 in 1964 to 18,850 in 2020--44 percent--is expected. Employment in paper and allied products will increase to 1980 and decline thereafter (Table III-35).

Table III-35
Employment in forest product industries, Willamette Basin

		Lumber and Wood Products	Paper and Allied Products	Total
	Lower Subarea	7,547	3,705	11,252
	Middle Subarea	11,040	1,230	12,270
1964	Upper Subarea	15,080	302	15,382
	Total	33,667	5,237	38,904
	Lower Subarea	5,850	4,000	9,850
	Middle Subarea	9,300	1,200	10,500
1980	Upper Subarea	12,400	300	12,700
	Total	27,550	5,500	33,050
	Lower Subarea	4,375	3,500	7,875
	Middle Subarea	7,100	1,100	8,200
2000	*Upper Subarea*	9,500	300	9,800
	Total	20,975	4,900	25,875
	Lower Subarea	3,750	3,200	6,950
	Middle Subarea	6,500	900	7,400
2020	Upper Subarea	8,600	300	8,900
	Total	18,850	4,400	23,250

THE MINING AND MINERAL INDUSTRIES

The bulk of the mineral output serves the construction industry and road building and road maintenance projects. Small quantities of metallic ores are mined and shipped to smelters in other western states; mercury output goes into national markets. Map III-4 shows the location of the basin's mineral resources.

In 1964 the value of minerals produced in Willamette Basin totaled $23.1 million--36 percent of the Oregon total. Most of the mineral production value, as in earlier years, was in sand and gravel, stone, cement, clays, and lime. Metal output, principally mercury, almost entirely from mines in the Upper Subarea (Lane County), has amounted to less than one percent of the value of all minerals produced in the past quarter century.

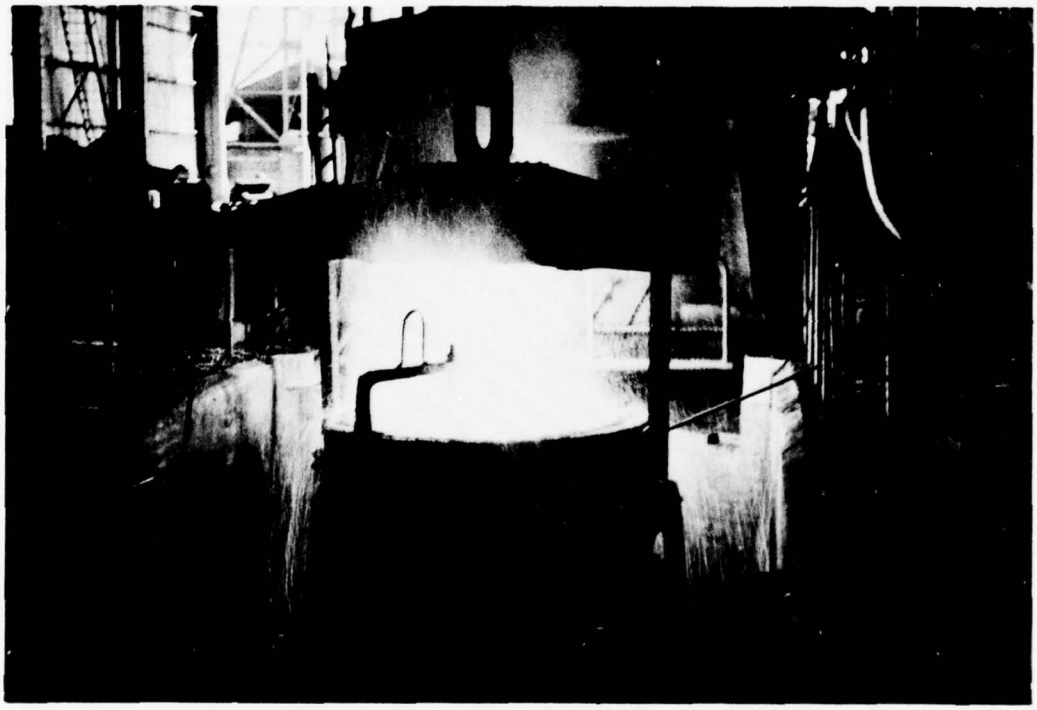
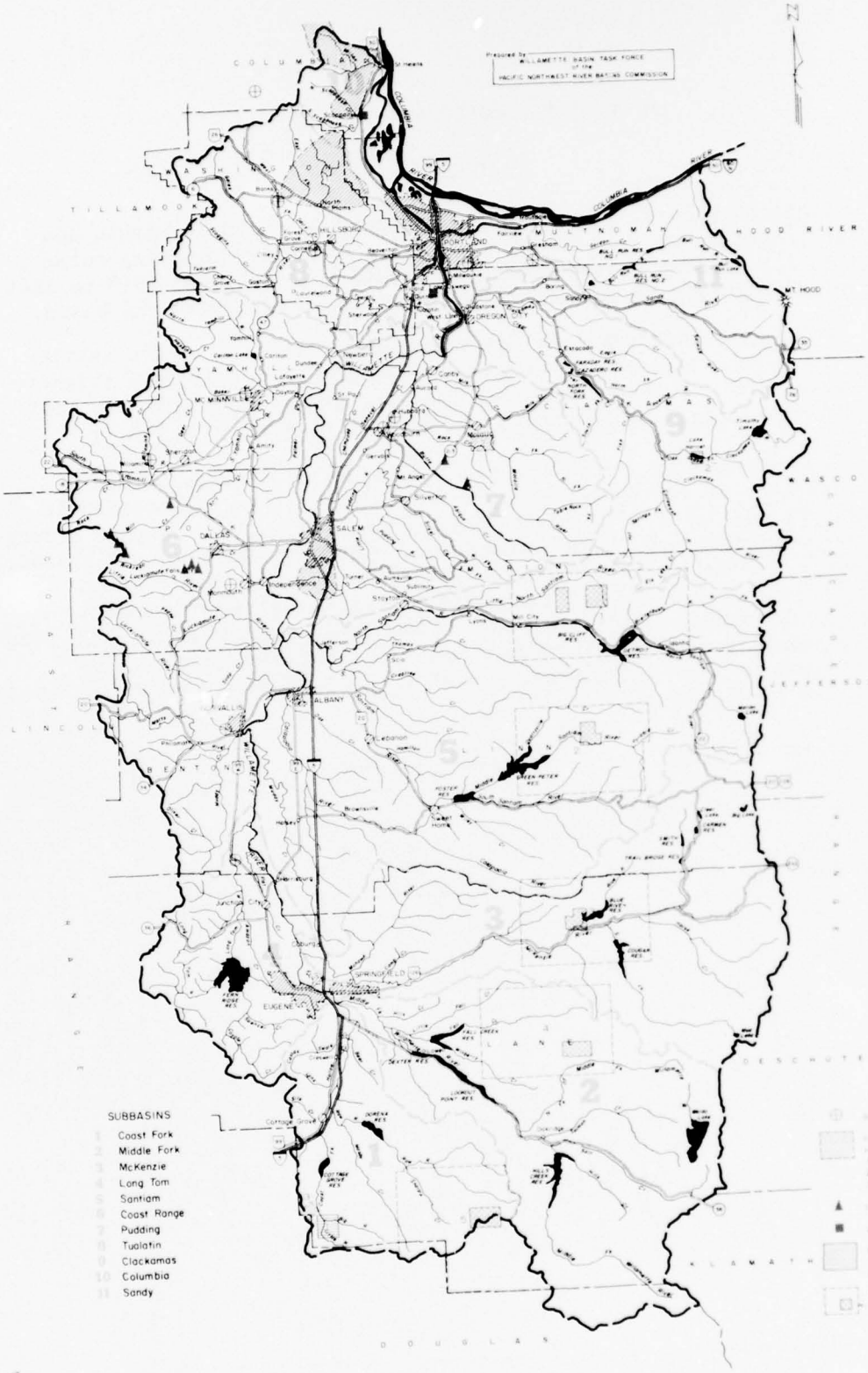


Photo III-15. The basin industries are becoming more diversified with less emphasis on indigenous resources. (Esco Corporation Photo)



MAP III - 4
WILLAMETTE BASIN STUDY
OREGON
MINERAL RESOURCES
1967

WBTF-0-1069-L

MINERAL RESOURCES AND INDUSTRIES

Nonmetals

Nonmetal mineral resources include sand and gravel, basalt and miscellaneous stone, limestone, and clays. Nonmetal commodity output, with an accumulated value of more than $300 million, from 1940 to 1964 accounted for over 99 percent of all minerals produced in the basin.

The demand for nonmetals has been closely related to the settlement and development of the basin. Population increases have triggered a greater need for these outputs. Sand and gravel have been the most important nonmetals in the basin in terms of production value.

Sand and gravel production totaled 147 million tons, valued at $145 million, in the quarter-century 1940-1964. This represented 48 percent of the value of minerals produced in the basin. Despite a long-term rise in sand and gravel production, output in the six-year period, 1959-1964, turned slightly downward, decreasing from 13.8 million tons in 1959 to 9.1 million tons in 1964. Completion of a number of major dam construction projects by the U. S. Army Corps of Engineers has temporarily reduced the requirements for sand and gravel. The past trends in sand and gravel, and stone production are shown in Figure III-8 and Table III-36.

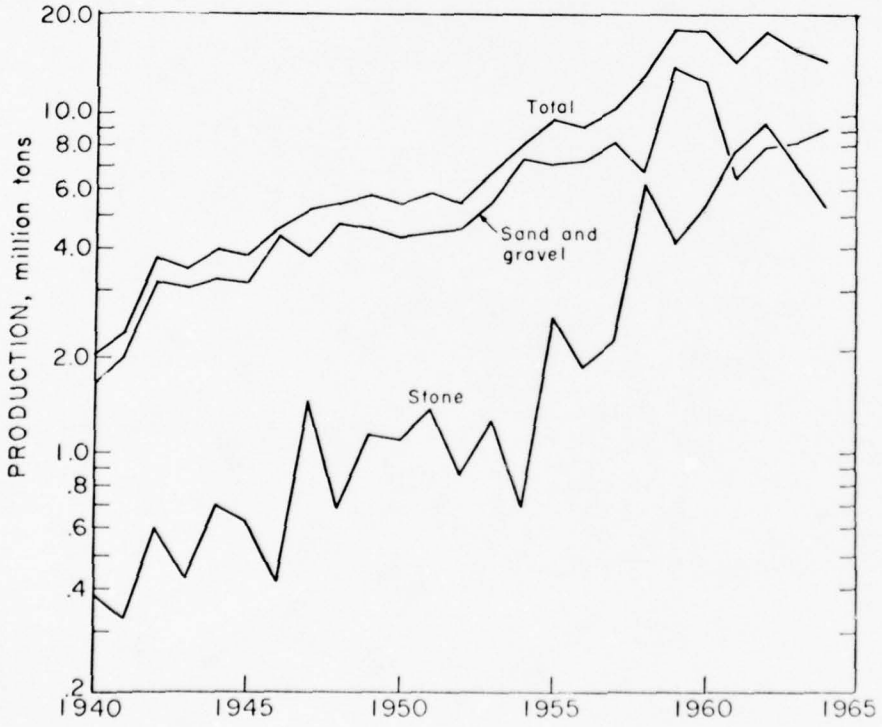


Figure III-8. - Sand, Gravel, and Stone Production, Willamette Basin, 1940-1965.

Sand and gravel reserves for road and other construction projects are generally believed to be adequate. There is some danger that encroaching urbanization and zoning regulations will eliminate known reserves and cause some local shortages, but these will be filled from alternative and more distant sources.

The value of stone, both crushed and broken, ranks second in Willamette Basin mineral industry production. Stone production totaled 69 million tons during the 1940-1964 period and was valued at about $71 million.

Photo III-16. Sand and gravel being dredged from Willamette River into barges. (Corps of Engineers Photo)

Table III-36
Sand and gravel, and stone production, Willamette Basin, 1959-64

Year	Sand and Gravel		Stone	
	Tonnage	Value	Tonnage	Value
1959	13,766,959	$10,992,587	4,201,330	$4,088,687
1960	12,479,333	11,517,401	5,006,146	4,620,156
1961	6,409,566	7,155,320	7,781,166	8,320,298
1962	8,039,533	8,369,953	9,558,538	9,168,749
1963	8,296,703	10,297,276	7,326,160	7,952,623
1964	9,071,000	$12,254,000	5,376,681	4,915,047

The demand for stone, a basic construction material, has increased because of accelerated construction and building programs in recent years. Crushed stone is used as a roadbase material and as a surfacing aggregate. More than 25 million tons of stone have been used for dam construction, revetment, and related works in the last 10 years. Crushed limestone is produced for farm use.

Large quantities of low-priced raw materials such as sand and gravel and crushed stone will continue to be used in major construction. The Federal Highway Program is anticipated to continue during early stages of the projection period, and an expansion of programs for interstate, primary and secondary road systems may be expected. This expansion is expected to generate further increases in demand for road materials and aggregates. Significant increases in the production of sand and gravel and stone will result. Production is projected to reach an annual rate of 20 million tons by 1980 and 41 million tons by 2020.

Clay and shale (classified as miscellaneous clay) are abundant in Willamette Basin. Clay is used almost entirely for manufacturing building brick, drain tile, and other heavy clay products. Part of the shale mined is expanded into lightweight aggregate used in concrete and other structural products. Ball clay, mined in association with miscellaneous clay, is used in stoneware.

Production of clay has generally declined in recent years and several operations have shut down. In 1964, 8 brick and tile plants were operating in the basin compared with 15 in 1955; however, certain plants idle in 1964 have operated intermittently in recent years.

Significant deposits of clays with high alumina content are found in four locations in the basin. The extraction of alumina from clay, while technically feasible, is still in the experimental stages.

Production of clays is expected to increase at a slightly lower rate than the general level of construction activity. The projected output is about 255,000 tons annually by 1980 and 400,000 tons by 2020--an annual growth rate of about 1.3 percent.

The only cement plant in Willamette Basin is located at Lake Oswego; it has operated since 1916. This operation uses limestone imported by barge from Texada Island, British Columbia, Canada. The plant is on rail, highway, and inland water transportation routes, all used to ship the product to Northwest markets. Production and capacity of this plant have increased with the rapidly expanding markets for cement in the basin, southwestern Washington, and other Pacific Northwest areas.

The basin's cement markets will continue to expand consistent with population expansion. Cement consumption in Oregon over the past decade has averaged 1.6 barrels per person annually, slightly below the national average (see Table III-37). Future consumption in the basin, projected on the basis of a 1.7 barrel per capita use, should approach 3 million barrels by 1980.

Table III-37
Estimated cement consumption

Year	Per Capita Use Oregon	Willamette Basin Use
	(376-pound barrels)	
1950	1.71	1,697,000
1955	1.41	-
1960	1.75	2,046,000
1961	1.64	1,978,000
1962	1.67	2,044,000
1963	1.72	2,153,000
1964	1.60	2,062,000
1980	1.70	3,000,000

Lime is used in Willamette Basin primarily in chemical and industrial applications. It has been produced as captive tonnage for use by the processing companies and principal tonnages have been for calcium carbide manufacture. A by-product, as calcium carbonate sludge, has been regenerated to quicklime and used in chemical systems of the Kraft pulp mills in the valley.

Commercial lime production for the open market was initiated in 1964 at a new plant in north Portland. Quicklime and hydrated lime are distributed to Northwest chemical, metallurgical and construction industries. Production is likely to remain centered in the Portland area where plants can be served by water transportation. As with cement, Willamette Basin consumption is projected on the basis of past trends in per capita consumption (See Table III-38). The annual open market use of lime in 1980 will be 76,000 tons.

Table III-38
Estimated lime consumption

Year	Per Capita Use Oregon	Willamette Basin Use
	(pounds)	(tons)
1955	62.8	-
1960	66.1	38,600
1961	63.1	38,700
1962	61.4	37,600
1963	68.5	42,900
1964	69.1	44,500
1980	86.0	76,000

Metals

Metallic deposits include mercury, gold, silver, copper, lead, zinc, ferruginous bauxite, and limonite bog ore. The value of production of these metals has not been significant in comparison with nonmetallic products. Production of these metals from 1900 through 1963 was valued at $2.68 million; mercury production was valued at $1.6 million and gold about $0.9 million, but only small amounts of silver, copper, lead, and zinc were produced (see Table III-39). The largest metal production in the basin occurred during the depression years of 1930 to 1939. Since 1940, metal values have accounted for only $0.5 million of the total mineral output of $302 million.

Table III-39
Value of metals production, Willamette Basin, 1900-1963

Mercury	$1,606,946
Gold	899,133
Silver	53,564
Copper, lead & zinc	116,604
	$2,676,247

Most metal production has come from Lane County deposits, with emphasis on mercury, gold, and silver mining. Other metals have been produced sporadically as by-products. Permanent nonferrous or precious-metal mining industries have not yet been established in the basin because commercially proven deposits or reserves are lacking.

Gold was mined starting with the early settlement of the basin. Production was important at the turn of the century and again during the 1930's. Gold operations were halted during World War II and have not been important since. The potential for gold appears limited because of the lack of known reserves and increasing capital, labor and supply costs.

Mercury reserves are not extensive. Output has come from two districts in the basin--the Black Butte area in Lane County and the Oak Grove area in Clackamas County. During the 1940-1964 period, mercury was produced in only 7 years with a total value of $280,000. There is little indication that production will differ significantly from the past. Mercury mines will be operated only during periods of relatively high market prices, with the Black Butte mine expected to be the only major producer.

The ferruginous bauxite deposits are yet to be exploited commercially. They are located principally in northern Washington County and the Salem Hills area in western Marion County. Reserves are estimated at 80 million tons, with an average of 35 percent alumina. Since world reserves are estimated to exceed 5 billion tons, it appears doubtful that the Willamette Basin deposits will be used in the foreseeable future unless the usual sources are cut off by worsening political situations, known reserves are depleted, or major changes in technology occur.

Bog iron ore was mined and produced commercially at the Iron Mountain deposit near Lake Oswego from 1867 to 1894. Bog iron deposits are also exposed in Washington County. None have been mined commercially for many years. Possibilities of development are low because many deposits are small. Moreover, the principal deposit has been engulfed by urban development.

Fuels

Coal is found in six counties in the basin, but only small quantities have been mined and distributed or used locally. Little detailed exploration of these deposits has taken place because the coal is of a lower grade than that available from sources outside the region. These resources hold very little promise for development in the foreseeable future. The advent of natural gas and nuclear power as an energy source for local industry places coal in an even less favorable position.

The basin lacks proven petroleum reserves. Petroleum exploration to date consists of more than 130,000 feet of exploratory drilling. This exploration has not resulted in any significant findings even though dry holes have shown some traces of petroleum and natural gas. Recent exploration interest in the basin peaked about 1960 when leasing activity was high and several test holes were drilled. Thus far, no commercial production has been developed.

INDUSTRIAL MINERALS DEMAND

Many industries in the basin are heavily dependent upon imports of mineral raw materials, because the basin is deficient in reserves of industrial minerals. Many important commodities--alumina, cement, clays, coal and coke, and petroleum--are imported. Table III-40 shows estimates of significant mineral commodities shipped into Willamette Basin for industrial use in 1963.

Alumina is shipped by rail and freighter from plants in Texas and Arkansas for reduction at the Troutdale smelter. Cement is imported in large quantities by competing producers to supply markets throughout Oregon and Southern Washington.

Sulfite paper mills use 20,000 to 25,000 tons of paper filler and coater clays annually. These materials are obtained from Georgia and Idaho.

About 35,000 tons of coal are consumed annually, principally by retail users. The demand for coal for industrial purposes has declined rapidly. Foundries and primary metal plants use over 20,000 tons of coke per year with the ferroalloy industry being the most significant user.

Table III-40
Estimates of the major industrial mineral raw materials shipped into the Willamette Basin for consumption, 1963

Mineral	Quantity
Alumina - short tons	180,000
Cement - thousand 376-lb. barrels	2,150 1/
Clay (kaolin) - short tons	20,000 - 25,000
Coal - short tons	30,000 - 35,000
Coke:	
Coal coke and coke breeze - short tons	24,000
Petroleum coke - short tons	50,000
Lime - short tons	45,000
Natural gas - million cubic feet	3[illegible],000
Petroleum (crude) - short tons	246,000
Perlite - short tons	2/
Salt - short tons	80,000 - 100,000
Silica:	
Sand - short tons	60,000
Quartz - short tons	9,000
Sodium sulfate - short tons	20,000 - 25,000
Stone (limestone) - short tons	450,000
Sulfur (elemental) - short tons	30,000
Talc (soapstone) - short tons	2/
Vermiculite - short tons	2/

1/ Includes production from one cement plant in Willamette Basin.
2/ Concealed to avoid disclosing individual company data.

During the three-year period (1961-1963) waterborne shipments of crude petroleum averaged about 220,000 short tons annually, reaching 245,893 tons in 1963.

OUTLOOK AND EMPLOYMENT PROJECTIONS

In the future, the Willamette Basin mining and mineral industry is expected to show continued gains in production of sand and gravel, stone, clay, cement and lime, primarily to serve local needs. Metal production is expected to contribute an even smaller share than in the past. Available data do not indicate significant fuel deposits of commercial value.

Employment is mainly in the mining and quarrying of non-metallic minerals (sand and gravel, and stone); from 1959-1964 this category accounted for about 95 percent of the industry's employment. For this reason, employment projections for the industry are tied primarily to the outlook for sand and gravel, and stone. Metal mining has historically varied within narrow limits and has accounted for only a minor portion of total mining employment; therefore, metal mining in the basin is likely to remain relatively unchanged throughout the projection period. Mining employment in the basin for the projection period is given in Table III-41.

Table III-41
Average employment in mining, Willamette Basin

Subareas	Actual 1/		Projected		
	1947	1964	1980	2000	2020
Upper	322	291	345	370	400
Middle	203	202	235	255	280
Lower	165	238	280	305	320
Total	690	731	860	930	1,000

1/ Source: State of Oregon, Department of Employment

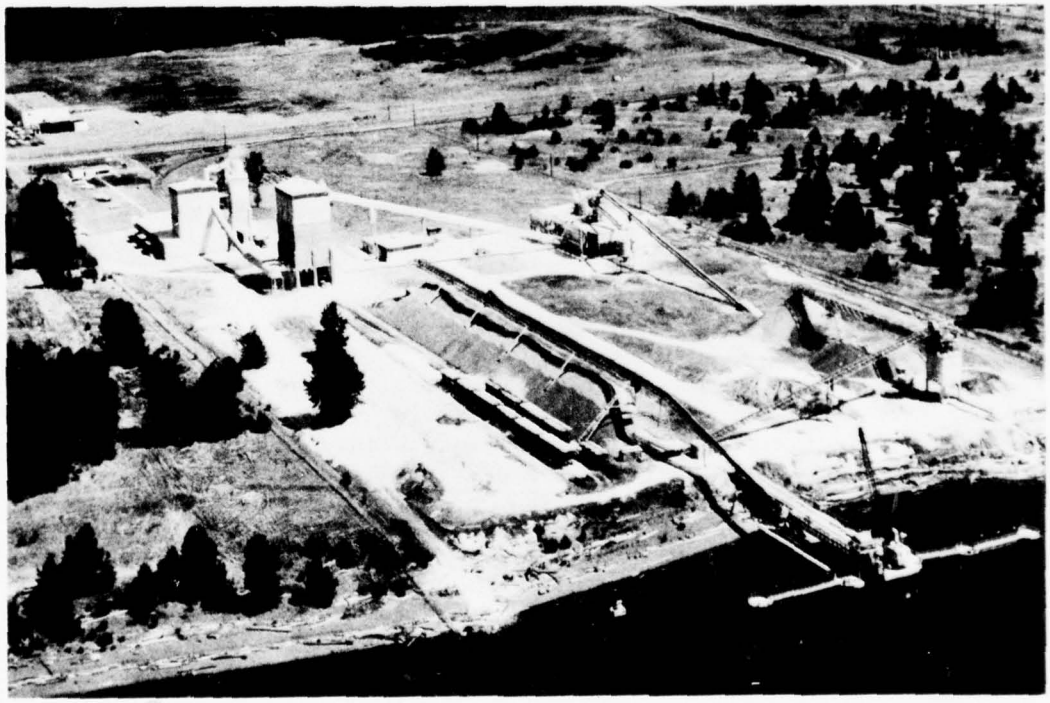


Photo III-17 The Ash Grove Lime & Portland Cement Company is located near the mouth of the Willamette River. (Port of Portland Photo)

PRIMARY METALS

Primary metal manufacturing firms include those which: (1) smelt and refine metals from ore, pig, or scrap; (2) roll, draw, and alloy metals; (3) manufacture castings, forgings, and other basic metal products; and (4) manufacture nails, insulated wire and cable. The firms using these metals for higher-stage fabrication are categorized as fabricated metals firms, and are included in "all other" manufacturing industries, analyzed in the following chapter.

Of 45 firms in the basin engaged in primary metal manufacturing in 1964, 13 had 100 or more employees. Because of the large number of product categories included in this group, there are only a small number of plants in each subgroup. There is only one steel mill, one aluminum plant, and one silicon metal producer. When there are only a small number of plants in a group, data limitations and nondisclosure rules hamper both analysis and presentation of information.

NATIONAL TRENDS

Of the five principal metals consumed nationally in 1960, iron and steel made up 90.3 percent of the total; aluminum, 5.7 percent; and copper, lead and zinc combined, 4.0 percent. Because of variable growth rates among the metals, these proportions have since changed. Aluminum has been taking a larger proportion of a growing market at the expense of steel. Substitution not only among metals but also between metals and other products--such as plastics, cement, and wood--will continue to cause uneven rates of growth in the future. Production of primary metals--a composite of a heterogeneous group--has increased 3.3 percent per year during the last 40 years. The growth rate has been less than those of the Gross National Product (GNP) and the Federal Reserve Board index of industrial production. In 1963, the value added by manufacture of primary metals was $15.3 billion, 3.2 percent of GNP. Employment in primary metals nationally in recent years has increased at a rate less than that of total employment; it is thus regarded as a slow-growth industry.

REGIONAL TRENDS

There are major plants located in the Pacific Northwest which produce the five principal metals: steel, aluminum, copper, lead and zinc. The greatest plant capacity is in the aluminum industry which has located in the region largely because of favorable power rates. In 1960, 28.4 percent of national aluminum production capacity was located in the Pacific Northwest. Expansion has kept pace with national growth of the industry; in 1965 the region had 29.1 percent of the national capacity.

Production of other metals, some of which is not sufficient to supply regional markets, has been increasing. Between 1947 and 1963, value added by manufacture of primary metals increased at an average annual rate of 3.8 percent compared to the national rate of 3.0 percent. Comparative employment trends in recent years are discussed under Employment Analysis.

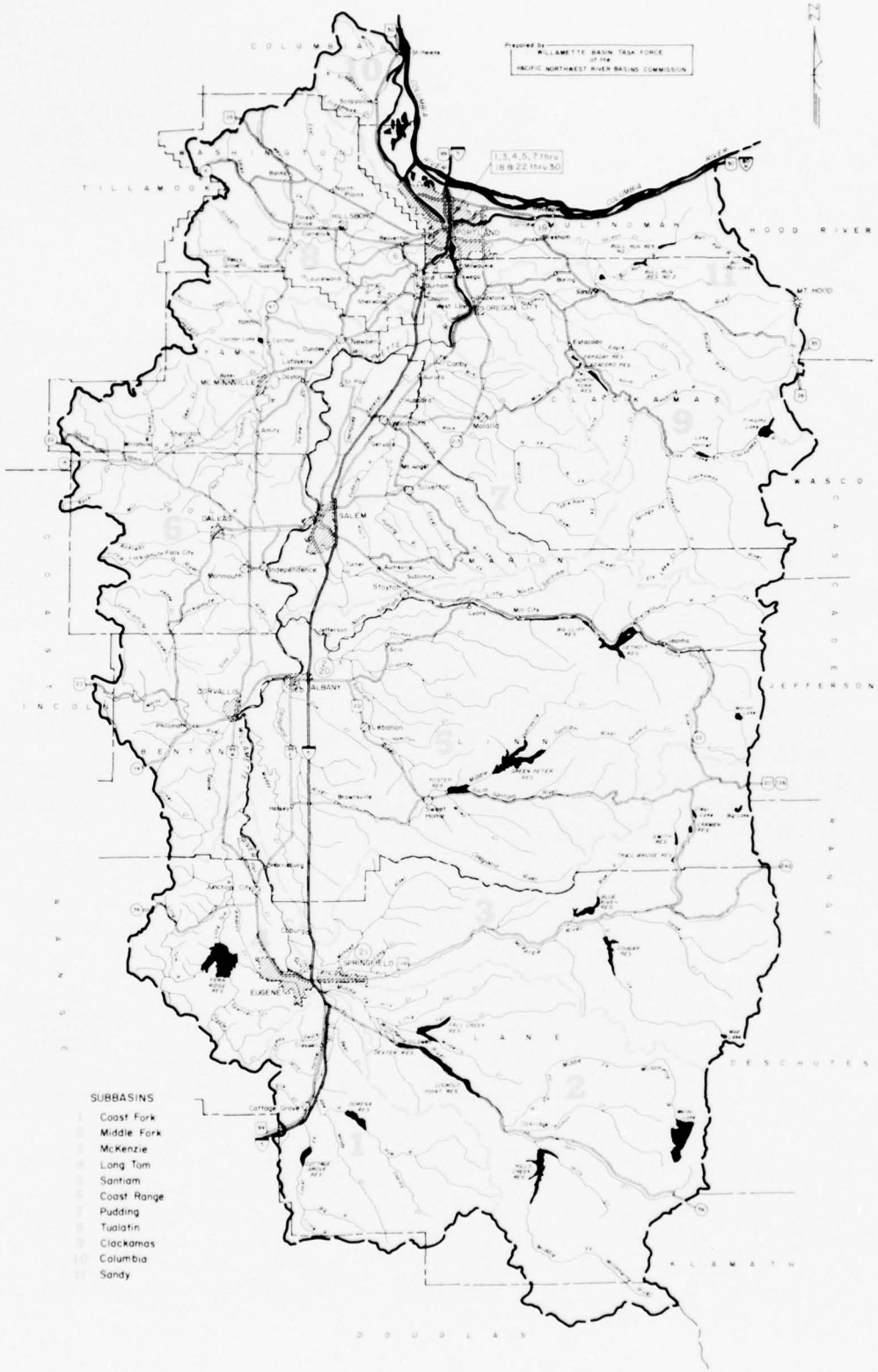
BASIN TRENDS

Output of primary metals in the basin covers a variety of products ranging from ingots and metal sheets to extruded forms and cable. Seventy percent of the 4,779 employed by the industry in 1964 were engaged in processing of ferrous metals, the remainder in nonferrous metals. Table III-42 shows the number of plants, employment and payroll of the major categories of the industry in the basin. Among the various manufacturing industries, primary metals ranks eighth in employment.

Table III-42
Number of plants, employment, and payroll in major primary metal categories, Willamette Basin, 1964

	Number of Plants	Employment	Payroll (1,000)
Blast furnaces, steel works, & rolling & finishing mills	6	1,507	$12,200
Iron & steel foundries	13	1,903	13,181
Primary smelting & refining of nonferrous metals	3	790	5,872
Secondary smelting & refining of nonferrous metals & alloys; Rolling, drawing & extruding of nonferrous metals; Miscellaneous	6	172	1,192
Nonferrous foundries	17	407	2,580
Total	45	4,779	$35,025

Eighty-five percent of the industry, in terms of both the number of plants and number of employees, is located in the Lower Subarea. In 1964 there were only two plants in the Upper and five in the Middle Subareas, with a total of 739 employees. The largest, Wah Chang Corporation in Albany, employed more than 500 persons. Primary metals plant locations with more than 20 employees in 1963 are shown on Map III-5 and Table III-43.



Source: Oregon Directory of Manufacturers, 1964

MAP III-5
WILLAMETTE BASIN STUDY
OREGON

PRIMARY METAL PLANT LOCATIONS (1963)

1967

WBTF-0-121-L

Table III-43
Primary metal plant locations, Willamette Basin, 1963

BLAST FURNACES, STEEL WORKS			
1 Union Carbide Co.	Portland	180	employees
3 Oregon Steel Mills, Inc.	Portland	460	"
4 Beall Pipe and Tank Co.	"	300	"
5 Northwest Copper Works, Inc.	"	70	"
6 Oregon Culvert Co.	Beaverton	20	"
IRON AND STEEL FOUNDRIES			
7 Crawford and Doherty Foundry	Portland	58	"
8 Industrial Iron Works	"	80	"
9 Northwest Foundry & Furnace Co.	"	70	"
10 Rich Manufacturing Co. of Calif.	"	160	"
11 Tube Forgings of America, Inc.	"	100	"
12 Columbia Steel Casting Co., Inc.	"	140	"
13 Esco Corporation	"	900	"
14 Oregon Steel Foundry	"	100	"
15 Pacific Steel Foundry	"	60	"
16 Precision Castparts Corp.	"	170	"
17 Western Foundry Co.	"	80	"
18 Western Steel Cast Co. of Oregon	"	45	"
PRIMARY SMELTING, NON-FERROUS			
19 Reynolds Metals Co.	Troutdale	560	"
21 National Metallurgical Corp.	Springfield	40	"
SECONDARY SMELTING, NON-FERROUS			
22 M. B. Kirk and Son, Inc.	Portland	50	"
NON-FERROUS FOUNDRIES			
23 Control Brass and Aluminum Foundry	"	20	"
24 Macadam Aluminum & Bronze Co.	"	20	"
25 Pacific Light Metals Foundry Co.	"	65	"
26 Service Bronze and Brass Works	"	26	"
27 Product Engineering Co.	"	90	"
MISC. PRIMARY METAL INDUSTRIES			
28 Columbia Forge and Machine Works	"	100	"
29 Portland Chain Manufacturing Co.	"	80	"
30 Schmitt Steel, Inc.	"	110	"
2 Wah Chang Corp.	Albany	525	"
20 Oregon Metallurgical Corp.	Albany	150	"

(20 or more employees)

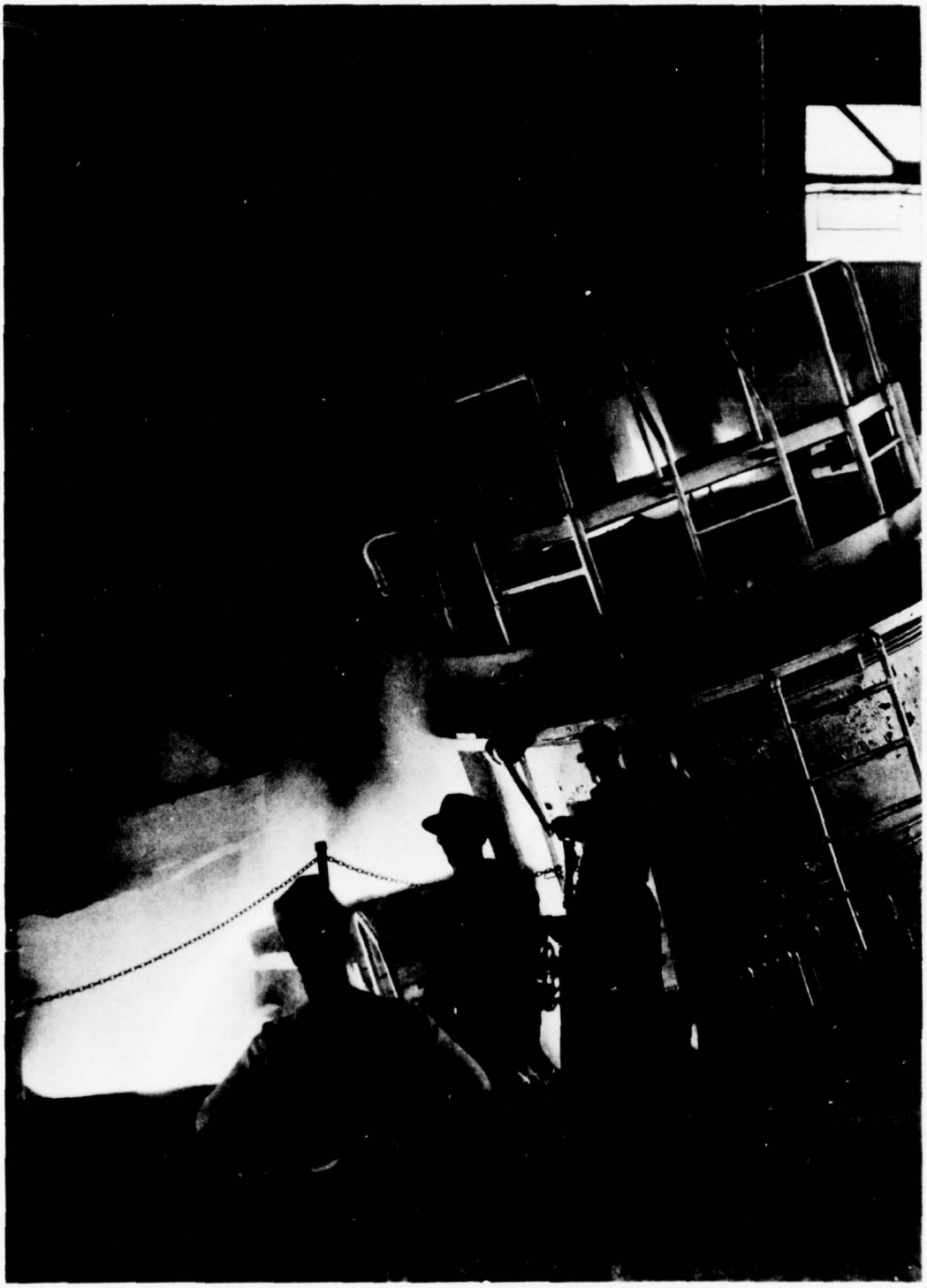


Photo III-18. The basin's 13 iron and steel foundries employ about 1,900 people. (Esco Corporation Photo)

Many products manufactured in the basin are shipped to regional and national markets, minor tonnages enter the world market. The commodity exported in largest quantity is aluminum, produced at the Reynolds plant in Troutdale. In total, however, the basin is a net importer of primary metals as shown in Table III-44.

Table III-44
Net shipments of primary metal products, railroads and waterborne commerce, 1/ Willamette Basin, 1962 and 1964

Railroad Freight Movement 1962		Waterborne Freight Traffic 1964	
Commodity	Tonnage	Commodity	Tonnage
	(expressed in short tons)		
Aluminum bar	+ 80,846	Iron & steel, semi-finished	- 5,887
Aluminum, NEC	- 12,434	Ferrous Castings	- 157
Copper; brass & bronze	- 16,787	Manganese ore	-59,964
Lead & zinc; bar, ingot and pig	- 30,317	Aluminum metal	+32,215
Lead & zinc NOS	- 180	Copper, lead, zinc & alloys	+10,307
Magnesium metals & alloys	+ 11	Nickel	+ 4,492
Ferro alloys	+ 8,602		
Other metals	+ 18,675		
Iron & steel, incl. pipe	-233,769		

1/ The minus sign denotes net imports and the plus sign denotes net exports. Rail shipment data are for the State of Oregon, but the major portion of the shipments are accounted for by those of the basin. Waterborne shipment data are for the Port of Portland.

COMPARATIVE TRENDS

Generally, production increase in the basin has paralleled that of the region and exceeded that of the nation. Value added by manufacture of primary metals increased from $37.2 in 1947 to $65.0 million in 1963 (constant 1960 dollars), an average annual increase of 3.6 percent compared to a national increase of 3.0 percent. The greatest rate of growth during the 16-year span was between 1947 and 1958. During the 1958-1963 period, production in the basin lagged behind both the region and the nation. The rate of employment increase in recent years likewise failed to match that of the nation.

Major metals plants in the basin are the National Metallurgical Co., Springfield; Union Carbide Co., Portland; Oregon Steel Mills, Inc., Portland; Reynolds Metals Co., Troutdale; the Wah Chang Corp., and Oregon Metallurgical Corp., Albany. Mineral commodities used at these facilities do not originate within the basin, and because of a general lack of raw materials capable of meeting the strict specifications required by the existing industries, it is unlikely that any will in the future. Most of these metallurgical firms use considerable electricity and are located in the area because of the availability of low-cost power as well as the metallurgical technology available by reason of the location of the Bureau of Mines Metallurgy Research Center at Albany.

Silicon Metal and Ferroalloys

Silicon metal is used largely at aluminum plants as an alloying constituent; therefore, its future is tied closely to growth in aluminum production. Silicon metal production is projected to grow at the same rate as that projected for aluminum production. Although there are a number of suitable locations for silicon metal plants in Willamette Basin, projections of future production have been limited to the Upper Subarea, primarily because the technology and plant operation are established in that area. The availability of low-cost power will be about the same throughout the basin, and transportation costs will not differ significantly from other locations in the basin. There are no known silica deposits in the basin that could influence the location of a silicon metal plant.

In 1965 the installed furnace production capacity for ferrosilicon, silicomanganese, and ferromanganese in the Pacific Northwest was 71,500 tons annually. Approximately 18,000 tons or 25 percent of this capacity is in Willamette Basin. Assuming that the basin will maintain a proportionate share of future Pacific Northwest output, silicon metal and ferroalloy production is projected to reach 40,000 tons in 1980, and 165,000 tons by 2020.

Estimated future consumption of mineral raw materials for ferroalloy production in the basin is based on the assumption that each of the three--ferromanganese, silicomanganese, and ferrosilicon--will be produced in approximately equal quantities (see Table III-45).

Table III-45

Silicon metal and ferroalloy production and raw materials consumed, Willamette Basin, 1980-2020

	1980	2000	2020
		(thousand tons)	
Production:			
Pacific Northwest	125	211	390
Willamette Basin	40	78	165
Raw material consumption:			
Manganese (48 percent Mn)	29	46	76
Coke	15	23	38
Silica (97 percent SiO_2)	27	60	140
Coal or hogged wood	3	4	8
Ferrous scrap	6	9	13
Limestone	6	10	14

Ferroalloy production in the projection period is expected to continue in the Lower Subarea. Availability of low-cost power, ready access to water transportation, and technology in the area indicate the Lower Subarea location. There are no known silica, manganese ore, or other mineral deposits in the basin that might influence the location of the ferroalloy industry of Willamette Basin.

Steel

Present Willamette Basin steel production is dependent on iron and steel scrap; there are no integrated iron ore reduction plants. It is possible that a prereduced iron ore pellet (85 to 95 percent metallic iron) will be used to supplement the scrap charge. Gilmore Steel is constructing a pelletizing plant in Portland that will go into production in early 1969. However, projections of consumption were made using the present ratio of iron ore used per unit of steel produced.

It is assumed that the present location of the steel plant (Portland) will influence future smelting plant locations, and that future steel output will continue to be from the Lower Subarea. Projected steel production and raw material consumption are shown in Table III-46.

Table III-46
Steel production and raw material consumption, Willamette Basin, 1980-2020

	1980	2000	2020
Steel production (thousand tons)	280	560	890
Raw materials:			
Steel scrap (thousand tons)	300	600	950
Coke breeze (tons)	490	980	1,550
Limestone (tons)	7,000	14,000	22,000
Burnt lime (tons)	2,800	5,600	8,700
Dolomite (tons)	2,100	4,200	6,580
Iron ore (tons)	1,680	3,360	5,250
Fluorspar (tons)	168	336	525

Primary Aluminum

Primary aluminum production for the area is projected to increase at an average annual rate of between 5.5 and 6.0 percent during the period 1965 through 1980. Aluminum production in the Pacific Northwest is projected to grow at about the same rate as the United States during the 1975-85 period. Pacific Northwest growth from 1985-2010, is forecast at less than the national growth as nuclear-generated power becomes less expensive, allowing aluminum reduction plant locations to be closer to large markets.

"Exotic" Metals

National titanium sponge consumption is projected to reach 51,000 tons annually by 1980, an annual average increase of about 11 percent over the 1962 demand of 6,700 tons. Assuming the basin production growth parallels national consumption growth, employment could rise by 6 to 8 percent annually after allowing for productivity increases. It seems likely that this rate would be much less over the long term after 1980.

The demand for zirconium will depend to a large extent on the future use of nuclear reactors and on whether zirconium outperforms competing metals such as stainless steel and aluminum. Possibly more important to the outlook for the exotic metals industry will be the demand for fabricated products made of columbium, hafnium, tantalum, tungsten, vanadium, and various other metals. An indication of the future of these metals could be gained from detailed studies of demand and comparative locational economics of production; however, this is beyond the scope of this study.

PROJECTIONS

Projections of the consumption of primary metals are based on growth of national population and GNP. Trends in demand for major products of each metal, substitution between metals and other materials, and availability of resources are recognized.

The outlook for production of the major primary metals in the basin is based on a series of industry studies prepared by the Bureau of Mines for the Bonneville Power Administration. The industries studied were steel, aluminum, copper, lead, zinc, abrasives, ferroalloys, magnesium, and titanium. (The aluminum study was prepared by Ivan Bloch & Associates, Portland, Oregon.) The growth rate of other metals not included in the Bureau of Mines summary was estimated on the basis of the composite growth rate of the major metals industry. An increase in production of approximately 4.0 percent per year to 1980 and 33 percent thereafter was considered reasonable.

Employment projections for individual industries reported by the Bureau of Mines were derived by allocating employment forecasts for these industries in the Pacific Northwest to Willamette Basin plants (Table III-47). Individual industry projections are not given because of the limited number of plants in the basin and the restricted nature of certain of the employment data. Employment in the remainder of the primary metals industry was estimated on the basis of projected output, and the production-to-employment relationship anticipated during the forecast period.

Table III-47
Employment in primary metals manufacturing industries, Willamette Basin and Subareas

		Lower Subarea		Middle Subarea		Upper Subarea	
Year	Basin	% of Basin Total		% of Basin Total		% of Basin Total	
1958	4,540	1/	1/	1/	1/	1/	1/
1964	4,779	84.5	4,036	1/	1/	1/	1/
1980	6,600	82.0	5,410	16.0	1,050	2.0	140
2000	9,600	80.0	7,680	17.0	1,630	3.0	290
2020	12,300	78.0	9,590	18.0	2,210	4.0	500

1/ *Nondisclosure rule prohibits publication of this figure*

CHEMICAL PRODUCTS INDUSTRY

Nationally, the product output of the chemical industry is the most heterogeneous of all manufacturing industries. Chemical products number in the tens of thousands, with more than 2,500 in the petrochemical group alone. The composition of the aggregate output is undergoing rapid change. Half of today's output represents products which were in their infancy in 1940 or have since been developed. Because of this complexity, only broad generalizations can be made about the level of development for many components of the basin's chemical industry.

The dominance of the forest products and agricultural industries in the region has been instrumental in shaping the development of the basin chemical industry. Understandably, chemicals required by these industries are in great demand locally. Industrial inorganic chemicals, viz., chlorine and sulphur products, are produced for the regional pulp and paper industry. Synthetic resins and adhesives are manufactured for the plywood and composition-board plants. Fertilizers, soil conditioners, pesticides, herbicides and fungicides are produced for both the regional agricultural uses and residential gardens. Chemicals produced in the basin for industrial markets are also manufactured for both special and general industrial uses; these include oxygen, acetylene, nitric acid, calcium carbide, and others. The diversification of the manufacturing base has encouraged a corresponding diversification of chemical production.

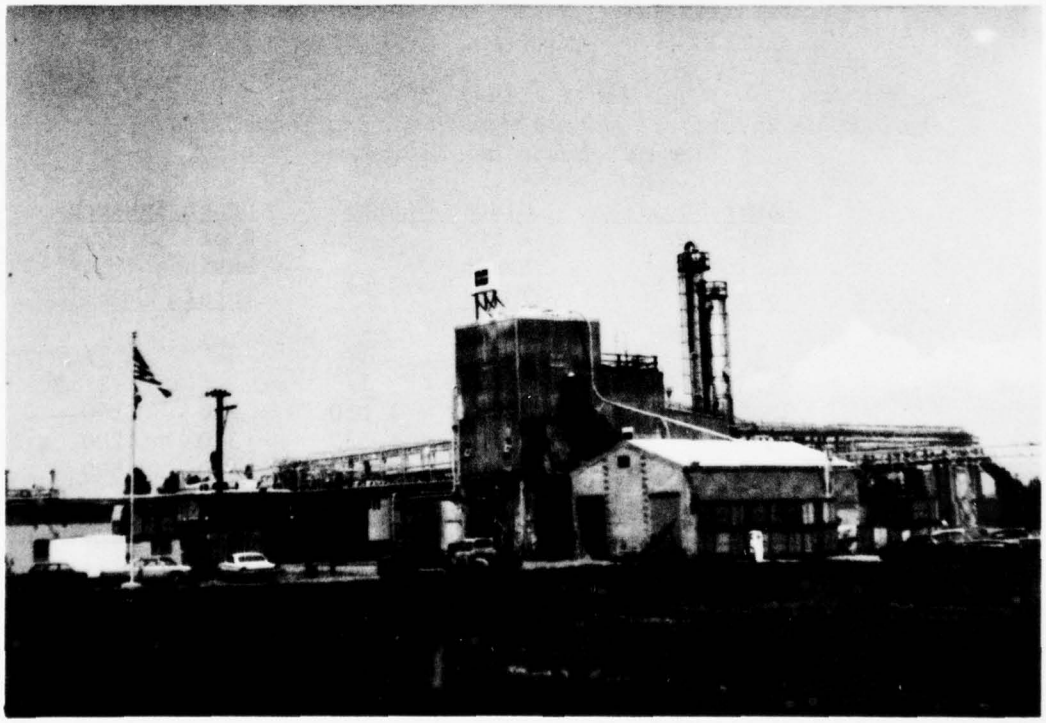


Photo III-19. The Monsanto Chemical Co. Plant in Eugene (Oregon State Department of Employment Photo)

Chemicals more related to the consumer market than to intermediate industrial markets are also produced in the basin; these include drugs, soaps and cleaners, paints, and some miscellaneous chemicals. Approximately two-thirds of these commodities are produced for terminal markets. Increased production, therefore, has been in response to expanding consumer markets associated with population growth.

In spite of the wide assortment of chemical products manufactured in the basin, the size of the industry is relatively small. Employment in 1964 was 1,633, and estimated output was approximately $37 million. In terms of both employment and production, the basin had 0.2 percent of the national chemical industry compared to 0.7 percent of the population. In an aggregate sense, the industry of the basin supplied only about 30 percent of the chemicals consumed in the basin. The basin is deficient in supplying its own markets in all chemical product categories. Table III-48 shows the net shipment by commodities for the most recent years for which data are available.

Table III-48
Net shipments of chemical products by railroads and waterborne commerce, Willamette Basin, 1/ 1962 and 1964

Railroad Freight Movement 1962		Waterborne Freight Traffic 1964	
Chemical Commodity	Tonnage	Chemical Commodity	Tonnage
	(expressed in short tons)		
Sulphuric acid	-11,000	Coal tar	- 8,935
Acids, NEC	-10,100	Misc., NEC	-508
Sodium products	-35,881	Sodium products	+880
Alcohol, NEC	-6,375	Industrial chem.	- 6,140
Blacks, NEC	-626	Paints	-205
Fertilizers, NEC	-114,740	Nitrogen fertilizers	-29,147
Insect & fungicides, NEC	-5,794	Other fertilizers	-643
Coal tar prod.	-5,526		
Tanning materials, NEC	-42		
Paint & allied products	-13,453		
Plastics	-6,491		
Cellulose	-626		
Drugs & toilet prep.	-12,035		

1/ *The minus sign denotes net imports. Data for rail shipments are for the State of Oregon, but the major portion of the shipments are accounted for by those of the basin. Data for water shipments are for Portland only. The source for railroad data is Oregon Public Utility Commission and for waterborne shipment, Corps of Engineers, "Waterborne Commerce of the United States," 1964.*

Conditions which have retarded development of the industry in the basin are associated with markets, national production patterns, and, for some chemicals, the lack of local sources of raw materials. The market sectors as indicated by the interindustry demand for chemical products are shown in Table III-49. Several factors stand out. The dominant commodity-producing industries of the region--agriculture and forest products--are not, in proportion to the total, large chemical users. Nationally, these two industries consume approximately 6 percent of the total chemical output.

Table III-49
National demand for chemical and allied products by major source 1/

	Chemical Categories by SIC 2/			
Demand by Source	281,286 287,289 percent	282 percent	283 percent	285 percent
(expressed as percent of total demand of selected chemical categories)				
Intermediate Market	72.5	83.6	26.5	33.9
Agriculture	9.7	.0	.4	.1
Mining	1.3	.0	.0	.3
Manufacturing	60.0	83.6	13.5	28.1
Lumber & wood products	.5	1.3	.1	2.0
Paper & allied products	2.9	2.4	.4	.1
Chemical & allied products 3/	39.0	42.7	7.5	1.3
Other manufacturing	17.6	37.2	5.5	24.7
Other industries	1.5	.0	12.6	5.4
End-product Market	18.9	7.2	66.3	59.7
Construction	3.6	.0	.0	57.4
Personal consumption	1.8	.2	55.9	.9
Other	13.5	7.0	10.4	1.4
Transfer to Other Industry	8.2	8.4	6.6	6.0
Total	99.6	99.2	99.4	99.6
Total Industry Share	45%	17%	32%	6%

1/ Computed from 1958 input-output table for United States, U. S. Dept. of Commerce, Office of Business Economics, "Survey of Current Business," November 1964

2/ The standard industrial classification (SIC) is: 281 industrial inorganics and organics, 282 plastics and synthetics, 283 drugs, 284 soaps, 285 paints, 286 gum and wood chemicals, 287 agricultural chemicals, and 289 miscellaneous.

3/ Includes synthetic textiles.

Much of the output is put back into the chemical industry, the chemical industry being its own best customer. The absence of an established chemical complex in the basin has therefore retarded expansion. The national center of chemical production has remained in the northeastern United States because of the agglomeration of economies relevant to input access and research. The categories that constitute the least share of the total output of the chemical industry nationally are those which are primarily end-product chemicals--drugs, soaps and cleaning detergents, and paints--whose market size is related to population. In the past the regional market has been insufficient to justify an economic scale of production for many of these items.

The absence of local sources of raw materials has likewise discouraged production of some chemicals. Of chemicals serving the intermediate market, the least developed in the basin are organic chemicals; the largest nationally of the organic chemical group, petrochemicals, is virtually nonexistent. This group includes synthetic rubber, plastic raw materials and materials for synthetic fabrics. The petrochemical industry is locationally oriented toward the resource input--oil or gas production--or toward the intermediate market center of tire, textile, or agglomerated fabrication. The absence of both conditions has discouraged basic petrochemical production.

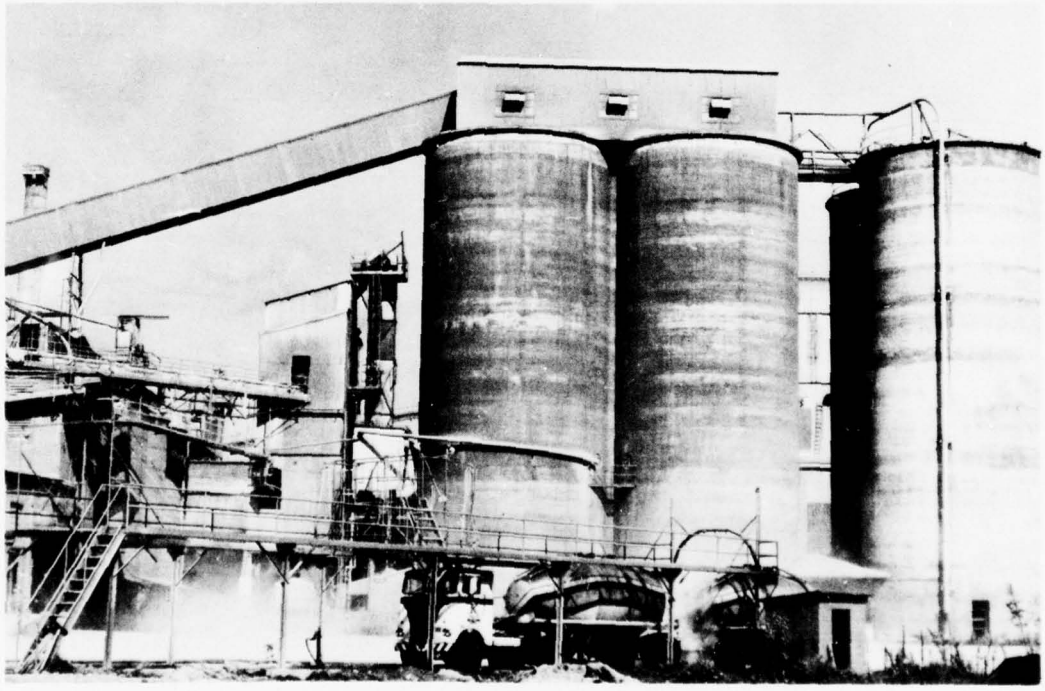


Photo III-20. Increasing needs for concrete in heavy construction create a constantly increasing demand for cement production. (Corps of Engineers Photo)

COMPARATIVE DEVELOPMENT

Production data for most individual chemical categories are not available. Differences in the composition of the chemical industry for the basin, region and nation are therefore shown in terms of employment, as indicated in Table III-50. Even though the number employed in each category is relatively small, the industry in the basin is diversified. Five of the seven major categories have 10 percent or more of total chemical employment. Basic industrial chemicals category is the largest; two firms in this group are the largest chemical firms in the basin. This group together with agricultural chemicals and paints comprise two-thirds of total employment in the industry. In contrast, employment in the region is concentrated in basic industrial chemicals; all other categories are 7 percent or less. (Nearly 50 percent of the region's total chemical employment is located at the Hanford atomic plant.)

Table III-50

Percent employment by major chemical category
Willamette Basin, Pacific Northwest, United States, 1964

Major Categories	Basin		Pacific N. W. [1/]	United States
	Number of Employees	Percent	Percent	Percent
Basic Industrial Chemicals	436	27	78	32
Plastic and Synthetic Resin	100	6	2	20
Drugs	163	10	1	13
Soaps, Cleaning Detergents	70	4	1	11
Paints	306	19	5	8
Agricultural Chemicals	313	19	7	6
Wood and Miscellaneous Chemicals	245	15	6	10
Total	1,633	100	100	100

1/ Pacific Northwest data are for 1962.

With reference to market orientation, the basin and nation are similar but the region differs markedly. In both the basin and nation, one-third of those employed are in industries which predominantly produce for the end-product market and two-thirds in industries which produce for the intermediate market, whereas the region has only 7 percent employed in the manufacture of end-product chemicals. The fact that the basin produces some chemicals for region-wide markets also contributes to the compositional differences in the industry between the basin and region.

NATIONAL OUTPUT PROJECTIONS

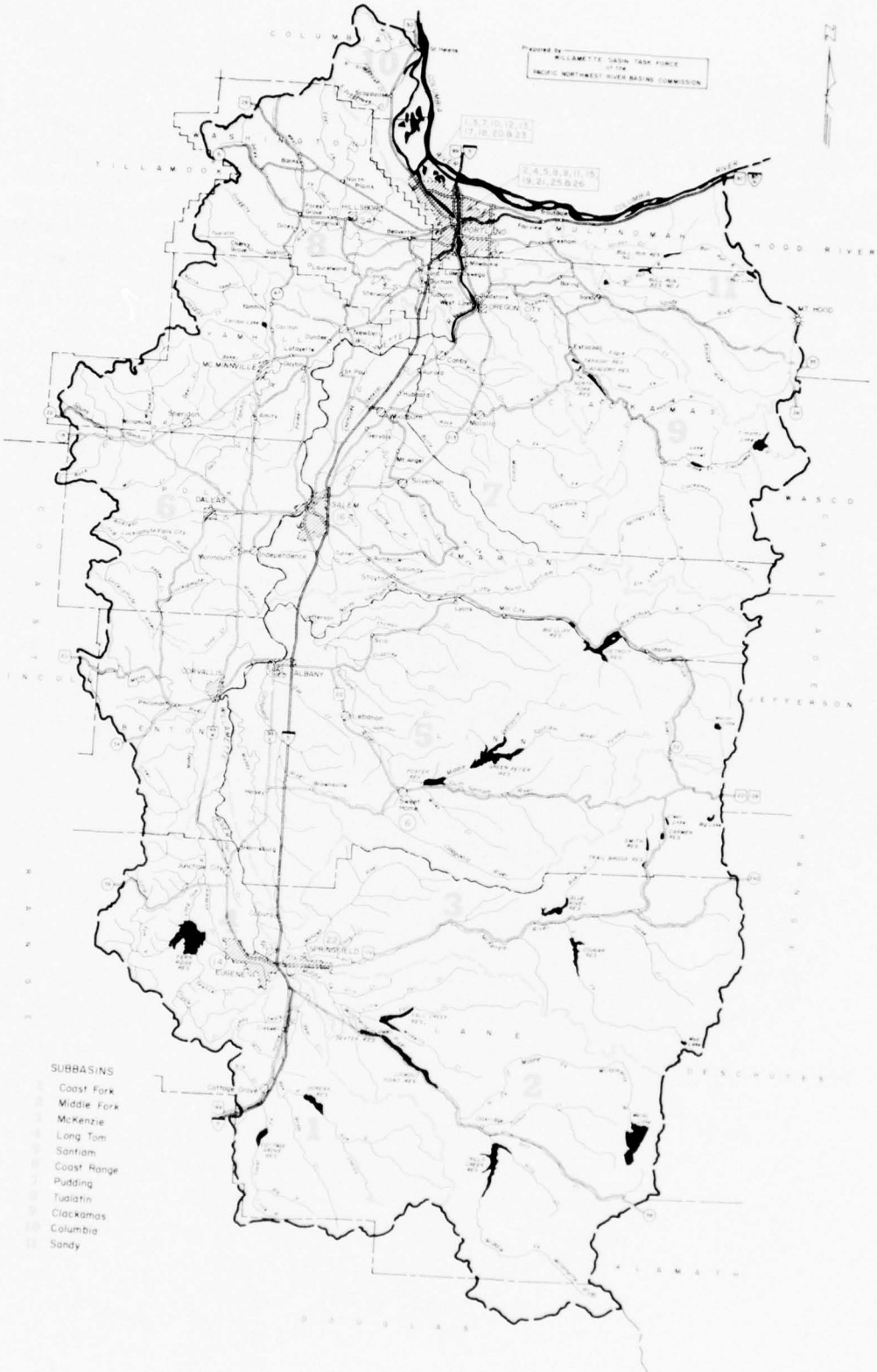
Output (value added by manufacture) of chemical products in the basin increased from an estimated $15.1 million in 1947 to $35.6 million in 1963 (constant 1960 dollars), approximately 5.5 percent annually. Production during the latter part of the period, however, has been accelerating. Between 1947 and 1954, average annual production remained essentially unchanged, but it increased 5.7 percent per year between 1954 and 1958 and 12.3 percent per year between 1958 and 1963. In the latter period, employment increased 27 percent.

The basin chemical industry exceeded the rate of expansion for the region and nation in both output and employment in recent years. Between 1958 and 1963, output in the basin expanded 80 percent while output in both the region and nation increased approximately 50 percent. Comparative employment changes revealed similar trends; between 1958 and 1965, Willamette Basin increased 33.0 percent compared to 6.5 and 10.5 percent for the Pacific Northwest and nation, respectively.

The rapid rate of development of the industry is a response to the growth in existing industrial and consumer markets, while at the same time the economy had grown sufficiently to provide markets supporting production of items new to the region. As production and population in the basin and region expand, it becomes economically feasible to manufacture more products locally. Increased advantages of market access stimulated expansion of many commodities of the chemical industry in the basin. These advantages are reflected in the favorable growth of this industry.

LOCATION OF PLANTS

The chemical products industry is concentrated in the Lower Subarea. Of the 68 plants in operation in 1964, 57 (with 88 percent of the employees) are located in the Portland Metropolitan Area, and 11 are located in the other two subareas. Although production and employment have been increasing, the number of firms has declined slowly in recent years. The location of firms having 20 or more employees is shown on Map III-6 and summarized in Table III-51.



MAP III-6
WILLAMETTE BASIN STUDY
OREGON

CHEMICAL PLANT LOCATIONS (1964)

1967

WBFT-0-1122-L

Table III-51
Chemical plant locations, Willamette Basin
(20 or more employees)

Chemical Plants	Location	No. Employees
INDUSTRIAL CHEMICALS		
1 Industrial Air Products	Portland	148
2 Pacific Carbide & Alloy Co.	"	48
3 Pennsalt Chemical Corp.	"	185
4 Stauffer Chemical Co.	"	49
5 Union Carbide Corp.	"	20
PLASTIC MATERIALS AND SYNTHETICS		
6 Inter-Pacific Resins, Inc.	Sweet Home	20
DRUGS		
7 Haack Laboratories, Inc.	Portland	20
8 Don Hall Laboratories, Inc.	"	30
9 Stanley Drug Products, Inc.	"	140
SOAP, CLEANERS		
10 Mount Hood Soap Co.	"	28
11 Associated Chemists, Inc.	"	20
12 Packer-Scott Co.	"	36
PAINTS AND ALLIED PRODUCTS		
13 Walter N. Boysen Co.	"	31
14 Iverson Paints, Inc.	Eugene	29
15 Miller Paint Co.	Portland	30
16 Norris Paint & Varnish Co.	Salem	22
17 Pittsburgh Plate Glass Co.	Portland	33
18 Rodda Paint Co.	"	36
19 Spe-De-Way Products Co., Inc.	"	23
AGRICULTURAL CHEMICALS		
20 Chipman Chemical Co., Inc.	"	95
21 Miller Products Co.	"	50
MISCELLANEOUS CHEMICAL PRODUCTS		
22 Central Processing Co.	Springfield	40
23 Hercules Powder Co.	Portland	40
24 Pacific Adhesives Co.	Hillsboro	30
25 Pacific Resins & Chemicals, Inc.	Portland	33
26 California Ink Co.	"	25

CHEMICAL OUTLOOK

The two industries which consume much of the chemical output in the basin are pulp and paper products and agriculture. Approximately 40 kinds of chemicals are required in the production of pulp and paper products, the two most important being chlorine and sulfur products, for which projections made by Bonneville Power Administration were adopted. The chemicals in greatest demand in agriculture are phosphate products, potash, and ammonia. Projected production of ammonia is related to estimated use of fertilizer in agriculture. Future production of phosphate products and potash in the basin is unlikely.

Development of petrochemicals, gum, and wood chemicals industries is not likely to take place and is not included in the projections. If offshore petroleum is discovered, the probability of petrochemical production in the basin would be greatly enhanced, but would more likely be near the coast. The present state of research in chemical production from wood fiber, as well as technological problems inherent in processing, do not permit appraisal of the development prospects of wood chemicals. Should either of these industries develop, the projections may be understated.

Projected level of other chemicals were based on two estimating procedures: (1) production relationships during 1947 to 1963 between the basin, region, and nation, and (2) relationship between each major chemical component to a relevant demand factor, e.g., paint to construction estimates drugs to population, and industrial chemicals to index of manufacturing production. The composite of these projections and the three major chemicals mentioned above, together with comparative historic trends, are indicated in Table III-52. National projections are shown in Table III-53.

Table III-52

Trends in production, chemical and allied industries, Willamette Basin, Pacific Northwest, United States (expressed as an index of 1960 constant dollars)

	Basin			Pac. N. W. [1/]		United States	
	Value of Output per $1 billion in U. S.	Index	Annual Increase %	Index	Annual Increase %	Index	Annual Increase %
1947	$2,600,000	61		31		41	
			.8		6.1		7.6
1954	$1,641,000	65		59		68	
			5.7		9.9		5.9
1958	$1,627,000	81		86		86	
1960	$1,727,000	100	12.3	100	9.0	100	8.2
1963	$1,958,000	144	6.0	132		127	4.5
1980	$2,275,000	320				243	
			4.6				4.0
2000	$2,600,000	790				531	
			3.2				3.2
2020	$2,600,000	1,490				1,000	

1/ Includes the states of Idaho, Oregon and Washington only.

Table III-53

Index of national chemical output, 1960-2020

	1960	1980	2000	2020
Chemicals & Allied Products	100	243	531	1,000
Chemical Products (drugs, soap, paint & fertilizers)	100	205	433	900
Industrial Chemicals	100	274	613	1,150
Inorganic	100	238	564	1,150
Organic	100	288	630	1,150

1/ Source data show year 2000; data for 2020 extrapolated.

Source: Hans Landsburg, et. al., Resources in America's Future, Resources for the Future, Inc., 1963

Output is projected to increase from about $20 million in 1958 to almost $370 million by the year 2020. Employment is projected to increase from about 1,550 in 1963 to more than 5,000 by 2020. Table III-54 summarizes the output and employment projections of the chemical industry.

Table III-54
Output and employment of chemical and allied products industries, Willamette Basin and Subareas

	Total Willamette Basin			Lower Subarea		Mid. Subarea		Upper Subarea	
	Output		Emp.	Output	Emp.	Output	Emp.	Output	Emp.
	Constant 1960 Dollars (millions)	Index*		Percent of Total		Percent of Total		Percent of Total	
1958	$ 19.9	81	1,228	96.1	1,180	3.4	42	0.5	6
1963	35.6	144	1,556	89.5	1,393	4.4	68	6.1	95
1980	79.0	320	2,200	85.0	1,870	6.0	130	9.0	200
2000	195.0	790	3,650	83.0	3,030	7.0	250	10.0	370
2020	368.0	1,490	5,100	83.0	4,250	7.0	350	10.0	500

* *Index 1960 = 100*

"ALL OTHER" MANUFACTURING INDUSTRIES

Diversification of the basin manufacturing base is increasing rapidly. Many manufacturing industries which were in the embryonic stage a few years ago have experienced the most rapid rates of expansion. The development of a more balanced mix of manufacturing industries is characteristic of many growing areas. Nationally, production facilities have diversified as population and economic growth in areas reach levels which permit economic production. Trends toward industrial dispersion have resulted in greater similarity of subnational areas. The industries combined in this group are shown in Table III-55.

Table III-55
Index of relative development, 1/
"All Other" manufacturing industries,
Willamette Basin, 1963

Sic. No.	Industry	Employment Index	Production Index
Nondurables			
22	Textiles	36	44
23	Apparel	32	46
27	Printing, publishing	68	66
29	Petroleum, related prod.	29	38
30	Rubber, misc. plastics	18	20
31	Leather	6	13
Durables			
25	Furniture, fixtures	75	91
32	Stone, clay, glass	53	62
34	Fabricated metals	64	78
35	Nonelectrical machinery	50	56
36	Electrical machinery	55	51
37	Transportation equip.	37	27
38	Professional instr.	47	45
39	Misc. manufacturing	30	27

1/ An index of 100 would indicate that the industry in Willamette Basin is of the same "relative" magnitude as the industry is nationally.

NATIONAL ASPECTS

The "All Other" manufacturing category represents a significant proportion of the national economy. In 1963 "All Other" output comprised 21 percent of GNP and nearly two-thirds of total manufacturing production. The relative contribution of this category to the national wealth has been increasing. During the 1947-1963 period, the value added by manufacture increased at a greater rate than either the GNP or the Federal Reserve Board index of industrial production.

"All Other" industries also make a significant contribution to employment opportunities. Nationally, in 1964, they comprised 17.4 percent of the total employment and 70.7 percent of total manufacturing employment. The group, as a whole, is a growth component. Between 1958 and 1964, its national rate of increase (10.8 percent) exceeded that of total national employment.

RELATIVE DEVELOPMENT IN BASIN AND REGION

"All Other" manufacturing is not proportionately as significant in the basin or the region as it is in the nation. In 1963 value added by manufacture was $398 million in the basin and $1,851 million in the region, which for both was about one-half the national share based on population distribution.

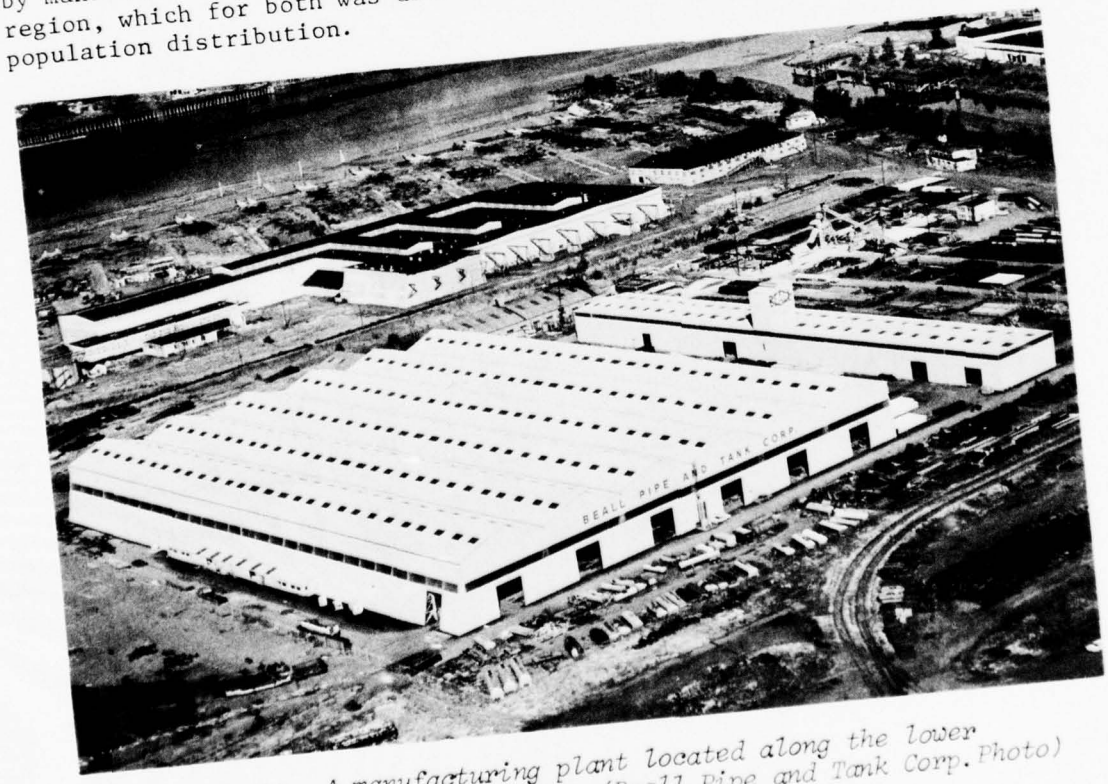


Photo III-21. A manufacturing plant located along the lower Willamette River. (Beall Pipe and Tank Corp. Photo)

The basin is not self-sufficient in the production of any of these industrial components (Tables III-55 and III-56). However, 13 of the 14 industries have increased production relative to the nation between 1958 and 1963, thus the degree of dependence has lessened. The industries that are relatively less developed are those locationally oriented to raw materials not available from local sources. Those dominantly market oriented have attained greater maturity.

Table III-56

Net shipments of products of "All Other" manufacturing industries by railroad and waterborne commerce, Willamette Basin, 1962 and 1964

	Railroad Freight 1/ Traffic 1962 (short tons) 3/	Waterborne 2/ Traffic 1964 (short tons) 3/
Textiles	-19,119	-150
Apparel	40	-8,898
Furniture and fixtures	-10,079	
Petroleum, related prod.	151,154	-5,145,478
Rubber, misc. plastics	-20,277	-492
Leather	-159	
Stone, clay, glass	-113,017	-271,402
Fabricated metals	-21,624	-9,631
Nonelectrical machinery	-34,759	6,094
Electrical machinery	-29,136	-2,209
Transportation equip.	-168,673	-31,530
Misc. manuf. prod.	-93,352	

1/ Data for rail shipment are for the State of Oregon, but the major portion of the shipments are accounted for by those of the basin.
2/ Data for waterborne shipments are for Portland only.
3/ The minus sign denotes net imports.

The basin's share of national and regional value added by manufacture for each of the component industries is shown in Table III-57. Output shown in the basin relative to national output range from a high of 0.61 percent for furniture and fixtures to a low of 0.09 percent for leather and leather products. All showed substantial gains during the 1958-1963 period, except printing and publishing. The basin exceeded its share of the regional output in all but two industries--transportation equipment and petroleum and related products. With relation to the region, the basin's share in 12 of the 14 industries increased during the same period. The increasing shares indicate that rising demand for consumer products and capital equipment exerted by economic and population growth in the region had an impact, increasing the diversification of the basin's manufacturing base.

Table III-57

Value added by manufacture for "All Other" manufacturing industries, Willamette Basin, 1958 and 1963

(In thousands of 1960 Dollars)

	1958			1963		
	Basin Value Added	Percent of PNW	Percent of U.S.	Basin Value Added	Percent of PNW	Percent of U.S.
Nondurables	$ 68,164	31	.26	$104,626	33	.30
Textiles	8,092	66	.17	18,033	73	.29
Apparel	14,320	44	.24	23,620	46	.30
Printing, Publishing	37,068	29	.47	45,901	29	.44
Petroleum, Related Prod.	4,998	13	.20	9,188	12	.26
Rubber, Misc. Plastics	2,792	70	.08	5,964	63	.13
Leather	894	32	.05	1,920	64	.09
Durables	183,724	17	.29	293,028	19.1 1/	.33
Furniture & Fixtures	12,644	23	.54	18,831	44	.61
Stone, Clay, Glass	17,621	19	.32	29,828	25	.41
Fabricated Metals	42,273	37	.45	61,995	43	.52
Machinery, ex. Elect.	39,862	39	.32	62,934	44	.37
Electrical Machinery	30,517	71	.29	55,291	64	.34
Transportation Equip.	25,365	4	.17	40,757	4	.18
Professional Instru.	8,382	71	.29	14,113	94	.30
Misc. Manufacturing	7,060	31	.15	9,279	34	.18
Population		21.6	.662		21.9	.664

1/ *If transportation equipment is excluded (excluding the bias of Boeing Aircraft Co.), production of durables in the basin would have been approximately one-half of that of the region.*

Value added by manufacture in the basin for this group increased from $256 million in 1958 to $398 million in 1963, an increase in real output of over 50 percent. This growth rate was experienced in categories except printing, publishing, and miscellaneous manufacturing. Industries contributing the most value added by manufacture were non-electrical machinery, electrical machinery, and fabricated metals, which accounted for $180 million, nearly half the total of the "All Other" manufacturing group.

Production Trends

The average annual growth rate of production in the basin since World War II exceeded the national rate. Between 1947 and 1963, the value added by "All Other" manufacturing increased 5.7 percent 5.7 percent per year compared to a national annual increase of 4.5 percent. The rate of increase in the basin in the last five years of the 16-year span was more than double that of the decade immediately following the warm. Between 1958 and 1963, comparative annual rates of growth were 9.3 percent in the basin and 6.2 percent in nation.

Compared to the region, the average annual growth rate of the basin between 1947 and 1963 was less. However, if the value added by manufacture of transportation equipment were excluded from the regional total (to eliminate the atypical influence to regional data of Boeing Aircraft Company) the growth rates in the basin and region would be of similar magnitude. During the most recent period, 1958 to 1963, the rate of increase in the basin exceeded that of the region as well as the nation.

Comparative trends in value added by manufacture for each of the industries in this group between 1958 and 1963 are shown in Table III-58. Output of 10 of the 14 industries in the basin increased 10 percent or more annually; the rate of increase in all industries except printing and publishing surpassed that of the nation.

Table III-58

Comparative trends in production 1/ of "All Other" manufacturing industries Willamette Basin, Pacific Northwest, United States 1958 to 1963

	Average Annual Percent Increase		
	Basin	Pacific Northwest	United States
Nondurables			
Textiles	17.3	14.9	4.8
Apparel	10.4	8.8	5.3
Printing, Publishing	4.3	4.5	5.8
Petroleum, Related Prod.	12.9	13.9	7.2
Rubber & Misc. Plastics	16.3	19.0	7.0
Leather	16.4	1.4	2.2
Durables			
Furniture & Fixtures	8.3	4.6	5.6
Stone, Clay, Glass	11.1	4.6	5.5
Fabricated Metals	8.0	2.9	4.7
Machinery, ex. Elect.	9.5	7.3	6.4
Electrical Machinery	12.6	15.2	9.4
Transportation Equipment	9.8	7.5	8.3
Professional Instruments	11.0	4.9	10.0
Misc. Manufacturing	5.7	3.6	2.1

1/ *Production is measured in terms of value added by manufacture in current dollars. The price index for durable goods for the two years of comparison was identical. For nondurable goods, the price index in 1963 was only 3 percent greater than in 1958.*

Trends in the basin were also more favorable than those of the region during the 1958-1963 period. Output grew faster than in the region in 11 of the 14 industries. The three industries in the basin which failed to grow as fast as in the region were petroleum and related products, rubber and miscellaneous plastics, and electrical machinery.

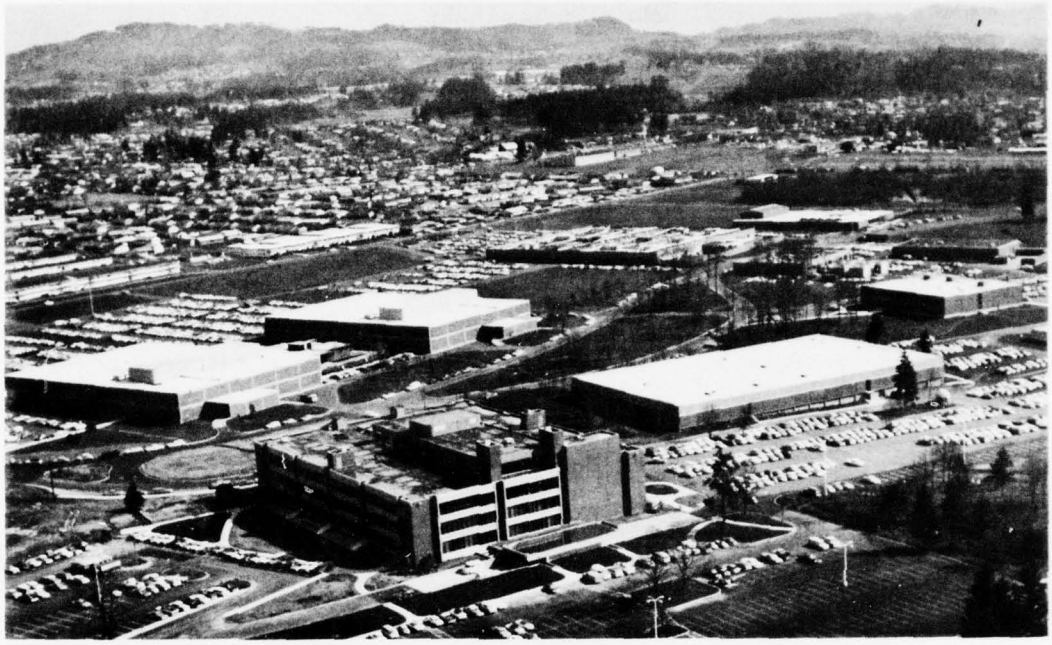


Photo III-22. Industrial Park west of Portland; manufacturer of oscilloscopes and associated instruments. (Tektronix Photo)

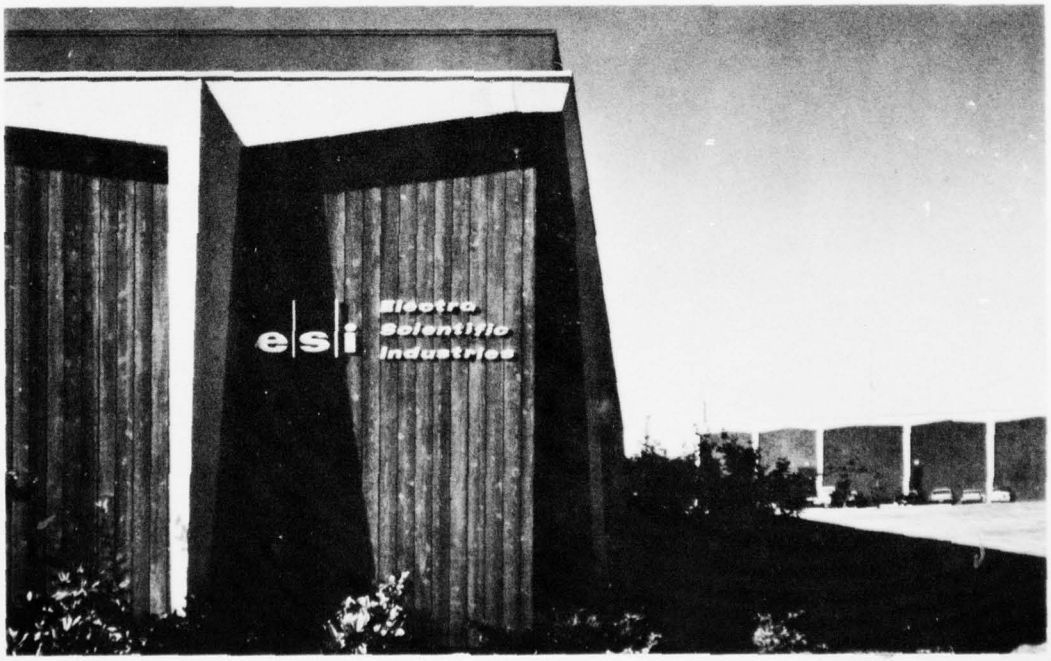


Photo III-23. Light industry in the Portland area. (Electro Scientific Photo)

Employment Trends

Comparative changes in employment in the region and the nation were similar to those of output. Employment in "All Other" manufacturing industries in the basin increased 33 percent from 1958 (29,394) to 1964 (39,203). The rate of increase in the basin was three times greater than it was in the nation and much greater than in the region. Of the major employment divisions in the basin, only the most rapid growing services increased at a greater rate--37 percent.

The rate of employment change in 12 of the 14 industries in this group was more favorable in the basin than in the nation; printing and publishing and professional instruments were the only industries below the national level. The basin also had a more favorable rate of employment change than the region in most of the 14 industries.

The "All Other" industries contributed considerably to the basin's higher growth rate in total employment. The employment shift attributable to the competitive effect in this group increased total employment in the basin 6,516 above that which would have been attained had each industry changed at their respective national rates between 1958 and 1964. The four largest industries in the group--electrical machinery, nonelectrical machinery, fabricated metals, and transportation equipment, each with between 5,000 and 6,000 employees--contributed significantly to the competitive shift.

None of the industries in the "All Other" manufacturing group represents as large a share of total employment in the Area as it does nationally. However, the result of the rapid growth between 1958 and 1964, the categories in total have become a larger proportion of total employment and total manufacturing employment in the Area. In 1964 these industries represented 7.8 percent of total employment and 39.6 percent of total manufacturing employment.

The "All Other" industries are concentrated in the Lower Subarea, which has a comparative advantage for industrial employment. Its advantages include ocean shipping facilities, which assures favorable distribution costs for both inbound and outbound commodities, a large skilled labor supply and a sizeable local market for consumer and producer goods. In 1964, 87 percent of the 39,200 workers employed in these industries was employed in plants in the Lower Subarea. Employment in the Middle and Upper Subareas, however, has increased at a greater rate in recent years, as shown in Table III-59.

Table III-59
Number employed, percent change and distribution, "All Other" manufacturing industries, Willamette Basin Subareas, 1958 and 1964

	1958		1964		
	No. Employed	Percent of Basin Employment	No. Employed	Percent of Basin Employment	Percent Increase 1958-64
Lower Subarea	26,140	88.9	34,306	87.5	31.2
Middle Subarea	2,428	8.3	3,335	8.5	37.4
Upper Subarea	826	2.8	1,562	4.0	89.2
Total Willamette Basin	29,394	100.0	39,203	100.0	33.4

FUTURE OUTLOOK

Growth in the "All Other" industries has responded to a rapid rise in industrial markets. Population increase and rising per capita income in the basin and region have enlarged local markets for many personal consumption commodities and household items. Increase production by existing firms and establishment of new firms have caused increased demand for capital equipment and inputs for higher stage fabrication and industrial expansion. Concomitant expansion in government, services, and construction has required more building supplies, furniture, and office equipment. Clearly, growth in all sectors of the economy has added to the demand for products of this industry group and has stimulated increased production.

Petroleum refining is one of the industries that uses large quantities of water. For this reason it is often singled out for special study and for projections along with other high water-using industries. However, no oil refineries exist in the basin and it appears unlikely that any will be constructed during the early decades of the projection period.

The major demand components for products of each of the "All Other" manufacturing industries and their major subcategories are shown in Table III-60. Two broad market categories are shown: final demand (or end-product market) and intermediate demand or market. Final demand includes purchases made by households and individual consumers, state and local governments, Federal government, private industry (for capital formation), sales abroad, and inventory change. Intermediate demand represents purchases by industry as inputs for combination with other products and as inputs into other commodities for resale.

The dominant share of the output of nearly half the industries listed went directly to the end-product market. Direct personal consumption accounts for the major part of the purchases of clothing, household furniture and household appliances. Location and size of the market for these commodities are directly associated with population and per capita income. Demand by industry for capital equipment is a major market determinant of several industries: those manufacturing machinery, electrical machinery, instruments, and transportation equipment. State and local governments, Federal government, and foreign buyers purchase from all of these industries.

The intermediate market is associated with population size of an area and its industrial mix. The construction industry absorbs a large part of the output of stone, clay and glass products, fabricated metals and machinery. The manufacturing industry, in addition to placing a demand on the construction and capital goods industries, purchases commodities from the "All Other" manufacturing group as inputs for other products. The interdependence of industries is shown in Table III-60 and is part of the force generating the expansion of manufacturing in the basin.

Table III-60 1/

Major National Demand Components, "All Other" Manufacturing Industries

Industry	Final Demand			Intermediate Demand			% of Basin Ind'ry
	Personal Expend.	Exports	Other	Constr	Manuf	Other	
Textiles							
fabrics, yarn	6.5	1.9	0	0	85.1	5.5	100
floor covering	29.7	1.8	.9	.1	47.0	20.5	0
Apparel							
apparel	78.1	1.0	0	0	18.2	2.7	57
misc.	48.1	.8	4.5	0	26.6	20.0	43
Furniture & Fixtures							
household	73.2	.5	6.1	9.0	7.0	4.2	93
other	8.6	1.2	63.6	14.8	4.5	7.3	7
Printing, Publishing	19.3	.7	2.2	.1	16.2	61.5	100
Petroleum & Related Prod.	40.3	3.6	5.1	7.6	14.3	29.1	100
Rubber-Misc. Plastics	19.0	3.1	3.1	5.5	43.7	25.6	100
Leather							
industrial	0	3.1	0	0	95.4	1.5	88
footwear	83.6	1.2	2.0	0	9.3	3.9	12
Stone, Clay & Glass							
glass	5.9	3.1	0	7.6	72.1	11.3	18
stone, clay	2.8	1.3	.5	60.9	27.2	7.3	82
Fabricated Metals							
containers	0	1.2	1.9	0	92.7	4.2	7
heating, plumbing, structural	.9	2.8	7.9	75.4	5.2	7.8	48
stamping, screw, bolts	6.7	.8	.8	3.0	74.9	13.8	5
other	5.8	3.8	4.2	14.1	55.6	16.4	40
Non-electrical Machinery							
engines	5.7	9.6	34.3	.1	27.2	23.1	-
farm machinery	.3	7.3	65.1	.1	3.7	23.5	4
construction, mining	0	23.0	43.7	6.2	6.3	20.8)	32
handling machinery	0	7.0	46.8	23.6	6.2	16.4)	
metal working mach.	.8	9.0	32.7	0	47.0	10.5	2
special industry mach.	.8	14.6	56.0	0	16.7	11.9	15
general industry mach.	0	7.3	31.2	7.8	40.3	13.4)	6
machine shop prod.	0	.9	4.1	.2	76.9	17.9)	
office mach.	2.6	6.0	51.6	0	9.5	30.3	-
service industry mach.	11.0	6.0	44.6	9.7	10.3	18.4	41
Electrical Machinery							
industrial	.3	5.4	32.3	9.7	36.7	15.6	84
household appliances	67.2	4.5	1.4	7.4	1.7	17.8	2
lighting & wiring	13.6	2.8	1.0	40.0	28.2	14.4	1
radio, TV, communications	22.5	3.3	39.6	1.0	15.3	18.3	2
components and accessories	5.6	3.4	8.0	.1	60.4	22.5	4
misc.	16.7	4.6	11.7	1.2	35.2	30.6	7
Transportation Equipment							
motor vehicles	39.2	3.9	16.1	0	29.4	11.4	39
aircraft & parts	.2	4.4	51.7	0	23.7	20.0	15
other	19.2	7.9	47.5	.1	14.8	10.5	46
Professional Instr.							
scientific	9.7	5.1	32.1	5.7	22.8	24.6	49
optical, photo	28.9	5.6	19.7	0	10.4	35.4	51
Miscellaneous Mfg.	45.7	2.1	9.4	2.4	14.2	26.2	100

1/ *From 1958 national input-output inter-industry matrix*

Photo III-24. The fabricated metals industry is one of the growing number of manufacturing industries moving into the basin. (Gerber Photo)

The locations of some of the "All Other" industries, particularly the petroleum, textiles, leather, and rubber and miscellaneous plastic products industries, are determined by proximity to sources of raw materials. The quantity of raw materials for these industries has not been sufficient locally to stimulate any sizeable development. The other 10 industries are locationally market oriented and engage in assembly or higher stages of fabrication and refinement of materials which may have been processed elsewhere. Given a sufficient market areas, these industries require only a satisfactory labor supply, an adequate transportation system, and a suitable business and cultural climate. These 10 are the manufacturing industries which as a whole have experienced the greatest rate of growth in the basin.

Projected national output indexes for each industry in the "All Other" manufacturing category are shown in Table III-61. There are marked variations among industries. Output of leather and leather products is expected to double between 1960 and 2000 whereas that for scientific instruments is expected to increase nearly 15-fold. Each of the projections, by Resources for the Future, Inc., was based on anticipated personal consumption patterns, estimated purchases by industry and government, net sales abroad, and expenditures for capital formation in a growing economy. The composite growth rate of the "All Other" manufacturing industries is assumed to parallel that of total manufacturing as it did between 1947 and 1963. Between 2000 and 2020, output is expected to increase with the same relationship to GNP as it has historically.

Table III-61
Index of national output
of "All Other" manufacturing industries

	1950	1960	1980	2000
Industrial Production	69.0	100	244	554
Manufacturing, total	69.8	100	249	575
Durables, total	68.4	100	279	669
Fabricated metals	79.4	100	235	509
Nonelectrical mach.	69.5	100	314	810
Electrical mach.	59.9	100	279	673
Transportation equip.	52.0	100	353	1013
Professional instr.	49.2	100	471	1489
Stone, clay, glass	74.6	100	225	472
Furniture, fixtures	68.4	100	236	505
Misc. manuf.	79.6	100	171	294
Nondurables, total	69.8	100	213	402
Textiles	91.0	100	168	259
Apparel	68.5	100	183	324
Leather	91.2	100	148	207
Printing, publishing	71.4	100	188	303
Petroleum, related prod.	68.3	100	181	335
Rubber, misc. plastics	62.7	100	317	782

Source: Hans Landsberg et al, Resources in America's Future, Resources for the Future, Inc., 1963.

The markets for some industries such as apparel, printing and publishing, petroleum and related products, and building materials are related to population size. As examples, stone, clay and glass products, and related petroleum products such as paving and roofing materials are required for residential construction. Demand is a function of population growth. Printing and publishing industries serve primarily the local and regional markets and can also be expected to expand with population. Markets for many other categories are likewise a function of population and incomes.

The market for other industries in the "All Other" group is associated more directly with the kind and size of established manufacturing industries. Much of the output of fabricated metal products, machinery, fabrics, glass products, electrical machinery, and transportation equipment is used as capital goods and as inputs into other manufacturing industries.

The prospects for future development in the basin of the "All Other" industries will depend upon the many factors affecting market demand and costs of production and distribution. The composite effect of these factors on growth of these industries is reflected in recent historic trends. Comparative trends in the basin, region, and nation in total output of these categories during the 1947-1963 period, are shown shown in Table III-62. National, regional, and basin trends for each of the industries are an important basis for projecting future output levels.

Table III-62
Comparative production trends and projections
"All Other" manufacturing industries,
Willamette Basin, Pacific Northwest, United States
(In Constant 1960 Dollars)

	Willamette Basin			Pacific Northwest	United States
Year	Output 1/ ($1,000)	Index of Output (1963-100)	Average Annual Increase (percent)	Average Annual Increase (percent)	Average Annual Increase (percent)
1947	164,151	41			
			4.2	7.5	4.5
1954	218,209	55			
			4.2	13.5	2.5
1958	255,917	64			
			9.3	7.3	6.2
1963	397,654	100			
			6.2		4.4
1980	1,095,000	275			
			5.5		4.3
2000	3,180,000	800			
			5.0		4.3
2020	8,450,000	2,125			

1/ *Value added by manufacturer.*
2/ *The increases in the U. S. for projection periods were obtained from Resources for the Future.*

The comparative trends for each of the industries served as a basis for projecting future output levels. The results of this method were checked against an independent estimate of each major industry based on trends of the major demand determinants related to that industry. Both methods, though necessarily subjective, resulted in approximately the same magnitude. The share of local and regional markets supplied by local production are expected to increase as larger markets permit establishment of industries previously excluded.

Employment estimates for each of the projection periods were derived by applying worker productivity to estimated production. Gains in productivity have resulted from increased application of more efficient capital equipment, better trained workers, and improved managerial organization and practices. However, plants become larger and industries more complex, and it becomes economical to staff for "in-house" supporting services, which typically are not as subject to labor saving measures. Accordingly, productivity increases are anticipated to average approximately 2.9 percent annually until 1980, 2.4 percent until 2000, and 2.0 percent thereafter.

Output and employment projections for the basin are shown in Table III-63. Employment in each subarea is estimated on past relationships among subareas. Recent trends have indicated a comparatively greater rate of employment increase in "All Other" manufacturing industries in the Middle and Upper Subareas than in the Portland Metropolitan area.

Table III-63
Value added and employment of "All Other" manufacturing industries, Willamette Basin and subareas

Year	Value Added Study Area (million dollars)	Numer of Persons Employed			
		Study Area	Lower Subarea	Middle Subarea	Upper Subarea
1963	397	37,282	32,760	3,224	1,298
1964	n.a.	39,203	34,306	3,335	1,562
1980	1,160	63,000	50,000	7,500	5,500
2000	3,575	113,000	85,000	15,000	13,000
2020	9,480	198,000	147,000	27,000	24,000

PART IV

PROJECTIONS

PROJECTIONS

Estimates of future production and employment for the commodity-producing industries were presented in Part III. This section summarizes those employment projections and also includes projections of (1) employment in the noncommodity-producing industries, (2) population including age-sex distribution, and (3) income.

Employment in the noncommodity-producing industries is shown as a single total. The major industry components are not broken out as they are not necessary for this study. Population projections are made for the total basin and for each of the subareas.

Economic expansion of an area results from the mutual interaction of many forces. There are exogenous forces (those external to the economy) and endogenous forces (those originating within the economy itself). These forces cannot be readily separated to ascertain the specific impact that each has made, or will make, on an area. Likewise, the sequence of development follows no set pattern. For example, population increase in many parts of California, Florida, and elsewhere preceded an equivalent increase in employment opportunity and hence was itself a cause of bolstering employment. On the other hand, population expansion in central Washington followed new economic opportunities in farming and supporting enterprises made possible by the development of an irrigation project. Economic expansion is the result of many forces operating in various sequences and following no predictable pattern with respect to either time or place.

The methodology followed provides for the mutual interdependence of forces of economic development. Two independent projections are made: (1) economic and (2) demographic. The economic projection is derived by projecting output in specific industries and then estimating future employment and labor force. The labor force estimate derived by this method is regarded as the probable demand for labor. Demographic trends and projections reflect the combined impact of all forces which have caused population growth in the past and are expected to prevail in the future. Probable modifications of these trends are recognized and are specifically indicated. The labor-force estimate derived from this population projection is conceptually regarded as the supply of labor. The results of these two methods are compared and reconciled to derive an "equilibrium" projection which is regarded as the most likely of a number of possibilities.

Details of the projection methodology are explained in Addendum E. Addendum I analyzes the difference between assumptions, methodologies, and projections of this study--a "Type 2" study--and those for "Type 1" studies prepared for the Water Resources Council.

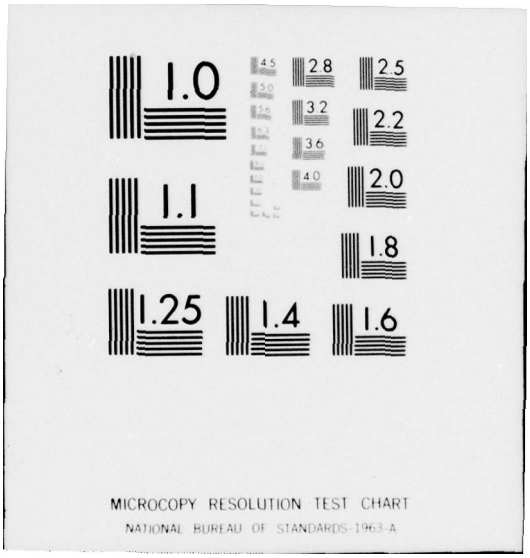
AD-A036 748 PACIFIC NORTHWEST RIVER BASINS COMMISSION VANCOUVER WASH F/G 8/6
THE WILLAMETTE BASIN COMPREHENSIVE STUDY OF WATER AND RELATED L--ETC(U)
1969

UNCLASSIFIED

NL

3 OF 3
ADA036748

END
DATE FILMED
4-77


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

EMPLOYMENT PROJECTIONS

BASIC INDUSTRIES

Estimated future employment in each of the commodity-producing industries is presented in Part III, and is summarized in Tables IV-1 through IV-4. Only a brief discussion on each is presented following.

Agriculture

Although the industry's output and its sales to and purchases from other sectors of the economy will increase, farm employment is projected to decrease substantially. In 1965, 27,250 were employed in agriculture. By 1980, the total is expected to decline to 18,700 and by 2020 employment will be only 11,000, 40 percent of the current level.

Mining

Employment in the extractive phase of the mineral industry is minor and is expected to remain so. The number employed is projected to increase gradually to approximately 1,000 by 2020. The rate of increase in production will be considerably greater.

Manufacturing

Employment in all categories of manufacturing combined is projected to increase a nominal 20 percent to 1980; thereafter the rate of increase will accelerate. The retarded rate of increase in employment to 1980 is anticipated because the economy of the basin is heavily weighted with manufacturing industries that are declining in employment. In 1965, two manufacturing categories--lumber and wood products, and food products--accounted for almost one-half of total manufacturing employment. As these "slow growth" industries become a smaller proportion of the manufacturing base, their depressing influence on total manufacturing employment will lessen.

The number employed in total manufacturing by 2020 is expected to reach 250,350, an increase of almost 150 percent over the 104,470 employed in 1965. A brief summary of anticipated employment trends for each of the major manufacturing categories follows:

Food and Kindred Products

Food processing is the second largest manufacturing industry in the Study Area. In 1965 the industry employed 14,760, representing 14 percent of the total in manufacturing. The number employed is expected to decline steadily during the study period, because the increased output will be accomplished with reduced employment. By 1980 employment is expected to be approximately 12,600 and will decline continuously thereafter to an estimated 11,700 by 2020.

Lumber and Wood Products

Employment in the manufacture of lumber, plywood, particle board and other wood products totaled 34,550 in 1965, or one-third of the total manufacturing labor force. It is the principal manufacturing industry in the basin. Anticipated shifts in the product mix of the industry and increases in labor productivity are expected to result in reduced employment in the future. Employment is projected to decrease to 27,550 in 1980 and decline further to 18,850 by 2020.

Paper and Allied Products

The number employed in the production of pulp and paper products is estimated to increase from 5,370 in 1965 to 5,500 in 1980. Anticipated advancement in technology will thereafter result in decreased employment to approximately 4,400 by 2020. Production is projected to increase during the next two decades and remain essentially unchanged after the 1980's.

Chemical and Allied Products

The rate of increase in output of chemical products in the basin has well exceeded that of the nation during the last 10-year period. The favorable rate of increase is expected to continue as the basin supplies a greater portion of the region's demand. Employment is estimated to increase from 1,833 in 1965 to 2,200 in 1980. The number of workers is projected to reach 5,100 by 2020, an increase of nearly 200 percent above the present level. Output by 2020 is estimated to be approximately 10 times greater than it was in 1963.

Primary Metals

Total employment in all categories of primary metals is expected to increase steadily from 5,220 in 1965 to 12,300 by 2020, an increase of approximately 135 percent. Production of ferrous metals will increase to meet rising local and regional demands. A large part of the output of nonferrous metals, particularly aluminum and the "exotic" metals, will continue to flow to national markets.

"All Other" Manufacturing

Manufacturing industries in this group have experienced the greatest growth. These trends are expected to continue. Among these industries are electrical machinery, nonelectrical machinery, professional instruments, and fabricated metals. These industries are rapidly expanding as the local and regional markets become large enough to permit the establishment of economical production units. Almost all industries in the basin have exceeded both the regional and national rates of increase. Two conditions, (1) the rapidly expanding local industrial and consumer markets, and (2) the tendency to increased self-sufficiency as an economy reaches an "economic threshold" of more products, are expected to continue to promote rapid expansion of these manufacturing industries. Employment is projected to increase from 42,737 in 1965 to 63,000 in 1980, and to continue to increase to 198,000 by 2020.

Federal Government

The five agencies with the largest number of employees in the basin are: (1) Post Office, (2) Forest Service, (3) Corps of Engineers, (4) Bonneville Power Administration, and (5) Veteran's Administration and Hospital, in that order. Federal employment totalled 14,040 in 1965. Three agencies--Post Office, Forest Service, and Bonneville Power Administration--anticipate an increase of approximately 30 percent by 1980; the Corps of Engineers and Air Force and National Guard envision no change. It is estimated that the rate of employment increase for the other agencies will be within the range of the major agencies. Federal Government employment has been increasing at a rate less than that of total employment; this trend is expected to continue in the future. Total Federal employment in the basin is expected to reach 17,000 by 1980 and approximately 24,000 by 2020.

RESIDENTIARY INDUSTRIES

Residentiary industries are defined as those providing services primarily to the population in and adjacent to the basin. The size of the population served is therefore a major determinant of the number employed in these industries. Industries included in this category are transportation, communications, and utilities; construction; retail and wholesale trade; finance, insurance, and real estate; services; self-employed; and State and local government. Employment resulting from recreation and tourism is included in the residentiary industries and is related within the residentiary-base employment ratio.

The basic industries in the Study Area, those providing commodities for a regional or national market and hence largely independent of the market size of the basin itself, are essentially the primary force which sets the pace of economic growth. The residentiary industries, which largely serve the local market, are therefore dependent upon the level of development in basic industries. The relationship between the two is indicated by the residentiary-basic employment ratio. Qualifications regarding the definition and identification of basic and residentiary industries are noted in the introduction.

In 1965 there were 383,780 employed in residentiary industries. Based on the residentiary-basic industry employment ratio, it is estimated that there will be 495,440 employed in these industries in 1980 and 1,016,850 by 2020.

Table IV-1
Employment and labor force, Willamette Basin

	1960	1965	1980	2000	2020
Basic Industries	138,927	146,650	154,010	199,255	286,350
Agriculture	33,440	27,250	18,700	14,200	11,000
Mining	647	890	860	930	1,000
Manufacturing	92,021	104,470	117,450	164,125	250,350
Food & kindred products	14,993	14,760	12,600	12,000	11,700
Lumber & wood products	31,746	34,550	27,550	20,975	18,850
Paper & allied products	5,423	5,370	5,500	4,900	4,400
Chemical & allied products	1,497	1,833	2,200	3,650	5,100
Primary Metals	4,786	5,220	6,600	9,600	12,300
All other manuf.	33,576	42,737	63,000	113,000	198,000
Federal Government	12,819	14,040	17,000	20,000	24,000
Residentiary Industries 1/	314,535	383,780	495,440	681,945	1,016,850
Total Civilian Employment	453,462	530,430	649,450	881,200	1,303,200
Unemployed 2/	23,500	22,470	27,050	36,300	54,300
Total Civilian Labor Force	476,962	552,900	676,500	917,500	1,357,500
Armed Forces	2,144	2,245	2,500	3,500	4,500
Total Labor Force	479,106	555,145	679,000	921,000	1,362,000

1/ *Included in this category are transportation, communications, and utilities; construction; trade; finance, real estate and insurance; services; state and local government; and nonagricultural self-employed.*

2/ *Assumed to be four percent of the civilian labor force during projection periods.*

Table IV-2
Employment and labor force, Lower Subarea

	1960	1965	1980	2000	2020
Basic Industries	80,476	84,600	94,690	130,870	196,610
Agriculture	14,000	10,100	7,480	5,680	4,400
Mining	252	270	280	305	320
Manufacturing	55,881	63,330	74,730	110,885	174,890
Food & kindred products	9,311	8,540	7,600	7,300	7,100
Lumber & wood products	7,676	7,780	5,850	4,375	3,750
Paper & allied products	3,813	3,760	4,000	3,500	3,200
Chemical & allied products	1,419	1,585	1,870	3,030	4,250
Primary metals	3,969	4,390	5,410	7,680	9,590
All other manuf.	29,693	37,275	50,000	85,000	147,000
Federal Government	10,343	10,900	12,200	14,000	17,000
Residentiary Industries 1/	214,676	258,830	310,585	438,145	680,150
Total Civilian Employment	295,152	343,530	405,275	569,015	876,760
Total Labor Force 2/	310,734	357,083	424,300	593,700	915,200

1/ *Included in this category are transportation, communications and utilities; construction; trade; finance, real estate and insurance; services; state and local government; and nonagricultural self-employed.*

2/ *Includes total civilian employment, unemployment, and armed forces.*

Table IV-3
Employment and labor force, Middle Subarea

	1960	1965	1980	2000	2020
Basic Industries	37,172	36,930	34,905	39,105	49,910
Agriculture	15,680	13,050	8,790	6,670	5,170
Mining	146	200	235	255	280
Manufacturing	19,850	21,740	22,980	28,680	40,460
Food & kindred products	4,322	4,770	3,800	3,600	3,500
Lumber & wood products	10,550	11,120	9,300	7,100	6,500
Paper & allied products	1,308	1,250	1,200	1,100	900
Chemical & allied products	D	85	130	250	350
Primary metals	D	D	1,050	1,630	2,210
All other manuf. 1/	3,670	4,515	7,500	15,000	27,000
Federal Government	1,496	1,940	2,900	3,500	4,000
Residentiary Industries 2/	61,578	75,520	111,240	144,350	190,650
Total Civilian Employment	98,750	112,450	146,145	183,455	240,560
Total Labor Force 3/	105,616	119,853	153,200	191,800	251,300

1/ Includes chemicals and primary metals at 1960 and primary metals at 1965.

2/ Included in this category are transportation, communications, and utilities; construction; trade; finance, real estate, and insurance; services, State and local government; and nonagricultural self-employed.

3/ Includes total civilian employment, unemployment, and armed forces.

D: Disclosure rule, not available for publication.

Table IV-4
Employment and labor force, Upper Subarea

	1960	1965	1980	2000	2020
Basic Industries	21,279	25,120	24,415	29,280	39,830
Agriculture	3,760	4,100	2,430	1,850	1,430
Mining	249	420	345	370	400
Manufacturing	16,290	19,400	19,740	24,560	35,000
Food & kindred products	1,360	1,450	1,200	1,100	1,100
Lumber & wood products	13,520	15,650	12,400	9,500	8,600
Paper & allied products	302	360	300	300	300
Chemical & allied products	D	163	200	370	500
Primary metals	D	D	140	290	500
All other manuf. 1/	1,108	1,777	5,500	13,000	24,000
Federal Government	980	1,200	1,900	2,500	3,000
Residentiary Industries 2/	38,281	49,330	73,615	99,450	146,050
Total Civilian Employment	59,560	74,450	98,030	128,730	185,880
Total Labor Force 3/	62,756	78,209	102,300	134,500	194,300

1/ *Includes chemicals and primary metals at 1960 and primary metals at 1965.*

2/ *Included in this category are transportation, communications, and utilities; construction; trade; finance, real estate, and insurance; services; State and local government; and nonagricultural self-employed.*

3/ *Includes total civilian employment, unemployment, and armed forces.*

D: *Disclosure rule, not available for publication.*

POPULATION PROJECTIONS

The population of the basin, estimated at 1,338,900 in 1965, is projected to increase to 1,767,500, 2,422,000, and 3,591,000 by 1980, 2000, and 2020, respectively. The population projections, by subarea, are shown in Table IV-5.

Table IV-5
Population
Willamette Basin and Subareas

	1960	1965	1980	2000	2020
Lower Subarea	728,088	811,000	1,047,300	1,476,000	2,298,000
Middle Subarea	277,921	329,900	437,700	556,000	729,000
Upper Subarea	162,890	198,000	282,500	390,000	564,000
Total	1,168,899	1,338,900	1,767,500	2,422,000	3,591,000

The estimates of population levels are derived as a product of the total labor force and the ratio of population to the labor force; the total labor force is the sum of total civilian employment, unemployment and armed forces. Employment levels for each projection period are shown in Table IV-1 and for each of the subareas in Tables IV-2, -3, and -4. Labor-force participation rates are estimated to be 38.5 percent in 1980, 38.0 in 2000, and 37.9 in 2020. Although there are cyclical shifts in labor-force participation rates, over long-run periods the number of persons entering the labor force makes up a fairly stable proportion of the total population. A slight reduction is expected, however, as the duration of education is extended and age of retirement comes earlier.

The age-sex composition of the population was derived by the demographic method. The demographic method reflects age-specific fertility and mortality rates in conjunction with migration. Age-sex composition projections for 1980 are shown in Table IV-6. For periods more removed in time from a known age-sex base, reliability of the estimates decreases. Therefore, for 2000 and 2020, it was assumed that the proportion of the total population in each age and sex group in the basin will closely approximate that for the nation computed by the U. S. Bureau of Census; these proportions are shown in Table IV-7.

Table IV-6
Population by age and sex, Willamette Basin and Subareas, 1980

	Age Category	Males		Females	
		Percent	Number	Percent	Number
Willamette Basin Study Area	0 - 14	15.3	270,920	14.7	261,160
	15 - 24	8.4	147,700	8.0	140,070
	25 - 44	13.5	239,310	13.0	231,450
	45 - 64	8.0	141,430	9.1	160,190
	65 & over	4.1	71,630	5.9	103,640
	TOTAL	49.3	870,990	50.7	896,510
Lower Subarea	0 - 14	15.2	159,190	14.4	150,810
	15 - 24	8.2	85,890	8.1	84,830
	25 - 44	12.4	129,860	13.0	136,150
	45 - 64	8.6	90,070	9.2	96,350
	65 & over	4.6	48,170	6.3	65,980
	TOTAL	49.0	513,180	51.0	534,120
Middle Subarea	0 - 14	15.2	66,530	15.4	67,410
	15 - 24	8.7	38,080	7.2	31,510
	25 - 44	16.1	70,470	12.8	56,030
	45 - 64	6.7	29,320	9.1	39,830
	65 & over	3.1	13,570	5.7	24,950
	TOTAL	49.8	217,970	50.2	219,730
Upper Subarea	0 - 14	16.0	45,200	15.2	42,940
	15 - 24	8.4	23,730	8.4	23,730
	25 - 44	13.8	38,980	13.9	39,270
	45 - 64	7.8	22,040	8.5	24,010
	65 & over	3.5	9,890	4.5	12,710
	TOTAL	49.5	139,840	50.5	142,660

Table IV-7

Estimated percentage distribution of population by age and sex, Willamette Basin, 2000 and 2020

2000		
Age Category	Males Percent	Females Percent
0 - 14	15.1	14.5
15 - 24	8.7	8.4
25 - 44	13.5	13.4
45 - 64	8.6	9.1
65 & over	3.5	5.2
TOTAL	49.4	50.6

2020		
Age Category	Males Percent	Females Percent
0 - 14	15.2	14.5
15 - 24	8.3	8.1
25 - 44	13.5	13.4
45 - 64	9.1	9.8
65 & over	3.4	4.7
TOTAL	49.5	50.5

PERSONAL INCOME ESTIMATES

Per capita income is projected to increase approximately 2.2 percent annually during the projection period. Total personal income in 1960 was $2,792 million and is expected to increase 132 percent to $6,478 million in 1980. By 2020, it is estimated to reach $31,240 million. Past and projected estimates of per capita and total personal income are presented in Table IV-8.

Table IV-8
Per capita and total personal income
Willamette Basin
(1960 dollars)

	Per Capita Personal Income	Total Personal Income (millions)
1960 1/	$2,357	$ 2,792
1980	3,665	6,478
2000	5,665	13,720
2020	8,700	31,240

1/ Average for 1960-1961.

Photo IV-1. The basic resource. *(Oregon State Department of Labor Photo)*

ADDENDA

PRECEDING PAGE BLANK-NOT FILMED

ADDENDA

ADDENDUM A	DETAIL OF ECONOMIC BASE MODEL METHOD OF ANALYSIS
ADDENDUM B	DETAIL OF EMPLOYMENT SHIFT ANALYSIS
ADDENDUM C	EMPLOYMENT TRENDS, 1940-1960
ADDENDUM D	EMPLOYMENT DATA WILLAMETTE BASIN STUDY AREA AND SUBAREAS, 1958-1967, TABLE D1 - D10 OREGON STATE EMPLOYMENT, 1947-1967, TABLE D-11 - D-15 PACIFIC NORTHWEST EMPLOYMENT, 1947-1966, TABLE D-16 - D-20 UNITED STATES EMPLOYMENT, 1947-1966, TABLE D-21 - D-25
ADDENDUM E	PROJECTION METHODOLOGY
ADDENDUM F	AN ALTERNATIVE PROCEDURE FOR PROJECTING EMPLOYMENT
ADDENDUM G	COMPARATIVE POPULATION PROJECTIONS WILLAMETTE BASIN STUDY AREA AND SUBAREAS - 1985
ADDENDUM H	POPULATION PROJECTIONS, WILLAMETTE BASIN, BY TRIBUTARY BASIN, 1960-2020
ADDENDUM I	COMPARISON OF WILLAMETTE RIVER ECONOMIC BASE STUDY PROJECTIONS WITH STUDY PROJECTIONS BY OFFICE OF BUSINESS ECONOMICS
ADDENDUM J	DEFINITIONS OF INDUSTRY GROUPS
ADDENDUM K	SUPPORTING STUDIES

A D D E N D U M A

DETAIL OF ECONOMIC BASE MODEL METHOD OF ANALYSIS

The methodology of the "export" or "economic base" model involves the following steps:

1. Identify the basic industries and analyze past and project future employment of each.

2. Analyze the past and project the future employment ratio between basic and residentiary employment.

3. Derive the future labor force as the total of the two employment categories and the assumed level of unemployment.

4. Derive the projected population by applying estimated labor force participation rates to the projected labor force.

The most crucial part of the analysis is the identification and projection of basic industries (Step 1). Most industries are not wholly basic or residentiary, but mixed. Strict conformity to the conceptual model would necessitate the determination of the proportion of sales entering each of the two markets. These data are not published and often not recorded by firms. Furthermore, since a finished product sometimes involves several stages of production by several independent firms, the net export component of sales is usually not known. The degree of approximation required would not seem to justify the expense necessary to obtain a high degree of refinement of these data. Accordingly, the following definition and assumptions were made concerning basic industries of Willamette Basin: A basic industry is one which (1) exports a considerable proportion of its products to markets outside the basin, or (2) produces a product replaceable by competition from firms outside the basin. Industries which are classed in this study as basic include: (1) the extractive industries--agriculture, mining, forestry, and fisheries; (2) manufacturing; and (3) Federal government employment. The latter, regarded as an industry for the sake of expository simplicity or convenience, is classed as basic because funds for the payment of Federal employees are regarded as exogenous. It is recognized that firms in two manufacturing categories, food and kindred products, and printing and publishing, are typically oriented to the local market. In Willamette River Basin, however, a significant part of food and kindred products sales is to export markets. Printing and publishing, although only in part subject to competition from firms outside the basin, is treated as if it were basic in order to permit all commodity producing industries to be similarly categorized for calculation purposes. The other categories were assumed basic only if the index of specialization 1/ was greater than 1.5. No others met this criteria.

Residentiary industries, which are geared to local needs and hence depend primarily upon the expected population and income growth in the area they are expected to serve, are the remainder.

The employment multiplier of each of the basic industries differs due to difference in earnings. The number of residentiary workers that are supported by a given number of apparel workers is less than the number which are supported by the same number of primary metal workers because the latter receive higher wages. The composite employment multiplier was calculated by weighting each basic employment category by an index which reflected the variability in average income among the categories.

Three relationships of the basin economy in terms of the population and employment variables can be expressed.

$$Pa = E_B + E_R + U$$

where P = basin population
E_B = employment in basic industries
E_R = employment in residentiary industries
U = unemployment

$$a = \frac{E_B + E_R + U}{P} = \text{labor participation rate}$$

$$E_B = (E_{B1} + E_{B2} \ldots E_{Bn}) = \Sigma E_{Bj}, \text{ whose j denotes industry.}$$

$$E_R = b(E_B) \qquad b = \text{percentage } E_R \text{ is of } E_B$$

1/ Index of specialization is defined as:

$$\frac{E_i^b}{\Sigma E_{1\ldots j}} \div \frac{E_i^n}{\Sigma E_{1\ldots j}}$$

where E_i^b & E_i^n are employment in the ith industry in the basin and nation, respectively. This index reflects the relative locational advantage the area has for the establishment of these industries.

A change in the level of employment in basic industries can be related to the effect it may have upon the level of employment in residentiary industries and upon the level of the basin's population. The change in employment in residentiary industries as a result of a change in basic industries can be expressed:

$$E_R + \Delta E_R = bf\ (E_B + \Delta E_B)$$

f = factor which adjusts for changing trend of b

A change in population will be: (assuming labor participation rate constant)

$$\Delta P = \frac{1}{a} (\Delta E_B + E_R + U)$$

The determination of ΔE_B is made on the basis of summation of estimates of each of the basic industries. Employment in basic industries was derived as indicated in the section treating the particular industry.

The model implies that stimulus for growth emanates only from expansion in basic employment and income. Endogenous forces in areas of 1.3 million population may provide for some expansion. The rising residentiary-basic ratio indirectly recognizes development which is not directly caused by expansion in basic industries.

This method was augmented by other analyses to serve as reliability indicators. Projected values of key national economic and demographic measures are disaggregated to the region and basin. In addition, trend relationships among states for the last two decades were compared for 35 industrial categories. Basin projections were apportioned to each subarea on the basis of the intra-area relative growth rates.

In making future estimates, careful consideration was given to factors which produced differential growth in the past and to factors that may alter these trends.

A D D E N D U M B

DETAIL OF EMPLOYMENT SHIFT ANALYSIS

"Shift analysis" is a method used in this study for analyzing the reasons underlying changes, or "shifts", in the relative numbers employed in each industry during a certain period, in this case 1958-1964. Among the factors considered in this analysis are:

1. The importance of the industry in the national economy and whether, nationally, the industry has been a fast-growing, slow-growing, or declining industry, in terms of employment, during the study period.

2. The uniformity of employment in the industry, as a percent of total employment, throughout the nation. If variations in the relative importance of the industry among the various states are declining, so that deviations from the national average are narrowing, then a marked growth in the importance of an industry in the Study Area, beyond what would have been anticipated on the basis of the national average, would have special significance.

3. The employment structure in the Willamette Study Area as compared with that of the United States, and the change that took place in this relationship, for each industry, during 1958-64. This comparison shows whether employment increased at the amount that would have been expected, on the basis of the percentage change in the national labor force, for the industry.

4. In cases where employment increased at a rate different from that which would have been expected, on the basis of the changes in the structure of the national labor force during the same period, an analysis to determine whether, and to what extent, this was due to the abnormal composition of the labor force in the Study Area, or to competitive (e.g., locational) advantages or disadvantages.

These factors are discussed, in that order, in the following pages.

Changes in National Employment Composition

Significant changes have occurred in the relative size of the major employment categories in response to differential shifts in demand for products and services and to changes in technology. The three basic industries--manufacturing, mining, and agriculture--accounted for 32 percent of total civilian employment in 1964 in contrast to 43 percent in 1947. Also showing relative declines were transportation and Federal government. During this same period, an increased share of total

employment has accrued to (1) retail trade, (2) services, (3) state and local government, and (4) finance, insurance and real estate. In the self-employed group, wholesale trade, contract construction, and communications and utilities categories, the proportion employed in each has remained essentially unchanged during the post-war period. National trends for the major industry groups are shown in Figure B-1.

The industries gaining or losing in proportion of total employment comprised approximately 40 percent each of the total employment in 1964, whereas industry groups which maintained a fairly constant share of total employment represent only 20 percent of the aggregate employment. Regions and basins which contain a larger proportion of industries which are slow-growing or declining nationally, will likely grow less rapidly than those with a preponderance of rapid-growing industries. The employment composition of "industry mix" of an area has been an important factor in its economic growth in the past and will be a factor in its future expansion.

Employment in the Study Area has been concentrated in those industries that have been slow growing nationally. The influence that the difference of industry mix, between the Study Area and the nation has had on comparative growth rates is analyzed in the employment section.

Comparative National Industry Growth Rates

The proportion of total employment in each industry and their changes during the post-war period were indicated above. These changes are the result of differential growth rates among the industrial categories. The purpose of this section is to bring into clearer focus these variations. Growth rates of a particular industry vary from one time period to another; however, as indicated on Figure B-1, the trend of each major category has been fairly consistent during post-war years.

Employment in all industries in the nation increased 10.0 percent between 1958 and 1964, but not all increased at the same rate. Considerable variations from this average exist, as indicated on Figure B-2. Among the major industrial groups, the noncommodity producing categories--less subject to labor-saving technological or organizational innovations, and for whose output demand has increased markedly--have shown the greatest employment growth. Historically, the growth rate of industries providing business and personal services has exceeded that of total employment.

Major industries which experienced an absolute reduction in employment nationally were agriculture and mining. The number employed in both reached a peak in the early years of this century, and has since declined steadily. The relatively inelastic demand for agricultural products, and increases in output per worker in both agriculture and mining have been instrumental in fostering this decline. Employment in transportation and communications and utilities remained essentially unchanged between 1958 and 1964. The production functions of these three industries permit increases in output with little change in labor input. Employment in manufacturing and in Federal civilian government

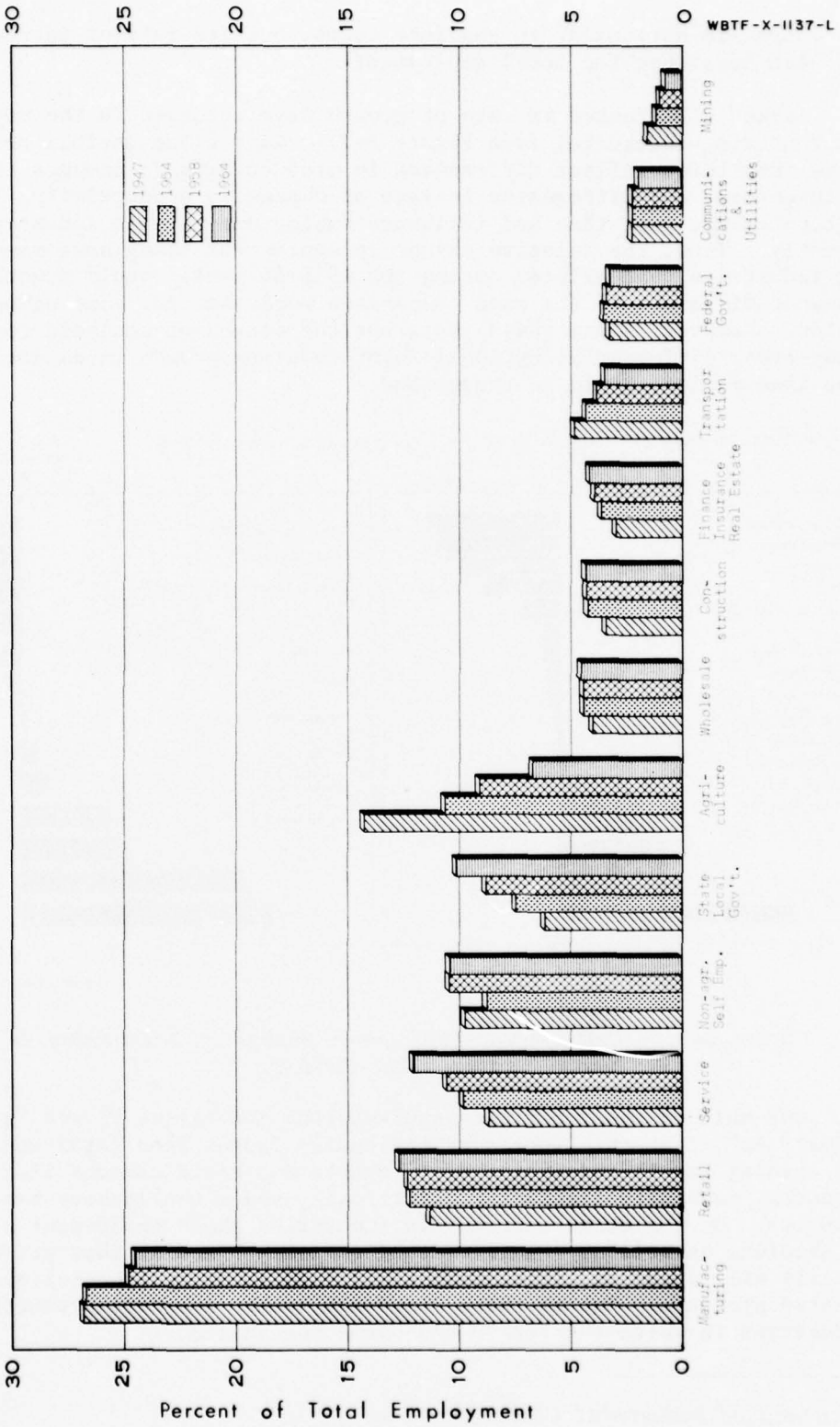


Figure B-1. - Employment Distribution by Major Industrial Categories in the United States, 1947-54-58-64.

has increased nationally in absolute terms, but its rate of increase has been less than for total employment.

Marked differences in rate of growth have occurred in the major manufacturing categories (see Figure B-2). Rate differentials among these industries reflect differences in product demand, changes in balance of inventory, and differences in rate of change in productivity. These factors change over time and influence employment in each industry differently. Thus, the relative change in employment among some manufacturing industries that existed during the 1958-64 period would doubtless be somewhat different if the same comparison were made for some other time period. However, since these years are the period of analysis for the Study Area, differential national inter-industry growth rates during the same time period should be recognized.

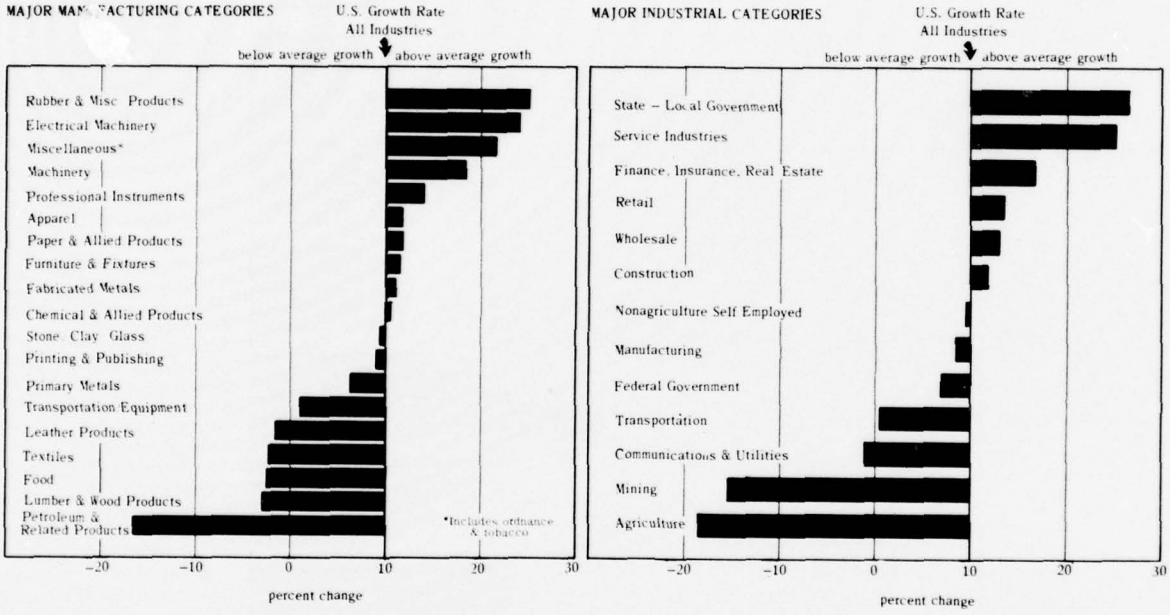


Figure B-2. - Comparative Employment Growth of Industries in the United States, 1958-1964.

One-half of the two-digit manufacturing industries 1/ are "growth industries", i.e. they increased nationally faster than total employment. The leading growth industries are: rubber and miscellaneous plastic products, machinery (including electrical), and miscellaneous manufactured products. On the other extreme are industries whose employment suffered an absolute as well as relative decline--leather and leather products, textile mill products, food, lumber and wood products, and petroleum and related products. Two of these--food and lumber and wood products--are industries in which the region and basin specialize.

1/ Standard Industrial Classification

Subnational areas endowed with a dominance of growth industries have a favorable "industrial mix" and, therefore, greater growth potential. However, as previously mentioned, there are factors which may change the rates of employment growth in each industry so that industries which in one period qualify as growth industry may not continue to do so.

Variability in Employment Patterns in Subnational Areas

The employment pattern and industrial growth rates of the nation, indicated above, are used as the standard or "norm" with which the region and Study Area are compared. These comparisons reflect the basin's competitive position in the regional and national economy. However, it is also essential to (1) identify industries whose proportion of total employment is relatively uniform among areas and whose is disparate, and (2) indicate if the employment structure of the various subnational areas is becoming more or less uniform.

To synthesize the "typical" employment pattern of subnational areas in order to show the central tendency and dispersion of each industry, a composite employment distribution is constructed based on the share of employment each industry was of total employment for each state. For each of the four years--1947, 1954, 1958, and 1963--employment distribution (by major employment divisions, all 2-digit manufacturing industries, and 10 other subgroups) of each state is calculated. 1/ The percent that employment in each industrial category is of total nonagricultural employment for each state is arrayed to determine the central tendency and dispersion of the employment percentages for each industry. The median and interquartile range 2/ of this composite employment pattern of the

---

1/ *The source of data is U. S. Bureau of Labor Statistics, Employment & Earnings for States and Areas 1939-1963, 1964. The employment data relate to the nonfarm sector, excluding proprietors, self-employed, and unpaid family workers. It is recognized that the Study Area is only about one-third to one-fourth the size in both population and area of the "average" state. The degree of population density and urban-rural distribution, however, are comparable. Furthermore, the comparisons are only to indicate general trends among the major components of employment that now prevail and may likely continue to prevail when the Study Area increases in population more nearly to the present size of the average state. Data are not available in the disaggregation desired for basins more nearly comparable to the Willamette, so that the approximation afforded by state data is a compelling one. To emphasize the reason for the comparisons, the term comparison areas may be used instead of states.*

2/ *The interquartile range is between the first and third quartile or the points on the distribution between which the central 50 percent of the cases lie.*

major nonagricultural industry divisions of the 48 contiguous states is indicated on Figure B-3. These measure variability in employment existing in each industry among subnational economies and permit a ranking of industries as to degree of relative variability.

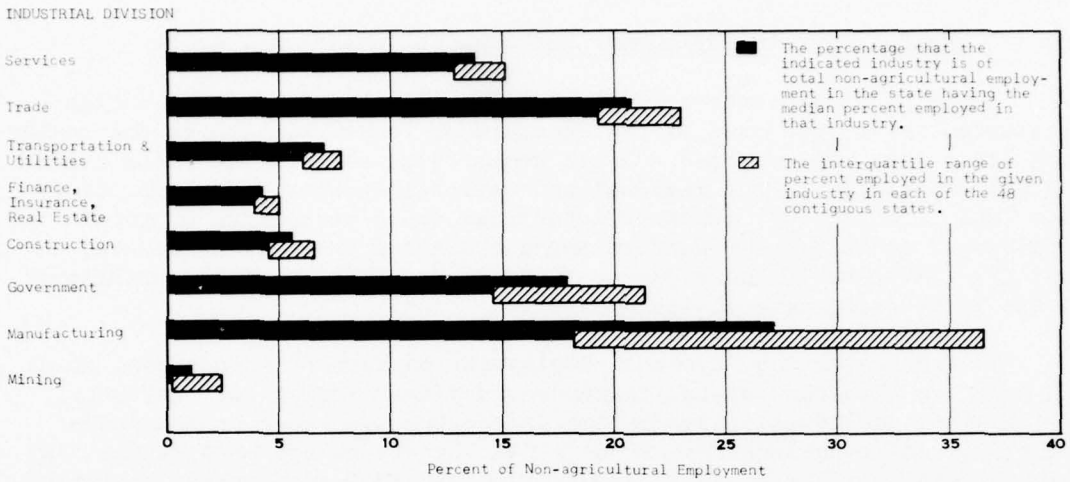


Figure B-3. - Composite Nonagricultural Employment Distribution and Interquartile Dispersion.

Some industries vary in share of employment more than others. Employment in industries geared largely to the local market correlates with the size of the local population and total employment. Variability among comparison areas in the proportion of total employment in these industries was relatively small. In contrast, industries oriented to regional and national markets showed marked variability among areas. These industries are ranked on Figure B-3 on the basis of relative variability; services shows the least variability and mining the most. Table B-1 shows the same measures numerically and includes the major subcategories of the employment divisions. For ease of interpretation, dispersion is indicated by the semi-interquartile range. 1/ Similarity is indicated between areas for all categories except manufacturing and mining.

1/ *The semi-interquartile range is* $\frac{Q1 - Q3}{2}$ *. This value plus and minus the median in a normal distribution will coincide with the interquartile range. In a skewed distribution, it will not coincide. Most of the less disaggregated industrial categories are not sufficiently skewed to negate the use of this measure as an approximation of the range for 50 percent of the cases.*

Table B-1

Composite nonagricultural employment distribution and variability of comparison areas (48 states) of the United States 1963

(Industries are ranked on basis of relative variability)

Industry Category	Median Percent of Total Nonagriculture Employment	Semi-Interquartile Range (Percent)	Number of States Reporting
Service	13.7	± 1.2	44
Trade	20.7	± 1.9	48
Retail	16.2	± 1.5	42
Wholesale	4.9	± 0.9	42
Transp., Comm., & Utilities	7.1	± 0.9	48
Comm. & Utilities	2.7	± 0.4	37
Transportation	4.8	± 0.7	29
Excluding Railroad	2.8	± 0.6	29
Railroad	1.6	± 0.5	29
Finance, Insurance, Real Estate	4.4	± 0.6	48
Construction	5.6	± 1.1	47
Government	17.9	± 3.4	48
State & Local	13.3	± 2.1	43
Federal	4.5	± 1.6	43
Manufacturing	27.2	± 9.2	48
Durable Goods	13.0	± 4.3	43
Nondurable Goods	11.8	± 4.4	43
Mining	1.1	± 1.0	43

The "typical" comparison area has 13.7 percent of total nonagricultural employment in service industries. One-half of the areas deviate from this median by only 1.2 percent or less. Service employment is clearly a uniform component of the industrial structure. The share employed in trade has approximately the same degree of uniformity, with a median of 20.7 percent and semi-interquartile range of ± 1.9 percent. The relative variability 1/ is considerably less in retail trade than in wholesale trade. But even for the latter, the semi-interquartile range is less than one percent with a median of approximately five percent. Transportation, communications, and utilities; finance, insurance, and real estate; and construction, show only slightly greater relative variability than do services and trade. The most disparate of the major nonagricultural employment divisions, excluding the commodity-producing industries of manufacturing and mining, is government employment. Here again, the relative variability was less than 20 percent. Much of this variability was attributable to relatively greater dispersion in Federal than in State and local government employment. The latter shows approximately the same degree of relative variability as finance. All industrial categories listed in Table B-1, excluding the basic industries, manufacturing and mining as well as Federal government and railroads, have a relative variability of less than 20 percent with some less than 10 percent. These industries have a sufficiently high correlation with total employment and total population to be regarded as residentiary by definitions of this study.

The basic industrial categories of manufacturing and mining indicate considerable variability among areas. Employment in manufacturing is two to four times as variable as it is in the residentiary industries. Even relatively greater variability exists in mining.

Relative variability is even greater among most two-digit manufacturing categories. Table B-2 lists the categories in order of relative variability. The percent employed in manufacturing industries: (1) which can operate economically on a small scale; (2) whose products are perishable or have high transportation cost relative to value; and/or (3) which for convenience or timing must be located near the market, is not extremely variable among comparison areas. Stone, clay, and glass products (S.I.C. 32); food and kindred products (S.I.C. 20); and printing, publishing, and allied industries (S.I.C. 27) are in this group. The proportion of total employment in industries which produce equipment, and/or those engaged in primary processing of localized resources, such as primary metals and lumber, varies considerably between areas. These industries show little correlation to the size of the area's population and total employment. Future growth in manufacturing industries as well as mining and agriculture, therefore, cannot be estimated with confidence on the basis of growth in total employment or population.

1/ *Relative variability was measured by* $\frac{(Q1 - Q3)\ (\frac{1}{2})}{median}$

Table B-2

Variability in percent of total nonagriculture employment employed in 2-digit manufacturing industries in comparison areas (states) 1963

(Industries are ranked on basis of relative variability)

S.I.C. Number		Median	First Quartile	Third Quartile	Number of States
32	Stone, Clay, Glass	0.9	0.8	1.2	36
20	Food	3.1	2.5	3.8	48
27	Printing	1.3	1.0	1.7	42
28	Chemicals	1.4	1.0	1.8	33
34	Fabricated Metals	1.5	0.9	2.0	34
25	Furniture	0.6	0.5	0.9	29
26	Pulp and Paper	1.2	0.9	1.8	34
36	Electrical Machinery	2.0	1.2	3.9	32
33	Primary Metals	1.3	0.9	2.7	37
35	Machinery, Ex. Electrical	1.9	1.0	3.7	31
23	Apparel	1.6	0.8	3.5	35
24	Lumber	1.3	0.5	2.7	35
37	Transportation Equipment	1.7	0.9	4.1	31
22	Textiles	1.2	0.4	3.2	29
	Other 1/				

1/ *The other two-digit categories include rubber, petroleum, leather, professional instruments, tobacco, ordnance, and miscellaneous. These are the smallest components of employment and have the greatest variability. Inasmuch as less than one-half of the states reported these categories separately, the measures would not be reliable and, therefore, were excluded in the table.*

These measures of variability in employment structure of subnational areas refer to one point in time--1963. The question arises, "Is the variability increasing or decreasing?" Many regional economists have noted the trend toward greater industrial diversification and hence, greater uniformity in employment composition among regions. As regions grow and as markets increase, economic forces encourage development of industries previously precluded in part because of dis-economies of small scale operations. Another factor is that a larger segment of manufacturing industries has become freed from close proximity to the raw material source. The degree of economic uniqueness of regions has, consequently, been lessening.

An effort is made in this study to determine if trends toward greater similarity in industrial distribution of employment in smaller subnational areas more nearly the size of the Willamette Basin Study Area also prevail. A comparison of employment distribution trends in each of the 48 contiguous states between 1947, 1954, 1958, and 1963 indicates that it has. Three tests were used. 1/ These tests further indicated that differences among states, in the proportion that each major employment division is of total employment, is narrowing. The same is also true of most of the subcategories of manufacturing. Lowell Ashby's study found the same trends prevailed between 1940 and 1960, using "household" employment data, "...the employment structure of region, state, and even local areas has become more homogeneous over the 20-year span." 2/ Significant variability still exists, however, in some industries for reasons previously noted. The trend toward less deviation from the national average was indicated.

Employment Structure of the Study Area and Region Compared to the United States

The purpose of this section is to indicate (1) the present distribution of employment among industries in the Pacific Northwest and the Study Area; (2) changes in distribution between 1958 and 1964; and (3) differences in employment pattern of the Study Area and region relative to the nation.

1/ *One test was the range between the state with the largest percent of total employment in a given industry for each of the four years indicated. Another test was comparing the trend in the range between the 10th and 90th percentile. The final test was the interquartile range divided by the median of all states.*

2/ *U. S. Department of Commerce, Staff Working Papers in Economics and Statistics No. 7, "Regional Change in a Regional Setting," April 1964.*

The major industry in the Study Area, in terms of the numbers employed in 1964 is manufacturing with 98,900. The other major employment categories in order of employment size are: self-employed--69,500; retail trade--67,000; state and local government--62,900; and services--57,500. In 1964 these five categories accounted for 70.7 percent of total Study Area employment. These are also the five major categories in the region and the nation. The other eight major categories with the exception of mining each employed over 10,000, ranging from 28,400 in wholesale trade to 11,400 in communications and utilities. The number employed in the Study Area and the importance of each compared to the region and the nation are indicated in Table B-3.

The employment structure of the Study Area's economy in 1964 differs in some significant respects from the regional and the national economies. These differences are clearly portrayed on Figure B-4, thus necessitating a minimum of textual elaboration. The basis of comparison is the national employment structure. The Study Area's or region's deviation from the national pattern is expressed in terms of an index--the index of specialization. 1/ An index of unity, 1.00, indicates that the proportion that employment in a given industry in the area is of total employment in the area is the same as that industry is nationally of national total employment. An index greater than unity, say 1.20, indicates that employment in the industry in the area is proportionately greater than it is in the nation by 20 percent. An area whose index of specialization is greater than 1.00 for a particular industry can be said to "specialize" in that industry. An area is "under-specialized" with respect to a given industry if its index of specialization is less than 1.00.

1/ *The mathematical formula is:* $\frac{Eai}{Ta} \div \frac{Eni}{Tn}$

Eai = number of employees in industry "i" in the area.
Ta = number of employees in all industries in the area.
Eni = number of employees in industry "i" in the nation.
Tn = number of employees in all industries in the nation.

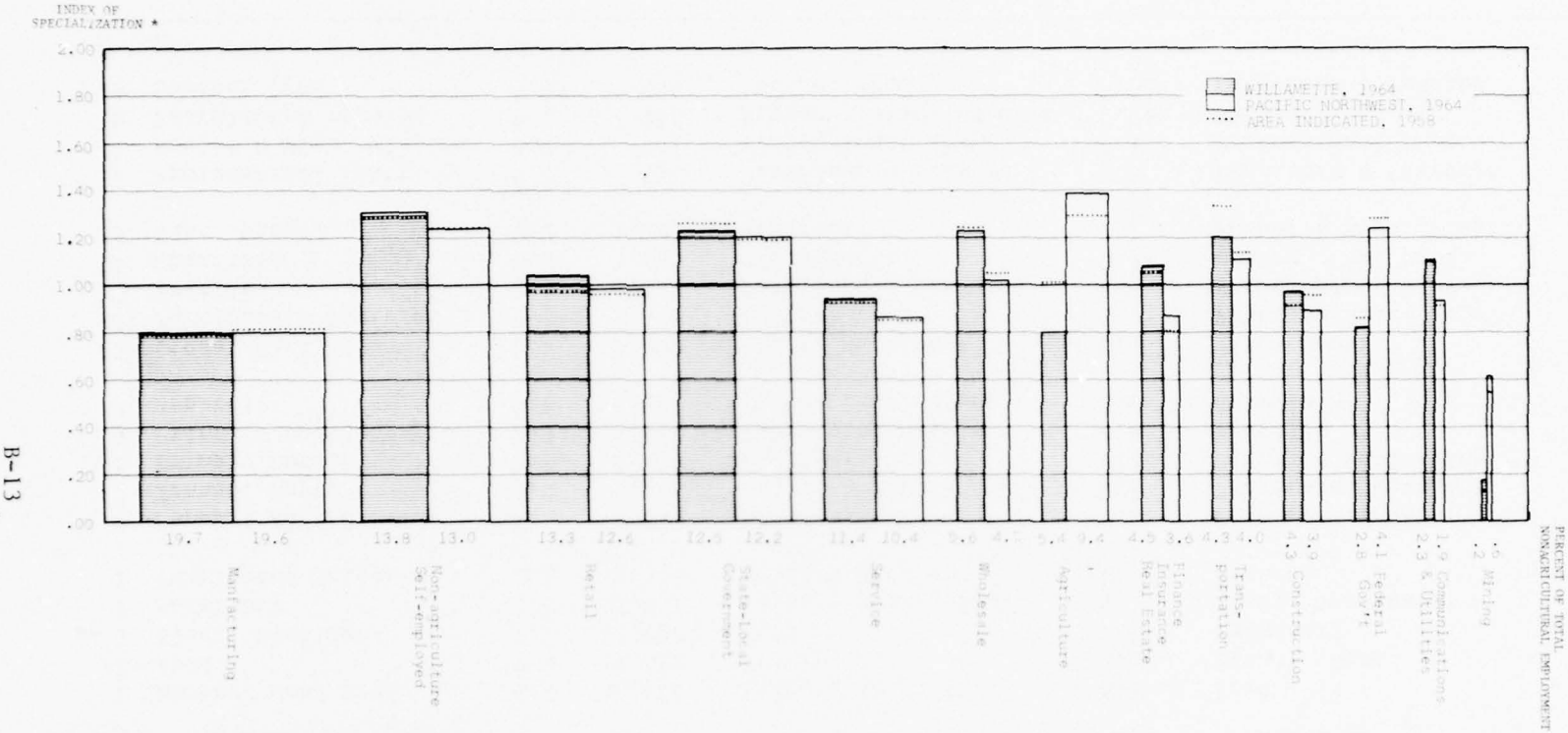
The national index for each industry is 1.00. For each of the major industry groups, as well as the two-digit manufacturing industries, the nation can be regarded as generally self-sufficient. That is, the output of goods and services of employees of each industry is sufficient to supply the national demand placed on that industry. The same generalization is applied to local areas. It follows, therefore, that if an area has proportionately more employment than the nation in a particular industry, that industry in the area must serve or supply an area greater than itself. Of course, trade may exist even if the index equals or is less than one. Caution should be exercised in the interpretation of this index because the output represented by employment may not be the same in kind or amount between areas. Likewise, the demand in each area may not be the same. The general interpretation does not apply to state as in case of local government employment. The index nevertheless is a useful tool in depicting general difference in employment structure between areas.

Table B-3

Comparative employment rank of major industries in the Willamette Basin Study Area, Pacific Northwest, & United States 1964

	WILLAMETTE BASIN STUDY AREA			PACIFIC NORTHWEST		UNITED STATES	
Rank	Industry	% of Total Empl.	No. Empl.	Industry	% of Total Empl.	Industry	% of Total Empl.
1	Manufacturing	19.7	98,941	Manufacturing	19.6	Manufacturing	24.6
2	Self-Employed	13.8	69,460	Self-Employed	13.0	Retail	12.7
3	Retail	13.3	67,028	Retail	12.6	Service	12.1
4	State & Local Govt.	12.5	62,858	State & Local Govt.	12.2	Self-Employed	10.5
5	Service	11.4	57,539	Service	10.4	State & Local Govt.	10.2
6	Wholesale	5.6	28,405	Agriculture	9.4	Agriculture	6.8
7	Agriculture	5.4	27,300	Wholesale	4.7	Wholesale	4.6
8	Finance, Ins., Real Est.	4.5	22,640	Federal Govt.	4.1	Construction	4.4
9	Transportation	4.3	21,582	Transportation	4.0	Finance, Ins., Real Est.	4.2
10	Construction	4.3	21,483	Construction	3.9	Transportation	3.6
11	Federal Govt.	2.8	13,862	Finance, Ins., Real Est.	3.6	Federal Govt.	3.3
12	Comm. & Public Ut.	2.3	11,438	Comm. & Public Ut.	1.9	Comm. & Public Ut.	2.1
13	Mining	0.1	731	Mining	0.6	Mining	0.9

WBTF-X-1140-L



THE INDEX OF SPECIALIZATION IS THE RATIO OF THE PERCENT THAT EMPLOYMENT IN AN INDUSTRY IN AN AREA IS OF TOTAL EMPLOYMENT IN THE AREA TO THE PERCENT THAT THE SAME INDUSTRY IS NATIONALLY OF TOTAL NATIONAL EMPLOYMENT. FOR EXAMPLE, EMPLOYMENT IN MANUFACTURING IS 19.7% OF TOTAL EMPLOYMENT IN THE STUDY AREA AND MANUFACTURING IN THE U.S. IS 24.6% OF TOTAL NATIONAL EMPLOYMENT. THE INDEX OF SPECIALIZATION IS THEREFORE $\frac{19.7\%}{24.6\%} = .80$

Figure B-4. - Employment Structure by Major Industry Groups of the Willamette Basin and Pacific Northwest Compared to the United States, 1958-1964.

Table B-4

Comparative employment rank of manufacturing industries in the Willamette Basin Study Area, Pacific Northwest, and United States 1964

	STUDY AREA			PACIFIC NORTHWEST		UNITED STATES	
Rank	Industry	% of Total Empl.	No. Empl.	Industry	% of Total Empl.	Industry	% of Total Empl.
1	Lumber, Wood Prod.	6.7	33,667	Lumber, Wood Prod.	6.5	Food	2.5
2	Food	2.9	14,422	Transp. Eqpt.	3.3	Transp. Eqpt.	2.3
3	Elect. Machinery	1.2	5,857	Food	2.8	Machinery	2.3
4	Machinery	1.1	5,631	Paper & Allied Prod.	1.3	Elect. Machinery	2.2
5	Fabricated Metals	1.1	5,526	Primary Metals	0.9	Apparel	1.9
6	Paper & Allied Prod.	1.1	5,237	Chemicals	0.8	Primary Metals	1.7
7	Transp. Eqpt.	1.0	5,065	Print. & Publishing	0.8	Fabricated Metals	1.7
8	Primary Metals	0.9	4,779	Machinery	0.7	Print. & Publishing	1.4
9	Print. & Publishing	0.9	4,562	Fabricated Metals	0.6	Textiles	1.3
10	Apparel	0.6	2,952	Stone, Clay, Glass	0.4	Chemicals	1.2
11	Stone, Clay, Glass	0.4	2,200	Elect. Machinery	0.4	Misc. Manuf.	1.1
12	Furniture & Fixtures	0.4	2,166	Apparel	0.3	Paper & Allied Prod.	0.9
13	Textiles	0.4	2,149	Furniture & Fixtures	0.3	Stone, Clay, Glass	0.9
14	Chemicals	0.3	1,633	Misc. Manuf.	0.2	Lumber, Wood Prod.	0.8
15	Misc. Manuf.	0.2	1,181	Textiles	0.1	Rubber & Misc. Plastic	0.6
16	Professional Instr.	0.2	957	Petroleum & related	0.1	Furniture & Fixtures	0.6
17	Rubber & Misc. Plastic	0.1	441	Professional Instr.	0.1	Professional Instr.	0.5
18	Petroleum & related	0.1	368	Rubber & Misc. Plastic	0.05	Leather Prod.	0.5
19	Leather Prod.	0.03	148	Leather Prod.	0.02	Petroleum & related	0.3

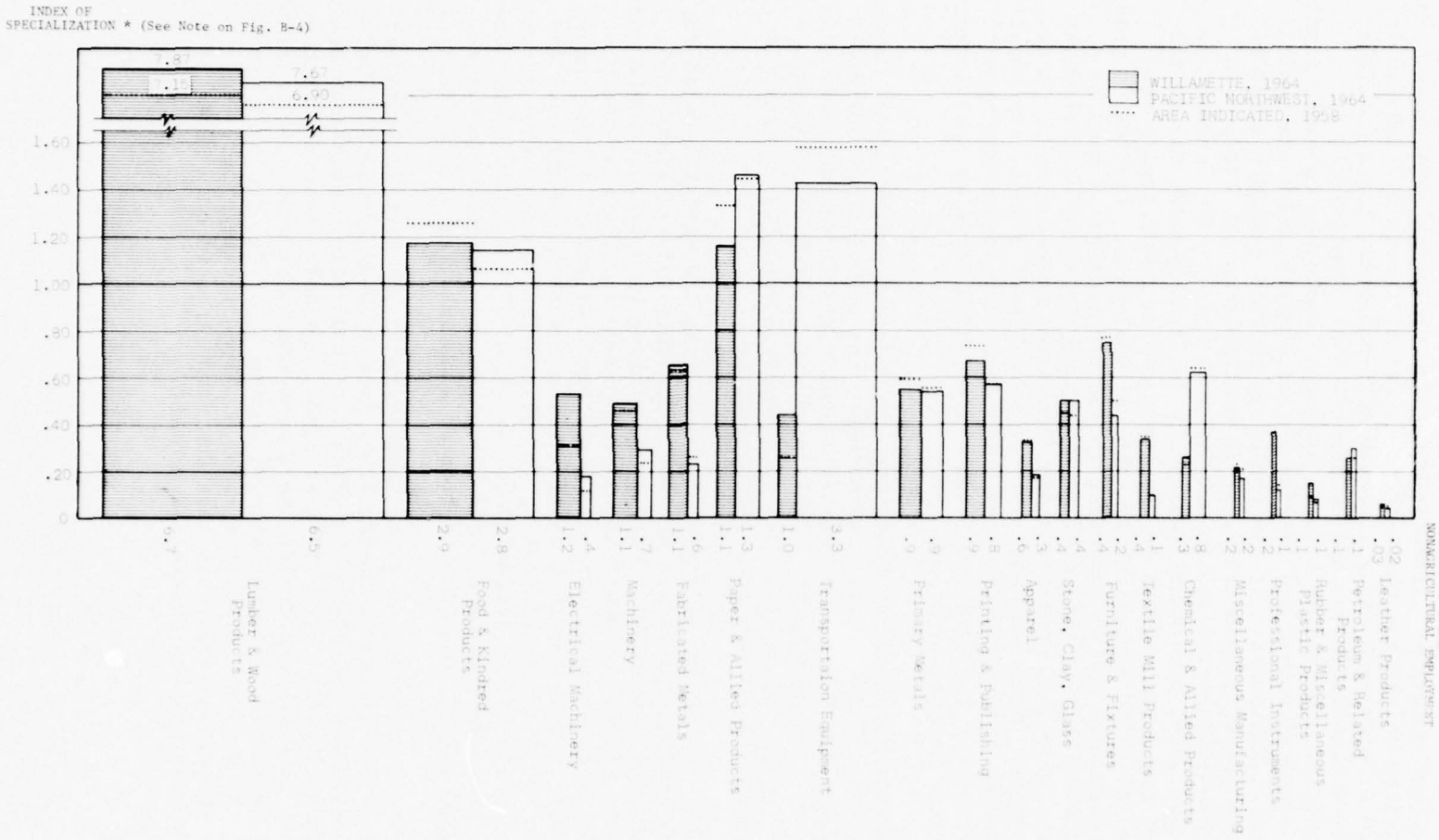


Figure B-5. - Employment Structure of Manufacturing Industries of the Willamette Basin and the Pacific Northwest Compared to the United States, 1958-64.

The Study Area is generally specialized in noncommodity producing categories, and underspecialized in commodity-producing industries. The four categories which have the highest degree of specialization--an index of 1.20 or more--are nonagriculture self-employed, State and local government, wholesale trade, and transportation. Nonagriculture self-employed is composed of a large number of employees in small family owned and operated retail and service establishments which are typical of the Pacific Northwest. If the employees in this category could be allocated to specific industries, it is certain that the Study Area would not be underspecialized in service industries. The "excess" in the State and local government employment is in large part due to the location of the State capitol in the basin and to fewer pupils per instructor in public education than the national norm. Portland's position as a wholesale and distributing center for foreign as well as domestic commodities is reflected in the high proportion of employment in wholesale trade and transportation (including warehousing). Other industries whose index exceeds 1.00, but by a lesser amount, are retail trade, finance, communications, and utilities. Industries having an index in excess of 1.00 are those industries which serve an area larger than the Study Area itself.

Industries in which the Study Area is underspecialized are: Manufacturing, agriculture, Federal government, and mining. Agricultural employment has decreased more sharply in the basin in recent years than in either the region or nation. This trend is typical of areas undergoing rapid urban expansion. Lack of commercial deposits of minerals has kept mining in the basin a minor industry.

The differences in the mix of manufacturing industries between the Study Area, region, and nation are shown on Table B-4 and Figure B-5. The area specializes in only three manufacturing categories: lumber and wood products, food, and paper and allied products. There are more employed in these three industries in the Study Area, and in the region as well, than in all the other manufacturing categories combined. Employment in the other manufacturing industries is less than that required for self-sufficiency, as suggested by the index of specialization. However, many have experienced a rapid rate of expansion in recent years (as discussed later) resulting in greater manufacturing diversification.

Employment distribution among industries in the Pacific Northwest is similar to the Willamette Basin Study Area in many respects. The three manufacturing industries in which the Study Area specializes are those in which the region specializes also. The only other manufacturing category in which the Pacific Northwest specializes is transportation equipment, reflecting the dominance of Boeing Aircraft Company in the economy of the region. Among the major employment categories, the region has proportionately more than the Study Area in only three: agriculture, mining, and Federal government.

Few industries showed abrupt change between 1958 and 1964. Employment distribution among industries is also shown on Figure B-4 and B-5 so that changes during the period are readily apparent. In the Study Area, agriculture and transportation had the greatest relative change, both decreasing. One general trend that has occurred nationwide is indicated. That is, variability in employment structure among subnational areas is decreasing in the noncommodity-producing industries and in the commodity producing industries not tied closely to a resource base. As population increases and markets expand, greater industrial diversification and less specialization normally follow.

The manufacturing industries in which the Study Area specializes, viz, forest products and food, are predominantly "processing" and not "fabricating" types of activity. The distinction is that the former use mainly materials which are in the raw stage and have not previously been through a manufacturing change in the flow of productive activity. This is changing in plywood; lumber and wood products; and canning, freezing, and preserving, as increased processing "fabricating" is being created by increased value added by manufacturing in these industries. As markets increase, economies of scale permit the establishment of more types of fabricating industries to satisfy local demand. Manufacturing in the Study Area is also emerging from the dominance of the initial resource-processing stage to more diversified fabrication and is becoming relatively less dependent upon its resource base.

Method of Analysis

An analysis of the difference between the overall growth rate of an area and that of the nation can be sought by asking the question: Does the industry mix of the basin reveal a dominance of industries which are fast or slow growing nationally, and, do those industries exhibit a competitive advantage in employment growth over that for the nation? 1/ The purpose of this section is to measure the contribution that each of these two factors has made to comparative growth of the Study Area and to indicate the implication that structural changes may have on future employment growth. This step essentially ties together employment analysis of the Study Area. "Shift analysis" is used. 2/

1/ *An industry is regarded as rapid or fast growing if its rate of employment increase nationally exceed that of the aggregate of all industries nationally. An industry exhibits a competitive advantage when its actual rate of growth exceeds its national rate of growth.*

2/ *"Shift analysis" is explained in detail, Survey of Current Business, October 1964, Lowell Ashby, "The Geographic Redistribution of Employment: An Examination of the Elements of Change." This is one of the methods used by the Office of Business Economics in its economic analysis of major river basins.*

The method and compilations are shown in Table B-5. Columns A and B indicate the employment in the Study Area for each of 32 industry groups for the terminal years of the period of analysis, 1958 and 1964. Column F lists the employment changes during the period. The latter is related to the three factors shown in Columns C, D, and E. The first element of comparative employment change, Column C, is that associated with aggregate national employment increase. Employment in the Study Area in 1958 is multiplied between 1958 and 1964. The entry in Column C for each industry, then, represents the increase that would be "expected" if employment in the Study Area had increased at the national rate for all industries combined in the same period. The total of Column C is the increase in employment in the Study Area that would be required to maintain the same porportional growth in total employment as the nation. Column G--the net relative change--is the amount that the Study Area has exceeded the employment it would have had in 1964 had it increased at the national rate of total employment from 1958 to 1964. The net relative change, Column G, is attributable to two factors: (1) differences between the Study Area and nation in the relative size of each industry, termed industrial mix, Column D, 1/ and (2) differences between the Study Area and nation in growth rate of each industry, termed competitive effect, Column E. 2/

This method shows the total impact of the industrial mix on the net relative change in employment but does not indicate the net contribution of each industry. To determine the net contribution that each industry made to comparative employment growth, a further adjustment is necessary. 3/ The results of this analysis are shown in Table B-6. 4/

1/ *The derivation of Column D is: The growth rate of all industries nationally is subtracted from the national growth rate of each industry and the results are applied to the 1958 Study Area of that same industry.*

2/ *To compute Column E, the national growth rate of a given industry is subtracted from the local growth rate of the same industry and the results are applied to the 1958 employment.*

3/ *The method was developed by Donald J. Morey, Economist, Bonneville Power Administration in a study, "The Contribution of Industrial Structure to the Comparative Employment Growth in the Pacific Northwest," BPA, 1965.*

4/ *Column H is the deviation in employment between the Study Area and nation (difference between the employment in each industry in the Study Area to that which it would have had in 1958 if it had the national distribution) multiplied by national industry growth rate minus national aggregate growth rate. Column I is the same as Column E in Table 5, the industry growth rate of the Study Area minus the industry national growth rate multiplied by the industry employment in the Study Area in 1958. Column J is the algebraic addition of Columns H and I.*

Table B-5

Employment and components of employment change
Willamette Basin Study Area
1958-1964

Industry	Employment 1958 (A)	Employment 1964 (B)	Changes Related to Nat'l Growth (C)	Changes Related to Ind'l Mix (D)	Changes Related to Compet. Effect (E)	Total C Change (F)	Net Relative Change (G)
Total Employment	427,916	503,267	42,792				
Nonagr. Self Emp	58,330	69,460	5,833	-187	5,484	11,130	5,297
A Agriculture	39,500	27,300	3,950	-11,269	-4,881	-12,200	-16,150
B Mining	610	731	61	-155	215	121	60
C construction	16,980	21,483	1,698	307	2,498	4,503	2,805
D Manufacturing							
20 Food	14,900	14,422	1,490	-1,848	-120	-478	-1,968
22 Textiles	2,153	2,149	215	-266	47	-4	-219
23 Apparel	2,584	2,952	258	46	64	368	110
24 Lumber	29,357	33,667	2,936	-3,820	5,194	4,310	1,374
25 Furniture	1,844	2,166	185	26	111	322	137
26 Paper	5,027	5,237	503	88	-381	210	-293
27 Printing	4,315	4,562	432	-40	-145	247	-185
28 Chemicals	1,228	1,633	123	6	276	405	282
29 Petroleum	314	368	31	-83	106	54	23
30 Rubber	297	441	30	44	70	144	114
31 Leather	149	148	15	-17	1	-1	-16
32 Stone, Clay, Glass	1,715	2,200	172	-9	322	485	313
33 P. Metals	4,540	4,779	454	-167	-48	239	215
34 F. Metals	4,524	5,526	452	51	499	1,002	550
35 Machinery	4,154	5,631	415	347	715	1,477	1,062
36 Elec. Machinery	2,608	5,857	261	366	2,622	3,249	2,988
37 Transp. Eqpt.	2,842	5,065	284	-257	2,196	2,223	1,939
38 Prof. Inst.	972	957	97	39	-151	-15	-112
39 Misc. *	923	1,181	92	107	59	258	166
E Trans, Comm, Util							
RR	8,328	7,931	833	-2,571	1,341	-397	-1,230
Trans. ex. RR	14,024	13,651	1,402	533	-2,308	-373	-1,775
Comm. & Util	10,828	11,438	1,083	-1,023	550	610	-473
F Trade							
Wholesale	23,660	28,405	2,366	724	1,655	4,745	2,379
Retail	51,370	67,028	5,137	1,798	8,723	15,658	10,521
G Finance, Ins. RE	17,640	22,640	1,764	1,212	2,024	5,000	3,236
H Services	42,090	57,539	4,209	6,431	4,809	15,449	11,240
I Government							
Federal	12,570	13,862	1,257	-357	392	1,292	35
State & Local	47,540	62,858	4,754	7,930	2,634	15,318	10,564
Total				-2,014	34,573	75,351	32,559

* *Including ordnance and tobacco*

Table B-6
Net contribution of each industry to employment shift
Willamette Basin Study Area
1958-1964

Industry	Shift Attrib. to Composition Effect (H)	Shift Attrib. to Competitive Effect (I)	Total Employment Net Shift (J)
Total Employment			
Non-Agr. Self Emp	-42	5,484	5,442
A Agriculture	-111	-4,881	-4,992
B Mining	1,119	215	1,334
C Construction	-29	2,498	2,469
D Manufacturing			
20 Food	-378	-120	-498
22 Textiles	495	47	542
23 Apparel	-93	64	-29
24 Lumber	-3,187	5,194	2,007
25 Furniture	-8	111	103
26 Paper	22	-381	-359
27 Printing	14	-145	-131
28 Chemicals	-20	276	256
29 Petroleum	315	106	421
30 Rubber	-301	70	-231
31 Leather	259	1	260
32 Stone, Clay, Glass	11	322	333
33 Primary Metals	116	-48	68
34 Fab. Metals	-30	499	469
35 Machinery	-414	715	301
36 Elec. Machinery	-805	2,622	1,817
37 Trans. Eqpt.	715	2,196	2,911
38 Prof. Inst.	-48	-151	-199
39 Misc. (Ord. Tob.)	-369	59	-310
E Trans., Comm., Ut.			
RR	-589	1,341	752
Trans. ex. RR	139	-2,308	-2,169
Comm. & Ut.	-93	550	457
F Trade			
Wholesale	141	1,655	1,796
Retail	-52	8,723	8,671
G Finance, Ins., RE	54	2,024	2,078
H Services	-532	4,809	4,277
I Govt.			
Federal	60	392	452
State & Local	1,627	2,634	4,261
Total	-2,014	34,573	32,559

Conclusions of Analysis

Differences in the employment growth rates and industrial composition between the Study Area, region, and nation were indicated earlier. The shift analysis permits measuring each influence on comparative economic growth.

Total employment in the Willamette Basin Study Area increased from 427,916 in 1958 to 503,267 in 1964, an increase of 75,348 (17.6 percent) in a span of six years. If the Study Area had experienced the same rate of growth as the nation during this period, its employment would have been 470,708. Likewise, if the Study Area had the same proportion of total employment in every industry as the nation, and if the growth rate of each industry were identical to that of the nation, the Study Area would have also employed 470,708 in 1964, or a growth in employment of 42,792 during the period. See Table B-5, Column C. Actual employment was 503,267 or 32,559 more than that required to match national increase. See Columns G and J on Tables B-5 and B-6, respectively. What part of this growth, which was in excess of national performance, is attributable to the difference in industry mix and what part to differences in industry growth rates? If the national growth rate for each industry is applied to the actual distribution of employment in the Study Area, employment would have been 468,694 or 2,014 less than what it would have been had it had the same distribution and growth rate as the nation (see Column D). The Area had an unfavorable "industry mix", or in other words, industries which are slow-growing nationally dominate in the Study Area. In spite of being specialized in slow-growing industries, the Area exceeded national growth by 32,559. That growth is, therefore, attributable to higher industry growth rates, which reflect the superior competitive position of the Study Area. Superior growth rates alone netted 34,573 above national performance. The increase in total employment would have been more than 2,000 greater had the industry mix not included a preponderance of slow growing industries.

The net contribution that each industry made to the comparative growth in total employment for the Study Area is shown in Table B-6, Column J, entitled, Net Employment Shift. It is determined by two factors: (1) competitive effect (Column I), which is the amount that the industry exceeded or failed to exceed the number expected had the industry grown at its national rate, and (2) composition effect (Column H), which is the effect attributable to the fact that the distribution or the size of the industry varies between the Study Area and the nation. The total of these two effects determines whether the industry has assisted or hindered the comparative employment growth of the Study Area.

The total net relative change (Table B-5, Column G) is equal to the total employment net shift (Table B-6, Column J), but the contributions of the individual industries to the respective totals differ. Both reflect that portion of the industry's contribution to comparative employment growth ascribable to the competitive effect. But, whereas net relative change takes the actual composition of employment in the Study Area as given, the net contribution of the industry to the employment shift isolates that portion of the industry's contribution to comparative employment growth directly attributable to differences in employment composition between the Study Area and the nation. The latter has been termed the composition effect. A slow-growing industry will make a positive contribution to the composition effect if its portion of total employment is less than that of the nation. Conversely, it will make a negative contribution if its share of total employment is greater than that of the nation.

The competitive effect of the Study Area's lumber industry was 5,194 employees. Part of this was attributable to the competitive advantage that the lumber industry in the Study Area has over that of the industry nationally. But because it is a slow-growth industry nationally and represents a larger share of total employment than it does in the nation, the net contribution of the lumber industry to comparative employment growth was only 2,007 employees (total net employment shift).

The Study Area owes its "greater than expected" economic expansion, as measured by employment change, to the superior competitive effect of its industries. The rate of increase in 25 of the 32 categories was greater than the national economy in which it is competing. Agriculture and transportation, except railroads, were the only major industries that demonstrated a significant competitive disadvantage in employment growth.

The industry mix did not of itself assist in promoting growth. The rapid growth industries are relatively smaller and the slow growth industries are relatively larger as a whole in the Study Area than the nation. Both conditions penalize potential growth. The contribution that each made as the result of their deviation from national composition is indicated in Table B-6, Column H.

The contribution of each major industry to net shift in employment is ranked in Table B-7. Retail trade and manufacturing lead all other categories. Among the two-digit manufacturing classification, the ones that made the greatest contribution were lumber and wood products, electrical machinery, and transportation equipment. In addition, nine other manufacturing industries contributed whereas only seven failed to contribute as the result of the combined composition and competitive effects. All other major employment categories contributed to the net employment shift except transportation (excluding railroad) and agriculture.

Table B-7
Rank order of industries
in contribution 1/ to net employment shift
Willamette Basin Study Area: 1958-1964

Major Categories	
Retail	8,671
Manufacturing	7,731
Self-Employed	5,442
Services	4,277
State & Local Govt.	4,261
Construction	2,469
Finance, Ins., RE	2,078
Wholesale	1,796
Mining	1,334
Railroad	752
Comm., Ut.	457
Federal Govt.	452
Transport., ex. RR	-2,169
Agriculture	-4,992
	32,559

1/ Increase in employment above national rate.

The employment structure of the basin has undergone rapid diversification during the 1958-1964 period. Among the basic industries, the slow growth ones have become a relatively smaller segment of the employment base while rapid growth industries have become proportionately larger. In response to the trend toward greater areal industrial homogeneity, the influence of industrial mix in areas of comparable size, nationwide, has tended to lessen. As the influence of industrial mix decreases, the competitive effects will become the more dominant element in overall growth rates. The analysis suggests that the Study Area had locational advantages that induced industrial development at a faster rate than in the nation as a whole.

A D D E N D U M C

EMPLOYMENT TRENDS, 1940-1960

Employment analysis in Part II uses employment data obtained from the Oregon State Department of Employment. The Oregon data are preferred for detailed analysis because employment is tabulated by site of employment, is available annually and for more recent years, and is more disaggregated. The major shortcoming of these data are the relatively short period (1958-1964) for which employment estimates are available for all industries for each county. In order to encompass a longer period of time for employment analysis, Bureau of Census data are also used. However, the latter data are based on the residence of the employee and are less disaggregated, and thus less comparable. Nonetheless, these data permit useful comparisons for the 1940 to 1950 and 1950 to 1960 periods.

The method of analysis 1/ is that developed by the Department of Commerce, Office of Business Economics 2/ and is similar to that developed in the main body of the report.

National and Regional Trends

National employment trends during the period between 1940-1950 and 1950-1960 differed significantly from population trends during these same periods. Between 1940 and 1950, employment increased 26.7 percent compared to a population increase of 14.5 percent. In the following decade, comparative growth was 15.4 and 18.4 percent, respectively. The difference in rates of change is largely due to the depressed economic condition in 1940 and the proportionately larger part of the population not of employment age in the latter period. During periods of relatively full employment and greater stability in the population-age structure, as is expected in the future, differences in rates between employment and population change will be reduced.

1/ *The "shift analysis" permits the allocation of comparative total growth between (1) that which is attributable to higher or lower rates of growth within particular industries and (2) that which is attributable to the industrial composition of the area. The standard of reference is the growth rate of the nation in terms of total employment and in employment for each of the categories of industries compared.*

2/ *Lowell D. Ashby, Regional Economics Division, Office of Business Economics, "Regional Change in a National Setting, Staff Working Papers in Economics and Statistics, No. 7," April 1964, and "The Geographical Redistribution of Employment: An Examination of the Elements of Change." Survey of Current Business, October 1964.*

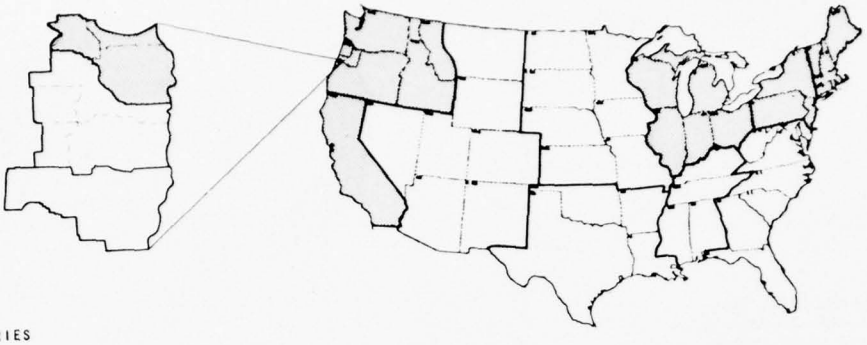
Regional differences in rates of employment change are noted. The extremes in rate of change between 1950 and 1960 are an increase of nearly 50 percent in California in contrast to less than a three percent increase in the East South Central states. The Pacific Northwest was among those with a greater rate of growth in the 1940's, but it fell below the national average during the 1950's (see Table C-1). Differential growth rates among divisions of the nation can be expected to persist as each is not only influenced differently by changes in demand for goods and services, but each also varies in comparative advantages in supplying the demand.

Table C-1
Comparative employment trends divisions of the United States 1940-1960

	Percent Increase 1940-1950		Percent Increase 1950-1960
California	61.4	California	48.7
Mountain	45.5	Mountain	40.0
Pacific Northwest	44.2	South Atlantic	19.6
E. No. Central	28.9	United States	15.4
South Atlantic	28.0	W. So. Central	15.0
United States	26.7	Pacific Northwest	14.5
W. So. Central	23.6	New England	13.0
Mid-Atlantic	21.9	E. No. Central	12.3
New England	19.6	Mid-Atlantic	10.6
W. No. Central	19.2	W. No. Central	5.7
E. So. Central	14.4	E. So. Central	2.9

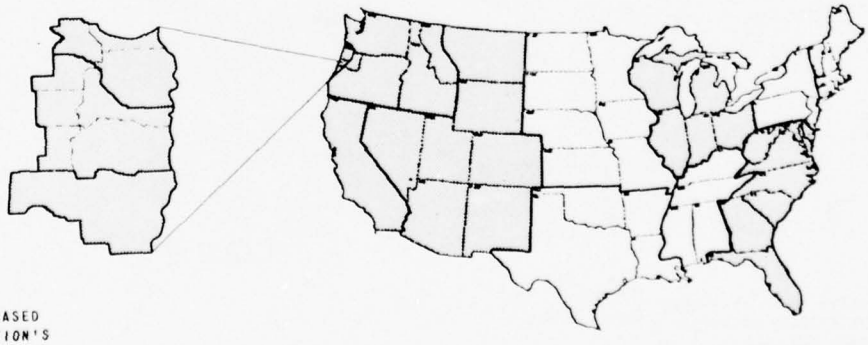
The reasons for the difference in growth rate can be examined at various levels of analysis. The analysis adopted here determines the growth component due to (1) the industrial composition--"mix"--of the area, and (2) the competitive effect of each industry.

The economic unit--region, state, basin--has a "positive industrial mix" if it has a preponderance of fast-growing industries. An industry is defined as fast-growing if its rate of employment increase in the nation exceeds the average rate of all industries in the nation. An area has a "positive regional share", which is a measure of competitive advantage, if the growth rate of a given industry in the area exceeds that of the growth rate of the same industry nationally.



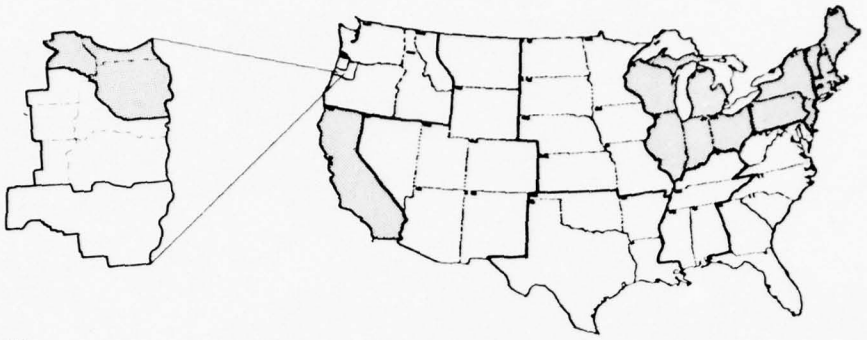
SHADED AREAS WERE FAVORED BY INDUSTRIES WITH ABOVE AVERAGE GROWTH RATES

SHADED AREAS TENDED TO HAVE GROWTH RATES IN EXCESS OF THEIR NATIONAL RATES

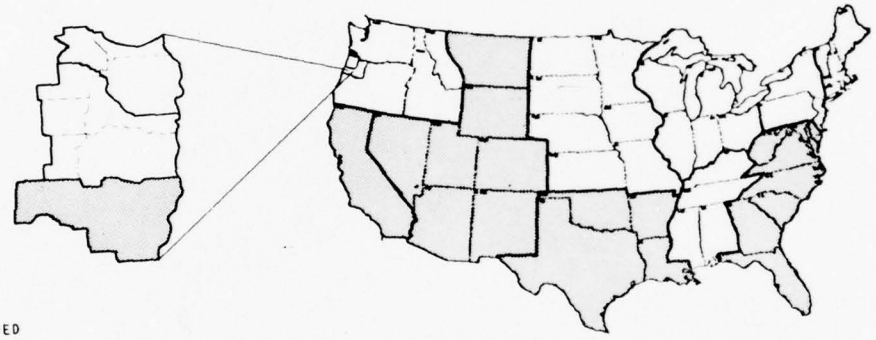


SHADED AREAS INCREASED THEIR SHARE OF NATION'S TOTAL EMPLOYMENT

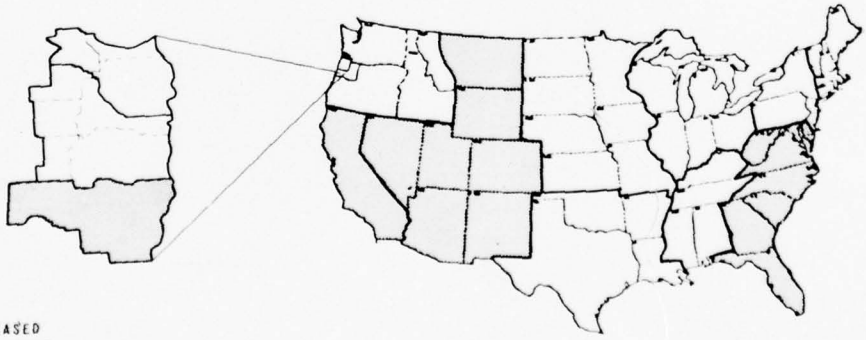
Figure C-1. - Employment Changes. Divisions of United States and Willamette Basin, 1940-1950.



SHADED AREAS WERE FAVORED BY INDUSTRIES WITH ABOVE AVERAGE GROWTH RATES



SHADED AREAS TENDED TO HAVE GROWTH RATES IN EXCESS OF THEIR NATIONAL RATES



SHADED AREAS INCREASED THEIR SHARE OF NATION'S TOTAL EMPLOYMENT

Figure C-2. - Employment Changes. Divisions of the United States and Willamette Basin, 1950-1960.

Table C-2

Employment and Components of Change
Pacific Northwest: 1940-1950 & 1950-1960

		Employment			1940-50				1950-60			
					Changes Related To			Total change	Changes Related to			Total change
		1940	1950	1960	National growth	Industrial mix	Regional share		National growth	Industrial mix	Regional share	
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(i)	(j)	(k)	(l)
1	Agriculture	222,637	211,857	156,078	59,366	-99,317	29,174	-10,777	32,798	-114,292	25,715	-55,779
2	Forestry & Fisheries	8,260	11,752	11,442	2,202	- 880	2,171	3,493	1,819	- 4,815	2,685	- 311
3	Mining	23,702	17,517	11,244	6,320	- 6,000	- 6,505	- 6,185	2,713	- 7,919	- 1,067	- 6,273
4	Contract Construction	67,907	131,716	127,199	18,105	27,486	18,215	63,806	20,393	- 6,724	-18,183	- 4,514
	Manufacturing:											
5	Food & Kindred Products	30,264	40,411	57,877	8,071	361	1,715	10,147	6,256	5,418	5,793	17,467
6	Textile Mill Products	3,150	4,062	3,834	840	- 598	671	913	628	- 1,564	708	- 228
7	Apparel	3,847	4,698	7,123	1,025	248	- 423	850	727	- 306	2,005	2,426
8	Lumber, Wood Products, Furniture	118,272	153,577	142,724	31,536	28	3,740	35,304	23,775	- 39,638	5,009	-10,854
9	Printing & Publishing	14,891	20,821	26,821	3,971	1,281	678	5,930	3,223	3,738	- 963	5,998
10	Chemicals & Allied Products	2,790	11,106	16,218	744	645	6,928	8,317	1,718	1,736	1,656	5,110
11	Electrical & Other Machinery	5,987	11,454	24,814	1,584	4,025	- 105	5,504	1,774	3,563	8,024	13,361
12	Motor Vehicles & Equipment	1,326	2,089	4,094	354	325	84	763	324	- 390	2,071	2,005
13	Other Transportation Equipment	14,874	28,934	74,655	3,967	4,542	5,554	14,063	4,479	25,129	16,114	45,722
14	Other & Miscellaneous	36,706	60,531	81,415	9,789	2,283	11,754	23,826	9,370	1,977	9,536	20,883
15	Railroads & Railway Express	34,035	47,879	36,053	9,073	- 1,557	6,326	13,842	7,412	- 22,823	3,586	-11,825
16	Trucking & Warehousing	15,485	23,783	29,065	4,129	1,882	2,285	8,296	3,681	3,386	- 1,786	5,281
17	Other Transportation	20,668	32,017	31,861	5,512	6,705	- 866	11,351	4,956	- 4,077	- 1,034	- 155
18	Communications	11,300	23,626	25,994	3,013	6,037	3,280	12,330	3,656	- 2	- 1,287	2,367
19	Utilities & Sanitary Service	16,067	26,407	28,662	4,285	2,824	3,233	10,342	4,089	- 276	- 1,554	2,259
20	Wholesale Trade	40,957	65,148	81,316	10,922	15,236	- 1,964	24,194	10,086	- 2,487	8,571	16,170
21	Food & Dairy Products Stores	39,581	48,677	48,713	10,555	- 4,483	3,027	9,099	7,537	- 8,503	1,003	37
22	Eating & Drinking Places	34,495	60,791	62,662	9,201	8,419	8,678	26,298	9,413	- 5,504	- 2,039	1,870
23	Other Retail Trade	109,953	169,655	193,577	29,319	13,254	17,128	59,701	26,263	3,250	- 5,591	23,922
24	Finance, Insurance & Real Estate	36,888	57,821	78,220	9,839	1,478	9,620	20,937	8,951	14,347	- 2,901	20,397
25	Hotels & Other Personal Services	49,176	59,371	59,182	13,111	- 8,104	5,188	10,195	9,191	- 6,640	- 2,740	- 189
26	Private Households	38,058	33,732	51,607	10,148	-21,500	7,026	- 4,326	5,223	485	12,169	17,877
27	Business & Repair Services	27,625	45,947	48,304	7,367	6,832	4,124	18,323	7,113	3,296	- 8,051	2,358
28	Entertainment, Recreation Services	11,473	16,040	14,754	3,058	- 234	1,741	4,565	2,482	- 2,220	- 1,550	- 1,288
29	Medical, Other Professional Services	94,906	161,668	255,259	25,306	16,488	24,969	66,763	25,028	68,682	- 119	93,591
30	Public Administration	44,088	80,581	97,202	11,756	18,826	5,911	36,493	12,476	9,591	- 5,445	16,622
31	Armed Forces	15,700	60,273	62,419	4,187	32,815	7,571	44,573	9,330	32,277	-39,460	2,147
32	Industry Not Reported	17,729	24,965	51,696	4,729	- 826	3,332	7,235	3,865	48,450	-25,585	26,730
	Total	1,212,757	1,748,906	2,002,084	323,384	28,521	184,260	536,165	270,749	(-) 2,855	-14,710	253,184

Table C-3

Employment and Components of Employment Change
Divisions of United States
1940-50 and 1950-60

(Thousands of Employees)

	Employment			1940-1950					1950-1960				
				Changes Related To			Total Change	Net Relative Change	Changes Related to			Total Change	Net Relative Change
	1940 (A)	1950 (B)	1960 (C)	National Growth (D)	Industrial Mix (E)	Regional Share (F)	(G)	(H)	National Growth (I)	Industrial Mix (J)	Regional Share (K)	(L)	(M)
U.S. (Less Alaska & Hawaii)	45,166.1	57,221.8	66,025.1	12,043.2	0.0	0.0	12,055.7	0.0	8,858.5	0.0	0.0	8,803.3	0.0
New England	3,060.1	3,661.2	4,137.9	816.0	225.2	- 440.1	601.0	- 214.9	566.8	198.2	- 288.2	476.8	- 90.0
Middle Atlantic	9,773.8	11,917.7	13,182.8	2,606.1	713.3	-1,175.4	2,144.0	- 462.1	1,845.0	642.4	-1,222.4	1,265.1	- 580.0
East North Central	9,256.8	11,931.3	13,403.4	2,468.3	507.1	- 300.8	2,674.5	206.3	1,847.1	277.1	- 652.1	1,472.1	- 375.0
West North Central	4,513.5	5,378.9	5,683.3	1,203.5	- 316.6	- 21.5	865.4	- 338.1	832.7	- 320.9	- 207.4	304.4	- 528.3
South Atlantic	6,215.1	7,953.7	9,509.8	1,657.3	- 416.6	498.1	1,738.6	81.5	1,231.2	- 370.3	695.0	1,556.1	324.8
East South Central	3,410.6	3,901.5	4,013.0	909.4	- 564.8	146.2	490.9	- 418.5	604.0	- 437.5	- 54.9	111.6	- 492.4
West South Central	4,152.1	5,131.1	5,899.6	1,107.1	- 411.1	282.8	978.9	- 128.2	794.3	- 229.0	203.2	768.5	- 25.8
California	2,525.3	4,075.5	6,061.7	673.3	299.4	647.4	1,550.2	876.9	630.9	269.7	1,085.6	1,986.2	1,355.3
Mountain	1,046.3	1,522.0	2,131.4	279.0	- 35.6	232.5	475.9	197.4	235.8	- 47.9	421.5	609.3	373.9
Pacific Northwest	1,212.6	1,749.0	2,002.0	323.3	28.6	184.4	536.4	212.5	270.8	- 2.6	- 14.9	253.4	- 17.6
Washington	607.7	896.9	1,054.4	162.0	46.5	80.7	289.3	127.2	138.9	50.6	- 32.0	157.5	18.6
Oregon	389.8	579.4	644.2	103.9	- 0.3	86.0	189.6	85.6	89.7	- 24.1	- 0.7	64.9	- 24.8
Idaho	158.6	206.4	237.2	42.3	- 16.8	22.4	47.8	5.5	32.0	- 23.7	22.5	30.8	- 1.2
Western Montana	56.5	66.3	66.2	15.1	- .8	- 4.7	9.7	- 5.8	10.2	- 5.4	- 4.7	.2	- 10.2

Table C-3 shows the results of the analysis of employment shifts for the divisions of the United States and is presented for comparing the performance of the Pacific Northwest with other regions. Columns A, B, and C indicate the employment for each of the last three decennial censuses. For the period 1950-1960, Column L indicates that employment increased 253,400 in the Pacific Northwest. This increase can be related to the three factors shown in Columns I, J, and K. Column I is computed by multiplying the Pacific Northwest employment total by the percent increase in total employment in the U. S. for the 1950-1960 period. Thus the Pacific Northwest would have had to increase employment by 270,800 to maintain its proportional share of the national increase. The employment change of -2,600, in Column J, is that related to industry mix. The relatively small magnitude of this change indicates that the industrial mix in the Pacific Northwest is nearly evenly divided between fast and slow-growing industries, with slightly more of the latter. Among the states in the region, only Washington had a positive industrial mix. Column K, or "Regional Share" shows the composite competitive advantages of the area for the 32 industries studied. Given the industrial mix of the Pacific Northwest in 1950, the region should have had an employment increase of 14,900 to have shared equally in national growth. Column M shows the net result of employment change--17,600 less than that required to keep pace with national growth--2,600 of which is explained by a slightly unfavorable mix and 14,900 of which is due to the less-than-national growth rate in all industries combined.

The region was favored, however, in the comparative growth of basic industries. Employment changes related to the regional share in agriculture, forestry, and fisheries, and manufacturing, were a significantly positive contribution to the growth of the Pacific Northwest during both decades. All manufacturing categories except printing and publishing exceeded the national rate of increase between 1950 and 1960. Of the basic industries only mining failed to exceed national performance during the 20-year span between 1940 and 1960.

Willamette Basin Employment Trends

Willamette Basin employment trends and performance relative to the nation are compared for each of 32 industrial categories (see Tables C-4 through C-7). The derivation of components of employment change for a particular industry is explained following (see Contract Construction, Table C-4).

Between 1940 and 1950 employment in construction (Columns A and B) increased 15,236 (Column G). Is this more or less than "expected" relative to national performance? If employment in construction in the Study Area increased at the U. S. rate for all industries combined in 1940, it would have increased 26.7 percent or 3,552 (Column D). The growth rate of construction nationally exceeded the rate for all industires by 40.5 percent. Therefore, construction employment in the Study Area should have increased an additional 5,393 (Column E) to coincide with national performance. Total increase in the Area was 15,236 (Column G) so the amount that the Area exceeded the amount it would have had, had it increased at the national rate, was 6,291 (Column F).

Between 1950 and 1960 the same reasoning applies but it may prove advantageous to follow an example of decline. The growth rate of total national employment was 15.4 percent. The derivation of 4,422 in construction in Column I is 15.4 x 28,560. The national increase in construction employment was 10.4 percent, which is 5.0 percent (15.4-10.4) less than the growth rate of total employment nationally. Employment of 1,458 (Column J) (28,560 x .050) is the amount (when national rates are applied to Study Area data) that employment in construction nationally expanded less than total employment of all industries nationally. The minus signs in the industrial mix column identify industries which are defined as "slow-growth industries" for the period indicated. Regional share (Column K) indicates a loss of 4,038, which is the amount less than "expected" when national rate of increase in construction employment is applied to 1950 Area employment in construction (28,560 x 110.4 - 27,485 + 4,038).

Increase in employment in the Study Area between 1940 and 1950 was considerably above that which would be expected had the Area followed the national rates of change. Total employment increased at twice the national rate. It was favored by having a preponderance of rapid growing industries and, on balance, getting a significantly larger employment share of each industry. In only six of the 32 industries, did the Study Area fail to increase at a rate higher than that of the nation. These are indicated by the minus signs in Column F, Table C-4.

Table C-4
Employment and Components of Change
Willamette Basin
1940-1950 & 1950-1960

Line		Employment			1940-50				1950-60			
					Changes Related To			Total change	Changes Related To			Total change
		1940	1950	1960	National growth	Industrial mix	Regional share		National growth	Industrial mix	Regional share	
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(I)	(J)	(K)	(L)
1	Agriculture	33,208	33,924	21,188	8,856	-14,815	6,675	716	5,251	-18,301	313	-12,737
2	Forestry & Fisheries	626	1,113	1,581	167	- 66	389	490	174	- 457	753	470
3	Mining	573	831	513	152	- 145	250	257	130	- 375	- 72	- 317
4	Contract Construction	13,323	28,560	27,485	3,552	5,393	6,291	15,236	4,422	- 1,458	- 4,038	- 1,074
	Manufacturing:											
5	Food & Kindred Products	6,995	8,821	12,516	1,866	85	- 123	1,828	1,364	1,181	1,146	3,691
6	Textile Mill Products	2,325	2,727	2,310	620	- 442	224	402	423	- 1,053	213	- 417
7	Apparel	1,465	1,968	2,901	390	94	19	503	305	- 128	756	933
8	Lumber, Wood Products, Furniture	22,259	37,579	34,051	5,936	3	9,380	15,319	5,816	- 9,698	352	- 3,530
9	Printing & Publishing	4,059	6,028	6,814	1,083	348	536	1,967	933	1,083	- 1,229	787
10	Chemicals & Allied Products	778	1,413	1,693	208	180	250	638	218	220	- 160	278
11	Electrical & Other Machinery	1,966	4,151	10,331	525	1,330	330	2,185	643	1,292	4,246	6,181
12	Motor Vehicles & Equipment	458	553	1,196	122	112	- 142	92	85	- 103	659	641
13	Other Transportation Equipment	375	584	3,388	99	115	- 6	208	90	506	2,208	2,804
14	Other & Miscellaneous	9,073	15,121	19,541	2,418	564	3,065	6,047	2,340	492	1,585	4,417
15	Railroads & Railway Express	7,123	10,992	8,553	1,900	- 325	2,295	3,870	1,702	- 5,241	1,099	- 2,440
16	Trucking & Warehousing	3,619	5,867	7,553	965	442	843	2,250	908	836	- 57	1,687
17	Other Transportation	4,980	6,939	6,733	1,328	1,614	- 984	1,958	1,074	- 883	- 397	- 206
18	Communications	2,534	5,867	6,423	676	1,353	1,304	3,333	907	0	- 351	556
19	Utilities & Sanitary Service	3,577	6,339	6,688	953	629	1,181	2,763	980	- 66	- 566	348
20	Wholesale Trade	10,296	18,766	22,134	2,745	3,829	1,894	8,468	2,905	- 715	1,179	3,369
21	Food & Dairy Products Stores	8,759	10,882	10,633	2,337	- 992	779	2,124	1,686	- 1,900	- 34	- 248
22	Eating & Drinking Places	7,440	13,643	13,971	1,985	1,817	2,405	6,207	2,112	- 1,236	- 550	326
23	Other Retail Trade	26,212	41,024	44,309	6,989	3,158	4,662	14,809	6,352	786	- 3,852	3,286
24	Finance, Insurance & Real Estate	9,667	15,657	20,525	2,578	387	3,025	5,990	2,424	3,886	- 1,442	4,868
25	Hotels & Other Personal Services	10,842	12,994	12,784	2,890	- 1,786	1,048	2,152	2,012	- 1,454	- 766	- 208
26	Private Households	9,064	8,804	10,911	2,418	- 5,121	2,443	- 260	1,363	125	618	2,106
27	Business & Repair Services	6,383	11,008	12,598	1,701	1,578	1,344	4,623	1,704	789	- 902	1,591
28	Entertainment, Recreation Services	2,464	4,034	3,122	658	- 50	963	1,571	625	- 560	- 978	- 913
29	Medical, Other Professional Services	22,175	39,537	62,557	5,913	3,853	7,597	17,363	6,120	16,798	104	23,022
30	Public Administration	10,352	17,088	21,936	2,760	4,420	- 444	6,736	2,645	2,034	168	4,847
31	Armed Forces	16	901	2,144	4	33	847	884	140	481	621	1,242
32	Industry Not Reported	4,266	4,650	12,012	1,137	- 199	- 555	383	718	9,024	- 2,382	7,360
	Total	247,252	378,365	431,094	65,931	7,396	57,785	131,112	58,571	- 4,095	- 1,756	52,720

Table C-5

Employment and Components of Change
Clackamas, Multnomah and Washington Counties
1940-1950 and 1950-1960

Line		Employment			1940-50 Changes Related To			1940-50 Total change	1950-60 Changes Related To			1950-60 Total change
		1940	1950	1960	National growth	Industrial mix	Regional share		National growth	Industrial mix	Regional share	
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(I)	(J)	(K)	(L)
1	Agriculture	13,285	13,874	8,845	3,543	- 5,927	2,973	589	2,148	- 7,484	308	- 5,028
2	Forestry & Fisheries	429	656	757	114	- 45	159	228	102	- 270	269	101
3	Mining	286	368	187	76	- 73	78	81	57	- 166	- 71	- 180
4	Contract Construction	9,372	18,476	17,237	2,499	3,793	2,812	9,104	2,861	- 943	- 3,156	- 1,238
	Manufacturing:											
5	Food & Kindred Products	4,947	5,899	8,326	1,319	60	- 426	953	913	790	723	2,426
6	Textile Mill Products	1,855	2,312	2,074	495	- 352	315	458	358	- 892	296	- 238
7	Apparel	1,279	1,923	2,762	340	82	221	643	298	- 125	666	839
8	Lumber, Wood Products, Furniture	10,763	12,592	9,551	2,870	2	- 1,043	1,829	1,949	- 3,250	- 1,741	- 3,042
9	Printing & Publishing	3,209	4,558	4,588	856	276	217	1,349	706	818	- 1,494	30
10	Chemicals & Allied Products	730	1,264	1,500	195	169	171	535	195	197	- 158	234
11	Electrical & Other Machinery	1,700	3,521	8,850	453	1,151	217	1,821	545	1,096	3,689	5,330
12	Motor Vehicles & Equipment	445	531	1,160	118	109	- 143	84	82	- 99	645	628
13	Other Transportation Equipment	344	541	3,054	91	105	0	196	84	469	1,960	2,513
14	Other & Miscellaneous	7,667	12,705	15,799	2,044	477	2,517	5,038	1,967	414	712	3,093
15	Railroads & Railway Express	5,469	8,066	6,053	1,458	- 250	1,389	2,597	1,249	- 3,845	584	- 2,012
16	Trucking & Warehousing	2,951	4,476	5,841	787	359	379	1,525	693	638	35	1,366
17	Other Transportation	4,615	6,127	5,927	1,230	1,497	- 1,216	1,511	949	- 780	- 369	- 200
18	*Communications*	2,064	4,436	4,763	550	1,102	720	2,372	686	0	- 359	327
19	Utilities & Sanitary Service	2,913	4,634	4,909	777	513	433	1,723	718	- 48	- 394	276
20	Wholesale Trade	8,681	15,069	17,550	2,315	3,229	844	6,388	2,333	- 574	724	2,483
21	Food & Dairy Products Stores	6,394	7,377	6,946	1,705	- 724	2	983	1,143	- 1,288	- 285	- 430
22	Eating & Drinking Places	5,788	9,603	9,686	1,544	1,413	860	3,817	1,486	- 870	- 535	81
23	Other Retail Trade	19,679	28,433	29,163	5,247	2,372	1,134	8,753	4,402	545	- 4,217	730
24	Finance, Insurance & Real Estate	8,076	12,284	15,466	2,153	323	1,731	4,207	1,902	3,048	- 1,768	3,182
25	Hotels & Other Personal Services	8,070	8,929	8,423	2,152	- 1,329	37	860	1,383	- 999	- 889	- 505
26	Private Households	6,373	5,893	6,814	1,700	- 3,600	1,421	- 479	912	84	- 76	920
27	Business & Repair Services	4,720	7,313	8,864	1,259	1,167	167	2,593	1,132	524	- 105	1,551
28	Entertainment, Recreation Services	1,948	3,117	2,305	519	- 39	689	1,169	483	- 432	- 864	- 813
29	Medical, Other Professional Services	14,976	25,034	37,451	3,993	2,602	3,463	10,058	3,875	10,635	- 2,093	12,417
30	Public Administration	7,249	11,511	13,635	1,933	3,095	- 765	4,263	1,782	1,370	- 1,029	2,123
31	Armed Forces	0	666	1,482	0	0	666	666	103	356	357	816
32	Industry Not Reported	2,904	2,871	8,952	774	- 136	- 672	- 34	444	5,571	64	6,079
	Total	169,181	245,059	278,920	45,109	11,421	19,350	75,880	37,940	4,490	- 8,571	33,859

Table C-6

Employment and Components of Change
Benton, Linn, Marion, Polk and Yamhill Counties
1940-1950 and 1950-1960

Line		Employment			1940-50 Changes Related To			1940-50 Total change	1950-60 Changes Related To			1950-60 Total change
		1940	1950	1960	National growth	Industrial mix	Regional share		National growth	Industrial mix	Regional share	
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(I)	(J)	(K)	(L)
1	Agriculture	16,198	16,496	10,241	4,320	- 7,226	3,205	299	2,553	- 8,900	- 90	- 6,257
2	Forestry & Fisheries	90	233	478	24	- 10	130	144	37	- 95	305	247
3	Mining	156	270	167	41	- 39	112	114	43	- 122	- 24	- 103
4	Contract Construction	2,581	6,361	6,291	688	1,045	2,046	3,779	985	- 325	- 730	- 70
	Manufacturing:											
5	Food & Kindred Products	1,589	2,275	2,940	425	19	243	687	351	304	7	662
6	Textile Mill Products	395	397	224	105	- 76	- 28	1	62	- 154	- 81	- 173
7	Apparel	182	34	119	49	12	- 208	- 147	5	- 2	82	85
8	Lumber, Wood Products, Furniture	6,266	13,631	11,036	1,671	0	5,693	7,364	2,109	- 3,517	- 1,188	- 2,596
9	Printing & Publishing	590	1,042	1,414	158	50	243	451	161	188	24	373
10	Chemicals & Allied Products	27	80	112	7	6	41	54	12	12	7	31
11	Electrical & Other Machinery	191	437	987	52	128	66	246	68	136	346	550
12	Motor Vehicles & Equipment	6	12	20	2	1	2	5	1	- 2	8	7
13	Other Transportation Equipment	25	22	278	6	8	- 18	- 4	3	19	234	256
14	Other & Miscellaneous	1,247	2,022	3,117	332	77	365	774	312	65	716	1,093
15	Railroads & Railway Express	647	1,049	768	173	- 29	258	402	162	- 501	56	- 283
16	Trucking & Warehousing	456	861	963	121	57	228	406	133	123	- 154	102
17	Other Transportation	256	473	472	69	82	66	217	73	- 60	- 14	- 1
18	Communications	318	853	940	85	170	280	535	132	0	- 45	87
19	Utilities & Sanitary Service	488	1,038	995	129	85	335	549	159	- 11	- 193	- 45
20	Wholesale Trade	1,103	2,077	2,314	293	410	269	972	321	- 79	- 6	236
21	Food & Dairy Products Stores	1,601	2,240	2,262	428	- 181	393	640	347	- 391	66	22
22	Eating & Drinking Places	1,133	2,596	2,558	303	277	885	1,465	402	- 235	- 205	- 38
23	Other Retail Trade	4,430	7,961	9,366	1,181	533	1,815	3,529	1,233	152	20	1,405
24	Finance, Insurance & Real Estate	1,109	2,179	3,339	296	43	730	1,071	337	542	281	1,160
25	Hotels & Other Personal Services	1,737	2,447	2,453	462	- 286	533	709	379	- 274	- 98	7
26	Private Households	1,845	1,853	2,471	492	- 1,043	558	7	287	26	305	618
27	Business & Repair Services	1,148	2,356	2,249	305	284	618	1,207	365	169	- 640	- 106
28	Entertainment, Recreation Services	330	602	466	89	- 7	191	273	93	- 84	- 145	- 136
29	Medical, Other Professional Services	5,210	10,109	16,368	1,390	905	2,605	4,900	1,565	4,296	400	6,261
30	Public Administration	2,547	4,554	6,505	679	1,088	240	2,007	705	542	704	1,951
31	Armed Forces	0	152	566	0	0	152	152	24	81	308	413
32	Industry Not Reported	907	1,255	2,094	242	- 42	148	348	193	2,436	- 1,790	839
	Total	54,808	87,967	94,573	14,617	- 3,657	22,196	33,156	13,612	- 5,661	- 1,354	6,597

Table C-7
Employment and Components of Change
Lane County
1940-1950 and 1950-1960

Line		Employment			1940-50 Changes Related To			1940-50 Total change	1950-60 Changes Related To			1950-60 Total change
		1940	1950	1960	National growth	Industrial mix	Regional share		National growth	Industrial mix	Regional share	
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(I)	(J)	(K)	(L)
1	Agriculture	3,725	3,554	2,102	993	- 1,662	497	- 172	550	- 1,917	- 85	- 1,452
2	Forestry & Fisheries	107	224	346	29	- 11	100	118	35	- 92	179	122
3	Mining	131	193	159	35	- 33	60	62	30	- 87	23	- 34
4	Contract Construction	1,370	3,723	3,957	365	555	1,433	2,353	576	- 190	- 152	234
	Manufacturing:											
5	Food & Kindred Products	459	647	1,250	122	6	60	188	100	87	416	603
6	Textile Mill Products	75	18	12	20	- 14	- 63	- 57	3	- 7	- 2	- 6
7	Apparel	4	11	20	1	0	6	7	2	- 1	8	9
8	Lumber, Wood Products, Furniture	5,230	11,356	13,464	1,395	1	4,730	6,126	1,758	- 2,931	3,281	2,108
9	Printing & Publishing	260	428	812	69	22	76	167	66	77	241	384
10	Chemicals & Allied Products	21	69	81	6	5	38	49	11	11	- 9	13
11	Electrical & Other Machinery	75	193	494	20	51	47	118	30	60	211	301
12	Motor Vehicles & Equipment	7	10	16	2	2	- 1	3	2	- 2	6	6
13	Other Transportation Equipment	6	21	56	2	2	12	16	3	18	14	35
14	Other & Miscellaneous	159	394	625	42	10	183	235	61	13	157	231
15	Railroads & Railway Express	1,007	1,877	1,732	269	- 46	648	871	291	- 895	459	- 145
16	Trucking & Warehousing	212	530	749	57	26	236	319	82	75	62	219
17	Other Transportation	109	339	334	29	35	166	230	52	- 43	- 14	- 5
18	Communications	152	578	720	41	81	304	426	89	0	53	142
19	Utilities & Sanitary Service	176	667	784	47	31	413	491	103	- 7	21	117
20	Wholesale Trade	512	1,620	2,270	137	190	781	1,108	251	- 62	461	650
21	Food & Dairy Products Stores	764	1,265	1,425	204	- 87	384	501	196	- 221	185	160
22	Eating & Drinking Places	519	1,444	1,727	138	127	660	925	224	- 131	190	283
23	Other Retail Trade	2,103	4,630	5,780	561	253	1,713	2,527	717	89	345	1,151
24	Finance, Insurance & Real Estate	482	1,194	1,720	129	19	564	712	185	296	45	526
25	Hotels & Other Personal Services	1,035	1,618	1,908	276	- 171	478	583	250	- 181	221	290
26	Private Households	846	1,058	1,626	226	- 478	464	212	164	15	389	568
27	Business & Repair Services	515	1,339	1,485	137	127	559	823	207	96	- 157	146
28	Entertainment, Recreation Services	186	315	351	50	- 4	83	129	49	- 44	31	36
29	Medical, Other Professional Services	1,989	4,394	8,738	530	346	1,529	2,405	680	1,867	1,797	4,344
30	Public Administration	556	1,023	1,796	148	237	81	466	158	122	493	773
31	Armed Forces	16	83	96	4	33	29	66	13	44	- 44	13
32	Industry Not Reported	455	524	966	121	- 21	- 31	69	81	1,017	- 656	442
	Total	23,263	45,339	57,601	6,205	- 368	16,239	22,076	7,019	- 2,924	8,169	12,264

During the following decade, the Study Area failed by 5,851 to maintain its share of increase in national employment. However, when considering the effect of the unfavorable industrial mix, which accounted for 4,095 of the loss, the area had only 1,756 less than required to keep apace of national employment expansion. Sixteen of the 32 industrial categories compared, failed to increase at a rate equal to that of the nation. Those which failed by 1,000 employees or more were: construction, printing and publishing, other retail trade, finance, and industries not reported. Industries that exceeded the corresponding national rate of growth sufficiently to gain more than 1,000 employees in the Area include: food and kindred products, electrical and other machinery, other transportation equipment, miscellaneous manufacturing, railroads, and wholesale trade.

The employment trends noted in this addendum were used to supplement those in Part II of this study and as a guide to future projections.

A D D E N D U M D

Table D-1
Employment by industry, 1958
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	427,916	279,936	95,240	52,740
A Agriculture	39,500	17,100	18,110	4,290
Self-employed, non-agr., domestics	58,330	36,400	12,750	9,180
B Mining	610	325	131	154
C Construction	16,980	12,000	2,810	2,170
D Manufacturing	84,446	51,336	18,880	14,230
Durable	53,479	28,613	12,606	12,260
Non-durable	30,967	22,723	6,274	1,970
20 Food and kindred products	14,900	9,300	4,280	1,320
22 Textile mill products	2,153	2,000	153	-
23 Apparel and similar products	2,584	2,503	D	D
24 Lumber and wood products	29,357	6,996	10,621	11,740
25 Furniture and fixtures	1,844	1,727	D	D
26 Paper and allied products	5,027	3,710	1,017	300
27 Printing, publish. & allied	4,315	3,280	695	340
28 Chemicals & allied products	1,228	1,180	42	6
29 Petroleum & related products	314	314	-	-
30 Rubber-misc. plastics	297	297	-	-
31 Leather, leather products	149	D	D	-
32 Stone, clay, glass	1,715	1,245	367	103
33 Primary metals	4,540	D	D	D
34 Fabricated metals	4,524	4,200	214	110
35 Machinery, except electric	4,154	3,440	542	172
36 Electric machinery	2,608	2,480	111	17
37 Transportation equipment	2,842	2,680	125	37
38 Professional-scientific instr.	972	D	D	D
39 Misc. manufacturing	923	865	26	32
E Transportation & utilities	33,180	27,000	3,160	3,020
40 Railroads	8,328	7,300	460	568
Transportation except railroads	14,024	11,224	1,200	1,600
All transportation	22,352	18,524	1,660	2,168
48-49 Commun., elec., gas, sanitary	10,828	8,476	1,500	852
F Trade	75,030	57,000	10,910	7,120
Wholesale	23,660	21,000	1,400	1,260
Retail	51,370	36,000	9,510	5,860
G Finance, insurance, real estate	17,640	13,500	2,700	1,440
H Services - misc.	42,090	31,475	6,329	4,286
I Total government	60,110	33,800	19,460	6,850
Federal	12,570	10,400	1,250	920
State-local	47,540	23,400	18,210	5,930

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-2

Employment by industry, 1959

Willamette Basin Study Area & Subareas

(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	446,021	292,361	96,990	56,670
A Agriculture	33,425	13,695	15,700	4,030
Self-employed, non-agr., domestics	60,990	37,800	13,320	9,870
B Mining	730	381	152	197
C Construction	19,210	13,500	2,980	2,730
D Manufacturing	90,726	54,866	20,260	15,600
Durable	57,997	31,315	13,162	13,520
Non-durable	32,729	23,551	7,098	2,080
20 Food and kindred products	15,589	9,470	4,709	1,410
22 Textile mill products	2,375	2,225	150	-
23 Apparel and similar products	2,673	2,591	82	-
24 Lumber and wood products	32,080	8,050	11,120	12,910
25 Furniture and fixtures	2,015	1,880	D	D
26 Paper and allied products	5,409	3,680	1,400	329
27 Printing, publish. & allied	4,391	3,350	700	341
28 Chemicals & allied products	1,435	1,390	45	-
29 Petroleum & related products	380	380	-	-
30 Rubber-misc. plastics	365	365	-	-
31 Leather, leather products	112	D	D	-
32 Stone, clay, glass	1,678	1,180	406	92
33 Primary metals	4,405	D	D	D
34 Fabricated metals	4,210	3,836	215	159
35 Machinery, except electric	4,764	3,964	630	170
36 Electric machinery	3,800	3,633	140	27
37 Transportation equipment	3,016	2,842	132	42
38 Professional-scientific instr.	1,101	D	D	-
39 Misc. manufacturing	928	840	38	50
E Transportation & utilities	33,640	27,300	3,300	3,040
40 Railroads	9,690	7,100	790	1,800
Transportation except railroads	12,580	10,900	1,310	370
All transportation	22,270	18,000	2,100	2,170
48-49 Commun., elec., gas, sanitary	11,370	9,300	1,200	870
F Trade	81,360	61,700	11,580	8,080
Wholesale	25,800	21,800	2,490	1,510
retail	55,560	39,900	9,090	6,570
G Finance, insurance, real estate	17,910	13,600	2,810	1,500
H Services - misc.	44,840	33,619	6,768	4,453
I Total government	63,190	35,900	20,120	7,170
Federal	12,990	10,800	1,300	890
State-local	50,200	25,100	18,820	6,280

Source: State of Oregon, Dept. of Labor, Research & Statistics Division

Note: Totals may not add due to rounding

D: Disclosure rule, not available for publication

Table D-3

Employment by industry, 1960
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	453,462	295,152	98,750	59,560
A Agriculture	33,440	14,000	15,680	3,760
Self-employed, non-agr., domestics	62,070	38,200	13,500	10,370
B Mining	647	252	146	249
C Construction	19,751	13,671	3,070	3,010
D Manufacturing	92,021	55,881	19,850	16,290
Durable	59,923	32,571	13,142	14,210
Non-durable	32,098	23,310	6,708	2,080
20 Food and kindred products	14,993	9,311	4,322	1,360
22 Textile mill products	2,285	2,135	150	-
23 Apparel and similar products	2,731	2,613	D	D
24 Lumber and wood products	31,746	7,676	10,550	13,520
25 Furniture and fixtures	1,971	1,858	D	D
26 Paper and allied products	5,423	3,813	1,308	302
27 Printing, publish. & allied	4,347	3,214	757	376
28 Chemicals & allied products	1,497	1,419	D	D
29 Petroleum & related products	313	D	-	D
30 Rubber-misc. plastics	334	D	-	D
31 Leather, leather products	175	D	D	-
32 Stone, clay, glass	2,029	1,485	422	122
33 Primary metals	4,786	3,969	D	D
34 Fabricated metals	4,887	4,434	259	194
35 Machinery, except electric	4,881	4,031	662	188
36 Electric machinery	4,389	4,182	175	32
37 Transportation equipment	3,210	3,001	154	55
38 Professional-scientific instr.	1,096	D	D	-
39 Misc. manufacturing	928	840	47	41
E Transporation & utilities	33,060	26,600	3,280	3,180
40 Railroads	9,147	7,000	670	1,477
Transportation except railroads	13,223	11,480	1,000	743
All transportation	22,370	18,480	1,670	2,220
48-49 Commun., elec., gas, sanitary	10,690	8,120	1,610	960
F Trade	82,900	62,000	12,230	8,670
Wholesale	21,550	18,390	1,500	1,660
Retail	61,350	43,610	10,730	7,010
G Finance, insurance, real estate	18,640	14,100	2,990	1,550
H Services - misc.	46,543	34,548	7,164	4,831
I Total government	64,390	35,900	20,840	7,650
Federal	12,819	10,343	1,496	980
State-local	51,571	25,557	19,344	6,670

Source: State of Oregon, Dept. of Labor, Research and Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-4

Employment by industry, 1961

Willamette Basin Study Area & Subareas

(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	456,798	296,868	99,970	59,960
A Agriculture	32,480	13,500	15,430	3,550
Self-employed, non-agr., domestics	65,160	41,400	13,780	9,980
B Mining	619	235	146	238
C Construction	17,856	11,926	3,000	2,930
D Manufacturing	90,992	54,942	19,670	16,380
Durable	59,155	32,089	12,836	14,230
Non-durable	31,837	22,853	6,834	2,150
20 Food and kindred products	15,132	9,314	4,438	1,380
22 Textile mill products	1,881	1,715	166	-
23 Apparel and similar products	2,565	2,458	D	D
24 Lumber and wood products	30,548	7,128	9,930	13,490
25 Furniture and fixtures	1,895	1,743	D	D
26 Paper and allied products	5,386	3,787	1,297	302
27 Printing, publish. & allied	4,471	3,314	765	392
28 Chemicals & allied products	1,564	1,463	D	D
29 Petroleum & related products	330	D	-	D
30 Rubber-misc. plastics	346	325	D	D
31 Leather, leather products	162	149	D	D
32 Stone, clay, glass	1,876	1,278	435	163
33 Primary metals	4,670	3,801	D	D
34 Fabricated metals	4,600	4,089	292	219
35 Machinery, except electric	4,634	3,798	650	186
36 Electric machinery	5,469	5,157	280	32
37 Transportation equipment	3,395	3,129	226	40
38 Professional-scientific instr.	1,115	D	D	-
39 Misc. manufacturing	953	852	65	36
E Transportation & utilities	30,680	24,200	3,240	3,240
40 Railroads	6,714	4,749	500	1,465
Transportation except railroads	13,104	11,319	1,040	745
All transportation	19,818	16,068	1,540	2,210
48-49 Commun., elec., gas, sanitary	10,862	8,132	1,700	1,030
F Trade	84,080	63,000	12,260	8,820
Wholesale	25,440	22,000	1,700	1,740
Retail	58,640	41,000	10,560	7,080
G Finance, insurance, real estate	19,260	14,500	3,140	1,620
H Services - Misc.	48,691	36,265	7,444	4,982
I Total government	66,980	36,900	21,860	8,220
Federal	13,663	11,000	1,603	1,060
State-local	53,317	25,900	20,257	7,160

Source: State of Oregon, Dept. of Labor, Research & Statistics Division

Note: Totals may not add due to rounding

D: Disclosure rule, not available for publication

Table D-5
Employment by industry, 1962
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	470,594	305,774	102,190	62,630
A Agriculture	31,440	13,000	14,800	3,640
Self-employed, non-agr., domestics	65,700	42,700	13,720	9,280
B Mining	710	227	194	289
C Construction	19,420	12,810	3,300	3,310
D Manufacturing	94,128	56,868	19,950	17,310
Durable	61,771	33,849	12,882	15,040
Non-durable	32,357	23,019	7,068	2,270
20 Food and kidred products	15,170	9,103	4,587	1,480
22 Textile mill products	2,224	1,998	226	-
23 Apparel and similar products	2,840	2,741	D	D
24 Lumber and wood products	31,756	7,276	10,220	14,260
25 Furniture and fixtures	1,990	1,869	D	D
26 Paper and allied products	5,374	3,790	1,281	303
27 Printing, publish. & allied	4,361	3,178	786	397
28 Chemicals & allied products	1,520	1,396	D	D
29 Petroleum & related products	344	328	D	D
30 Rubber-misc. plastics	357	336	D	D
31 Leather, leather products	167	D	D	-
32 Stone, clay, glass	2,040	1,451	378	211
33 Primary metals	4,525	3,785	D	D
34 Fabricated metals	4,518	4,063	259	196
35 Machinery, except electric	4,985	4,077	699	209
36 Electric machinery	6,109	5,791	285	33
37 Transportation equipment	3,629	3,437	D	D
38 Professional-scientific instr.	1,210	D	D	-
39 Misc. manufacturing	1,009	891	83	35
E Transportation & utilities	30,700	24,100	3,310	3,290
40 Railroads	6,532	4,465	597	1,470
Transportation except railroads	13,329	11,435	1,064	830
All transportation	19,861	15,900	1,661	2,300
48-49 Commun., elec. gas, sanitary	10,839	8,200	1,649	990
F Trade	87,026	64,596	12,960	9,470
Wholesale	25,907	22,580	1,597	1,730
Retail	61,119	42,016	11,363	7,740
G Finance, insurance, real estate	20,150	15,000	3,410	1,740
H Services-misc.	51,620	38,473	7,796	5,351
I Total government	69,700	38,000	22,750	8,950
Federal	13,421	10,704	1,647	1,070
State-local	56,279	27,296	21,103	7,880

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-6

Employment by industry, 1963
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	486,385	315,755	106,130	64,500
A Agriculture	30,130	11,600	14,900	3,630
Self-employed, non-agr., domestics	67,340	44,300	13,770	9,270
B Mining	687	267	208	212
C Construction	21,109	13,429	4,190	3,490
D Manufacturing	95,315	57,925	20,330	17,060
Durable	63,120	35,030	13,230	14,860
Non-durable	32,195	22,895	7,100	2,200
20 Food and kindred products	14,906	8,843	4,673	1,390
22 Textile mill products	2,165	1,937	228	-
23 Apparel and similar products	2,811	2,707	94	10
24 Lumber and wood products	31,781	7,391	10,490	13,900
25 Furniture and fixtures	2,032	1,924	D	D
26 Paper and allied products	5,360	3,837	1,199	324
27 Printing, publish. & allied	4,339	3,175	790	374
28 Chemicals & allied products	1,556	1,393	68	95
29 Petroleum & related products	401	375	D	D
30 Rubber-misc. plastics	497	490	D	D
31 Leather, leather products	160	D	D	-
32 Stone, clay, glass	2,189	1,528	422	239
33 Primary metals	4,430	3,701	D	D
34 Fabricated metals	5,035	4,474	282	279
35 Machinery, except electric	5,284	4,260	745	279
36 Electric machinery	5,935	5,629	272	34
37 Transportation equipment	4,051	3,869	D	D
38 Professional-scientific instr.	1,184	D	D	-
39 Misc. manufacturing	1,199	1,072	89	38
E Transportation & utilities	31,820	25,200	3,280	3,340
40 Railroads	7,602	5,632	528	1,442
Transportation except railroads	13,201	11,226	1,077	898
All transportation	20,803	16,858	1,605	2,340
48-49 Commun., elec., gas, sanitary	11,017	8,342	1,675	1,000
F Trade	90,471	66,701	13,760	10,010
Wholesale	26,533	23,013	1,710	1,810
Retail	63,938	43,688	12,050	8,200
G Finance, insurance, real estate	21,720	16,000	3,700	2,020
H Services - misc.	55,853	41,433	8,732	5,688
I Total government	71,940	38,900	23,260	9,780
Federal	13,713	10,780	1,793	1,140
State-local	58,227	28,120	21,467	8,640

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-7

Employment by industry, 1964
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	503,267	327,027	107,430	68,810
A Agriculture	27,300	10,900	12,700	3,700
Self-employed, non-agr., domestics	69,460	45,800	14,080	9,580
B Mining	731	238	202	291
C Construction	21,483	13,533	4,490	3,460
D Manufacturing	98,941	59,501	20,850	18,590
Durable	67,029	36,992	13,857	16,180
Non-durable	31,912	22,509	6,993	2,410
20 Food and kindred products	14,422	8,477	4,485	1,460
22 Textile mill products	2,149	1,948	201	-
23 Apparel and similar products	2,952	2,853	D	D
24 Lumber and wood products	33,667	7,547	11,040	15,080
25 Furniture and fixtures	2,166	2,077	D	D
26 Paper and allied products	5,237	3,705	1,230	302
27 Printing, publish. & allied	4,562	3,212	864	486
28 Chemicals & allied products	1,633	1,430	70	133
29 Petroleum & related products	368	329	D	D
30 Rubber-misc. plastics	441	424	D	D
31 Leather, leather products	148	D	D	-
32 Stone, clay, glass	2,200	1,486	438	276
33 Primary metals	4,779	4,036	D	D
34 Fabricated metals	5,526	4,914	288	324
35 Machinery, except electric	5,631	4,480	813	338
36 Electric machinery	5,857	5,555	272	30
37 Transportation equipment	5,065	4,882	D	D
38 Professional-scientific instr.	957	D	D	D
39 Misc. manufacturing	1,181	1,060	84	37
E Transportation & utilities	33,020	26,100	3,430	3,490
40 Railroads	7,931	5,919	508	1,504
Transportation except railroads	13,651	11,624	1,131	896
All transportation	21,582	17,543	1,639	2,400
48-49 Commun., elec., gas, sanitary	11,438	8,557	1,791	1,090
F Trade	95,433	69,793	14,750	10,890
Wholesale	28,405	24,565	1,800	2,040
Retail	67,028	45,228	12,950	8,850
G Finance, insurance, real estate	22,640	16,300	4,120	2,220
H Services - misc.	57,539	42,062	9,368	6,109
I Total government	76,720	42,800	23,440	10,480
Federal	13,862	10,878	1,854	1,130
State-local	62,858	31,922	21,586	9,350

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-8
Employment by industry, 1965
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	530,430	343,530	112,450	74,450
A Agriculture	27,250	10,100	13,050	4,100
Self-employed, non-agr., domestic	70,750	46,300	14,450	10,000
B Mining	890	270	200	420
C Construction	23,450	14,100	5,200	4,150
D Manufacturing	104,470	63,330	21,740	19,400
Durable	71,490	40,300	14,290	16,900
Non-durable	32,980	23,030	7,450	2,500
20 Food and kindred products	14,760	8,540	4,770	1,450
22 Textile mill products	2,355	2,115	240	-
23 Apparel	3,020	2,920	D	D
24 Lumber and wood products	34,550	7,780	11,120	15,650
25 Furniture and fixtures	2,410	2,280	D	D
26 Paper and allied products	5,370	3,760	1,250	360
27 Printing and publishing	4,630	3,185	955	490
28 Chemicals and allied products	1,833	1,585	85	163
29 Petroleum refining & related ind.	378	340	D	D
30 Rubber-misc. plastics products	486	460	D	D
31 Leather and leather products	148	125	23	-
32 Stone, clay & glass products	2,230	1,500	480	250
33 Primary metal industries	5,220	4,390	D	D
34 Fabricated metal products	6,190	5,500	275	415
35 Machinery, except electrical	6,365	5,090	905	370
36 Electrical equipment & supplies	6,350	5,945	370	35
37 Transportation equipment	5,630	5,405	D	D
38 Professional-scientific instr.	1,289	1,280	D	D
39 Miscellaneous manufacturing ind.	1,256	1,130	91	35
E Transportation and utilities	34,440	27,100	3,590	3,750
All transportation	22,600	18,300	1,700	2,600
40 Railroads	8,000	5,900	450	1,650
Transportation except railroads	14,600	12,400	1,250	950
48-49 Commun. & public utilities	11,840	8,800	1,890	1,150
F Trade	101,300	73,800	15,550	11,950
Wholesale	30,470	26,400	1,920	2,150
Retail	70,830	47,400	13,630	9,800
G Finance, insurance & real estate	24,030	17,600	4,130	2,300
H Services & miscellaneous	61,470	44,730	10,010	6,730
I Total government	82,380	46,200	24,530	11,650
Federal	14,040	10,900	1,940	1,200
State and local	68,340	35,300	22,590	10,450

Source: State of Oregon, Dept. of Labor, Research & Statistics Div.
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-9
Employment by industry, 1966
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	557,595	362,435	118,510	76,650
A Agriculture	27,860	10,000	13,660	4,200
Self-employed, non-agr., domestic	70,340	45,900	14,680	10,150
B Mining	910	305	205	400
C Construction	22,770	14,350	5,020	3,400
D Manufacturing	113,230	71,350	22,630	19,250
Durable	78,700	47,785	14,465	16,450
Non-durable	34,530	23,565	8,165	2,800
20 Food and kindred products	15,785	8,885	5,350	1,550
22 Textile mill products	2,135	1,895	240	-
23 Apparel	2,945	2,830	D	D
24 Lumber and wood products	34,055	8,165	10,890	15,000
25 Furniture and fixtures	2,765	2,620	130	15
26 Paper and allied products	5,640	3,870	1,280	490
27 Printing and publishing	4,870	3,330	1,005	535
28 Chemicals and allied products	2,055	1,750	125	180
29 Petroleum refining & related ind.	375	340	D	D
30 Rubber-misc. plastics products	560	530	D	D
31 Leather and leather products	165	135	30	-
32 Stone, clay & glass products	2,390	1,670	470	250
33 Primary metal industries	5,930	4,855	985	90
34 Fabricated metal products	6,785	6,085	255	445
35 Machinery, except electrical	7,440	5,935	1,020	485
36 Electrical equipment & supplies	8,540	8,040	445	55
37 Transportation equipment	7,765	7,495	D	D
38 Professional-scientific instr.	1,730	1,720	D	D
39 Miscellaneous manufacturing ind.	1,300	1,200	D	D
E Transportation and utilities	35,505	27,865	3,740	3,900
All transportation	23,395	18,890	1,805	2,700
40 Railroads	8,000	5,900	450	1,650
Transportation except railroads	15,395	12,990	1,355	1,050
48-49 Commun. & public utilities	12,110	8,975	1,935	1,200
F Trade	107,375	78,665	16,310	12,400
Wholesale	32,235	27,865	2,070	2,300
Retail	75,140	50,800	14,240	10,100
G Finance, insurance & real estate	25,310	18,700	4,210	2,400
H Services & miscellaneous	65,695	47,400	10,795	7,500
I Total government	88,210	47,900	27,260	13,050
Federal	14,620	11,200	2,170	1,250
State and local	73,590	36,700	25,090	11,800

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication

Table D-10
*Employment by industry, 1967**
Willamette Basin Study Area & Subareas
(annual averages of number of persons employed)

	Total	Subareas		
		Lower	Middle	Upper
Total Employment	566,635	367,910	122,475	76,250
A Agriculture	29,150	9,900	15,300	3,950
Self-employed, non-agr., domestic	69,900	44,600	15,250	10,050
B Mining	890	290	220	380
C Construction	21,780	14,430	4,300	3,050
D Manufacturing	111,630	71,090	22,140	18,400
Durable	76,465	47,110	13,745	15,610
Non-durable	35,165	23,980	8,395	2,790
20 Food and kindred products	16,130	8,940	5,660	1,530
22 Textile mill products	2,135	1,920	215	-
23 Apparel	2,910	2,810	D	D
24 Lumber and wood products	31,735	7,730	9,845	14,160
25 Furniture and fixtures	2,480	2,320	140	20
26 Paper and allied products	5,660	3,950	1,240	470
27 Printing and publishing	5,070	3,530	990	550
28 Chemicals and allied products	2,040	1,735	125	180
29 Petroleum refining & related ind.	400	355	D	D
30 Rubber-misc. plastics products	680	630	D	D
31 Leather and leather products	140	110	30	-
32 Stone, clay & glass products	2,360	1,610	470	280
33 Primary metal industries	6,105	4,825	1,190	90
34 Fabricated metal products	7,125	6,340	305	480
35 Machinery, except electrical	7,410	5,970	1,000	440
36 Electrical equipment & supplies	8,865	8,350	465	50
37 Transportation equipment	7,235	6,945	D	D
38 Professional-scientific instr.	1,705	1,680	D	D
39 Miscellaneous manufacturing ind.	1,445	1,340	D	D
E Transportation and utilities	35,825	28,200	3,725	3,900
All transportation	23,525	19,060	1,765	2,700
40 Railroads	7,815	5,660	485	1,670
Transportation except railroads	15,710	13,400	1,280	1,030
48-49 Commun. & public utilities	12,300	9,140	1,960	1,200
F Trade	109,690	80,700	16,990	12,000
Wholesale	33,170	28,700	2,220	2,250
Retail	76,520	52,000	14,770	9,750
G Finance, insurance & real estate	26,650	19,700	4,300	2,650
H Services & miscellaneous	68,720	49,400	11,550	7,770
I Total government	92,400	49,600	28,700	14,100
Federal	15,400	11,700	2,400	1,300
State and local	77,000	37,900	26,300	12,800

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, not available for publication
* *Preliminary*

Table D-11
Employment by industry, OREGON STATE
(annual averages in thousands of persons)

	1947	1948	1949	1950
Total Employment	584.4	599.4	591.2	607.5
A Agriculture	85.7	83.3	85.5	81.0
Self-employed, non-agr., domestics	79.1	83.0	86.9	88.9
B Mining	1.2	1.4	1.4	1.3
C Construction	24.6	25.5	23.2	26.3
D Manufacturing	134.9	139.7	127.7	138.0
Durable	96.7	101.9	90.3	100.2
Non-durable	38.2	37.8	37.4	37.8
20 Food and kindred products	21.1	20.1	20.1	20.0
22 Textile mill products	3.2	3.1	2.8	2.5
23 Apparel and similar products	2.4	2.3	2.3	2.4
24 Lumber and wood products	73.9	80.3	71.7	80.0
25 Furniture and fixtures	3.6	3.8	3.1	3.2
26 Paper and allied products	4.8	5.1	5.2	5.5
27 Printing, publish. & allied	4.7	5.0	5.1	5.2
28 Chemicals & allied products	1.3	1.3	1.1	1.3
29 Petroleum & related products	0.2	0.3	0.4	0.4
30 Rubber-misc. plastics	0.1	0.1	0.1	0.1
31 Leather, leather products	0.4	0.4	0.3	0.4
32 Stone, clay, glass	1.8	1.9	1.9	1.9
33 Primary metals	3.1	3.1	2.8	3.2
34 Fabricated metals	3.1	3.4	3.2	3.7
35 Machinery, except electric	4.5	4.6	3.6	4.0
36 Electric machinery	0.5	0.5	0.4	0.6
37 Transportation Equipment	4.0	2.1	1.5	1.6
38 Professional-scientific instr.	0.7	0.7	0.7	0.8
39 Misc. manufacturing	1.4	1.4	1.3	1.2
E Transportation & utilities	46.3	47.2	46.2	47.1
40 Railroads	16.2	15.7	14.8	15.5
Transportation except railroads	17.2	16.9	16.8	17.2
48-49 Commun., elec., gas, sanitary	12.9	14.6	14.6	14.4
F Trade	95.4	98.4	96.7	98.1
Wholesale	23.3	25.1	24.9	24.6
Retail	72.1	73.3	71.8	73.5
G Finance, insurance, real estate	13.6	14.3	14.3	15.2
H Services - misc.	47.3	47.5	46.7	47.8
I Total government	56.3	59.1	62.6	63.8
Federal	16.7	15.8	16.3	16.7
State-local	39.6	43.3	46.3	47.1

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-12

Employment in industry, OREGON STATE
(annual averages in thousands of persons)

	1951	1952	1953	1954
Total Employment	629.1	631.1	631.5	623.7
A Agriculture	80.8	80.0	80.5	83.8
Self-employed, non-agr., domestics	86.8	83.2	82.5	83.7
B Mining	1.2	1.3	1.2	1.2
C Construction	27.4	25.1	24.0	22.6
D Manufacturing	150.4	148.3	146.4	138.5
Durable	110.5	109.3	106.3	99.7
Non-durable	39.9	39.0	40.1	38.8
20 Food and kindred products	21.4	20.3	20.8	19.9
22 Textile mill products	2.5	2.6	2.8	2.8
23 Apparel and similar products	2.4	2.5	2.5	2.4
24 Lumber and wood products	86.4	84.5	81.5	76.1
25 Furniture and fixtures	3.3	3.3	2.4	2.1
26 Paper and allied products	6.0	6.1	6.4	6.5
27 Printing, publish., & allied	5.2	5.2	5.1	5.0
28 Chemicals & allied products	1.5	1.5	1.6	1.4
29 Petroleum & related products	0.4	0.4	0.4	0.4
30 Rubber-misc. plastics	0.1	0.1	0.2	0.2
31 Leather, leather products	0.4	0.3	0.3	0.3
32 Stone, clay, glass	2.0	1.9	1.9	1.9
33 Primary metals	3.7	3.4	3.3	3.4
34 Fabricated metals	4.2	4.2	4.4	4.9
35 Machinery, except electric	5.2	5.0	5.1	4.4
36 Electric machinery	0.9	1.1	1.1	1.2
37 Transportation equipment	2.7	3.5	3.9	3.0
38 Professional-scientific instr.	0.7	0.9	1.1	1.1
39 Misc. manufacturing	1.4	1.5	1.6	1.6
E Transportation & utilities	49.2	49.5	49.1	46.8
40 Railroads	16.0	15.7	16.0	15.1
Transportation except railroads	18.2	18.8	17.8	17.1
48-49 Commun., elec., gas, sanitary	15.0	15.0	15.3	14.6
F Trade	102.1	104.5	106.7	104.1
Wholesale	26.7	26.9	27.7	27.5
Retail	75.4	77.6	79.0	76.6
G Finance, insurance, real estate	15.9	17.0	17.8	17.8
H Services - misc.	50.2	53.2	53.9	53.3
I Total government	65.2	69.0	69.4	71.9
Federal	17.4	18.5	17.6	17.1
State-local	47.8	50.5	51.8	54.8

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-13

Employment by industry, OREGON STATE
(annual averages in thousands of persons)

	1955	1956	1957	1958
Total Employment	644.9	662.0	646.5	644.3
A Agriculture	81.7	79.3	78.7	76.7
Self-employed,non-agr.,domestics	87.8	90.7	88.1	92.6
B Mining	1.2	1.2	1.3	1.2
C Construction	22.6	24.8	23.1	23.9
D Manufacturing	146.2	148.0	138.8	136.6
Durable	107.2	107.3	98.8	96.5
Non-durable	39.0	40.7	40.0	40.1
20 Food and kindred products	20.1	21.0	20.4	20.8
22 Textile mill products	2.8	2.6	2.5	2.3
23 Apparel and similar products	2.4	2.6	2.7	2.5
24 Lumber and wood products	82.2	79.0	71.3	69.8
25 Furniture and fixtures	2.1	2.2	2.1	2.0
26 Paper and allied products	6.6	7.1	7.1	7.0
27 Printing,publish. & allied	5.1	5.2	5.3	5.3
28 Chemicals & allied products	1.2	1.3	1.3	1.3
29 Petroleum & related products	0.4	0.4	0.3	0.3
30 Rubber-misc. plactics	0.2	0.2	0.2	0.3
31 Leather, leather products	0.2	0.3	0.2	0.2
32 Stone, clay, glass	2.0	2.2	2.5	2.5
33 Primary metals	4.1	4.7	5.0	5.4
34 Fabricated metals	4.7	5.3	5.2	4.7
35 Machinery, except electric	5.0	5.3	4.8	4.6
36 Electric machinery	1.4	1.8	2.3	2.5
37 Transportation equipment	3.1	4.2	3.2	3.0
38 Professional-scientific instr.	1.0	1.2	1.1	1.0
39 Misc. manufacturing	1.5	1.4	1.3	1.0
E Transportation & utilities	48.1	49.8	48.7	45.2
40 Railroads	15.4	15.7	14.6	12.9
Transportation except railroads	18.0	18.2	18.0	17.1
48-49 Commun.,elec.,gas,sanitary	14.7	15.9	16.1	15.2
F Trade	107.9	110.9	106.5	103.7
Wholesale	29.0	30.1	29.7	28.8
Retail	78.9	80.8	76.8	74.9
G Finance,insurance,real estate	18.2	19.1	19.1	19.5
H Services - misc.	56.3	58.5	57.8	56.9
I Total government	74.9	79.7	84.4	88.0
Federal	17.9	18.8	19.6	20.3
State-local	57.0	60.9	64.8	67.7

Source: State of Oregon, Dept. of Labor, Research & Statistics Division
Note: Totals may not add due to rounding
D: Disclosure rule, cannot disclose total

Table D-14

Employment by industry, OREGON STATE
(annual averages in thousands of persons)

	1959	1960	1961	1962
Total Employment	672.2	682.3	679.3	695.0
A Agriculture	78.3	76.2	71.4	69.3
Self-employed, non-agr., domestics	95.7	96.9	98.8	97.7
B Mining	1.3	1.2	1.2	1.3
C Construction	25.6	26.1	24.5	26.1
D Manufacturing	146.7	144.4	139.1	143.4
Durable	104.7	103.0	98.5	102.2
Non-durable	42.0	41.4	40.6	41.2
20 Food and kindred products	21.4	21.1	20.8	20.9
22 Textile mill products	2.5	2.5	2.0	2.3
23 Apparel and similar products	2.7	2.7	2.6	2.8
24 Lumber and wood products	74.7	71.9	67.1	68.9
25 Furniture and fixtures	2.2	2.3	2.4	2.5
26 Paper and allied products	7.6	7.3	7.3	7.3
27 Printing, publish. & allied	5.4	5.3	5.4	5.3
28 Chemicals & allied products	1.5	1.5	1.6	1.6
29 Petroleum & related products	0.3	0.3	0.3	0.4
30 Rubber-misc. plastics	0.3	0.4	0.4	0.4
31 Leather, leather products	0.2	0.2	0.2	0.2
32 Stone, clay, glass	2.6	2.7	2.7	2.8
33 Primary metals	5.7	5.7	5.5	5.4
34 Fabricated metals	5.0	5.0	4.7	4.7
35 Machinery, except electric	5.2	5.2	4.9	5.3
36 Electric machinery	3.8	4.5	5.4	6.3
37 Transportation equipment	3.3	3.5	3.5	3.9
38 Professional-scientific instr.	1.1	1.1	1.1	1.1
39 Misc. manufacturing	1.1	1.1	1.2	1.3
E Transportation & utilities	44.6	44.4	43.2	43.5
40 Railroads	12.4	11.5	10.9	10.8
Transportation except railroads	17.4	18.0	17.3	17.5
48-49 Commun., elec., gas, sanitary	14.8	14.9	15.0	15.2
F Trade	109.6	113.6	112.8	117.1
Wholesale	30.5	31.2	30.6	31.2
Retail	79.1	82.4	82.2	85.9
G Finance, insurance, real estate	19.7	20.7	21.5	22.8
H Services - misc.	59.2	63.5	66.6	70.5
I Total government	91.5	95.3	100.2	103.3
Federal	21.0	21.7	22.3	22.7
State-local	70.5	73.6	77.9	80.6

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-15

Employment by industry, OREGON STATE
(annual averages in thousands of persons)

	1963	1964	1965	1966	1967*
Total Employment	712.7	730.0	775.8	807.3	817.3
A Agriculture	65.6	62.7	61.6	60.6	60.2
Self-employed, non-agr., domestics	98.4	99.8	106.8	107.4	106.0
B Mining	1.4	1.6	1.7	1.7	1.7
C Construction	29.2	31.1	33.4	33.0	30.3
D Manufacturing	145.1	149.5	158.2	167.2	164.2
Durable	104.0	108.7	115.4	122.2	118.0
Non-durable	41.1	40.8	42.8	45.0	46.2
20 Food and kindred products	20.7	20.3	20.9	22.3	23.0
22 Textile mill products	2.3	2.2	2.5	2.3	2.3
23 Apparel	2.9	2.9	3.1	3.0	2.9
24 Lumber and wood products	69.2	72.2	74.2	73.0	69.1
25 Furniture and fixtures	2.6	2.5	3.0	3.4	3.1
26 Paper and allied products	7.2	7.2	7.5	8.1	8.4
27 Printing and publishing	5.3	5.5	5.7	6.0	6.1
28 Chemicals and allied products	1.6	1.7	2.0	2.2	2.2
29 Petroleum refining & related ind.	0.4	0.4	0.4	0.4	0.4
30 Rubber-misc. plastics	0.5	0.5	0.5	0.6	0.7
31 Leather, leather products	0.2	0.2	0.2	0.2	0.2
32 Stone, caly, glass	3.1	3.0	3.2	3.3	3.2
33 Primary metals	5.3	5.7	6.1	6.8	7.1
34 Fabricated metals	5.2	5.7	6.4	7.1	7.3
35 Machinery, except electric	5.7	6.1	7.1	8.1	7.9
36 Electrical equip. & supplies	6.3	6.0	6.5	8.8	9.2
37 Transportation equipment	4.3	5.1	6.0	8.3	7.6
38 Professional-scientific instr.	0.9	0.9	1.3	1.8	1.7
39 Misc. manufacturing	1.4	1.5	1.6	1.6	1.8
E Transportation and utilities	43.5	44.1	46.4	47.5	47.8
40 Railroads	10.6	10.5	10.8	10.8	10.6
Transportation except railroads	17.9	17.9	19.3	20.0	20.2
48-49 Commun., elec., gas, sanitary	15.2	15.7	16.3	16.7	17.0
F Trade	122.3	125.5	136.5	143.7	147.0
Wholesale	32.4	33.6	36.7	38.7	39.3
Retail	89.9	91.9	99.8	105.0	107.7
G Finance, insurance and real estate	24.2	25.6	28.2	29.8	31.5
H Services - misc.	75.1	79.1	84.8	91.1	96.9
I Total government	107.9	111.0	118.2	125.3	131.7
Federal	23.3	22.9	24.0	24.6	25.2
State-local	84.6	88.1	94.2	100.7	106.5

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding
** preliminary*

Table D-16
Employment by industry, PACIFIC NORTHWEST
(annual averages in thousands of persons)

	1947	1948	1949	1950
Total Employment	1620.2	1761.0	1744.2	1776.9
A Agriculture	261.0	257.6	259.2	254.3
Self-employed, non-agr. domestics	215.9	227.3	233.9	240.1
B Mining	15.8	16.6	16.7	17.7
C Construction	71.8	85.7	77.3	82.8
D Manufacturing	343.0	349.7	331.1	348.0
Durable	228.7	235.0	218.8	234.2
Non-durable	114.3	114.7	112.3	113.8
20 Food and kindred products	63.9	59.7	58.9	58.7
22 Textile mill products	3.9	3.9	3.3	3.1
23 Apparel and similar products	5.3	5.2	5.2	5.5
24 Lumber and wood products	147.6	155.3	139.2	154.8
25 Furniture and fixtures	8.2	8.1	6.7	7.1
26 Paper and allied products	18.0	18.9	18.6	19.6
27 Printing, publish. & allied	13.3	13.8	14.1	14.0
28 Chemicals & allied products	10.2	12.9	11.9	12.2
29 Petroleum & related products	0.6	0.7	0.7	0.7
30 Rubber-misc. plastics	0.2	0.2	0.2	0.2
31 Leather, leather products	0.9	0.9	0.7	0.8
32 Stone, clay, glass	7.9	8.0	7.5	7.9
33 Primary metals	15.3	16.0	14.4	16.0
34 Fabricated metals	8.2	8.1	7.7	9.1
35 Machinery, except electric	5.8	10.8	8.6	9.5
36 Electric machinery	1.5	1.0	1.0	1.1
37 Transportation equipment	26.7	24.7	30.5	25.6
38 Professional-scientific instr.	1.0	1.0	1.0	1.2
39 Misc. manufacturing	3.0	2.9	3.0	3.1
E Transportation & utilities	138.3	137.4	132.8	135.7
40 Railroads	48.8	47.6	45.8	47.3
Transportation except railroads	53.6	51.5	48.9	51.0
48-49 Commun., elec,, gas, sanitary	35.9	38.3	38.1	37.4
F Trade	288.9	293.6	288.7	292.3
Wholesale	76.1	78.5	77.0	77.5
Retail	212.8	215.1	211.7	214.8
C Finance, insurance, real estate	41.7	43.6	44.2	47.2
H Services - misc.	145.5	147.5	146.2	147.6
I Total government	210.5	213.5	225.5	229.9
Federal	71.8	73.4	76.1	77.1
State-local	138.7	140.1	149.4	152.8

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-17

Employment by industry, PACIFIC NORTHWEST
(annual averages in thousands of persons)

	1951	1952	1953	1954
Total Employment	1855.5	1860.9	1863.8	1844.1
A Agriculture	251.3	242.8	242.9	243.3
Self-employed, non-agr., domestics	239.6	235.9	235.7	239.2
B Mining	17.8	17.9	17.1	15.1
C Construction	90.6	86.0	82.7	82.8
D Manufacturing	381.1	378.0	381.3	368.9
Durable	261.3	259.8	261.3	250.2
Non-durable	119.8	118.2	120.0	118.7
20 Food and kindred products	61.8	58.1	59.3	57.7
22 Textile mill products	3.1	3.1	3.4	3.4
23 Apparel and similar products	5.6	6.0	6.1	6.0
24 Lumber and wood products	165.1	156.8	152.0	140.6
25 Furniture and fixtures	6.9	7.0	6.0	5.4
26 Paper and allied products	21.7	21.5	22.1	22.5
27 Printing, publish. & allied	13.9	13.9	13.9	14.0
28 Chemicals & allied products	13.6	14.6	14.4	14.3
29 Petroleum & related products	0.8	0.8	0.7	0.6
30 Rubber-misc. plastics	0.2	0.2	0.3	0.3
31 Leather, leather products	0.9	0.7	0.7	0.7
32 Stone, clay, glass	8.5	8.2	8.1	7.6
33 Primary metals	18.0	18.1	19.1	18.6
34 Fabricated metals	10.1	10.7	10.7	11.4
35 Machinery, except electric	11.8	11.7	11.6	10.2
36 Electric machinery	1.5	2.4	2.4	2.4
37 Transportation equipment	36.1	41.5	46.4	48.3
38 Professional-scientific instr.	1.0	1.2	1.4	1.5
39 Misc. manufacturing	3.3	3.4	5.4	5.1
E Transportation & utilities	141.3	140.9	140.6	132.9
40 Railroads	49.0	48.3	48.2	44.6
Transportation except railroads	54.1	54.0	53.5	51.1
48-49 Commun., elec., gas, sanitary	38.2	38.6	38.9	37.2
F Trade	304.4	310.4	312.6	308.3
Wholesale	81.8	83.2	84.0	85.3
Retail	222.6	227.2	228.6	223.0
G Finance, insurance, real estate	48.6	50.8	52.9	55.1
H Services - misc.	153.2	159.2	160.0	158.8
I Total government	248.0	258.6	255.8	258.2
Federal	93.4	98.1	92.0	86.3
State-local	154.6	160.5	163.8	171.9

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-18

Employment by industry, PACIFIC NORTHWEST
(annual averages in thousands of persons)

	1955	1956	1957	1958
Total Employment	1902.3	1945.0	1950.2	1933.1
A Agriculture	239.4	231.9	234.5	230.9
Self-employed, non-agr., domestics	246.6	254.3	250.7	254.6
B Mining	16.1	16.9	15.5	12.3
C Construction	81.2	83.1	81.1	81.1
D Manufacturing	393.8	401.8	403.1	393.8
Durable	269.5	276.0	277.3	269.4
Non-durable	122.5	125.3	125.8	124.4
20 Food and kindred products	57.7	58.2	56.8	57.3
22 Textile mill products	3.4	3.3	3.2	2.9
23 Apparel and similar products	6.2	6.4	6.4	6.1
24 Lumber and wood products	154.1	149.9	133.9	128.9
25 Furniture and fixtures	5.7	6.2	5.9	5.5
26 Paper and allied products	24.1	25.1	25.1	24.7
27 Printing, publish. & allied	14.5	14.9	15.3	15.2
28 Chemicals & allied products	14.7	15.0	16.4	15.3
29 Petroleum & related products	1.1	1.4	1.5	1.7
30 Rubber-misc. plastics	0.3	0.3	0.3	0.6
31 Leather, leather products	0.8	0.9	0.7	0.5
32 Stone, clay, glass	7.9	7.9	8.0	7.5
33 Primary metals	21.2	23.5	23.2	19.4
34 Fabricated metals	11.4	12.1	12.1	11.6
35 Machinery, except electric	11.0	11.6	12.6	9.9
36 Electric machinery	2.6	3.2	3.8	4.5
37 Transportation equipment	50.2	56.4	73.5	77.1
38 Professional-scientific instr.	1.4	1.5	1.4	1.3
39 Misc. manufacturing	5.1	5.3	2.5	3.5
E Transportation & utililities	135.0	138.3	136.8	127.6
40 Railroads	44.7	44.5	42.2	37.5
Transportation except railroads	52.1	52.9	53.0	49.3
48-49 Commun., elec., gas, sanitary	38.2	40.9	41.6	40.8
F Trade	321.3	329.6	327.6	321.3
Wholesale	89.0	92.3	93.3	91.1
Retail	232.3	238.3	234.3	230.2
G Finance, insurance, real estate	58.4	60.0	60.6	61.7
H Services - misc.	165.3	172.6	175.2	175.3
I Total government	264.6	273.4	282.4	289.5
Federal	86.1	87.3	87.0	85.2
State-local	178.5	186.1	195.4	204.3

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-19
Employment by industry, PACIFIC NORTHWEST
(annual averages in thousands of persons)

	1959	1960	1961	1962
Total Employment	1996.4	2010.4	2014.5	2072.3
A Agriculture	230.7	225.3	216.0	208.3
Self-employed, non-agr., domestics	260.3	263.8	266.5	267.8
B Mining	11.3	10.1	10.6	10.8
C Construction	83.8	82.6	82.4	84.5
D Manufacturing	413.0	401.5	398.2	418.7
Durable	285.0	272.5	269.2	287.7
Non-durable	128.0	129.0	129.0	131.0
20 Food and kindred products	58.2	58.8	59.1	59.8
22 Textile mill products	3.2	3.2	2.6	2.9
23 Apparel and similar products	6.5	6.5	6.4	6.8
24 Lumber and wood products	140.4	134.2	126.2	129.8
25 Furniture and fixtures	5.4	5.3	5.4	5.4
26 Paper and allied products	25.9	26.1	26.0	26.6
27 Printing, publish. & allied	15.5	15.8	15.9	15.9
28 Chemicals and allied products	15.7	15.6	16.0	15.9
29 Petroleum & related products	1.8	1.7	1.7	1.7
30 Rubber-misc. plastics	0.6	0.8	0.8	0.9
31 Leather, leather products	0.5	0.5	0.5	0.5
32 Stone, clay, glass	8.5	8.4	8.3	8.7
33 Primary metals	18.7	18.6	17.8	17.7
34 Fabricated metals	11.8	12.3	11.7	11.8
35 Machinery, except electric	10.9	11.5	11.0	12.0
36 Electric machinery	6.2	7.2	8.0	8.9
37 Transportation equipment	78.2	69.7	74.3	87.0
38 Professional-scientific instr.	1.4	1.4	1.5	1.4
39 Misc. manufacturing	3.9	4.8	5.1	4.9
E Transportation & utilities	126.3	126.3	123.6	124.2
40 Railroads	36.4	34.5	32.5	32.1
Transportation except railroads	50.6	52.1	51.2	52.0
48-49 Commun., elec., gas, sanitary	39.3	39.7	39.9	40.1
F Trade	334.9	343.0	340.1	353.5
Wholesale	93.8	95.7	94.6	96.1
Retail	241.1	247.3	245.5	257.4
G Finance, insurance, real estate	64.6	66.4	68.0	72.3
H Services - misc.	181.8	190.1	195.6	207.2
I Total government	296.6	304.1	314.4	324.9
Federal	84.7	84.4	86.1	88.3
State-local	211.9	219.7	228.3	236.6

Source: USBLS Employment Statistics for States and Areas
Note: Totals may not add due to rounding

Table D-20

Employment by industry, PACIFIC NORTHWEST
(annual averages in thousands of persons)

	1963	1964	1965	1966
TOTAL EMPLOYMENT	2085.7	2108.7	2208.1	2344.1
A Agriculture	203.9	198.5	190.6	189.1
Self-employed, non-agr., domestics	270.0	274.4	286.5	294.8
B Mining	11.0	11.6	11.7	12.0
C Construction	83.2	83.1	93.7	101.5
D Manufacturing	411.6	412.5	429.9	478.9
Durable	280.2	280.3	299.0	342.2
Non-durable	131.4	132.2	130.9	136.7
20 Food and kindred products	59.1	58.9	59.7	64.2
22 Textile mill products	3.0	2.8	3.2	3.1
23 Apparel and similar products	6.8	7.2	7.7	7.7
24 Lumber and wood products	130.6	137.4	140.9	139.6
25 Furniture and fixtures	5.1	5.3	5.9	6.5
26 Paper and allied products	27.2	27.5	28.4	29.6
27 Printing, publish, & allied	15.9	16.3	16.6	17.7
28 Chemicals & allied products	16.2	16.3	12.1	11.0
29 Petroleum & related products	1.7	1.7	1.6	1.6
30 Rubber-misc plastics	1.0	1.0	1.1	1.3
31 Leather, leather products	0.5	0.5	0.5	0.5
32 Stone, clay, glass	9.4	9.2	9.6	10.1
33 Primary metals	18.6	19.8	20.9	23.2
34 Fabricated metals	11.2	11.8	14.2	15.4
35 Machinery, except electric	13.0	14.2	16.8	19.2
36 Electric machinery	8.7	8.5	9.4	12.9
37 Transportation equipment	79.0	69.1	75.9	109.1
38 Professional-scientific instr.	1.2	1.2	1.7	2.2
39 Misc. manufacturing	3.5	3.6	3.7	4.0
E Transportation & utilities	123.5	123.8	126.1	130.7
40 Railroads	31.5	31.4	31.1	30.0
Transportation except railroads	52.1	52.0	54.1	57.9
48-49 Commun., elec., gas, sanitary	39.9	40.4	40.9	42.8
F Trade	358.8	363.1	388.6	412.3
Wholesale	97.4	98.7	103.5	108.6
Retail	261.4	264.4	285.1	303.7
G Finance, insurance, real estate	74.7	76.9	81.3	85.8
H Services - misc.	213.1	219.9	237.8	254.6
I Total government	335.5	343.3	361.9	384.4
Federal	88.3	87.0	88.0	92.6
State-local	247.2	256.3	273.9	291.8

Source: USBLS Employment Statistics for the United States.
Note: Totals may not add due to rounding.
All figures are annual averages.

Table D-21
Employment by industry, UNITED STATES
(annual averages in thousands of persons)

	1947	1948	1949	1950
Total Employment	57,812	59,117	58,423	59,748
A Agriculture	8,256	7,960	8,017	7,497
Self-employed, non-agr., domestics	5,675			
B Mining	955	994	930	901
C Construction	1,982	2,169	2,165	2,333
D Manufacturing	15,545	15,582	14,441	15,241
Durable	8,385	8,326	7,489	8,094
Non-durable	7,159	7,256	6,953	7,147
20 Food and kindred products	1,799	1,801	1,778	1,790
22 Textile mill products	1,299	1,332	1,187	1,256
23 Apparel and similar products	1,154	1,190	1,173	1,202
24 Lumber and wood products	845	818	741	808
25 Furniture and fixtures	336	346	317	364
26 Paper and allied products	465	473	455	485
27 Printing, publish. & allied	721	740	740	748
28 Chemicals & allied products	649	655	618	640
29 Petroleum & related products	221	228	221	218
30 Rubber-misc. plastics	323	312	283	311
31 Leather, leather products	412	412	389	395
32 Stone, clay, glass	537	549	514	547
33 Primary metals	1,279	1,290	1,134	1,247
34 Fabricated metals	989	979	881	982
35 Machinery, except electric	1,375	1,372	1,182	1,210
36 Electric machinery	1,035	991	862	991
37 Transportation equipment	1,275	1,270	1,210	1,265
38 Professional-scientific instr.	267	262	239	250
39 Misc. manufacturing	421	422	385	400
E Transportation & utilities	4,166	4,189	4,001	4,034
40 Railroads	1,557	1,517	1,367	1,391
Transportation except railroads				
48-49 Commun., elec., gas, sanitary				
F Trade	8,955	9,272	9,264	9,386
Wholesale	2,361	2,489	2,487	2,518
Retail	6,595	6,783	6,778	6,868
G Finance, insurance, real estate	1,754	1,829	1,857	1,919
H Services - misc.	5,050	5,206	5,264	5,382
I Total government	5,474	5,650	5,856	6,026
Federal	1,892	1,863	1,908	1,928
State-local	3,582	3,787	3,948	4,098

Source: USBLS Employment Statistics for the United States
Note: Totals may not add due to rounding

Table D-22
Employment by industry, UNITED STATES
(annual averages in thousands of persons)

	1951	1952	1953	1954
Total Employment	60,784	61,035	61,945	60,890
A Agriculture	7,048	6,792	6,555	6,495
Self-employed, non-agr. domestics				5,373
B Mining	929	898	866	791
C Construction	2,603	2,634	2,623	2,612
D Manufacturing	16,393	16,632	17,549	16,314
Durable	9,089	9,349	10,110	9,219
Non-durable	7,304	7,284	7,438	7,185
20 Food and kindred products	1,823	1,828	1,839	1,818
22 Textile mill products	1,238	1,163	1,155	1,042
23 Apparel and similar products	1,207	1,216	1,248	1,184
24 Lumber and wood products	840	790	771	708
25 Furniture and fixtures	357	357	370	342
26 Paper and allied products	511	504	530	531
27 Printing, publish. & allied	768	780	803	814
28 Chemicals & allied products	707	730	768	753
29 Petroleum & related products	231	235	241	238
30 Rubber-misc. plastics	334	338	361	328
31 Leather, leather products	380	384	389	373
32 Stone, clay, glass	587	564	581	553
33 Primary metals	1,364	1,282	1,383	1,219
34 Fabricated metals	1,078	1,064	1,156	1,070
35 Machinery, except electric	1,457	1,517	1,554	1,417
36 Electric machinery	1,114	1,185	1,333	1,190
37 Transportation equipment	1,575	1,703	1,969	1,754
38 Professional-scientific instr.	294	313	337	321
39 Misc. manufacturing	406	394	421	391
E Transportation & utilities	4,226	4,248	4,290	4,084
40 Railroads	1,449	1,400	1,377	1,215
Transportation except railroads				
48-49 Commun., elec., gas, sanitary				
F Trade	9,742	10,004	10,247	10,235
Wholesale	2,606	2,687	2,727	2,739
Retail	7,136	7,317	7,520	7,496
G Finance, insurance, real estate	1,991	2,069	2,146	2,234
H Services - misc.	5,576	5,730	5,867	6,002
I Total government	6,389	6,609	6,645	6,751
Federal	2,302	2,420	2,305	2,188
State-local	4,087	4,188	4,340	4,563

Source: USBLS Employment Statistics for the United States
Note: Totals may not add due to rounding

Table D-23

Employment by industry, UNITED STATES
(annual averages in thousands of persons)

	1955	1956	1957	1958
Total Employment	62,944	64,708	65,011	63,966
A Agriculture	6,718	6,572	6,222	5,944
Self-employed, non-agr., domestics				6,754
B Mining	792	822	828	751
C Construction	2,802	2,999	2,923	2,778
D Manufacturing	16,882	17,243	17,174	15,945
Durable	9,541	9,834	9,856	8,830
Non-durable	7,340	7,409	7,319	7,116
20 Food and kindred products	1,825	1,842	1,805	1,773
22 Textile mill products	1,050	1,032	981	919
23 Apparel and similar products	1,219	1,223	1,210	1,172
24 Lumber and wood products	740	731	655	615
25 Furniture and fixtures	364	376	374	361
26 Paper and allied products	550	568	571	564
27 Printing, publish. & allied	835	862	870	873
28 Chemicals & allied products	773	797	810	794
29 Petroleum & related products	237	236	232	224
30 Rubber-misc. plastics	363	369	372	344
31 Leather, leather products	386	383	373	359
32 Stone, clay, glass	588	605	595	562
33 Primary metals	1,323	1,355	1,355	1,154
34 Fabricated metals	1,122	1,140	1,167	1,077
35 Machinery, except electric	1,449	1,572	1,586	1,362
36 Electric machinery	1,241	1,323	1,344	1,249
37 Transportation equipment	1,855	1,853	1,909	1,607
38 Professional-scientific instr.	324	338	342	324
39 Misc. manufacturing	396	403	387	373
E Transportation & utilities	4,141	4,244	4,241	3,976
40 Railroads	1,205	1,190	1,121	957
Transportation except railroads				1,548
48-49 Commun., elec., gas, sanitary				1,470
F Trade	10,535	10,858	10,886	10,750
Wholesale	2,796	2,884	2,893	2,848
Retail	7,740	7,974	7,992	7,902
G Finance, insurance, real estate	2,335	2,429	2,477	2,519
H Services - misc.	6,274	6,536	6,749	6,811
I Total government	6,914	7,277	7,616	7,839
Federal	2,187	2,209	2,217	2,191
State-local	4,727	5,069	5,399	5,648

Source: USBLS Employment Statistics for the United States
Note: Totals may not add due to rounding

Table D-24

Employment by industry, UNITED STATES
(annual averages in thousands of persons)

	1959	1960	1961	1962
Total Employment	65,581	66,681	66,796	67,846
A Agriculture	5,836	5,723	5,463	5,190
Self-employed, non-agr., domestics				
B Mining	732	712	672	650
C Construction	2,960	2,885	2,816	2,902
D Manufacturing	16,675	16,796	16,326	16,853
Durable	9,373	9,459	9,070	9,481
Non-durable	7,303	7,336	7,256	7,372
20 Food and kindred products	1,790	1,790	1,775	1,762
22 Textile mill products	946	924	893	902
23 Apparel and similar products	1,226	1,233	1,215	1,264
24 Lumber and wood products	659	627	583	589
25 Furniture and fixtures	385	383	368	385
26 Paper and allied products	587	601	601	614
27 Printing, publish. & allied	889	911	917	926
28 Chemicals & allied products	809	828	828	849
29 Petroleum & related products	216	212	202	195
30 Rubber-misc. plastics	373	379	375	408
31 Leather, leather products	374	363	358	361
32 Stone, clay, glass	604	604	582	592
33 Primary metals	1,183	1,231	1,143	1,166
34 Fabricated metals	1,123	1,135	1,085	1,128
35 Machinery, except electric	1,452	1,479	1,419	1,493
36 Electric machinery	1,396	1,467	1,473	1,568
37 Transportation equipment	1,662	1,587	1,458	1,543
38 Professional-scientific instr.	345	354	347	359
39 Misc. manufacturing	388	390	378	390
E Transportation & utilities	4,011	4,004	3,903	3,906
40 Railroads	925	885	817	796
Transportation except railroads	1,637	1,664	1,644	1,675
48-49 Commun., elec., gas, sanitary	1,449	1,455	1,443	1,435
F Trade	11,127	11,391	11,337	11,566
Wholesale	2,946	3,004	2,993	3,056
Retail	8,182	8,388	8,344	8,511
G Finance, insurance, real estate	2,594	2,669	2,731	2,800
H Services, misc.	7,115	7,392	7,610	7,947
I Total government	8,083	8,353	8,594	8,890
Federal	2,233	2,270	2,279	2,340
State-local	5,850	6,315	6,315	6,550

Source: USBLS Employment Statistics for the United States
Note: Totals may not add due to rounding

Table D-25

Employment by industry, UNITED STATES
(annual averages in thousands of persons)

		1963	1964	1965	1966
Total Employment		68,809	70,357	71,088	72,895
A	Agriculture	4,946	4,761	4,361	3,979
	Self-employed, non-agr.,domestics		7,408	5,957	5,052
B	Mining	635	635	632	628
C	Construction	2,983	3,106	3,181	3,281
D	Manufacturing	17,005	17,303	18,032	19,081
	Durable	9,625	9,848	10,385	11,186
	Non-durable	7,380	7,455	7,645	7,896
	20 Food and kindred products	1,744	1,730	1,752	1,761
	22 Textile mill products	889	892	921	951
	23 Apparel and similar products	1,285	1,310	1,354	1,396
	24 Lumber and wood products	587	597	610	622
	25 Furniture and fixtures	389	402	429	456
	26 Paper and allied products	620	630	640	671
	27 Printing, publish. & allied	931	952	981	1,026
	28 Chemicals & allied products	865	877	906	954
	29 Petroleum & related products	189	187	182	183
	30 Rubber-misc. plastics	418	430	472	513
	31 Leather, leather products	351	354	351	357
	32 Stone, clay, glass	602	616	627	641
	33 Primary metals	1,172	1,227	1,296	1,326
	34 Fabricated metals	1,153	1,197	1,268	1,352
	35 Machinery, except electric	1,531	1,612	1,726	1,868
	36 Electric machinery	1,557	1,549	1,658	1,893
	37 Transportation equipment	1,609	1,623	1,738	1,906
	38 Professional-scientific instr.	365	369	387	427
	39 Misc. manufacturing	387	400	421	440
E	Transportation & utilities	3,914	3,976	4,033	4,137
	40 Railroads	772	758	735	717
	Transportation except railroads	1,702	1,762	1,793	1,861
	48-49 Commun.,elec.,gas,sanitary	1,433	1,456	1,506	1,558
F	Trade	11,803	12,188	12,683	13,220
	Wholesale	3,119	3,220	3,317	3,459
	Retail	8,685	8,969	9,366	9,761
G	Finance,insurance,real estate	2,873	2,944	3,019	3,086
H	Services - Misc.	8,230	8,533	9,098	9,582
I	Total government	9,199	9,502	10,091	10,850
	Federal	2,358	2,348	2,378	2,565
	State-local	6,841	7,155	7,713	8,284

Source: USBLS Employment Statistics for the United States
Note: Totals may not add due to rounding

A D D E N D U M E

PROJECTION METHODOLOGY

Economic Projections

The generating force of economic growth in a subnational area is regarded as emanating from expansion in the "basic" industries for which the area has a competitive advantage. In the Study Area these have historically been forest products, agriculture, and food processing. As these industries expanded, other supporting industries developed and employment and population increased. With the compounding effect of expansion in "basic" and supporting industries and a growing consumer market, commodities which were formerly imported came into production locally. These import-competing industries have the same generating force and become in effect "basic" industries also. As the area continues to grow, its import-competing industries may develop to a level that permits them to compete in national and world markets. These import-competing industries will take on the same economic importance to the area's economy as the "hard-core" basic industries. An area can, in time, develop a population and an industrial base large enough to become self-sufficient in nearly all industries. 1/

Projections of output, employment, labor force, and population in this report assume that economic development will follow the general pattern discussed above. The definition of "basic" industries is cited in the introductory chapter and Addendum A. The steps in the procedure are indicated below:

A. Economic expansion of the national economy is a major determinant of the future level of economic development in the Study Area. Projected parameters of national growth--population, personal income, GNP, employment growth, output per employee--are listed in the assumptions. Others are indicated where applied.

B. Outputs for extractive and manufacturing industries ("basic" industries) are projected by various methods. Some are related to the demand for certain end-use commodities, some to the availability of the resource, and some to the relationship of output of the industry in the Study Area to output in the region and/or nation. The specific method is indicated in the section dealing with the projection of each commodity-producing industry.

C. Future employment in the "basic" commodity industries is obtained by applying projected productivity levels to output estimates obtained in Step B.

1/ *The exceptions are notably those primary processing industries which require raw materials not available in the area or too expensive to obtain.*

D. Projected Federal government employment was derived from estimates of the major agencies in the Study Area.

E. The employment estimate in residentiary industries was obtained by applying the ratio of employment in basic industries to nonbasic industries to the total of steps C and D. The ratio was estimated recognizing (1) trends during the past 25 years in the Study Area and in the region, and (2) the ratio of employment in the two categories projected for the nation by OBE for 1980, 2000, and 2020.

F. Labor Force is derived by summing employment in steps C, D, and E; unemployment (assumed to be four percent) and the estimated number in the armed forces.

G. Population is estimated from the two factors: labor force and labor force participation rates. Future labor force participation rates were based on previous relationships (ratios) between those of the Study Area and nation and the projected national rate stated as one of the assumptions.

Demographic Projections

An independent population projection serves as a reliability test of the economic projection. Many techniques are available and several were used. The method regarded by most analysts as superior for short or intermediate time periods is called the cohort-survival method, which was used to derive an estimate of population for the Study Area for 1980. The method recognizes the age-sex composition of the present population; age and sex are the major determinants of differential natural increase. Applicable fertility and mortality rates were applied to known age-sex groupings of 1960 and calculated for each five years to 1980. Added to each five-year period are the number of in-migrants estimated on the basis of historical trends. After 1980, trend extrapolations were used recognizing only aggregate fertility, mortality and migration levels. The level of confidence for the specific data did not justify extension beyond 1980 by the cohort-survival technique.

Residentiary-basic Employment Ratio

The residentiary-basic employment ratio has been increasing in response to changes in labor productivity and changes in demand for goods and services. Commodity-producing industries in total have experienced larger increases in output per employee and demand for services has increased faster than demand for commodities. Nationally, the ratio has increased from approximately 1.12 in 1940 to 1.81 in 1964. The Study Area and region have followed the same trend, increasing at approximately the same rate.

In the Study Area in 1964, the ratio was 2.57, which was greater than that of the Pacific Northwest (1.97) and the nation. A high ratio is typical of basins with a sizeable metropolitan area which provides trade, transportation, financial, and other services to an extended area.

It is assumed that the residentiary-basic ratio in the Study Area will increase 1.3 percent annually to 1980. This compares to an increase in the ratio in the Study Area of 1.6 percent annually between 1940 and 1964 and coincides with the rate of divergence of the two employment categories forecast nationally by the Office of Business Economics between 1960 and 1980. At this rate, the ratio in the Study Area will be 3.2 in 1980. For 2000 and 2020, the rate of increase is expected to be one-half of that implied for the nation in the OBE preliminary projections, resulting in residentiary-basic ratios in the Study Area of 3.4 and 3.6, respectively. The rate of increase in the ratio will in all probability fall relative to the nation and the region as the proportion of population in the Study Area to that of the surrounding area it serves increases.

A D D E N D U M F

AN ALTERNATIVE PROCEDURE FOR PROJECTING EMPLOYMENT

Conceive of employment in four parts (1) commodity and Federal employment paid for by non-residents, say E_1 (exports), (2) service employment paid for by non-residents, E_2 (exports), (3) commodity employment paid for by residents, R_2 (internal), (4) service employment paid for by residents, R_2 (internal). As a loose balance-of-payments statement, we can say that commodity consumption of a region equals imports of commodities, plus internal commodity production for domestic use. Since imports equal exports, we have (neglecting financial transfers, taxes, and the like):

1. Commodity consumption = $E_1 + E_2 + R_1$

If we assume that national patterns of consumption are similar to those of the region, we can assume a service-consumption pattern.

2. Commodity consumption = constant (k) x total employment.

Here total employment measures total consumption level.

Another relationship is given by the ratio of exports to total, a self-sufficiency index. This gives a relation:

3. Exports = constant (M) x total employment.

To apply these equations, one may assume first a value for self sufficiency in 1964. A figure of one-fourth has been chosen, that is the assumption is made that one out of every four workers is engaged in export business. This is rather low as compared to levels found in many balance-of-payment regional studies. However, the relation depends very much on what definition and approximating procedure is used. Since we are using rather large categories and broad classification for estimating purposes, it may be expected that export measures will be low. The figure is reasonable also on the basis of city employment data. If one takes the employment of individual cities in 1960, and counts as export employment that portion of any occupation which is above the national average proportion, he will obtain a figure on that order, and even below .25 for some very large metropolitan areas such as Providence, Rhode Island. For smaller cities, however, the ratio is higher.

The split between exports and internal employment is obtained in this manner. For service employment 1964 (except State and local government), it is assumed that the percentage of the specialization index over unity (the national average) is export. These are finance, services, wholesale trade, and transportation, which presumably, are devoted to serving surrounding areas; and also commodity-exporting industries. State and local government is not counted as export, because the specialization index, although above unity, is little higher than that of the Pacific Northwest, suggesting that there is little net payment to the Willamette area from outside.

It is assumed that half of agriculture, all of Federal, and as much of manufacturing as is necessary to raise all exports to the one-fourth ratio mentioned above are export employments.

For the year 2020, employment data for commodity industries and Federal government, reasonable on the basis of past experience, are available. These have been distributed on the basis of the ratio (E_1/R_1) of 1964. This is of course purely arbitrary, but an arbitrary division is adequate since the effect on the economy of increased self sufficiency is the same as that of increased exports. It is simpler to use the relations of 1964. This gives us E_1 and R_1 for 2020.

Next export services, E_2, were estimated. It is assumed that relative to the growth of the region (and the nation) this category would decline. Double the 1964 figures are used.

In light of equation (1), we now have commodity consumption for 2020. If we assume that all exports are used to pay for commodity imports, we know that total commodity consumption is total exports E_1 and E_2 plus internal commodity production R_1. The total $R_1 + E_1 + E_2$ is commodity consumption. This total in the table is 337,000.

As a last step, we must assume a relation between commodity and non-commodity consumption in the region; that is we must use equation (2). It is assumed that this constant k will continue the trend toward services of the past. The suggestion of OBE is that this will rise from about 2.2 in 1960 to about 3.0 for 2020. This trend seems to reflect higher productivity gains of agriculture and manufacturing than of service industries. Applying this constant 3 to $R_1 + E_1 + E_2 =$ 337,000 we obtain 1,011,000 for services internal employment in 2020 = R_2.

Total employment is thus projected to be $E_1 + E_2 + R_1 + R_2 =$ 1,348,000.

Table F-1
Calculation of Projected Employment
Willamette Basin Study Area
(employment in thousands of persons)

		(1) Employment 1964 e_i	(2) Index of specialization 1964	(3) Export employment 1964	(4) Internal employment 1964	(5) Export employment 2020	(6) Internal employment 2020
a.	Agriculture	27,300	.80	13,650	13,650	5,500	5,500
b.	Mining	731	.19		731		1,000
c.	Construction	21,483	.99		21,483		
d.	Manufacturing	98,941	.80	67,460	31,481	167,000	79,500
e.	Non-agriculture self employed	69,460	1.31	16,534	52,926	33,100	All "non-commodity" 1,011,000
f.	Transportation	21,582	1.20	3,597	17,985	7,200	
g.	Communications and utilities	11,438	1.10	1,040	10,398		
h.	Wholesale trade	28,405	1.23	5,312	23,093	10,500	
i.	Retail trade	67,028	1.04	2,675	64,353		
j.	Finance, insurance, real est.	22,640	1.08	1,687	20,953	3,700	
k.	Services	57,539	.94		57,539		
l.	Federal gov't	13,862	.82	13,862		24,000	
m.	State, local government	62,858	1.23		62,858		
	TOTAL	503,267		125,817	377,450	251,000	1,097,000

(1) Oregon State Department of Employment.

(2) $S_i = (e_i/e) / (E_i/E_i)$ where i denotes industry group, e regional employment, and E, U. S. Employment.

(3) $e_i (1 - 1/S_i)$ for e, f, g, h, j. and 50 percent of e_i in a, all of l. d is residual from the total (one-fourth of e).

(4) (1) - (3).

A D D E N D U M G

COMPARATIVE POPULATION PROJECTIONS
WILLAMETTE BASIN STUDY AREA & SUBAREAS
1980

Lower Subarea		
Pacific Northwest Bell Telephone Co. 1/		1,022,160
Metropolitan Planning Commission		1,022,000
Battelle Memorial Institute 2/	Low	981,000
	Medium	1,032,000
	High	1,084,000
Oregon State Board of Census 3/		1,080,295
Oregon Division of Planning & Development 4/		1,065,000
Middle Subarea		
Oregon State Board of Census 3/		331,120
Oregon Division of Planning & Development 4/		470,000
Pacific Northwest Bell Telephone Co.		492,080
Upper Subarea		
Oregon State Board of Census 3/		245,157
Oregon Division of Planning & Development 4/		308,000
Bureau of Municipal Research 5/	Low	237,000
	Medium	252,000
	High	266,000
Pacific Northwest Bell Telephone Co.		285,630
Total Study Area		
Pacific Northwest Bell Telephone Co. 1/		1,799,870
Oregon State Board of Census 3/		1,656,572
Oregon Division of Planning & Development 4/		1,840,000

1/ *Pacific Northwest Bell Telephone Co., "Population & Household Trends, 1960-1980," April 1965.*

2/ *Battelle Memorial Institute, "A Report on Rivergate Industrial Land Demand, Study to the Port of Portland," July 1965. Projection for Portland SMSA was reduced .14, the assumed ratio that Clark County would be of Portland SMSA.*

3/ *Oregon State Board of Census, "Population of Oregon: 1960 and 1985," Release No. P-9, October 1963. The Board has been renamed Center for Population Research & Census.*

4/ *Oregon Division of Planning & Development; unpublished projections of 1975 were extended to 1980 at the same rate of change as projected for the 1965-75 period.*

5/ *University of Oregon, Bureau of Municipal Research, "Population Forecasts, Lane Co. & Eugene - Springfield Area," Staff Report No. 4, October 1, 1965.*

ADDENDUM H

Table H-1
Population projections, Willamette Basin
by tributary basin 1/
1960-2020

Basin	Population in thousands 1960	1980	2000	2020
UPPER SUBAREA TOTAL	156	271	374	541
Eugene-Springfield urban area	99	178	253	377
Willamette outside urban areas	13	23	31	44
Coast Fork outside urban area	15	24	32	42
Long Tom outside urban area	12	19	24	32
McKenzie outside urban area	6	9	11	15
Middle Fork outside urban area	11	18	23	31
MIDDLE SUBAREA TOTAL	290	457	580	761
Salem urban area	77	137	188	258
Willamette outside urban area	72	127	172	243
Calapooia	8	10	11	12
Luckiamute	5	6	6	6
Marys	8	11	13	16
Mill Creek outside urban area	6	9	10	12
Molalla	11	16	20	26
Muddy Creek (east side)	2	3	3	3
Pudding	29	42	50	62
Rickreall	8	11	12	13
Santiam	37	47	50	54
Yamhill	27	38	45	56
LOWER SUBAREA TOTAL	722	1,038	1,463	2,278
Portland urban area	649	927	1,298	2,007
Willamette outside urban area	4	6	9	14
Tualatin outside urban area	40	63	99	170
Sandy outside urban area	5	7	10	17
Clackamas outside urban area	15	21	27	38
Scappoose and Milton Creeks	9	14	20	32
WILLAMETTE BASIN TOTAL	1,168	1,766	2,417	3,580

1/ *The population figures correspond to hydrologic rather than economic boundaries. See the narrative discussion on page I-9 and the note to Table II-2 in the main body of the appendix.*

A

A D D E N D U M I

COMPARISON OF WILLAMETTE BASIN ECONOMIC BASE STUDY PROJECTIONS WITH STUDY PROJECTIONS BY OFFICE OF BUSINESS ECONOMICS

The projections in this appendix--a "Type 2" study--which were completed during August 1966, differ in some degree from the "Type 1" study projections made by the Regional Economics Division, Office of Business Economics, and the Economic Research Service (OBE-ERS). The "Type 1" projections were transmitted by the Economics Committee, Water Resources Council, March 1968.

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 the lack thereof. Both studies therefore analyze and project regional employment opportunities, and then regional population. Projections of personal income are included.

Comparison of Projections

The following tabulations show differences between major economic parameters for the Willamette Basin Study Area in the two studies:

Total Employment

	1960	1980	2000	2020
Willamette E.B.S. 1/	455,606	652,700	803,300	1,306,600
OBE-ERS 2/ (prelim.)	431,094	679,650	949,329	1,279,940
Difference	+24,512	-26,950	-66,029	+26,660
Percent OBE-ERS	+5.69	-3.97	-6.96	+2.08

Population

Willamette E.B.S. 1/	1,168,899	1,767,500	2,422,000	3,591,000
OBE-ERS 2/ (prelim.)	1,168,899	1,727,267	2,397,553	3,237,150
Difference	-	+40,233	+24,447	+353,850
Percent OBE-ERS	-	+2.3	+1.0	+10.9

1/ *E.B.S. - Economic Base Study*
2/ *Adjusted to nine-county area*

Per Capita Income (1960 Dollars)

	1960	1980	2000	2020
Willamette E.B.S. 1/	$2,357	$3,665	$5,665	$8,700
OBE-ERS 2/ (prelim.)	3/	$4,312	$7,329	$12,691
Difference	-	-647	-1,664	-3,991

1/ *E.B.S. - Economic Base Study*
2/ *Adjusted to nine-county area*
3/ *Approximately the same as the Willamette E.B.S. figure: 1959-$2,281, 1962-$2,405 (both in 1960 dollars)*

Methodologies and Assumptions Compared

Employment

The use of different data is one source of disparity between the two studies. The economic base study in this volume 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 4/ and are annual averages; basin data and regional data, including Idaho, Oregon, Washington, and western Montana were used. The OBE-ERS 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 Willamette 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 OBE-ERS 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 this study than the OBE-ERS figure. The OBE-ERS study assumes lower future fertility rates than the Willamette study. Employment projections of this study undoubtedly reflect the higher national population assumptions, but the differences in the two methodologies prevent a direct measure.

In Willamette E.B.S., 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 industires 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.

B

The methodological differences between the studies cannot be directly quantified; but the comparison of the employment projections indicates that the E.B.S. study method, given the differences in basic data and assumptions, resulted in somewhat lower results than would have obtained under the OBE-ERS procedures. The differences, however, are small considering the time period involved.

Population

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. This study assumed modest progressive reduction in the civilian labor force participation rate throughout the study period. The OBE-ERS study, on the other hand, assumed slight increases in labor-force-participation throughout the projection period. The OBE-ERS 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.

Income

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.

1/ *Sophia Cooper and Denis F. Johnston, "Labor Force Projections for 1970-80," Monthly Labor Review, February 1965.*

In this study, per capita income is estimated to increase approximately 2.2 percent annually during the projection period. In the OBE-ERS study, it is assumed that per capita personal income will increase at a more rapid rate--2.9 percent.

The OBE-ERS 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 Willamette study national totals, obtained from Water Resources Council, were used, and per capita incomes were projected from national assumptions. In the Willamette study population figures were then applied to develop total personal incomes.

Summary

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.

A D D E N D U M J

DEFINITIONS OF INDUSTRY GROUPS

Agriculture and Agricultural Services

This group includes all agriculture and farming and includes all establishments primarily engaged in performing agricultural, animal husbandry, and horticultural services on a fee or contract basis. Examples are farming--the production of crops and/or livestock on a farm, sorting, grading and/or packing fruits or vegetables for the grower, crop dusting, licensed veterinarians, poultry hatcheries, landscape gardening, etc.

Contract Construction

This group includes all firms primarily engaged in construction by contract, whether of buildings, highways, pipelines, excavating or general construction. It also includes specialty contractors, such as painting, air conditioning, roofing, flooring, electrical, plumbing, or plastering. Construction is construed to mean new, additional, alteration, or demolition. Installation of pre-fab materials or equipment by a contractor comes within this division. However, when such installation is made by the vendor or manufacturer of the materials or equipment, it is not considered as construction.

Manufacturing

With the exceptions hereinafter noted, this division includes all establishments primarily engaged in altering, combining, or adding to materials or substances for the purpose of enhancing the value or usability.

Not included in manufacturing are such activities as processing of raw materials on a farm, fabrication at a construction site by a contractor, or processing for retail sale on the premises of firms ordinarily engaged in retail trade.

Treated in this study as separate divisions of manufacturing were:

20. Food processing, which includes animal feeds.

22. Textile manufacturing; primarily all phases of textile producting including spinning, plug manufacture of felt goods, and upholstery padding.

23. Apparel manufacture, which includes leather apparel, draperies, awnings, textile bags, and apparel findings.

24. Lumber and wood products, which includes all primary processing of lumber and veneer, plus prefabrication of wooden buildings or structural members thereof, and manufacture of wooden boxes, barrels, and tanks.

25. Furniture manufacture.

26. Pulp, paper, paperboard, and container manufacture.

27. Printing, publishing, and boodbinding, including typesetting, engraving, etc.

28. Chemicals and allied products, including industrial compressed gases.

29. Petroleum refining and related industries, including paving and roofing materials and miscellaneous products of petroleum and coal.

30. Rubber and miscellaneous plastics products.

31. Leather and leather products.

32. Stone, clay, and glass manufacture, including manufacture of asbestos textiles, mineral wool, statuary and art goods, and gypsum products.

33. Primary metal industries, such as smelting, refining, rolling, drawing, alloying, casting and forging, also metal powder and paste.

34. Fabricated metal products, except machinery and transportation equipment.

35. Machinery, except electrical.

36. Electrical machinery (includes appliances and electronic components).

37. Transportation equipment.

38. Manufacture of professional and scientific equipment.

39. Miscellaneous manufacturing; jewelry, toys, musical instruments, artist supplies, notions, etc.

Transportation

Railroads, motor carriers, warehousing, water transportation, airlines, freight forwarding, pipelines; and local suburban transportation.

Communications

Telephone and telegraph; radio and television broadcasting, and commercial shortwave systems.

Utilities

Light, heat, and power, whether electric or gas; water supply, and sanitary services.

Wholesale Trade

Includes all establishments primarily engaged in selling merchandise to retailers or other industrial, commercial, or professional users without regard to the type of merchandise purveyed.

Retail Trade

Includes all establishments primarily engaged in selling merchandise for personal, household, or farm consumption and in rendering service incidental to the sale of goods.

Finance, Insurance, and Real Estate

In addition to banks and trust companies and insurance business of whatever nature, this division includes credit agencies, holding companies, brokers, dealers in commodities and contracts, owners, lessors and developers of real estate.

Services

Includes hotel and other lodging places but not eating places; personal, business, repair, and amusement services; medical, legal, engineering, and other professional services; educational institutions; non-profit membership organizations; and other miscellaneous services.

Government

Treated separately here are:

1. Federal government.
2. State and local government.

A D D E N D U M K

SUPPORTING STUDIES

1. Bonneville Power Administration, "Petroleum," Pacific Northwest Economic Base Study, 1966, 196 pages.

2. Bonneville Power Administration, "Agriculture and Food Processing," Pacific Northwest Economic Base Study, Preliminary 1964, 118 pages.

3. Bonneville Power Administration, "Personal Income," Pacific Northwest Economic Base Study, 1964.

4. Bonneville Power Administration, "Copper, Lead and Zinc," Pacific Northwest Economic Base Study, 1966, 139 pages.

5. Bonneville Power Administration, "Forest Industries," Pacific Northwest Economic Base Study, 1966, 174 pages.

6. Bureau of Municipal Research, University of Oregon, "Employment Forecast, Eugene-Springfield Area," 1961, 116 pages.

7. Bonneville Power Administration, "Coal," Pacific Northwest Economic Base Study, 1965, 203 pages.

8. U. S. Forest Service, Pacific Northwest Forest and Range Experiment Station, "Prospective Timber Supplies and Forest Industrial Development in the Willamette River Basin," 1965, 69 pages.

9. Bonneville Power Administration, "Sulfur," Pacific Northwest Economic Base Study, 1965, 51 pages.

10. Norman S. Petersen and Richard W. Knostman, "The Mineral Industry of the Willamette Basin--Trends and Outlook," U. S. Bureau of Mines, Preliminary, 1965, 110 pages.

11. Bonneville Power Administration, "Recreation," Pacific Northwest Economic Base Study, 1967, 180 pages.

12. U. S. Bureau of Mines, "An Evaluation of the Western Phosphate Industry and Its Resources," Part I, 1964, 86 pages.

13. Directory of Oregon Manufactures - 1966, State of Oregon Department of Planning and Development, 1967, 354 pages.

14. Bonneville Power Administration, "Steel," Pacific Northwest Economic Base Study, Preliminary, 1962, 69 pages.

15. Bonneville Power Administration, "Ferroalloys," Pacific Northwest Economic Base Study, Preliminary, 1964, 135 pages.

16. Bonneville Power Administration, "Aluminum," Pacific Northwest Economic Base Study, Preliminary, 1966.

17. Bonneville Power Administration, "Titanium," Pacific Northwest Economic Base Study, 1964, 46 pages.

18. U. S. Department of Agriculture, "Willamette River Basin - Oregon, Interim Report," Economic Research Service, 1964, 260 pages.

19. Bonneville Power Administration, "Phosphorous," Pacific Northwest Economic Base Study, 1964, 83 pages.

20. Bonneville Power Administration, "Population," Pacific Northwest Economic Base Study, 1966, 58 pages.

21. Bonneville Power Administration, "Abrasives," Pacific Northwest Economic Base Study, 1965, 37 pages.

22. Bonneville Power Administration, "Magnesium," Pacific Northwest Economic Base Study, Preliminary, 1964, 101 pages.

23. U. S. Bureau of Census, "Population Estimates," Series P-25, No. 317, August 27, 1965.

24. U. S. Forest Service, "Timber Trends in the United States," Forest Resource Report No. 17, 1965, 235 pages.

25. U. S. Bureau of the Census, "Census of Manufactures," appropriate years.

26. "Economic Report of the President," 1963, 1964, 1965, Transmitted to Congress.

27. U. S. Bureau of the Census, "Census of Population," appropriate years.

28. U. S. Bureau of Mines, "Aluminum Fabrication in the Pacific Northwest - An Economic Survey," 1962, 29 pages.

29. Lowell D. Ashby, "Growth Patterns in Employment by County - Volume 8 Far West," U. S. Department of Commerce, 1965.

30. U. S. Department of Labor, "Indexes of Output per Man-hour Selected Industries, 1939 and 1947-62," 1964, 48 pages.

31. Gary A. Kingston, "Iron and Steel Scrap in the Pacific Northwest," U. S. Bureau of Mines, 1964, 50 pages.

32. Bonneville Power Administration, "Labor Force," Pacific Northwest Economic Base Study, 1966, 89 pages.

33. Bonneville Power Administration, "Employment," Pacific Northwest Economic Base Study, 1966.

34. Landsberg, Fischman & Fisher, "Resources in America's Future," Resources for the Future, Inc., 1963, 1017 pages.

35. Bert G. Hickman, "Growth and Stability of the Postwar Economy," The Brookings Institution, 1960, 426 pages.

36. Oregon State Board of Census, "Population Bulletin," P-9, 1963, 21 pages.

37. U. S. Bureau of Census, "Census of Agriculture," appropriate years.

38. Bureau of Business and Economic Research, "The Structure of the Oregon Economy - An Input/Output Study," University of Oregon, 1965, 35 pages.

39. U. S. Bureau of Reclamation, "Economic Effects of Reclamation Projects in New Mexico," 1962.

40. U. S. Department of Agriculture, "Changes in Farm Production and Efficiencies, A Summary Report," Statistical Bulletin No. 233, 1965.

41. Harvey S. Perloff, "How a Region Grows," Committee for Economic Development, 1963, 147 pages.

42. Charles M. Tiebout, "The Community Economic Base Study," Committee for Economic Development, 1962, 86 pages.

43. Williamson and Buttrick, "Economic Development - Principles and Patterns," Prentice-Hill Inc., 1959, 576 pages.

44. Edgar M. Hoover, "The Location of Economic Activity," McGraw-Hill Book Co, Inc., 1948, 310 pages.

45. Pacific Northwest Bell Telephone Co., "Population and Household Trends," 1965, 25 pages.

46. Metropolitan Planning Commission, "How Should Our Community Grow," Portland, Oregon, 1966.

COMPREHENSIVE STUDY

Willamette Basin

USDA SCS PORTLAND, OREG. 1968
WBTF-X-1040-L