

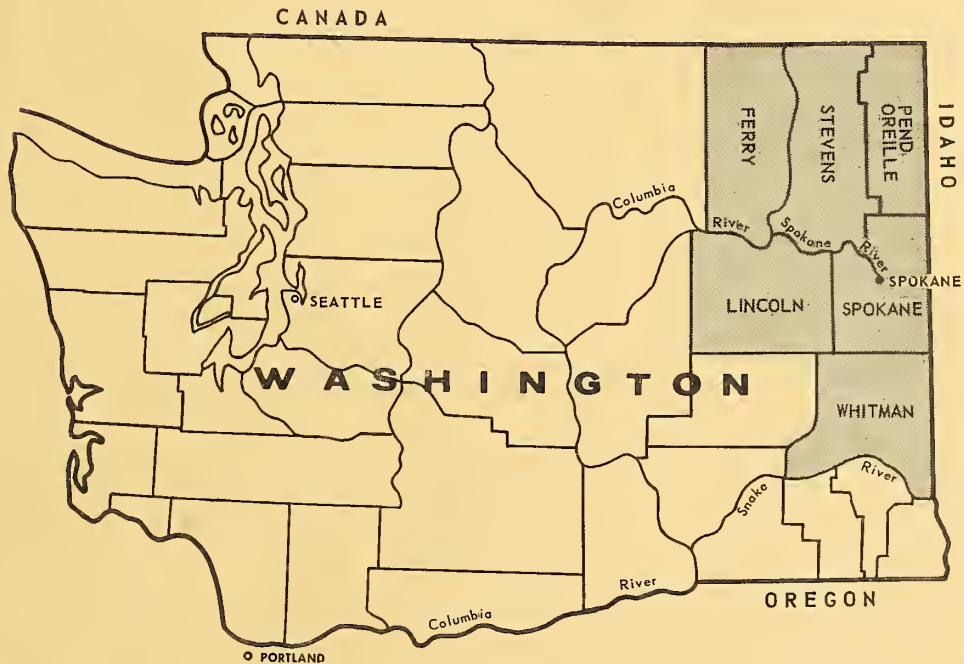
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FOREST RESOURCES and FOREST INDUSTRIES

for Northeast Washington



Administrative Report
prepared for the
Area Redevelopment Administration
U.S. Department of Commerce
for limited distribution

by

Division of Forest Economics Research

January 1964

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
Philip A. Briegleb, Director Portland, Oregon

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January 23, 1964

Administrator
Area Redevelopment Administration
Department of Commerce
Washington, D.C.

Through: Office of Rural Areas Development, USDA

Dear Sir:

Presented herewith are 75 copies of our final report entitled "Forest Resources and Forest Industries of Northeast Washington" as per letter agreement with the Area Redevelopment Administration, approved March 7, 1963, to make a study of forest resources and potentials for new or expanded wood industries in northeastern Washington.

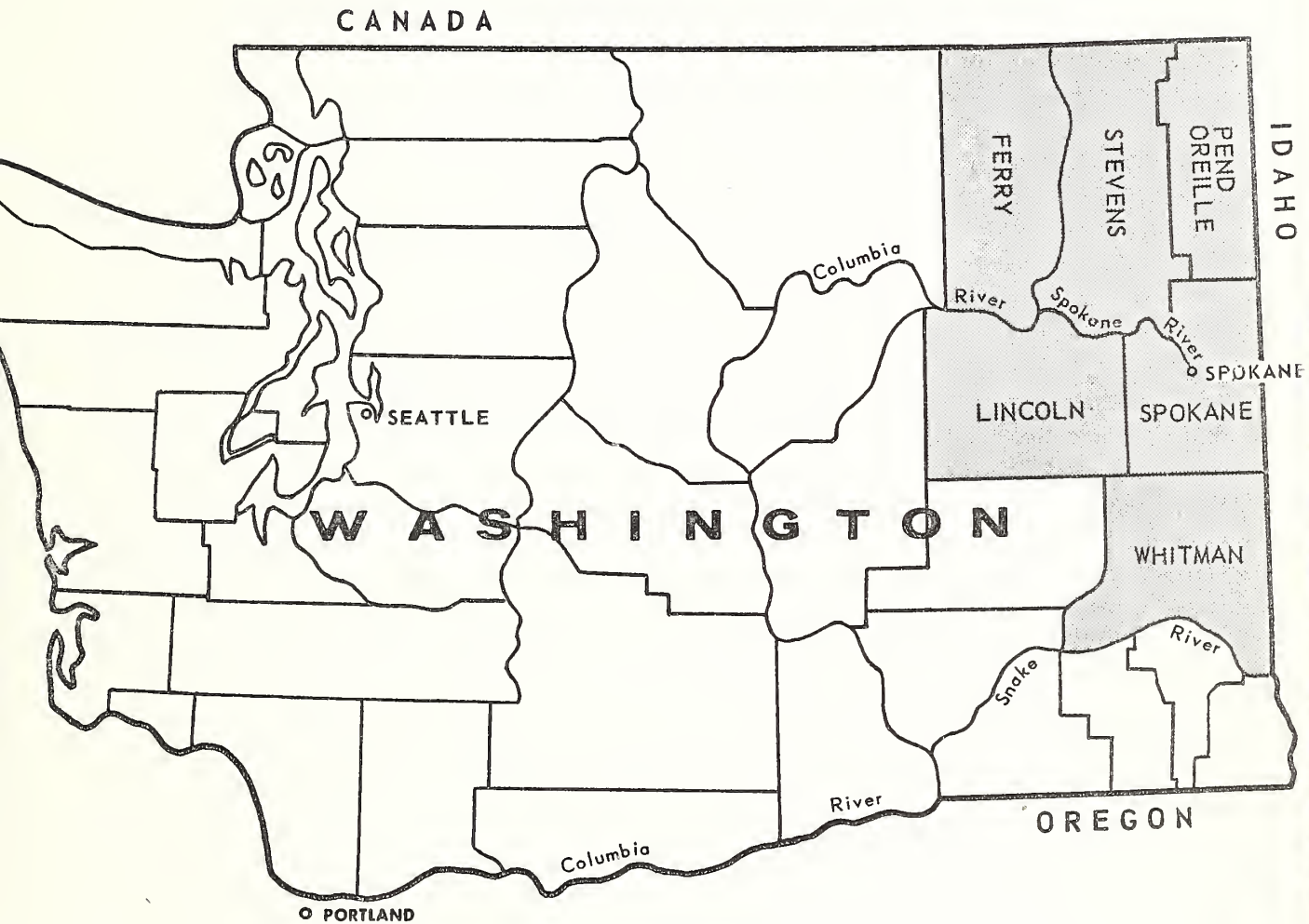
Sincerely yours,

A handwritten signature in cursive script that reads "Philip A. Briegleb".

PHILIP A. BRIEGLER
Director

Map of NORTHEAST WASHINGTON

showing relation to entire State



FOREST RESOURCES AND FOREST INDUSTRIES
OF NORTHEAST WASHINGTON

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FOREST SERVICE

U.S. DEPARTMENT OF AGRICULTURE

FOREWORD

This report presents and interprets basic information on the forest resources of northeast Washington collected as a part of the Forest Survey^{1/} conducted by the Forest Service. This information consists of data on forest land area, timber volume, timber harvest, and timber growth by kind, character and condition, and ownership class.

The forest resource data are supplemented by information on the timber-based industries, their relation to the forest as a source of raw material, other forest products and values, and pertinent other economic data.

For the purposes of this report northeast Washington is defined as consisting of Ferry, Lincoln, Pend Oreille, Stevens, Spokane, and Whitman Counties.

These six counties have a total land area of 7.9 million acres, of which 3.8 million acres or nearly half is forested. The commercial forest land has a total sawtimber volume of 17.2 billion board feet (Scribner rule);^{2/} nearly three-fourths of this timber volume is publicly owned. During the past decade log harvest has averaged about one-fourth of a billion board feet annually.

The forest wealth of this area contributed greatly to its early settlement and subsequent economic development. For well over half a century there has been a substantial timber industry in northeast Washington. Lumber production currently averages about 340 million board feet annually. Spokane, the largest city in the area, is also the economic center of the Inland Empire, which consists of northern Idaho and western Montana as well as northeast Washington.

Three of the six counties--Ferry, Pend Oreille, and Stevens--have had chronic substantial unemployment and are "designated for redevelopment" under the Federal Area Redevelopment Act of 1961. This act provides low-cost financing for industrial and commercial enterprises provided they meet certain qualifications.^{3/} Many of the anticipated proposals are

^{1/} A nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928, amended June 25, 1949.

^{2/} Timber volume data are presented in board feet, Scribner rule, throughout the report. This method of measuring timber volume is the one commonly used in commercial practice in this region.

^{3/} Full information regarding the provisions of the Area Redevelopment Act and program may be obtained from the State Representative, Area Redevelopment Administration, Department of Commerce, 312 First Avenue, N., Seattle 9, Washington.

either directly or indirectly dependent upon the forest resources for success. The Area Redevelopment Administration, therefore, requested the Forest Service to supply information on the forest resources and industrial opportunities based upon these resources in more detail than is customarily done and provided technical assistance funds to cover additional costs.

The economy of these three counties, including that based upon forests, is so closely connected with that of the remaining three counties that they could not be considered objectively out of this context. Therefore, information is presented for the area as a whole, and where feasible and pertinent, for the subject counties separately. Furthermore, the reader should bear in mind that the economy of northeast Washington is closely connected with that of north Idaho and western Montana.

This report analyzes the potential for expanded use of timber resources insofar as raw material and industrial technology are concerned. Consequently it provides some, but not all, of the information needed to evaluate industrial opportunities which depend upon the forest as a source of raw material. Before definitive evaluations can be made, other information such as nature and availability of markets now and prospectively will be needed since the timber industries are all market oriented. Finally, before individual applications or specific industrial locations can be judged, more intensive feasibility studies should be made which will consider all the factors of raw material supply, markets, management, and financing.

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INTRODUCTION

Northeast Washington has a total land area of 7.9 million acres or 12,319 square miles. This area can be divided roughly into two parts, one lying north of the Spokane River, an abruptly rolling, sharply broken, mountainous area, and the other lying south of the Spokane River, which is a gently rolling, river-channeled plateau.

The northern part, consisting of Ferry, Stevens, and Pend Oreille Counties and northern Spokane County, is dominated by the Colville Mountains, an extension of the Rocky Mountain chain. It is drained by the Columbia River and its tributaries, the Sanpoil and Pend Oreille. Most of the arable land is found within these river valleys. This northern area is heavily forested, having 3.5 million acres of forest land, which is 81 percent of its total land area and 92 percent of all forest land in northeast Washington. Of this forest land, 3.4 million acres are classified as commercial forest. Therefore, a major factor in the economy of this region is the harvesting and processing of this abundant natural resource.

The southern part consists of Lincoln, Whitman, and the southern two-thirds of Spokane County. This area is characterized by gently rolling hills, plains, and river-channeled plateaus, and is well suited to dry farming. According to the 1959 Census of Agriculture, 69 percent or 3.4 million acres of the 4.9 million acres classified as land in farms in northeast Washington were located in this area. About 2 million acres or 57 percent of the 3.4 million acres were classified as harvested cropland or land in summer fallow. Only a quarter of a million acres in the southern area were classified as commercial forest, two-thirds of which was located in Spokane County.

The completion of Grand Coulee Dam on the Columbia River in 1941 and the formation of Roosevelt Lake behind it created an important manmade geographic feature in this area. This dam created a navigable body of water stretching 150 miles from the dam to the Canadian border which forms the entire Ferry-Stevens County border. Unfortunately, accessibility to the lake is limited by the rugged terrain surrounding it, inhibiting its use as a primary transportation route. Roosevelt Lake, however, is the major recreation site of the immediate area and is readily available to the population center of Spokane. The entire perimeter of the lake is reserved for public recreation and is administered by the National Park Service, whose authority was established in 1946 with the creation of the Coulee Dam National Recreation Area.

The transportation and industrial hub of this region is Spokane, the largest city in the Inland Empire. Three transcontinental railroads, the Great Northern, Northern Pacific, and Chicago-Milwaukee and St. Paul, pass through Spokane (see map, p. 2). Branches of the Great Northern extend into Stevens and Ferry Counties. Pend Oreille County

is serviced by a branch of the Milwaukee which runs north from Newport. Both the Great Northern and the Northern Pacific cross Lincoln County on their way west from Spokane. A branch of the Union Pacific line runs south from Spokane through Whitman County. With the exception of the Colville Indian Reservation, all the land in this study area lies within 25 airline miles of a railroad.

Two transcontinental highway routes, U.S. 2 and U.S. 10, also pass through Spokane. Another major highway, U.S. 395, follows the Colville River valley north from Spokane to Kettle Falls and from there the Kettle River north to British Columbia. Other all-weather, blacktop State highways serve other parts of this area (see map). The southern portion of this study area, where the terrain is not a prohibitive factor in road construction, has an extensive system of all-weather county and State highways.

As might be expected, the majority of the labor force and industry is located in and around metropolitan Spokane, which is the second largest city of the State. Spokane County has a labor force of 100,000, which is $\frac{79}{100}$ percent of the study area's total labor force of 127,000. In five $\frac{4}{100}$ of the six counties included in the study, a total of \$184 million was added to value of products through manufacturing in 1958. Of this, \$170.6 million or 93 percent of the total was added in Spokane County.

Northeast Washington is an important segment of the State. It contains 18.5 percent of the land, 12 percent of the population and 11.8 percent of the working force. In 1959 it supported 12 percent of the State's retail establishments selling products, valued at 12.9 percent of the State's total sales. These establishments paid their employees 12.8 percent of the State's retail sales employee payroll. Manufacturing, on the other hand, differed from these closely related averages. The manufacturing establishments located within the study area were 10.5 percent of the State's total. Value added to products was only 8.5 percent of the total value added by manufacturing in the State, and the salaries paid employees totaled only 6.6 percent of the total salaries paid to all employees of all manufacturing establishments in the State.

The counties of primary interest in this study are Ferry, Stevens, and Pend Oreille. Each has a relatively small population, a comparatively high rate of unemployment, and an economy based largely on the harvesting and processing of forest products.

^{4/} Lincoln County totals are excluded to avoid disclosing information for individual firms.

Ferry County

Ferry County, the most easterly of the three designated counties, has a total land area of 1.4 million acres. It is bounded on the west by Okanogan County and on the east and south by Roosevelt Lake. The Kettle River Mountain Range extends from Canada on the north to Roosevelt Lake on the south. The east face of the Kettle Range drains into the Columbia River. The western half of the county is drained by the Sanpoil River, which traverses the western half of the county from Canada to the Columbia River. The county's minimum elevation is 1,300 feet above sea level, the elevation of Roosevelt Lake; the maximum elevation is 7,200 feet, the height of the Kettle River Range. The county has cool summers and cold winters; the average yearly temperature is about 45 degrees. Between 15 and 18 inches of rain fall here yearly.

About 80 percent of the total land area is classified as commercial forest land, which totals 1.1 million acres. Only 144,000 acres of the forest land are privately owned, practically all in the "farmer and miscellaneous" category. The harvesting of timber and the production of lumber, therefore, is an important factor in the county's economy: In 1959, 66 percent of the total wages paid in the county came from the lumber industry. In 1960 this percentage dropped to 57, but production of lumber still remains the greatest factor in the county economy.

Farmland makes up about 300,000 acres or 21 percent of the total land area, and much of this is relatively poor quality. However, only about 150 of the 283 farms in Ferry County constitute full-time occupations for the operator. The balance of the farmers seek part-time employment sometime during the year to supplement their income.

Mining has been another important economic activity in Ferry County since the turn of the century. Although a score of metals occur here, gold, silver, and copper are the principal ones mined. Republic, the largest town and the county seat, had the largest lode gold mine in the State and second largest in the United States in 1960. In that year 93 persons were employed in mining, receiving total wages of \$650,000.

In 1960, Ferry County had a population of 3,889. Republic had 1,064 inhabitants. Ferry County had a total working force of 1,358. In 1959, the total value added by manufacture was \$2,515,000. The employees of these manufacturing firms were paid \$1,408,000. Unemployment has become a critical problem in this county in recent years. In 1960, 8.2 percent of the total force remained unemployed. Since the majority of the manufacturing workers were employed in the lumber industry, it has become a focal point in attempts to solve this problem.

Stevens County

Stevens County, the second of the three counties, is bounded on the east by Pend Oreille County, on the west by Ferry County, on the north by Canada, and on the south by Spokane and Lincoln Counties. It is 90 miles long, ranging from 25 to 30 miles wide, containing a total of 1-1/2 million acres. Stevens County has the same rugged, mountainous terrain which is common to the three counties, but unlike Ferry County, Stevens County has many long, narrow, shoestring valleys of fertile farm soil. Located on the western side of the Selkirk Mountains, Stevens County is drained on the west by the Columbia River and on the south by the Spokane River and the Colville River which empty into the Columbia River south of Kettle Falls. Stevens County has the same range of elevation as Ferry County, 1,300 feet to about 7,300 feet. It has an average temperature of about 46 degrees. The annual rainfall for the county is between 16 and 20 inches, the highest proportion of it coming in May and June when it is most needed for agriculture.

Fifty percent of the total land area is classified as farmland. Of the 804,000 acres classified as farmland, 587,000 acres are subclassified as woodland. Two-thirds of this woodland is pastured. Farming is the primary occupation in Stevens County. In the 1960 Department of Commerce census, 1,593 people or 24 percent of the total labor force qualified as farmers, but more than half of these seek part-time jobs to supplement their living, principally in the forest industries.

In Stevens County, 1-1/4 million acres have been classified as commercial forest. This is 79 percent of the total area in the county. Employment in production of lumber and wood products in the county in 1960 was 788, 12 percent of the total work force available.

The total population of Stevens County in 1960 was 17,884. The county seat is Colville with a population of 3,806. Other towns with a population of notable size are Chewelah with 1,525 and Kettle Falls with 905 people.

One railroad, a branch line of the Great Northern, serves Stevens County. This branch departs from the main line about 15 miles above Spokane. From there it travels northwest following the Colville River valley, through the towns of Chewelah, Colville, and Kettle Falls. Here the line branches again, one branch following the Columbia River northeast into British Columbia and the other branch following the Kettle River valley north to Cascade.

The major highway in Stevens County is U.S. 395, which runs north from the city of Spokane through Chewelah, Colville to Kettle Falls. Another north-south route is State Highway 22 which spans the Spokane River at Miles, and follows the east bank of the Columbia River gorge north to Kettle Falls. The only east-west all-weather highway runs east from Colville to Tiger in Pend Oreille County.

Stevens County has a total labor force of 6,890 workers, of which 1,593 are employed in agriculture and 1,193 are engaged in manufacturing, including the production of lumber and forest products. In 1958, manufacturing added a value of \$6,265,000 to the products it produced. Employees in manufacturing firms took home a total of \$2,392,000 in wages.

Like Ferry County, Stevens is rich in mineral products. Magnesite is currently the principal product. About 250 people were engaged in mining and quarrying, receiving \$1,410,000 in wages in 1960.

Stevens County has had chronic unemployment in recent years. In 1962 the unemployed capable working personnel rose to a total of 11.5 percent of the total available labor force. Of the 6,890 available workers, 820 were unable to find employment. The importance of lumber manufacture in the county's employment picture makes it an obvious source of attempts to expand employment.

Pend Oreille

Pend Oreille County is in the extreme northeast corner of the State. It is bounded by Idaho on the east, Canada on the north, Stevens County on the west, and Spokane County on the south. Located on the western slopes of the Coeur d'Alene Mountains, it has a rough, sharply broken terrain. It is drained by the Pend Oreille River which enters the county from Idaho at the city of Newport and flows north to Canada and thence to the Columbia. Most of the arable land in the county is found in this river basin. The county's elevation runs from 1,500 feet above sea level to 7,318 feet.

Pend Oreille County has cool summers and cold winters. The mean annual temperature is around 45 degrees. The annual precipitation of about 25 inches gives this county a greater amount of available moisture than the two counties to the west.

Only 13.8 percent of the total land area in Pend Oreille County is classified as farmland. This is a total of 124,239 acres. Of this, 79,735 acres are subclassified as farm woodland, more than half of which are being used as farm pasture. In 1960, only 191 people were engaged in agriculture. This was about 10 percent of the total labor force available in the county. Most of the farming effort in this county is in raising beef and dairy cattle, and the land tilled is used to produce supplemental feed for these cattle.

In Pend Oreille County, 812,000 acres or 90 percent of the total land is classified as commercial forest. More than 60 percent of this land is in National Forest. The harvesting and processing of forest products employs more of the working force than any other occupation, and thus forest products industries are a major influence in the economy of this county.

This county has important lead and zinc deposits. In 1960, the mining and quarry industries employed 262 people who were paid \$1,506,000 in wages.

The total population of Pend Oreille County in 1960 was 6,914. Newport, the largest town in the county, is the county seat. In 1960, Newport was the home of 1,513 people. The only other town of notable size in Pend Oreille County is Ione with a population of 648.

Two railroads serve Pend Oreille County. The Great Northern's main line runs from Spokane to Newport and then continues on into Idaho. The Milwaukee Railroad runs a branch line north from Blanchard, Idaho, through Newport following the Pend Oreille River basin north to Metaline Falls. Although both passenger and freight service is offered on the Great Northern line, the Milwaukee line offers freight service only. There are two major highways in Pend Oreille County. The transcontinental highway, U.S. 2, runs north from Spokane through Newport into Idaho. An all-weather State highway follows the Pend Oreille River basin north from Newport to the Canadian border. As this highway passes through Tiger, it is met by the only east-west all-weather highway in the county coming from Colville.

In 1960, Pend Oreille County had a total labor force of 2,414 workers, of which 563 were employed in manufacturing firms. The great majority of these 563 people were engaged in the manufacture of lumber and wood products. In 1959, \$3,334,000 was added to the value of products through manufacturing in Pend Oreille County. In that year, \$1,399,000 was paid in wages by manufacturing firms to employees.

In recent years Pend Oreille County has had a severe unemployment problem. In 1962, 10.8 percent of the total working force were unemployed. Owing to the preponderance of commercial forest land and the dependence of the economy upon lumber manufacture, an evaluation of the raw forest products available for the expansion of forest-products-based industries is a first step in solving this problem.

THE FOREST RESOURCE^{5/}

Since early settlement, the forest resource has been important to the economy of northeast Washington. With agriculture it has been the major support of the entire economy. First, it served the needs of mining and the early farmers. Later, with the coming of the railroads and the depletion of white pine in the Lake States, lumbermen came with capital to invest in timber and mills. Although northeast Washington was the western fringe of the western white pine region, Spokane soon became the economic center of the Inland Empire timber industry. Ponderosa pine and western white pine were the choice species at first; now, Douglas-fir and western larch are used heavily. Cedar poles were also an important early product from this area. Despite recent development of other industries based upon inexpensive hydroelectric power such as light metals and some decline in timber products manufacture, the forests still represent a potential for continued industrial development.

Northeast Washington has 3.6 million acres of commercial forest land which comprise 46 percent of the total land area. It contains 17.2 billion board feet (Scribner) of sawtimber volume, practically all softwood species. Three-quarters of this volume is in public ownership. Douglas-fir (5.6 billion board feet) is the leading species, followed closely by ponderosa pine (5.1 billion board feet) and western larch (3.0 billion board feet). Softwoods total 17.1 billion board feet and hardwoods but 89 million board feet.

Annual timber harvest totaled 298 million board feet in 1962, up 13 percent from 265 million board feet in 1961. A peak of production was reached in 1959 when 334 million feet were harvested. Average harvest for the period 1955-62 inclusive was 282 million feet. It is estimated that the allowable cut from all forest lands under sustained yield is approximately 265 million board feet annually. Under more intensive management than is now being practiced, this figure could be increased.

^{5/} Detailed information, including definition of terms used, is contained in Forest Statistics for Northeast Washington, U.S. Forest Serv. Resource Bul. PNW 4, May 1963, a copy of which is appended to this report. In this publication timber volume data are given in both Scribner and International 1/4-inch log rules. The latter approximates lumber tally.

FOREST LAND

Nearly half of the total land area in northeast Washington is commercial forest land (table 1). The present condition and potential productivity of the commercial forest land are basic factors in appraising the capacity of the forest resource to maintain and expand the economy of this area. This is particularly true of Ferry, Pend Oreille, and Stevens Counties, which have 88 percent of the commercial forest land.

Forest-Land Ownership

Ownership of the commercial forest land is a significant and often determining factor in its use for producing continuous forest crops. Three-fifths of the commercial forest land in northeast Washington is in public ownership (table 2), practically all in the three problem counties. The major public ownerships are National Forest and Indian.^{6/}

All of the National Forest land and a major part of the other public forest land are managed under sustained yield for continuous production of timber products. Other public ownerships consist of Indian lands, 670,000 acres; Bureau of Land Management holdings, 137,000 acres; and State of Washington lands, 243,000 acres. The remaining public lands are either miscellaneous Federal such as military reservations or are owned by local government.

Forest industry lands are not a large factor in future consideration owing to the small amount held. There has been no strong move to increase these holdings by acquiring lands of small owners as has occurred in western Washington and Oregon. The industry forest lands are generally well managed and are being held for continued productions.

The "farmer and miscellaneous private" category amounts to over a third of the total commercial forest land and for that reason is important. What may be expected from these lands in the way of continuous timber crops could be a critical factor in the economy, particularly in Spokane County and the south part of Stevens and Pend Oreille Counties. Future prospects and problems in managing these lands will be discussed later in this report.

^{6/} Indian lands, although not publicly owned, are managed by the Bureau of Indian Affairs, U.S. Department of Interior, and for the purposes of this report are considered in the public ownership class.

Table 1.--Area by land classes, northeast Washington, 1962

(In thousand acres)

Land class	Area
Commercial forest	3,626
Unproductive forest	119
Productive reserved forest	28
Total forest	3,773
Nonforest	4,111
All land	7,884

Table 2.--Area of commercial forest land, by county group
and ownership class, northeast Washington, 1960

(In thousand acres)

County	All ownership	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Ferry	1,123	381	598	10	134
Pend Oreille	812	486	45	48	233
Stevens	1,256	208	395	80	573
Lincoln, Spokane and Whitman	435	--	29	23	383
All counties	3,626	1,075	1,067	161	1,323

Condition of Forest Lands

Distribution of commercial forest land by stand-size class, by stocking class, and by forest types complete the information needed to understand and analyze the future prospects of the forest resource of this area (table 3).

In northeast Washington there are 136 tree farms totaling 77,000 acres in area, which are part of a nationwide industry-sponsored program. Conditions and forest practices on these lands must meet Western Pine Association requirements for enrollment and maintenance of tree farm status. Although few in number, forest industry-owned tree farms are a large part of the acreage in tree farms.

Stocking of Forest Lands

More than 3 million acres of the 3.6 million acres of commercial forest land in northeast Washington are medium or well stocked with forest trees. Despite a severe fire history the area of nonstocked forest lands is relatively small, 126,000 acres, and 74,000 acres of this total are in "farmer and miscellaneous private" ownership.

On the surface this would appear to be a reasonably satisfactory condition; however, close analysis of the situation discloses several serious problems.

Past fires have altered the composition of the forest stands unfavorably to a considerable extent and left some areas understocked and irregularly forested. Dwarfmistletoe and forest diseases have contributed to these undesirable situations. On the other hand there are large areas of overstocked stands of the younger age classes on the valuable ponderosa pine lands. Invasion of ponderosa pine cutover lands by less valuable Douglas-fir is another management problem. Correction of these problems requires heavy investment of capital funds in planting; timber culture, principally thinning; and more intensive fire protection.

Forest Types

Douglas-fir is the ranking forest type by area in northeast Washington, accounting for 1.4 million acres; ponderosa pine next, 1.2 million acres; followed by lodgepole pine, 427,000 acres; and western larch, 234,000 acres.

Table 3.--Area of commercial forest land, by stand-size classes, ownership classes, and county group, northeast Washington, 1960

(In thousand acres)

Stand-size class and county	All ownership	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Ferry	849	236	518	7	88
Pend Oreille	365	259	16	26	64
Stevens	575	128	240	46	161
Other counties	159	--	19	10	130
Total	1,948	623	793	89	443
Poletimber stands:					
Ferry	124	51	34	2	37
Pend Oreille	266	104	19	19	124
Stevens	457	25	107	29	296
Other counties	176	--	8	6	162
Total	1,023	180	168	56	619
Sapling and seedling stands:					
Ferry	140	92	39	1	8
Pend Oreille	158	110	5	2	41
Stevens	175	51	33	2	89
Other counties	56	--	--	7	49
Total	529	253	77	12	187
Nonstocked areas:					
Ferry	10	2	7	--	1
Pend Oreille	23	13	5	1	4
Stevens	49	4	15	3	27
Other counties	44	--	2	--	42
Total	126	19	29	4	74
All classes	3,626	1,075	1,067	161	1,323

The same order of types exists in the three counties, Ferry, Pend Oreille, and Stevens. Distribution of types by ownership in these three counties is significant (table 4) for it is evidence of the prospects for sustaining the raw material base for the local timber industry and describes the character of products which may be harvested in the future. Later in this chapter this subject will be elaborated under discussion of allowable cut.

TIMBER VOLUME

Northeast Washington has a total sawtimber volume of 17.2 billion board feet (Scribner) and a total growing stock volume of 5.4 billion cubic feet. The board-foot cubic-foot ratio of 3.2 points to a lack of large-size sawtimber trees and a relatively even distribution among the smaller size classes (table 5).

In addition to size of timber, species, location, and ownership are factors for consideration in analyzing timber volume data and its availability as an industrial raw material.

Ferry, Pend Oreille, and Stevens Counties have 16.1 billion board feet or about 93 percent of the total sawtimber volume in northeast Washington (table 6). All of the National Forest timber is in these three counties where it amounts to 6.45 billion board feet or nearly 40 percent of the total volume. A somewhat similar situation exists with respect to "other public" timber volume. It totals 6.36 billion board feet, all but 137 million feet occurring in the same three counties. About 4.25 billion feet of this figure are on the Colville Indian Reservation, and another 500 million feet are on the Spokane Reservation in Ferry and Stevens Counties, respectively. Generally speaking, the timber in National Forest and Indian ownership is less accessible to manufacturing centers and railheads than the private. However, with the exception of the billion feet in forest industry ownership, the privately owned timber is in scattered small holdings and subject to all the problems of forest management and irregular harvest that seem to be inherent in such ownership.

Although Douglas-fir leads in sawtimber volume, it averages less than 20 inches in diameter and there is less than half a billion feet of it in trees over 30 inches in diameter. It is used primarily for construction lumber.

Ponderosa pine, which nearly equals Douglas-fir in sawtimber volume, 5.1 billion feet compared to 5.6 billion feet, averages larger in size and is of higher quality, comparing favorably with timber from other sections of the western pine region.

Western larch, third in timber volume with nearly 3.5 billion board feet, is cut in considerable quantity and used for generally the same end products as Douglas-fir.

Table 4.--Area of commercial forest land, by forest

types and ownership classes, Ferry, Pend

Oreille and Stevens Counties, 1960

(In thousand acres)

Type	All ownerships	Public ownerships	Private ownerships
Douglas-fir	1,340	894	446
Ponderosa pine	930	648	282
Lodgepole pine	376	230	146
Western larch	220	126	94
Western white pine	72	61	11
Other conifer types	154	98	56
Hardwoods	17	10	7
Nonstocked	82	46	36
Total	3,191	2,113	1,078

Table 6.--Volume of sawtimber by county group
and ownership classes, 1960

County	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
- - - - - <u>Million board feet</u> - - - - -					
Ferry	7,236	2,395	4,262	69	510
Pend Oreille	4,163	2,948	167	330	718
Stevens	4,735	1,105	1,795	586	1,249
Other counties	1,090	--	137	80	873
Total	17,224	6,448	6,361	1,065	3,350

Other high value species are western white pine and western redcedar. However, these species are found in limited quantities only, 625 million and 495 million board feet, respectively.

TIMBER HARVEST

During the 8-year period 1951-62, timber harvest in northeast Washington has ranged from 254 million board feet in 1957 to 334 million board feet in 1959, averaging 282 million feet. Until 1961, distribution of the cut by ownership class was reasonably constant with about half of the cut coming from private forest land and the remainder of the cut divided nearly evenly between National Forest and "other public" ownerships. One exception was in 1959, the peak year, when the surplus cut apparently was developed from "other public" forest lands.

During the past 2 years, although the cut from private lands decreased notably, the total cut has remained close to the 8-year average of 282 million feet. Decrease of the cut from private lands might foretell a trend which should be studied further to identify future implications. If this trend should persist, less than 100 million board feet annually can be expected to be harvested from private forest lands. The unpredictable element in timber harvest from private lands is the "farmer and miscellaneous" category. Production from "forest industry" owned lands has been unusually constant at about 11 million feet annually during recent years. Since the sawtimber inventory on these lands amounts to about 1 billion feet, there is no reason why a cut of about 10 million feet cannot be sustained and in fact increased moderately as these lands are put in better growing condition through good management practices.

Table 7 shows that during 1955-62 about 93 percent of the timber harvest in the study area has come from Ferry, Pend Oreille, and Stevens Counties. In recent years Ferry County has produced as much as the other two counties combined.

Table 8 gives timber harvest by species and ownership classes for 1962. Douglas-fir leads in timber cut with 114 million feet, followed by ponderosa pine, 72 million feet, and western larch, 59 million feet. Other species were harvested in lesser amounts. The cut of Douglas-fir and western larch appears to be in reasonable relation to the total inventory volume of these species. However, this is not the case with ponderosa pine where the harvest was relatively smaller compared to the inventory.

The relation of the cut of white pine to inventory volume appears reasonable. However, other considerations such as blister rust might require increasing the cut of white pine. The harvest of pulp species and cedar seems to be relatively high compared to the inventory. This is also true of lodgepole pine, contrary to the situation in other areas. These relationships are superficial indicators only, and other factors must be considered before definitive conclusions can be drawn.

Table 7.--Timber harvest by county group and ownership class,

northeast Washington, 1960-62 (Scribner rule)

Ownership class and county	1960		1961		1962		Average 1955-62 ^{1/}	
	Million bd. ft.	Per- cent	Million bd. ft.	Per- cent	Million bd. ft.	Per- cent	Million bd. ft.	Per- cent
Forest industry:								
Ferry	3.5	1.3	2.6	1.0	--	--	--	--
Pend Oreille	--	--	1.3	0.5	--	--	--	--
Stevens	6.5	2.3	4.6	1.7	--	--	--	--
Other counties	1.0	0.4	2.8	1.1	--	--	--	--
All counties	11.0	4.0	11.3	4.3	--	--	--	--
Farmers, misc. private:								
Ferry	18.6	6.7	7.7	2.9	--	--	--	--
Pend Oreille	14.5	5.3	10.3	3.9	--	--	--	--
Stevens	69.4	25.2	42.7	16.1	--	--	--	--
Other counties	20.0	7.3	15.2	5.7	--	--	--	--
All counties	122.5	44.5	75.9	28.6	--	--	--	--
All private:								
Ferry	22.1	8.0	10.3	3.9	11.8	3.9	20.6	7.3
Pend Oreille	14.5	5.3	11.6	4.4	16.1	5.4	17.2	6.1
Stevens	75.9	27.5	47.3	17.8	45.8	15.4	69.4	24.6
Other counties	21.0	7.7	18.0	6.8	15.7	5.3	19.7	7.0
All counties	133.5	48.5	87.2	32.9	89.4	30.0	126.9	45.0
National Forest:								
Ferry	32.4	11.8	24.2	9.1	44.1	14.8	30.1	10.7
Pend Oreille	23.8	8.6	50.8	19.2	50.2	16.8	35.1	12.4
Stevens	12.4	4.5	22.3	8.4	18.0	6.0	12.2	4.3
Other counties	--	--	--	--	--	--	--	--
All counties	68.6	24.9	97.3	36.7	112.3	37.6	77.4	27.4
Other public:								
Ferry	61.1	22.2	69.4	26.2	84.3	28.3	65.1	23.0
Pend Oreille	0.9	0.4	--	--	0.3	0.1	0.4	0.1
Stevens	10.9	4.0	10.6	4.0	11.9	4.0	12.5	4.4
Other counties	0.3	--	0.7	0.2	--	--	0.2	0.1
All counties	73.2	26.6	80.7	30.4	96.5	32.4	78.2	27.6
All ownership:								
Ferry	115.6	42.0	103.9	39.2	140.3	47.0	115.8	41.0
Pend Oreille	39.2	14.3	62.5	23.6	66.6	22.3	52.7	18.6
Stevens	99.2	36.0	80.2	30.2	75.6	25.4	94.1	33.3
Other counties	21.3	7.7	18.6	7.0	15.7	5.3	19.9	7.1
All counties	275.3	100.0	265.2	100.0	298.2	100.0	282.5	100.0

^{1/} Data by ownership classes not available in detail for 1954 and prior years

Table 8.--Timber harvest by county, ownership class, species,
in northeast Washington, 1962

Counties and ownership	Ponderosa pine	Western white pine	Douglas- fir	Western larch	Pulp species	Cedar	Lodgepole pine	Hard- woods	Total
Ferry:									
Private	3,291	--	6,073	2,272	134	25	5	--	11,800
National Forest	3,373	3	21,776	16,455	1,627	464	440	--	44,138
Other public	41,564	--	33,900	8,472	344	--	39	--	84,319
All ownerships	48,228	3	61,749	27,199	2,105	489	484	--	140,257
Stevens:									
Private	7,058	191	21,209	10,257	2,159	1,075	3,808	8	45,765
National Forest	891	278	6,482	7,005	1,596	914	789	--	17,955
Other public	5,134	18	3,943	1,847	730	204	10	--	11,886
All ownerships	13,083	487	31,634	19,109	4,485	2,193	4,607	8	75,606
Pend Oreille:									
Private	2,348	324	6,101	2,614	871	485	3,392	--	16,135
National Forest	1,821	6,001	10,044	8,964	14,899	6,861	1,579	--	50,169
Other public	164	12	144	--	5	1	--	--	326
All ownerships	4,333	6,337	16,289	11,578	15,775	7,347	4,971	--	66,630
Other counties:									
Private	6,511	153	4,580	1,053	932	47	2,430	--	15,706
National Forest	--	--	--	--	--	--	--	--	--
Other public	--	--	--	--	--	--	--	--	--
All ownerships	6,511	153	4,580	1,053	932	47	2,430	--	15,706
Total	72,155	6,980	114,252	58,939	23,297	10,076	12,492	8	298,199

1/ True fir, hemlock, and spruce.

The National Forests and Indian lands are under planting programs where natural regeneration is not assured. A small amount of thinning is being done on the National Forests and Indian lands as a cultural practice. Commercial thinning apparently remains in the future for the National Forest and Indian lands because of lack of markets for the products. On industry lands there may be a small amount of commercial thinning, but it is not significant. Extension of this practice will depend upon development of industries which will use this uniformly small material in sufficient quantities and at a price high enough to make it economical to the landowner.

The prospective annual cut for northeast Washington, based upon current forest conditions and continuation of present management practices, is estimated at 265 million board feet (Scribner). Of this total, 110 million feet are from the National Forests, 95 million feet from the Indian lands (Colville and Spokane reservations), 16 million feet from other public forest lands, and 44 million feet from private lands. During 1962 a total of 298 million board feet were harvested from this area, approximately 12 percent more than the prospective annual cut. Of this total, 112 million feet were cut on National Forest lands, 86 million feet from Indian lands, 11 million feet from other public lands, and 89 million feet from private lands.

National Forest and Indian lands have been managed under sustained yield policies for many years. Management objectives on other lands vary.

Growth information is mainly useful in calculating the allowable cut. However, it is an interesting independent figure and is indicative of present forest conditions. The following growth estimates are preliminary and subject to change as other information becomes available. Total current annual growth is 210 million board feet (Scribner) or about three-fourths of the prospective annual cut. Forest stands in private ownership are growing at a faster rate than those in public ownership. As old-growth forests in public ownership are cut and replaced by vigorous younger stands, growth rates on these lands will increase. The private lands are generally good timber-growing sites and potentially very productive. The danger is that much of the private forest lands in the "farmer and miscellaneous" category will be cut prematurely and not reach their potential. In fact, some of those lands are now being cut in this way.

FOREST MANAGEMENT

Past and present forest management practices are determining the nature and magnitude of future timber harvests from northeast Washington forests.

Practically all of the forest lands here have been given extensive forest management for several decades. All commercial forest lands are now under intensive forest fire protection. The National Forests are protected and managed by the Forest Service, the Indian lands by the Bureau of Indian Affairs, and the remaining forest lands are given fire protection by the Washington State Department of Natural Resources. Epidemic insect attacks are subjected to control measures when feasible by the State and Federal Governments with cooperation in some cases by the timber industry. For a number of years blister rust control measures were carried out on the white pine forests by the Federal Government in an attempt to control this disease which threatened extinction of these stands. Recent research has developed chemical control measures which promise to insure future white pine forests. At the same time, research is working on genetic development of blister rust-resistant white pine stock.

Slash disposal is carried on where necessary by public and private owners as a fire hazard abatement practice. This is governed by policy on Federal lands and by State law on other forest lands.

Timber from National Forest and Indian lands is sold through competitive bidding to loggers and timber manufacturers under short-term sales contracts, usually 5 years or less. Minimum bid prices are set, based upon appraisals made by Forest Service or Bureau of Indian Affairs personnel. Sales contracts specify utilization practices, method of cutting, and provisions for slash disposal and regeneration, among other things. Ponderosa pine is generally "selectively cut," and other stands are clear cut in patches.

Timber from "other public lands" is also sold by competitive bidding. Timber from industry-owned lands is generally harvested directly by the owners or by logging contractors hired by them.

Bruce (1959) found that statewide in Washington as many as two-thirds of the forest owners in the "farmer and miscellaneous" category sell their timber as stumpage with the buyer arranging for the logging. This finding probably applies reasonably well to northeast Washington. During the past 10 years, selling practice of these owners has changed from preponderantly selling the timber for a lump sum to selling by log scale. This usually results in leaving the land in better condition for future harvesting. The remaining owners harvest their own timber and sell logs to the mills. These owners view their timberlands as a source of employment as well as cash crops.

As a general rule lands in this ownership class in northeast Washington are partially cut; in some cases it is selective cutting; and in other cases "high grading." Generally, all merchantable trees are taken.

FOREST INDUSTRIES IN NORTHEAST WASHINGTON

In an attempt to reduce the chronic unemployment that exists in the three northern counties of northeast Washington, proposals have been made to expand the forest-based industries. Before specific proposals can be evaluated, the quantity and kind of raw products available to support any forest industry expansion must be determined. This figure is that which remains when present utilization is subtracted from allowable cut plus raw material not covered in allowable cut such as mortality salvage and residues developed from lumber manufacture. To determine present utilization, a survey of all forest industries in northeast Washington was made. Information was obtained on the species and volumes of raw products used by each industry and the products manufactured. Estimates of the amounts of residues which are being used or could potentially be used were also obtained from the survey.

Sawmills

In northeast Washington there were 42 sawmills operating during 1962. These mills ranged in size from a two-man operation capable of producing 4,000 board feet a day to mills which employed more than 100 employees and could produce 100,000 board feet in an 8-hour shift. Detailed information was obtained from 38 mills. Four mills were not visited. These are small mills which had a total production of less than 199,000 board feet in 1962; estimated values are given for these mills.

Sawmills are divided into three classes according to their 8-hour shift production capacity; the first class, 1 to 39 thousand board feet capacity; the second class, 40-79 thousand board feet; and the third class, 80-119 thousand board feet. The greatest number of mills, 29, fall into the first class. Nine mills are represented in the second class and only four mills are large enough to produce more than 80,000 board feet in an 8-hour shift. Included in the four largest mills is the Albeni Falls Division of the Diamond National Corporation. This mill, located in Idaho across the border from Newport, Washington, is included in the study because of the quantity of raw material it obtains from the study area, its potential as a source of mill residue, and its forest-land ownership in northeast Washington. When considering the raw product or stumpage supply for the study area, only stumpage cut within the boundaries of the area was considered. Of course, when considering the amount of residue

available for use within the area, the entire production of the industries surveyed was considered. During the survey four mills, all of the smallest size class, were found which commenced operations in 1963; these were not evaluated.

In 1962, the sawmills in northeast Washington produced a total of 339 million board feet of lumber. Almost half of this volume was surfaced and seasoned. An additional fourth was dried while at the millsite, most of which was then shipped to planing mills in the area for surfacing. Most of the remainder was shipped surfaced green.

A little more than 70 percent of all the mills from which information was received have planers, and this average is representative of all three classes (see table 9). Dry kilns are much more prevalent as the capacity of the mills increases. The overall average of mills having dry kilns is about 30 percent but ranges from 3 out of 4 mills in the largest capacity class to 3 out of 25 among the mills in the smallest capacity class. Of the four new mills, which began production during 1963, three have planers and none have dry kilns.

No sawmill in the smallest size class has a barker or chipper, although one has a hog. One-third of the medium class and all of the mills in the largest class have barkers. In the medium class there is one mill with a chipper and another with a hog. Three of the four largest mills have a chipper and the fourth has a hog.

Planing Mills

There are five planing mills in the study area. Three of these are located in Spokane County and one each in Ferry and Stevens Counties. They range in size from 45,000 to 110,000 board-foot capacity in an 8-hour shift. Three of the five have dry kilns and a fourth mill definitely expects to install one in the next 2 years.

Pulp and Paper Mills

Information from one pulp and paper mill was included in the study (Lockwood Trade Journal, 1963). This mill, located in Spokane County, has a 24-hour capacity of 137 tons of pulp, of which 42 tons are sulfite, 95 tons groundwood and 100 tons paper.

Table 9.--Equipment in sawmill by capacity class, 1962

Sawmill capacity per 8-hour shift	Total mills	Equipment other than head saw				
		Planer	Dry kiln	Barker	Chipper	Hog
1-39	29	18	3	0	0	1
40-79	9	7	5	3	1	1
80-119	4	3	3	4	3	1

Miscellaneous Forest Industries

There are four pole and piling yards included in the study. Each of these have barkers and three of them have treating plants, all of which are thermal nonpressure-type plants. The piling yard without a treating plant sends its production to one of the other plants within the area for treatment.

Raw Material Consumed

The total capacity of all the sawmills included in this study is 1,320,000 board feet of lumber in an 8-hour shift. This daily capacity is almost equally distributed among the three classes (see table 10). Based upon operating experience of sawmills in these size classes this would amount to an annual capacity on a one-shift per day basis of 275 million feet. In making this estimate, allowance was made for variation in number of shifts operated per year between mills of varying size class. A total of 285 million board feet (Scribner) of saw logs were consumed by these mills in 1962. Of this total, 265 million board feet were harvested within the study area, to which 4.8 million board feet must be added to account for the stumpage cut and utilized within the study area by other forest-products consuming industries. Thus 270 million board feet of the 298 million board feet harvested within the six-county area were consumed by forest industries within northeast Washington. The table shows that although the mills in the largest size class have the smallest gross capacity, they consumed twice the stumpage of the smallest class and 20 percent more stumpage than the second class. This is an indication of lost time due to breakdown, which is far more prevalent as the size of the mill grows smaller, and the fact that the smaller the mill, the greater the tendency to close down completely for a portion of the year due to weather, lack of logs, another seasonal occupation of the owner-operator, or other reasons.

Imports and Exports

Of the stumpage used by industries considered in the study, 45 million board feet were harvested in areas outside the six counties under consideration. About two-fifths of this volume was consumed by the Diamond National mill, which is actually located in Idaho; thus, in the strictest sense this volume cannot be considered an import. Another two-fifths of this import figure is due to the papermill's demand for specific species. Most of the remaining import volume is that of poles and piling imported from Idaho and Canada to yards within the study area for processing and treatment. Only about 2 million board feet of logs are imported into northeast Washington to be processed into lumber.

Table 10.--Capacity and consumption of forest products industries, 1962

Sawmill capacity per 8-hour shift	: Gross capacity : : per 8-hour : : shift : :	: Total : : consumption : :	: Consumption : : from : : study areas : :
- - - - - <u>Thousand board feet</u> - - - - -			
1-39	477	59,635	59,275
40-79	458	104,787	102,917
80-119	385	121,166	103,180
Other industries	--	24,465	4,757
Total	1,320	310,053	270,129

During 1962, 28 million feet of logs harvested in northeast Washington were exported to be processed elsewhere. Three-fourths of this volume was cut in Pend Oreille County and shipped to Idaho. About 3 million feet were exported to British Columbia and 3 million feet cut in Ferry County went to an Okanogan County mill. The remaining 1 million feet were lodgepole pine and were exported as pulpwood.

Raw Product Utilization in Ferry, Stevens
and Pend Oreille Counties

A total of 298,199,000 board feet were cut within the six counties in 1962. Of this stumpage, 282,493,000 board feet were harvested in the counties of primary consideration: Ferry, Stevens, and Pend Oreille. This is 95 percent of the total volume harvested in the entire area. It shows the significant role played by these three northern counties in supplying the raw forest product consumed by the forest-based industries in the entire study area. It is not surprising, therefore, to find, as indicated in table 11, that 31 out of 42 sawmills are located in these three counties and all but one are in the two lowest capacity classes. The one mill in the highest capacity class is located in Stevens County. However, the other three mills in the largest class, one located in Idaho, one in Spokane County, and the other in Lincoln County, draw a large proportion of their raw material from Ferry, Stevens, and Pend Oreille Counties.

LABOR SUPPLY IN NORTHEAST WASHINGTON

The total labor force in northeast Washington in 1960 was 127,023. In the three counties of primary consideration, Ferry, Stevens, and Pend Oreille, there was a total labor force of 10,327. Of this potential, 9,394 were employed; thus, the percentage of unemployed, capable workers actively seeking jobs in the three-county area was 9 percent of the total labor supply. The establishments engaged in manufacturing employed the greatest number of people. This category, which included the production of both durable and nondurable goods, employed 2,097 or 22 percent of the employed labor force in these three counties. Of those employed in manufacturing, 1,497 or 71 percent were engaged in the production of timber products.

According to the census classification, 2,062 of the total labor force were engaged in agriculture. Many of these workers, although classified as farmers, were in reality part-time farmers, supplementing their income with other employment. Much of this part-time employment is found in logging crews and small sawmills. Thus forest industries play a somewhat greater part in the employment picture than the census figures show.

The third largest employers of the working force in these three counties are the wholesale and retail establishments, which employ about 15 percent of the total working force.

Table 11.--Sawmill location by capacity class, 1962

Sawmill capacity: per 8-hour shift	Total	Sawmill location					
		Ferry County	Stevens County	Pend Oreille County	Spokane County	Lincoln County	Idaho State
<u>Thousand board feet</u>		<u>Number of mills</u>					
1-39	29	9	12	2	5	1	--
40-79	9	1	4	2	2	--	--
80-119	4	--	1	--	1	1	1

The majority, 79 percent, of the labor force in northeast Washington is located in Spokane County. This is a total of 99,909 workers, of which 92,730 were employed in 1960. Of these employed workers, 14,693 were employed by manufacturing firms, 14 percent of which were employed by forest products industries.

FOREST PRODUCTS RESIDUES DEVELOPED IN NORTHEAST WASHINGTON

In the survey of timber industries sawmill residues were divided into two categories, coarse and fine. Included in coarse residues are slabs, edgings and trimmings. Sawdust and shavings are classified as fine residues.

The total amount of residues developed in northeast Washington was estimated by multiplying the production of lumber in each county by the factors developed by Corder and Gedney (1956). In 1962, it was estimated that the mills in northeast Washington produced 141,513 tons of dry coarse residue, 92,613 tons of dry sawdust, and 65,330 tons of dry shavings. The greatest percentage of this residue was developed in the processing of Douglas-fir and larch. Seventy-five percent of the shavings and 64 percent of the coarse residue consisted of these two species. Pines accounted for 28 percent of the total coarse residue and 15 percent of the shavings. All other species accounted for 8 percent of the coarse residue and 10 percent of the shavings. It should be noted that although the Diamond National mill in Newport is actually in Idaho, it is considered for this study to be economically a part of Pend Oreille County (see tables 12-17).

Present Residue Use in Northeast Washington

Only about 35 percent of the residue developed in northeast Washington remains unused. All the residue which is used, however, should not be considered totally unavailable for future expansion of forest products industries. Present uses which provide little or no return to the producer of the residue can easily be supplanted by industries which are willing and able to pay for the residue they consume. For example, coarse residue, given away for fuel, and shavings, given away for domestic animal bedding, are certainly available to any industry willing to pay the slightest price for them.

Forty-eight percent of all the coarse residues developed are chipped and sent to pulpmills located outside of northeast Washington. About 13 percent is used as fuel and the remainder, 39 percent, is burned or left to rot. This high proportion of coarse residue converted to chips takes place in the larger sawmills. In the largest mill size class, 88 percent of the coarse residue is converted. In the second size class that percentage is only 28 and in the smallest size class

Table 12.--Total residue developed in northeast Washington, 1962

Industry by 8-hour capacity class and planing mills	Coarse residue	Sawdust	Shavings
<u>Thousand board feet</u>	<u>Tons (dry)</u>		
1-39	30,284	19,298	10,581
40-79	50,408	34,340	24,816
80-119	60,821	38,975	12,561
Planing mills	--	--	17,372
Total	141,513	92,613	65,330

Table 13.--Coarse residue developed in northeast

Washington, 1962

Industry by 8-hour capacity class	Ferry County	Stevens County	Pend Oreille County	Northeast Washington
Thousand board feet	Tons (dry)			
1-39	6,757	13,513	4,395	30,284
40-79	6,838	22,829	3,704	50,408
80-119	--	10,430	^{1/} 10,815	60,821
Total	13,595	46,772	18,914	141,513

^{1/} Including Diamond National plant at Albeni Falls, Idaho, considered economically in Pend Oreille County.

Table 14.--Coarse residues developed in northeast

Washington, 1962, by species

Industry by 8-hour capacity class	Ferry County	Stevens County	Pend Oreille County	Northeast Washington
Thousand board feet	Tons (dry)			
DOUGLAS-FIR--LARCH				
1-39	6,258	11,889	3,223	23,438
40-79	5,747	19,987	<u>1/</u> 2,661	36,867
80-119	--	2,694	<u>1/</u> 5,019	30,660
Total	12,005	34,570	10,903	90,965
PINE				
1-39	56	637	931	4,671
40-79	501	1,862	<u>1/</u> 410	10,601
80-119	--	6,260	<u>1/</u> 2,187	24,153
Total	557	8,759	3,528	39,425
OTHER				
1-39	443	987	231	2,175
40-79	590	980	633	2,940
80-119	--	1,476	<u>1/</u> 3,609	6,008
Total	1,033	3,443	4,473	11,123

1/ Including Diamond National plant at Albeni Falls, Idaho, considered economically in Pend Oreille County.

Table 15.--Sawdust developed in northeast Washington, 1962

Industry by 8-hour capacity class	Ferry County	Stevens County	Pend Oreille County	Northeast Washington
<u>Thousand board feet</u>	<u>Tons (dry)</u>			
1-39	4,315	8,736	2,515	19,298
40-79	4,459	14,966	2,444	34,340
80-119	--	3,184	<u>1/7,339</u>	38,975
Total	8,774	26,886	12,298	92,613

1/ Including Diamond National plant at Albeni Falls, Idaho, .
considered economically in Pend Oreille County.

Table 16.--Shavings developed in northeast Washington, 1962

Industry by 8-hour capacity class and planing mills	Ferry County	Stevens County	Pend Oreille County	Northeast Washington
Thousand board feet	----- Tons (dry) -----			
1-39	1,928	6,614	495	10,581
40-79	3,439	13,737	1,562	24,816
80-119	--	3,558	<u>1/</u> 4,818	12,561
Planing mills	686	1,098	--	17,372
Total	6,053	25,007	6,875	65,330

1/ Including Diamond National plant at Albeni Falls, Idaho considered economically in Pend Oreille County.

Table 17.--Shavings developed in northeast Washington
by species, 1962

Industry by 8-hour capacity class and planing mills	Ferry County	Stevens County	Pend Oreille County	Northeast Washington
Thousand board feet ----- Tons (dry) -----				
DOUGLAS-FIR--LARCH				
1-39	1,250	6,231	420	8,668
40-79	2,940	12,352	662	19,353
80-119	--	2,636	<u>1/</u> 2,347	7,608
Planing mills	514	823	--	11,844
Total	4,704	22,042	3,429	47,473
PINE				
1-39	478	179	23	1,307
40-79	198	821	<u>1/</u> 119	3,681
80-119	--	228	<u>1/</u> 789	2,147
Planing mills	103	165	--	4,876
Total	779	1,393	931	12,011
OTHER				
1-39	200	204	52	606
40-79	301	564	781	1,782
80-119	--	694	<u>1/</u> 1,682	2,806
Planing mills	69	110	--	652
Total	570	1,572	2,515	5,846

1/ Including Diamond National plant at Albeni Falls, Idaho, considered economically in Pend Oreille County.

none of the coarse residue is converted into chips. Conversely, it is in the smallest sawmill size class that the greatest percentage of coarse residue remains unused. Here 87 percent of the residue is burned or left to rot (see table 18).

Fifty percent of the total sawdust developed is used as fuel and 35 percent is burned or left unused. These percentages again are related to the sawmill size classes. The percentage of sawdust burned as fuel is high in the largest sawmill class, which disposes of 83 percent of their sawdust in this manner. In the smallest sawmill class, 87 percent of the sawdust is unused (see table 18).

The processing and subsequent sale of residues has become an integral part of the operations of large sawmills. The revenue from the sale of these residues is often large enough to become a strong factor in the profitability of an operation. The expected revenue from residue sale is taken into consideration in the bidding for stumpage and so the producer who can obtain the most return from his residue is in an advantageous position compared to a producer who finds no use for his residue.

The smaller the sawmill, the less likely that the residue will be profitably utilized. There is a considerable investment involved in the installation of a barker and a chipper and this investment is more than the small mill can justify. The smaller the mill, the less likely it is to be located on a main transportation route, and thus the transportation cost of residues may be prohibitive. The smaller the mill, the smaller the total amount of residue, and thus the volume produced may not be enough to give an attractive return on the investment in the processing and transportation equipment needed to utilize this residue. Thus the small mill is put at a disadvantage.

Table 18.--Production and disposition of sawmill residue by capacity class in northeastern Washington, 1962

Residue and disposition	Capacity per 8-hour shift (Thousand board feet)			Total all mills	Planing mills	Grand total	Percent totals
	80-119	40-79	1-39				
----- Tons (dry weight) -----							
Coarse residue:							
Pulp chips	53,658	14,307	--	67,965	--	67,965	48
Remanufacturing	--	--	--	--	--	--	--
Fuel	2,991	11,292	3,917	18,200	--	18,200	13
Unused	4,172	25,809	26,367	56,348	--	56,348	39
Total	60,821	51,408	30,284	142,513	--	142,513	--
Fine residue:							
Sawdust							
Agriculture and misc. uses	3,741	8,669	1,881	14,291	--	14,291	15
Fuel	32,209	11,697	2,498	46,404	--	46,404	50
Unused	3,025	13,974	14,919	31,918	--	31,918	35
Total	38,975	34,340	19,298	92,613	--	92,613	--
Shavings							
Agriculture and misc. uses	3,192	8,189	1,305	12,686	3,822	16,508	25
Fuel	6,701	9,182	759	16,642	10,944	27,586	43
Unused	2,668	7,445	8,517	18,630	2,606	21,236	32
Total	12,561	24,816	10,581	47,958	17,372	65,330	--

OUTLOOK FOR FOREST INDUSTRIES OF NORTHEAST WASHINGTON

The outlook for the forest industries of northeast Washington depends upon a number of factors, some interrelated and some independent. Obviously, the adequacy of the forest resource which provides the basic raw material is of first concern. Other factors of importance are the current degree of industrial integration and product refinement, opportunities for more intensified manufacture, general conditions in the timber industries nationwide--now and prospectively, markets for northeast Washington forest products, transportation facilities, availability of capital, and labor supply.

Although these factors relate specifically to the timber products industries, some are also of concern to other forest-based industries or businesses such as recreation and tourism. Naturally a prosperous and expanding timber industry will benefit all economic activity in the area.

Forest Industries

The sawmill and planing mill industry has always played a predominant role in influencing the economy of northeast Washington. Sawmills and planing mills are considered as a single industry in this study despite the fact that independent planing mills, most of which are located in or near Spokane, have long characterized the timber industry of this area. Although there has been some decrease in the number and volume of business of independent planing mills, they are still an important feature of the area serving a necessary and valuable function.

There is only one small pulp and paper mill and no veneer, plywood, or wood-fiber board plants in northeast Washington. The pole industry, founded upon abundant supplies of western redcedar, has declined in recent years but is still an important local industry.

Timber Supply for Industry

During 1962 the timber harvest from northeast Washington forest lands was 298 million board feet (Scribner). Sawmills (including the Albeni Falls mill of Diamond National Company) consumed 285 million board feet, and other forest products industries consumed an additional 30 million board feet. Movement of logs in and out of the area accounted for differences between logs harvested and logs consumed. Northeast Washington exported 28 million board feet of logs and imported 45 million board feet. The annual allowable cut under sustained yield from commercial forest lands of this area is estimated at 265 million board feet (Scribner), or 33 million board feet less than volume harvested in 1962.

In 1962 the timber harvest of 298 million board feet was the second highest on record for this area. In 1959, the peak year, 334 million board feet were cut. As shown earlier, the cut from private lands has been declining recently and the reverse is true of the cut from public lands. However, in 1962, cut from public lands approximated the allowable annual cut under sustained yield and there is no prospect of an increase in the allowable cut for the foreseeable future. The key to the situation, then, is the future prospect from private forest lands. Since cut from forest industry lands has apparently stabilized at about 10 to 11 million board feet, what happens on the "farmer and miscellaneous" lands will provide the answer to the problem of stumpage supply.

From the evidence at hand, timber harvest on these lands is declining both absolutely and relatively. This is the result of several factors. One is that the timber most attractive to the market because of location, size, and quality is diminishing. Analysis of information on stand-size class and volume by diameter class shows that forests on these lands run strongly to poletimber and small sawtimber stands. On the brighter side, these lands are generally good growing sites and are largely capable of growing ponderosa pine, which is bringing relatively high stumpage prices.

Any immediate increase in the harvest from these lands will be at the expense of future harvests. Very probably these lands can sustain the current volume of timber harvest for a decade or two, but thereafter it would have to be sharply reduced to build up growing stocks.

Can the forest resource be upgraded? Intensive management applied to the commercial forest lands of northeast Washington would result in greater yields on both private and public lands. This would involve restoring nonstocked and understocked lands to full production through planting programs, thinning of overstocked stands, and salvage of mortality in old-growth stands. It would require greatly increasing immediate capital investments in planting, timber culture, and road construction. It would also require a market for material smaller than saw-log size thinned from the younger stands to help pay costs of such programs. Such a market does not exist here at this time.

A considerable quantity of minimum size saw logs and cordwood could be obtained by thinning poletimber stands and from intermediate cuts of sawtimber stands. Economics permitting, these practices would provide an adequate supply of raw material for a kraft pulpmill, especially when used in combination with what chips could be developed in this area. However, recently increased kraft pulpmill capacity in the Northwest has invariably been located where a plentiful supply of chips could be obtained cheaply.

Weaver and other Bureau of Indian Affairs foresters have presented an analysis of costs and benefits of thinning and other timber stand improvement measures on the Colville Indian Reservation (Weaver, 1962). They concluded that the allowable annual cut from the reservation, only part of which is located in the northeast Washington counties, could be increased eventually from 120 million board feet (Scribner) to 200 million board feet. Costs of the necessary program were estimated at \$5,862,000 in nonrecurrent capital expenditures and \$512,000 in annual recurrent costs.

Similar programs on "farmer and miscellaneous" owned lands are beyond the reach of most owners in this group because of the long-term nature of such management. Compromise measures may be undertaken, however, by these owners. Agricultural Conservation Programs and technical assistance by Federal and private foresters are now available, and have been used moderately but not in sufficient strength to insure significant increase in prospective yields from these lands. Accelerated Public Works programs have contributed in some degree to advancement of forest management programs on public and Indian lands.

Another review of the timber management plans for the Indian lands is now underway by the Bureau of Indian Affairs. Recalculation of the annual allowable cuts is planned for the Spokane Reservation during 1964 and for the Colville Reservation during 1965. Although exact results cannot be predicted now, it is possible that the annual allowable cut can be increased by about 15 to 20 million board feet.

Markets and Transportation

Located in the interior, northeast Washington lumber producers are dependent upon rail or truck transportation to reach markets. Roosevelt Lake offers the only water transportation and it can be used only for intra-area transportation of either logs to mill or lumber to railhead.

Principal markets for lumber produced in the area are in the Prairie and Midwestern States and are reached by rail. Northeast Washington shippers have an advantage of some 3 to 5 cents a hundredweight in carload lots over lumber producers on the West Coast to St. Paul, Chicago, Council Bluffs, and other market points in these States. Small quantities of high-quality ponderosa pine products doubtless reach much wider markets.

On the other hand, Montana mills have a rail rate advantage over northeast Washington producers to midcontinent markets.

Local markets reached by truck and rail absorb only a small part of the total production of lumber. Surrounded as it is by other lumber producing areas, northeast Washington can capture only a part of the growing market in the Columbia Basin agricultural areas to the south and west of Spokane.

Many of the small mills and a few of the mills in the largest size classes produce rough lumber only. Their product is sold through wholesalers or directly to planing mills and remanufacturing plants in the area for surfacing and further processing before shipment to final markets. The Boise Cascade mill at Lincoln ships its product in the rough to a company-owned planing mill in Spokane for surfacing. In a few cases larger sawmills equipped with planers and kilns buy rough, green lumber from small mills and process it.

Three of the large lumber manufacturing plants, Deer Park Lumber Company, Boise Cascade, and Diamond National, are units in integrated enterprises national in character, and have extensive marketing facilities. Two of these, Boise Cascade and Diamond National, have a chain of retail lumber and building material yards. Other lumber manufacturers market their product through wholesalers or other types of middlemen.

The area is served by three transcontinental lines--Great Northern, Northern Pacific, and Chicago, Milwaukee, St. Paul, and Pacific Railroads. Only two of these lines, the Great Northern and the Milwaukee, reach into the hinterland of Ferry, Stevens and Pend Oreille Counties. The Lafferty Transportation Company, a public utility, provides transportation service on Roosevelt Lake, connecting with the Great Northern at Kettle Falls. It offers a towing service for logs, poles, and piling, and barge transportation for lumber. It has established rates on logs and lumber and publishes local freight tariffs.

Joint barge-rail rates permitting milling-in-transit at an intermediate rail point are in effect. The mill at Lincoln formerly shipped its product in rough form by barge to Kettle Falls and thence by rail to Spokane for processing before final shipment to market. It is reported that the Lincoln plant is now trucking its output to Spokane.

Industrial Integration

Although the three companies cited above are highly integrated they operate sawmills and planing mills only in this area with one exception: Boise Cascade Corporation operates a plant making housing components and a folding paper carton plant in Spokane, in addition to its sawmill and planing mill.

Two of these companies operate pulp and paper plants at locations neighboring northeast Washington. Boise Cascade operates a large kraft pulp and paper plant at Wallula, Washington, located on the Snake River about 125 miles southwest of Spokane. Potlatch Forest Industries, owner of Deer Park Lumber Company, has a large kraft pulp and paper mill at Lewiston, Idaho, also located on the Snake River, less than 100 miles south of Spokane. Both of these plants draw part of their raw material in the form of chips from northeast Washington.

The size and scope of these three forest products enterprises are pertinent to this study, bearing upon the conclusions. Boise Cascade Corporation manufactures and distributes a diversity of products, practically all related to wood or to containers and building materials. It also manufactures concrete products and textile bags, camping material and industrial textiles. It has forest products plants, including pulp and paper, in California, Colorado, Idaho, Montana, Oregon, Utah, and Washington. Its wholesale and retail outlets and stores, numbering well over a hundred, are located in Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. This corporation is now constructing a modern plywood plant at Elgin, Oregon, and is negotiating for the acquisition of a pulp and paper mill near Portland, Oregon.

Diamond National, successor to Diamond Match Company, manufactures lumber, plywood, pulp and paper, woodenware, matches, converted paper products and lithograph labels at mills and factories in California, Idaho, Montana, and the Eastern States. It operates a number of retail building material stores on the East and West Coasts. It also distributes stationery and other paper products through a subsidiary.

Potlatch Forest Industries, in addition to its Deer Park facility, operates sawmills in Idaho and Arkansas. It is currently negotiating for the acquisition of a pulp and paper company in Minnesota. It also manufactures plywood, pulp and paper at Idaho plants and has paper product plants on the Pacific Coast and in the East. This company has extensive forest land holdings in the Inland Empire.

Industrial Opportunities

Opportunities for increasing employment through reorientation or intensification of manufacture in existing forest products enterprise and establishment of new industrial plants can be discussed best industry by industry.

Poles and Piling

This industry is centered around western redcedar poles, a superior wood for this use, and has been an important economic activity in northeast Washington for 60 years or more. In the heyday of the industry, 1910-20, more than half a million poles were cut annually in north Idaho and northeast Washington. Except for a period immediately following World War II, production of poles has been declining not only in this area but in other areas in the West. During the postwar flurry, which was stimulated partly by expansion of rural electrification, other western species--lodgepole pine, Douglas-fir, and western larch--increased greatly in volume of production. The diminishing supply of western redcedar stumpage and improved preservation processes encouraged use of other western species. At the same time southern pine pole production increased. By 1962 production of western redcedar poles throughout the Pacific Northwest declined to 337,000 compared to 565,000 in 1950. Southern pine poles now account for 82 percent of the total pole production compared to 70 to 75 percent 10 to 15 years ago.

New processes, including treatment for fire retardation, may present greater opportunities for this industry in the future.

Lumber Manufacture

Lumber has been the traditional form of wood use and the sawmill has dominated the forest industries until recently. Increased costs of producing lumber engendered by rising stumpage and higher labor costs have encouraged substitution of other materials, particularly in construction and use of containers. Technical advances in the production of other cheaper raw materials, minerals and metals, and their fabrication, often closer to markets, have greatly increased competition with lumber products. On the other hand, other more highly fabricated wood products such as plywood, fiberboard and paper have taken markets from lumber, particularly inch boards for sheathing and subflooring and lumber for wooden boxes.

In view of these general conditions, the current installed sawmill capacity, and the stumpage supply situation in northeast Washington, there is no justification for increasing overall sawmill capacity until review of allowable cuts on the Indian lands is completed and exact amounts determined, probably by 1965. At that time, the situation should be reconsidered in light of the current policies governing disposal of Indian timber, plans and prospects of the tribes for establishing timber manufacturing plants on the reservations, and status of legislation regarding termination.

Actually, from the standpoint of industrial capacity, production at existing plants could be increased considerably over the 1962 production of 339 million board feet or the annual one-shift capacity of 275 million feet through operation of extra shifts, particularly on the part of the mills in the two larger size classes. However, stumpage supplies and market conditions don't encourage this. In fact, there is a strong likelihood that current levels of production cannot be sustained.

Undoubtedly, there are some mills in this area that are marginal operations owing to poor location, obsolescence, inadequate financing, or other reasons. It is not unlikely that new enterprisers may enter the area seeking favorable locations to establish more modern mills, especially if the lumber market should strengthen. This would not necessarily provide more employment. In fact, due to increasing labor productivity per unit of logs consumed the reverse might happen.

With much of the production in this area shipped in rough form, particularly in the three problem counties, employment could be increased through greater refinement of manufacture. Considering that only one of the four mills in the largest size class (the Boise Cascade mill at Lincoln) and two of the nine mills in the medium size class lack surfacing facilities, this opportunity is largely limited to mills in the smallest size class. Economics of such a move on the part of many of these mills is questionable, particularly due to the cost and length of time needed to amortize expensive equipment at low levels of output.

Plywood and Veneer

The softwood plywood industry, during its relatively short but dynamic life, has been and is still dominated by the Douglas-fir producers of western Oregon, western Washington and recently north-western California. During 1962 a total of 9.5 billion square feet of plywood (3/8-inch basis) were produced by this rapidly growing industry. Forecasts of softwood plywood demand estimate a total of 17.5 billion square feet by 1975, of which over half is for residential construction.

It has been only in the past few years that species other than Douglas-fir have been used to any extent. The industry grew on abundant supplies of high-quality virgin Douglas-fir growing west of the Cascade Range summit. Diminishing supplies of large old-growth Douglas-fir, technological improvements, and development and expansion of markets for sheathing grade plywood have led to use of smaller and lower quality Douglas-fir and to use of other softwood species. For example, in the past few years plywood plants have been established in western Montana using inland Douglas-fir and western larch primarily,

and producing sheathing grades of plywood almost entirely. A more recent development which also bears on opportunities for expanding plywood production in the interior of the Pacific Northwest is the emergence of southern pine as a possible competitor. Technical problems in using southern pines for plywood manufacture have been solved and two Douglas-fir producers (Georgia-Pacific Corporation and U.S. Plywood Company) have each recently commenced construction of a large, modern plywood plant in the South producing sheathing grades only initially. A third plant is being planned by a southern pine lumber producer and construction is expected to start soon. Establishment of other plants in the South is anticipated. Nearness to major markets and lower labor costs are important factors in this development.

A recent survey of plywood markets (Tec-Search, Inc., 1962) shows that of the 9.5 billion feet of plywood produced in 1962, 49 percent was used for residential construction, 21 percent for industrial use, 16 percent for nonresidential construction, 2 percent agricultural use, and 12 percent by do-it-yourself users. The survey also showed that about two-thirds of the sales of sheathing grade was used in residential construction. Another survey of geographic distribution of shipments of members of the Douglas Fir Plywood Association which covered 6.5 billion square feet during 1962 showed the following distribution: New England and Middle Atlantic States 18 percent, Midwestern and Prairie States 27 percent, Southeastern States 13 percent, other Southern States 14 percent, Rocky Mountain and Intermountain States 5 percent, and Pacific Coast States 22 percent. The remainder, amounting to a scant 1 percent, went to Alaska, Hawaii and foreign countries.

A new modern plywood plant costs from \$1,500,000 to \$3,000,000, depending upon size, intended product, and other cost factors. The minimum cost plant would have only one lathe and produce only sheathing plywood (Fleischer and Lutz, 1962).

Opportunities for establishing a softwood veneer and plywood industry in northeast Washington are limited by the quantity and quality of suitable species for peeling and competitive advantages of other regions for marketing sheathing grade of plywood. Logs suitable for and diverted to plywood use would reduce supplies of the better grade of logs available to the lumber industries. It is true, however, that veneer and plywood manufacture provides nearly twice as many hours of labor per unit of raw material consumed than does lumber manufacture. Unpublished data collected by the Pacific Northwest Forest and Range Experiment Station show that for the Pacific Northwest average number of man-years of employment per million board feet of logs (Scribner) consumed is 4.73 for the sawmill and planing mill industry compared to 9.0 for the veneer and plywood industry.

It is logical to assume that one of the three large integrated firms would be in a preferred position to establish a plywood plant in this area at least within the portions of the area from which they draw logs. They possess the capital, the technical and managerial competence, and distributing organizations and facilities with which to market the product to the best advantage. They are also in position to market the residues accumulating from cores, veneer clippings, etc., thus adding to revenues credited to the plywood operation.

This, of course, does not preclude establishment of a plywood plant by other enterprisers, particularly those operating existing sawmills in locations where an adequate supply of suitable logs can be obtained competitively. Peeler logs can bear a higher transportation cost than saw logs, thus extending supply areas.

Pulp and Paper

Establishment of a kraft pulp and paper mill in a lumber-producing area generally proves beneficial in a number of ways. In addition to adding to the manufacturing economy of the area, they furnish a market for unused material developing in lumber manufacture. A number of the kraft mills now use chips developed from mill residues exclusively for raw material. Some use small roundwood unsuited or of low value for lumber manufacture. There would be an employment advantage to the area if logs now used for lumber manufacture were used for manufacture of pulp and paper in the area. Pulp and paper mills in the Northwest provide an average of about 6.5 man-years of employment per million board feet of logs consumed compared to 4.73 man-years for sawmills and planing mills. Conversion of paper into products would add another 7 man-years of employment per million feet of logs. However, if pulp only were produced and shipped elsewhere for manufacture into paper, it would provide only about 2 man-years of employment per million feet of logs consumed.

Before it can be concluded that it would be desirable to divert logs now used for lumber manufacture to manufacture of pulp and paper, other economic factors than employment must be considered.

In addition to an assured adequate material supply, pulpmills using chemical processes require an abundant supply of pure water and means of disposing of the effluent cheaply without creating a water pollution problem. Obviously transportation, accessibility to markets, and labor supply are also needed.

It is generally considered that the minimum size kraft pulpmill for economical operation is 300 to 400 tons capacity per 24 hours. A mill of this size would require a capital investment of \$30 to \$40 million. It would use about 600 to 800 tons of dry wood per 24 hours or 210,000 to 280,000 tons a year based upon 350 days of operation.

Sawmills of northeast Washington developed 143,000 tons (dry weight) of coarse residues suitable for chipping during 1962. Of this total 56,000 tons were unused, 18,000 tons were used for fuel, and 68,000 tons were sold as pulp chips.

If a market were available, it is likely that some of the residues used for fuel would be converted to a more profitable use. On the other hand, some sawmills are too small to justify installation of barkers and chippers.

Establishment of a kraft mill in this area doubtless has been considered by prospective investors. Evidently even a minimum size mill would require other sources of raw material even if all the coarse residues developed in northeast Washington were available, including the chips now sold to pulpmills outside the area. This might mean shipping chips into the area from neighboring lumber-producing areas or use of roundwood or a combination of both. Studies in Oregon have shown that pulp chips can be transported as far as 300 miles by rail or 75 miles by truck profitably.

Cursory study has been given possible locations for a pulpmill. Roosevelt Lake presents only a few possible locations because of topography, lack of rail facilities and drawdown on the reservoir. Probable sites are at Kettle Falls and Lincoln. The latter site does not have rail connections now, although a spur connection to the Northern Pacific main lines near Wilbur could be constructed. Consensus of local informed people is that Kettle Falls is the most advantageous location. Boise Cascade Corporation is the owner of the best plant site at Kettle Falls--the former location of the Columbia River Lumber Company sawmill, now dismantled.

Two sites on the Colville Indian Reservation in Ferry County have been proposed; one at Inchelium on Roosevelt lake between Kettle Falls and the mouth of the Spokane River and the other at the mouth of the Sanpoil River. Neither of these locations has feasible rail transportation. Location on the reservation might have other problems also.

A recent report by two economists at Washington State University (Guthrie and Iulo, 1963) reports on a study of the pulp and paper situation in the Pacific Northwest. The authors forecast an 85-percent increase in U.S. pulp production by 1975. They emphasize the expanding pulp and paper markets in the West sparked by rapid growth of population in California. The report sees the possibility of western woodpulp production increasing from 5 million tons annually to 9 million tons in 1975. In a cautionary note the report points to competitive advantages of the Southern States.

Certainly the possibility of expanding pulp and paper production in northeast Washington merits further study of these critical factors.

Fiberboard

Fiberboard manufacture, including insulating board, hardboard, and particle board, has some aspects in common with pulp manufacture, but in other respects it is dissimilar. It uses sawmill coarse residues for raw material and it is highly automated. Contrary to woodpulp manufacture, planer shavings and sawdust can be used in some board-making processes and plants of small capacity are economical. Plants with a daily capacity of 50 to 70 tons of board, requiring a capital investment of less than \$1 to \$2 million depending upon type of board produced, are feasible. Raw material requirement for plants of this size are from 15,000 tons to 25,000 tons of dry wood material annually depending upon number of days operated, size of plant and type of product. Man-hours of labor required per ton of daily capacity were estimated at 7 to 10 in a study made some time ago (Pacific Power & Light Company, 1955). Theoretical calculation based upon reported capacity and labor employed at several representative west coast plants resulted in figures ranging from 6.5 man-hours to 8.6 man-hours per ton of daily capacity. Recent technical advances could account for this reduction of labor input. This industry has been expanding rapidly and is highly competitive. However, it offers opportunities for consideration and more intensive study of specific feasibility in northeast Washington.

A recent study (Carroll, 1963) made specifically with the situation in Ferry County in mind concluded that there were problems in use of wood from mixed species in particle board manufacture. Conclusions were that economies of plants designed to operate on planer shavings are not directly applicable to the whole wood supply of Ferry County. Secondly, it was concluded that use of mixed species increases complexity of the operation. The report does point out that alternatives are possible. It was found that mixture of fir and larch would not result in major processing problems, but that use of other species in mixture, even in small controlled proportions, would add significantly to the problem.

Recreation and Tourism

Obviously, timber is the principal product of northeast Washington forests. However, by no means should other products and uses be overlooked as a source of income, employment, and economic benefit. These products and uses, water, recreation, and food for wildlife and domestic livestock, are of increasing importance.

The abundance of forest streams and lakes of varying size coupled with Coulee Dam, which forms Roosevelt Lake, are attracting more visitors each year. Improvement of highways, both east and west and north and south, place this area at a crossroads of tourist travel which encompasses the Canadian and American Rockies and the Pacific Coast and its many tourist attractions.

Recreation visitors to this area are expected to surpass 1 million by next year. This is bound to have some economic impact on Ferry, Stevens, and Pend Oreille Counties, although it is not possible to make specific estimates of values and opportunities except to observe that small enterprises are suitable. These usually require only modest capital investment.

Christmas Trees

Only a few Christmas tree producers are known to be operating in this area. This industry offers opportunities for small operators and forest-land owners in the "farmer and miscellaneous" class and other local residents. Technical forestry advice is available through public agencies.

Special Situations

Two situations of differing nature and importance require mention before drawing conclusions. These are the drawdown situation on Roosevelt Lake and the future of the Colville Indian Reservation.

Roosevelt Lake Drawdown

By law a 70-foot drawdown is permitted on this lake. However, in the past it has usually averaged 35 to 40 feet. This amount of drawdown adds to the expense of using the lake for log storage and transportation (loading and unloading). Drawdown up to the legal limit would cause additional expense to industrial operators using the lake for log movement and storage or plant location. Excessive drawdown would also adversely affect recreational use.

Colville Indian Reservation

In 1957 Congress enacted P.L. 772 which required a proposal by the Confederated Tribes of the Colville Indian Reservation by July 1961. The tribes have submitted a proposal for initial legislation providing for appraisal of the reservation resources and clarification of the tribal rolls. This would be preliminary to other legislation which would propose a plan and terms of termination.

This could take several forms judging from action on other reservations having forest resources. To assist them in their considerations the Colville Business Council retained the Stanford Research Institute to make an economic analysis of alternatives. One course of action would be the establishment of an integrated forest industry on the reservation to provide job opportunities for tribal members. This might be done by competitive sale on a long-term contract requiring processing of logs at a mill financed by private capital, erected on the reservation and presumably using Indian labor in most positions. It might be done on a cooperative basis between the tribe and private investors or it might be done as a tribal investment such as has been done on the Fort Apache, Navajo, Menominee, and Red Lake Reservations with varying degrees of success. Another alternative is liquidation of the timber through sale to the Federal Government and/or private interests as was done in the case of the Klamath Indian Reservation in Oregon.

Obviously, action on any of these possibilities would have impact on the forest industries of this area. No legislative action is expected soon.

CONCLUSIONS

1. Stumpage supply and sustained yield considerations do not justify increasing aggregate installed sawmill capacity at this time. On the contrary, reduction in log harvest is probable in the near future. This would result in reduced lumber production in the problem area.
2. There might be some replacement of existing sawmills by other, more economical sawmills, which would not necessarily increase employment.
3. The status of the amount and allocation of timber harvest from the Indian lands is in a state of flux. Changes in plans and policies of the tribes could alter the entire timber supply situation in northeast Washington significantly.
4. Greater refinement of lumber processing could offset some loss of employment from lowered lumber production.
5. Veneer and plywood manufacture offers limited opportunities because of the raw material situation and competitive conditions, but should be considered as a prospect for expanding jobs. Any specific proposals for plant establishment should be preceded by thorough investigation of timber supply in relation to plant location, costs of plant installation and operation, market prospects, and possible effect on log supply to existing industry facilities.

6. Use of sawmill residues presents the best opportunity for establishing new forest industries in the area.

7. Magnitude of investment and quantities of mill residue available locally compared to amounts required would be limiting but not prohibitive factors in establishing a pulp and/or paper mill here. Fiberboard plants, requiring lesser amounts of capital and raw material, might offer industrial opportunity. For example, an average size fiberboard plant would employ 50 to 60 men in the plant operation. Specific proposals for establishing either of these industries should be thoroughly investigated before action is taken.

8. Recreation and tourism, Christmas tree growing, and small wood-using remanufacturing plants making miscellaneous products offer opportunities for small enterprises.

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U. S. Forest Service
Resource Bulletin PNW-4
May 1963

FOREST STATISTICS FOR NORTHEAST WASHINGTON

by

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U. S. DEPARTMENT OF AGRICULTURE

PREFACE

This publication summarizes the results of the third inventory of six northeast Washington counties: Ferry, Lincoln, Pend Oreille, Spokane, Stevens, and Whitman. The collection of field data was made during the years 1957 to 1961 in three separate inventory projects.^{1/}

The original inventory of Pend Oreille, Spokane, and Stevens Counties was made in 1934 and 1935 by the Northern Rocky Mountain Forest and Range Experiment Station. Results of this inventory appear in survey reports: "Forest Statistics, Pend Oreille County, Washington," March 1937, Forest Survey Release No. 2; "Forest Statistics, Spokane County, Washington," May 1937, Forest Survey Release No. 4; and "Forest Statistics, Stevens County, Washington," June 1937, Forest Survey Release No. 5.

During the same period, the Pacific Northwest Forest and Range Experiment Station inventoried the remaining counties: Ferry, Lincoln, and Whitman. Results of this inventory were published as "Forest Statistics for Ferry County, Washington," April 1937, and "Forest Statistics for Douglas, Lincoln, and Whitman Counties, Washington," January 1936.

The second inventory of northeast Washington was made during the period 1946 to 1948. A report of this inventory was published by the Northern Rocky Mountain Forest and Range Experiment Station as "Forest Resources of Northeast Washington," May 1949, Station Paper No. 21.

Such inventories are a part of the Forest Survey--a nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928, amended June 25, 1949. The purpose of the Forest Survey is to periodically inventory the extent and condition of forest lands and the timber and other forest products on them, to determine rates of forest growth and depletion, to estimate present consumption of timber products and probable future trends in timber requirements, to analyze and make available survey information needed in the formulation of forest policies and programs, and to make resurveys as necessary to keep the basic information up to date.

The Forest Survey is conducted in the various forest regions of the Nation by the regional Experiment Stations of the U. S. Forest Service. In the States of Oregon and Washington, it is the responsibility of the Pacific Northwest Forest and Range Experiment Station at Portland, Oreg.

^{1/} See "Forest Survey Procedures," p. 23.

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NORTHEAST WASHINGTON'S FOREST RESOURCE IN BRIEF

COMMERCIAL FOREST LAND--

Covers 3,626,000 acres or 46 percent of the area;
Has decreased 82,000 acres since 1948; and
Is 59 percent publicly owned.

GROWING STOCK VOLUME--

Amounts to 5,429 million cubic feet;
Is 99 percent softwoods; and
Is 68 percent publicly owned.

SAWTIMBER VOLUME--

Totals 19,642 million board feet, International 1/4-inch rule
(17,224 million board feet, Scribner rule);
Is 74 percent publicly owned;
Is 90 percent in trees less than 29 inches in diameter; and
Is 32 percent greater than in 1948.

NATIONAL FOREST OWNERSHIP--

Has 30 percent of the commercial forest area;
Controls 32 percent of the sawtimber area; and
Holds 38 percent of the sawtimber volume.

OTHER PUBLIC OWNERSHIP--

Has 30 percent of the commercial forest area;
Controls 41 percent of the sawtimber area; and
Holds 36 percent of the sawtimber volume.

FOREST INDUSTRY OWNERSHIP--

Has 4 percent of the commercial forest area;
Controls 4 percent of the sawtimber area; and
Has 6 percent of the sawtimber volume.

FARMER AND MISCELLANEOUS PRIVATE OWNERSHIP--

Has 36 percent of the commercial forest area;
Controls 23 percent of the sawtimber area; and
Holds 20 percent of the sawtimber volume.

Table 1.--Area by land classes, by county, northeast Washington, 1960

(In acres)

Land class	County										
	Total	Ferry	Lincoln	Pend Oreille	Spokane	Stevens	Whitman				
Commercial forest	3,626,000	1,123,000	60,000	812,000	365,000	1,256,000	10,000				
Unproductive forest	119,000	63,000	1,000	30,000	2,000	23,000	--				
Productive-reserved forest	28,000	--	--	1,000	27,000	--	--				
Total forest	3,773,000	1,186,000	61,000	843,000	394,000	1,279,000	10,000				
Nonforest	$\frac{1}{4}$ 4,111,000	220,000	1,411,000	57,000	734,000	312,000	1,377,000				
All land	$\frac{2}{7}$ 7,884,000	1,406,000	1,472,000	900,000	1,128,000	1,591,000	1,387,000				

$\frac{1}{4}$ Includes 14,551 acres of water according to Survey standards of area classification but defined by Bureau of the Census as land.

$\frac{2}{7}$ From U.S. Bureau of the Census, Land and Water Area of the United States, 1960.

Table 2.--Area of commercial forest land, by county and ownership classes, northeast Washington, 1960

(In acres)

County	All ownerships	National Forest	Other public	Forest industry	Farmer and miscel- laneous private
Ferry	1,123,000	381,000	598,000	10,000	134,000
Lincoln	60,000	--	--	--	60,000
Pend Oreille	812,000	486,000	45,000	48,000	233,000
Spokane	365,000	--	29,000	23,000	313,000
Stevens	1,256,000	208,000	395,000	80,000	573,000
Whitman	10,000	--	--	--	10,000
All counties	3,626,000	1,075,000	1,067,000	161,000	1,323,000

Table 3.--Area of commercial forest land, by stand-size and ownership classes, northeast Washington, 1960

(In acres)

Stand-size class	: All : ownerships :	: National : Forest :	: Other : public :	: Forest : industry :	: Farmer and : miscel- : laneous : private
Sawtimber stands	1,948,000	623,000	793,000	89,000	443,000
Poletimber stands	1,023,000	180,000	168,000	56,000	619,000
Sapling and seed- ling stands	529,000	253,000	77,000	12,000	187,000
Nonstocked areas	126,000	19,000	29,000	4,000	74,000
All classes	3,626,000	1,075,000	1,067,000	161,000	1,323,000

Table 4.--Area of commercial forest land, by stocking classes
of growing-stock trees and by stand-size classes,
northeast Washington, 1960

(In acres)

Stocking class	All stands	Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked stands
70 percent or more	1,987,000	1,042,000	644,000	301,000	--
40 to 70 percent	1,027,000	584,000	286,000	157,000	--
10 to 40 percent	486,000	322,000	93,000	71,000	--
Less than 10 percent	126,000	--	--	--	126,000
All classes	3,626,000	1,948,000	1,023,000	529,000	126,000

Table 5.--Area of commercial forest land, by forest types and ownership classes, northeast Washington, 1960

(In acres)

Type	All ownerships	Public ownerships	Private ownerships
Douglas-fir	1,413,000	898,000	515,000
Ponderosa pine	1,163,000	664,000	499,000
Western white pine	75,000	63,000	12,000
Lodgepole pine	427,000	233,000	194,000
Grand fir	53,000	11,000	42,000
Subalpine fir	3,000	1,000	2,000
Engelmann spruce	47,000	44,000	3,000
Western hemlock	36,000	31,000	5,000
Western redcedar	24,000	10,000	14,000
Western larch	234,000	129,000	105,000
Black cottonwood ^{1/}	18,000	5,000	13,000
Other hardwoods	7,000	5,000	2,000
Nonstocked	126,000	48,000	78,000
All types	3,626,000	2,142,000	1,484,000

^{1/} Includes quaking aspen.

Table 6.--Area of noncommercial forest land, by forest types,
northeast Washington, 1960
(In acres)

Type	All areas	Productive- reserved areas	Unproductive areas
Douglas-fir	12,000	12,000	--
Ponderosa pine	6,000	6,000	--
Western white pine	(<u>1/</u>)	--	--
Lodgepole pine	5,000	5,000	--
True fir—mountain hemlock	1,000	1,000	--
Grand fir	1,000	1,000	--
Western larch	(<u>1/</u>)	--	--
Hardwoods	1,000	1,000	--
Nonstocked	2,000	2,000	--
Noncommercial rocky	119,000	--	119,000
All types	147,000	28,000	119,000

1/ Less than 500 acres.

Table 7.--Volume of growing stock and sawtimber on commercial forest land by counties, northeast Washington, 1960

County	Growing stock	Sawtimber (International 1/4-inch rule)	Sawtimber (Scribner rule)
	<u>Million cu. ft.</u>	<u>Million bd. ft.</u>	<u>Million bd. ft.</u>
Ferry	1,944	8,121	7,236
Lincoln	36	102	89
Pend Oreille	1,372	4,836	4,163
Spokane	387	1,110	958
Stevens	1,677	5,423	4,735
Whitman	13	50	43
Total	5,429	19,642	17,224

Table 8.--Volume of timber on commercial forest land, by class
of timber and by softwoods and hardwoods, northeast
Washington, 1960

Class of timber	All species	Softwoods	Hardwoods
----- <u>Million cubic feet</u> -----			
Sawtimber trees:			
Saw-log portion	3,389	3,373	16
Upper-stem portion	255	254	1
Total	3,644	3,627	17
Poletimber trees			
	1,785	1,745	40
All growing-stock trees	5,429	5,372	57
Sound cull trees:			
Sawtimber-size	12	12	--
Poletimber-size	12	6	6
Total	24	18	6
Rotten cull trees:			
Sawtimber-size	152	152	--
Poletimber-size	--	--	--
Total	152	152	--
Salvable dead trees:			
Sawtimber-size	151	150	1
Poletimber-size	--	--	--
Total	151	150	1
Total, all timber	5,756	5,692	64

Table 9.--Volume of growing stock and sawtimber on commercial forest land, by ownership classes and by softwoods and hardwoods, northeast Washington, 1960

Timber and ownership classes	All species	Softwoods	Hardwoods
	<u>Million cu. ft.</u>	<u>Million cu. ft.</u>	<u>Million cu. ft.</u>
Growing stock:			
National Forest ^{1/}	1,881	1,876	5
Other public	1,804	1,788	16
Forest industry	301	297	4
Farmer and miscellaneous private	1,443	1,411	32
All ownerships	5,429	5,372	57
	<u>Million bd. ft.</u>	<u>Million bd. ft.</u>	<u>Million bd. ft.</u>
Sawtimber (International 1/4-inch rule):			
National Forest ^{1/}	7,449	7,434	15
Other public	7,110	7,068	42
Forest industry	1,209	1,202	7
Farmer and miscellaneous private	3,874	3,846	28
All ownerships	19,642	19,550	92
Sawtimber (Scribner rule):			
National Forest ^{1/}	6,448	6,433	15
Other public	6,361	6,320	41
Forest industry	1,065	1,059	6
Farmer and miscellaneous private	3,350	3,323	27
All ownerships	17,224	17,135	89

^{1/} Data for National Forest based on National Forest working circle inventories.

Table 11.--Volume of sawtimber on commercial forest land, by species and diameter classes, northeast Washington, 1960 (International 1/4-inch rule)

Species	Diameter class (inches at breast height)								Total
	11.0- classes	12.9	13.0- 14.9	15.0- 16.9	17.0- 18.9	19.0- 28.9	29.0- 38.9	39.0 and larger	
----- Million board feet -----									
Softwoods:									
Douglas-fir	6,304	1,129	1,051	784	669	2,077	467	127	
Ponderosa pine	5,780	559	607	607	591	2,325	975	116	
Western white pine	625	264	97	91	164	9	--	--	
Lodgepole pine	620	314	223	64	19	--	--	--	
Grand fir	910	204	201	167	102	222	14	--	
Subalpine fir	148	87	38	12	5	6	--	--	
Engelmann spruce	755	421	304	8	7	15	--	--	
Western hemlock	455	241	120	94	--	--	--	--	
Western redcedar	495	89	136	93	80	80	15	2	
Western larch	3,458	553	615	609	536	976	157	12	
Total	19,550	3,861	3,392	2,529	2,173	5,710	1,628	257	
Hardwoods:									
Quaking aspen	28	13	11	4	--	--	--	--	
Western paper birch	7	2	4	1	--	--	--	--	
Black cottonwood	57	9	13	(1/)	3	28	4	--	
Total	92	24	28	5	3	28	4	--	
All species	19,642	3,885	3,420	2,534	2,176	5,738	1,632	257	

1/ Less than 500,000 board feet.

Table 12.--Volume of sawtimber on commercial forest land, by species and diameter classes, northeast Washington, 1960 (Scribner rule)

Species	Diameter class (inches at breast height)										Total	
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9		29.0-30.9
----- Million board feet -----												
Softwoods:												
Douglas-fir	5,599	925	885	675	597	1,918	478	121				
Ponderosa pine	5,119	459	510	522	522	2,128	869	109				
Western white pine	531	217	82	78	146	8	--	--				
Lodgepole pine	517	257	188	55	17	--	--	--				
Grand fir	787	167	169	144	90	204	13	--				
Subalpine fir	124	72	32	10	4	6	--	--				
Engelmann spruce	628	346	256	7	6	13	--	--				
Western hemlock	380	198	101	81	--	--	--	--				
Western redcedar	427	73	114	80	71	73	14	2				
Western larch	3,023	452	517	525	474	896	147	12				
Total	17,135	3,166	2,854	2,177	1,927	5,246	1,521	244				
Hardwoods:												
Quaking aspen	27	12	11	4	--	--	--	--				
Western paper birch	7	2	4	1	--	--	--	--				
Black cottonwood	55	9	12	(1/)	3	27	4	--				
Total	89	23	27	5	3	27	4	--				
All species	17,224	3,189	2,881	2,182	1,930	5,273	1,525	244				

1/ Less than 500,000 board feet.

Table 13.--Volume of salvable dead sawtimber-size trees
on commercial forest land, by softwoods and
hardwoods, northeast Washington, 1960

Species group	Volume	
	International 1/4-inch rule	Scribner rule
	----- <u>Million board feet</u> -----	
Softwoods	537	467
Hardwoods	7	7
All species	544	474

Table 14. -- Annual mortality of growing stock and sawtimber on commercial

forest land, by ownership classes and by softwoods and hardwoods, northeast Washington, 1960

Ownership class	Growing stock		Sawtimber (International 1/4-inch rule)		Sawtimber (Scribner rule)	
	All species	Soft-woods	All species	Soft-woods	All species	Soft-woods
	Million cu. ft.	Hard-woods	Million bd. ft.	Hard-woods	Million bd. ft.	Hard-woods
National Forest	12	12	55	55 (1/)	48	48
Other public	9	9	35	34	31	30
Forest industry	1	1	3	3	2	2
Farmer and miscellaneous private	6	6	17	16	15	14
All ownerships	28	28 (1/)	110	108	96	94

1/ Less than 500,000 board feet.

Table 15.--Number of growing-stock trees on commercial forest land, by diameter classes and by softwoods and hardwoods, northeast Washington, 1960

Diameter class (inches d.b.h.)	All species	Softwoods	Hardwoods
5.0 - 6.9	156,498,000	152,015,000	4,483,000
7.0 - 8.9	88,209,000	86,554,000	1,655,000
9.0 - 10.9	47,179,000	46,457,000	722,000
11.0 - 12.9	35,968,000	35,702,000	266,000
13.0 - 14.9	21,609,000	21,372,000	237,000
15.0 - 16.9	10,959,000	10,934,000	25,000
17.0 - 18.9	6,165,000	6,156,000	9,000
19.0 - 28.9	9,403,000	9,353,000	50,000
29.0 - 38.9	1,064,000	1,060,000	4,000
39.0 and larger	68,000	68,000	--
All classes	377,122,000	369,671,000	7,451,000

Table 16.--Number of cull and salvable dead trees on
commercial forest land, by diameter groups
and by softwoods and hardwoods, northeast
Washington, 1960

Diameter class (inches d.b.h.)	Cull trees	Salvable dead trees
Softwoods:		
5.0 - 10.9	10,723,000	--
11.0 - 18.9	11,379,000	5,886,000
19.0 and larger	1,821,000	1,040,000
Total	23,923,000	6,926,000
Hardwoods:		
5.0 - 10.9	1,280,000	--
11.0 - 18.9	--	12,000
19.0 and larger	--	12,000
Total	1,280,000	24,000
All species	25,203,000	6,950,000

Table 17.--Timber harvest by ownership class, northeast Washington,
1950-60 (Scribner rule)

Year ^{1/}	Private	State	National Forest	Other public	Total
----- <u>Thousand board feet</u> -----					
1950	42,323		41,839	48,119	132,281
1951	111,839		42,267	48,185	202,291
1952	107,333		50,798	54,599	212,730
1953	117,287		35,783	58,434	211,504
1954	134,874		52,112	50,990	237,976
1955	151,564	5,733	49,814	59,567	266,678
1956	156,018	508	65,390	73,568	295,484
1957	130,780	2,504	66,245	54,196	253,725
1958	127,175	899	73,564	72,725	274,363
1959	139,798	2,291	86,007	105,433	333,529
1960	134,727	3,293	68,584	69,894	276,498

^{1/} For the years 1950-54, data for private and State ownerships were not separated.

ACCURACY OF THE 1960 REINVENTORY DATA

Forest Area and Timber Volume

Estimates of forest land area for National Forest and Indian ownerships were obtained from the most recent inventories. These estimates were based on complete enumeration by means of a forest type map, thus no sampling error was involved. Volume estimates for these areas and both volume and area estimates for the remaining portion of the six-county area were derived by sampling and thus have sampling errors. Sampling errors were calculated for total commercial and noncommercial forest land and total board-foot and cubic-foot volume only. In all cases an effort was made to hold errors due to techniques or judgment to a minimum by close supervision and frequent checks of all phases of the work.

Table 18 presents the estimated sampling errors as a percent of the total estimate at the 68-percent and 95-percent probability levels.

Table 18. -- Sampling error of estimates of forest area
and timber volume

Item	Estimated total	Sampling error in percent	
		68-percent probability	95-percent probability
Commercial forest land	3,626,000 acres	0.9	1.7
Noncommercial forest land	147,000 acres	1.9	3.6
Volume (Scribner)	17,224 million board feet	3.3	6.4
Volume	5,429 million cubic feet	2.6	5.0

The sampling error of a portion of the total area or volume estimate may be approximated by obtaining its proportion of the total estimate and referring to figure 1, page 20. The multiplying factor applied to the percent sampling error of the total estimate will give an approximation of the sampling error of the portion.

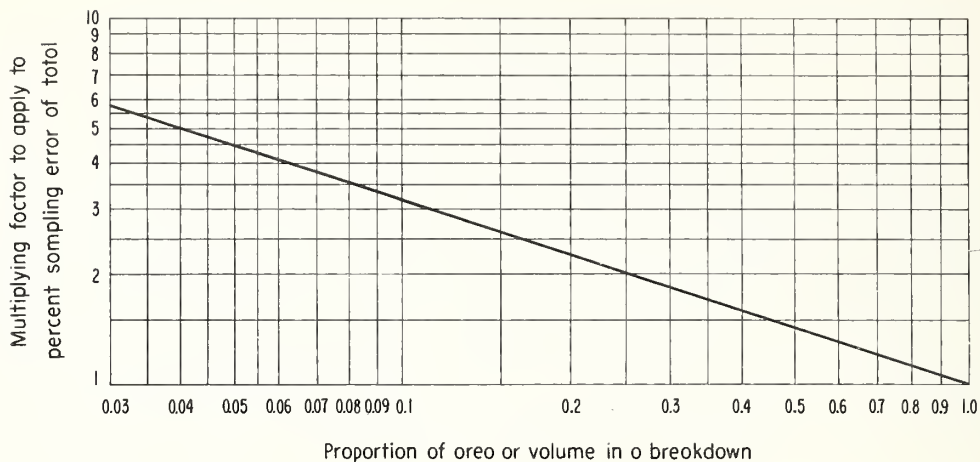


Figure 1.--Ratio of sampling error of an area or volume breakdown to sampling error of total area or volume.

For example, assume that the sampling error reported for a total is ± 5 percent, and an estimate of the sampling error for an item which is only 0.25 of this total is desired. Reading from figure 1, the multiplying factor for a proportion of 0.25 is 2. The estimated sampling error for the item is then 2 times ± 5 percent, the sampling error of the total, or ± 10 percent.

DIFFERENCES IN RESULTS OF INVENTORIES

Tables 19 and 20 show area and volume estimates for the 1960 and 1946-48 inventories. Some of the differences between forest-area and timber-volume estimates for the two inventories are due to physical changes, such as cutting and growth of stands, restocking of deforested area, and the shift of forest land to other uses such as urban development. Some of the differences are due to changes in the inventory procedures used, some to the changes in the standards of utilization recognized, and some to changes in Forest Survey standards and definitions. These variations make it difficult to draw meaningful conclusions from the comparison of the two sets of statistics.

It seems likely, however, that the change in the area of commercial forest land since 1948 is largely due to physical changes such as urban development, withdrawal of forest land for powerline and highway rights-of-way, and for agricultural and industrial uses.

The considerable increase in volume, however, is mostly due to better estimates resulting from improved inventory techniques and, to some extent, the effect of changed utilization standards.

Table 19.--Comparison of forest-area statistics fornortheast Washington

(In acres)

Land-use class	1946-48 reinventory	1960 reinventory
Commercial forest	3,708,000	3,626,000
Noncommercial forest:		
Productive-reserved	7,000	28,000
Unproductive	215,000	119,000
Total noncommercial forest	222,000	147,000
Total forest	3,930,000	3,773,000
Nonforest	4,016,000	4,111,000
All land	<u>1/</u> 7,946,000	<u>2/</u> 7,884,000

1/

From U.S. Bureau of the Census, Land and Water Area of the United States, 1940. This figure includes the area of Franklin D. Roosevelt Lake behind Grand Coulee Dam and other areas of water which have since been removed from the Bureau of the Census figures for land area.

2/

From U.S. Bureau of the Census, Land and Water Area of the United States, 1960.

Table 20.--Comparison of timber-volume statistics for
northeast Washington

(In million board feet, International 1/4-inch rule)

Species	1946-48 reinventory	1960 reinventory
Softwoods:		
Douglas-fir	4,696	6,304
Ponderosa pine	5,582	5,780
Western white pine	418	625
Lodgepole pine	420	620
Grand fir	329	910
Subalpine fir	61	148
Engelmann spruce	156	755
Western hemlock	261	455
Western redcedar	373	495
Western larch	2,533	3,458
Total	14,829	19,550
Hardwoods:		
Black cottonwood	52	57
Other	10	35
Total	62	92
All species	14,891	19,642

FOREST SURVEY PROCEDURES

This inventory contains the data from a group of separate subinventories: the Spokane Indian Reservation, 1957; the Colville National Forest, 1957; the Kaniksu National Forest, 1961; the Colville Indian Reservation, 1958; the remaining area outside the National Forests and Indian reservations, 1960.

The Colville and Kaniksu National Forests were inventoried by National Forest personnel of Forest Service Region 1. All other units were inventoried by the Pacific Northwest Forest and Range Experiment Station.

The Indian reservations and the National Forest inventory designs were similar in that they both used a forest type map prepared from aerial photos to obtain area statistics and a field sample for volume estimates. In contrast, the remaining area was inventoried with a two-stage sampling design using photo and field plots to obtain both area and volume estimates.

The basic field sample of the Indian reservations and the remaining area outside the National Forests consisted of field plots located on systematic grids with intervals of 1.7 and 3.4 miles, respectively. In the area outside the National Forest and Indian reservations, these field plots were supplemented by a systematic grid of photo plots. All the photo plots and field plot locations were examined on aerial photographs and classified into one of three land-use classes: Nonforest, noncommercial forest, or commercial forest land.

The field plots, consisting of a cluster of three 1/5-acre circular subplots spaced at 6-chain intervals, were located, established, and measured in the field. These plots provided a check on the accuracy of the photo interpretation of land-use class and were combined with the photo plots to provide an adjusted estimate of the proportion of area by land-use classes. The field plots also provided data on ownership, forest type, stocking, etc., for use in subdividing the adjusted gross commercial forest land area into area by ownership class, forest type, stand-size class, and stocking class.

Tree measurement data obtained on the field plots, expanded by the total adjusted acreage of commercial forest land represented by each field plot, provided estimates of volume and mortality by species and size class as well as by ownership.

DEFINITION OF TERMS

Land Area

Total Land Area

Includes dry land and unmeandered water surfaces.

Forest Land Area

Land at least 10 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized in reinventory was 10 acres where type maps were used and 1 acre where sampling procedures were used.

Nonforest Land Area

Land that does not qualify as forest land.

Forest Land Classes

Commercial Forest Land Area

Forest land which is producing or capable of producing industrial wood and not withdrawn from timber utilization.

Noncommercial Forest Land Area

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

Types

Commercial Forest Land Type

Forest land is typed on the basis of the predominant species, as indicated by cubic volume for sawtimber and poletimber stands and number of trees for sapling and seedling stands, or on the basis of forest condition, such as nonstocked cutover or burned-over land. Where none of the indicated species comprise 50 percent or more of a given stand, the stand is classified on the basis of plurality of cubic volume or number of trees. In classifying forest land by type, the minimum area recognized is 1 acre.

Noncommercial Forest Land Types

Productive-reserved. Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land. Types designated the same as for commercial forest land.

Unproductive. Forest land incapable of yielding crops of industrial wood products (usually sawtimber) because of adverse site conditions.

Subalpine. Forest stands at the upper elevational limits of tree growth.

Noncommercial rocky. Areas within the commercial forest zone but so steep and rocky that they are incapable of producing usable wood products.

Nonforest Land Types

Vegetative. Cultivated land, stump pasture, grass, or brush on non-forest land.

Nonvegetative. Includes barrens and towns.

Unmeandered water. Includes unmeandered streams and lakes, and tideflats.

Tree Classes

Sawtimber Tree

Tree of commercial species, 11.0 inches d.b.h. and larger, that contains at least one 16-foot coniferous saw log or one 8-foot hardwood saw log to a variable top diameter never less than 8.0 inches inside the bark. Also, 25 percent or more of the gross board-foot volume must be free from rot or defect.

Poletimber Tree

Tree of commercial species, 5.0 to 10.9 inches d.b.h., in which 25 percent or more of the gross cubic-foot volume is free from rot and defect.

Sapling and Seedling Trees

Live trees of commercial species, less than 5.0 inches d.b.h., and of good form and vigor.

Cull Tree

Live tree of sawtimber or poletimber size that is unmerchantable for saw logs, now or prospectively, because of defect, rot, or species.

Sound cull tree. Live tree of sawtimber or poletimber size that contains 25 percent or more of sound volume but will not make at least one merchantable saw log, now or prospectively, because of roughness, poor form, or species.

Rotten cull tree. Live tree of sawtimber or poletimber size in which less than 25 percent of the total volume is sound.

Mortality Tree

Tree which has died from natural causes and which was not a cull tree at the time of death.

Salvable Dead Tree

Standing or down dead tree that contains 25 percent or more of sound volume and at least one merchantable 16-foot coniferous or 8-foot hardwood saw log.

Stand-Size Classes

Sawtimber Stand

Stand of sawtimber trees having a minimum per-acre net volume of 1,500 board feet (International 1/4-inch rule).

Large sawtimber stand. Stand in which the majority of the volume is in trees 21.0 inches d. b. h. and larger.

Small sawtimber stand. Stand in which the majority of the volume is in trees from 11.0 to 20.9 inches d. b. h.

Poletimber Stand

Stand failing to meet sawtimber stand specifications but at least 10 percent stocked with poletimber and larger (5.0 inches d. b. h. and larger) trees and with at least half the minimum stocking in poletimber trees.

Sapling and Seedling Stand

Stand not qualifying as either a sawtimber or poletimber stand but at least 10 percent stocked with trees of commercial species and with at least half the minimum stocking in sapling and seedling trees.

Nonstocked Area

An area less than 10 percent stocked with present or potential growing-stock trees.

Stocking

Stocking is the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Degree of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and

stands. Stocking may be measured in terms of number of trees, volume, basal area, cover canopy, or other criterion or combination of criteria.

Well-Stocked Stand

A stand that is 70 percent or more stocked with present or potential growing-stock trees.

Medium-Stocked Stand

A stand that is 40 to 69 percent stocked with present or potential growing-stock trees.

Poorly Stocked Stand

A stand that is 10 to 39 percent stocked with present or potential growing stock trees.

Nonstocked Area

An area less than 10 percent stocked with present or potential growing-stock trees.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees of commercial species:

Scribner rule. The common board-foot log rule used in determining volume of sawtimber in the Pacific Northwest.

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

Growing Stock

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark.

All-Timber Volume

Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top outside bark.

Ownership Classes

National Forest Lands

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

Other Federal Lands

Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies.

State, County, and Municipal Lands

Lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.

Forest Industry Lands

Lands owned by companies or individuals operating wood-using plants.

Farmer-Owned Lands

Lands owned by operators of farms.

Miscellaneous Private Lands

Privately owned lands other than forest industry or farmer-owned lands.

TREE SPECIES

Tree species found in northeast Washington include:

Softwoods:

- Douglas-fir (Pseudotsuga menziesii)
- Engelmann spruce (Picea engelmannii)
- Grand fir (Abies grandis)
- Lodgepole pine (Pinus contorta)
- Ponderosa pine (Pinus ponderosa)
- Subalpine fir (Abies lasiocarpa)
- Western hemlock (Tsuga heterophylla)
- Western larch (Larix occidentalis)
- Western redcedar (Thuja plicata)
- Western white pine (Pinus monticola)

Hardwoods:

- Black cottonwood (Populus trichocarpa)
- Quaking aspen (Populus tremuloides)
- Red alder (Alnus rubra)
- Western paper birch (Betula papyrifera var. commutata)

RECENT FOREST SURVEY REPORTS

<u>Number</u>	<u>Title</u>	<u>Date</u>
PNW-1	1961 Washington Log Production	January 1963
146	1961 Oregon Log Production	December 1962 (rev.)
145	Forest Statistics for Clallam County, Washington	July 1962
144	Forest Statistics for Jefferson County, Washington	June 1962
143	Forest Statistics for King County, Washington	June 1962
142	Forest Statistics for Island and Kitsap Counties, Washington, 1959; San Juan County, Wash- ington, 1960	May 1962
141	Forest Statistics for Pierce County, Washington	May 1962
140	1960 Washington Log Production	March 1962
139	Forest Statistics for Okanogan County, Washington	March 1962
138	1960 Oregon Log Production	January 1962
137	Forest Statistics for Grant County, Oregon	November 1960
136	Forest Statistics for Southeast Washington	July 1960

Available from:

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