

## PART III

## Physical Description

Physical Regions of Washington

On the basis of surface features, Washington may be divided into eight general regions. Agricultural settlement is influenced by factors of topography, climate, soil, forest vegetation and water resources distinctive to each of the physiographic regions. Each has become a different type of farming area as settlers have learned to adapt crops and livestock to the conditions, or have improved limitations through drainage or irrigation.

Coastal Plains

A narrow, sandy plain with shallow bays, tidal flats, stream deltas and low headlands lies between the coastline and the Coast Range. It extends from the Columbia River mouth almost to Cape Flattery, being widest and lowest in the Grays Harbor and Willapa Bay districts. The climate is mild and damp with a long growing season, but it is too cool, cloudy and wet for most crops. Originally this area was covered with heavy forests and much is now covered with woodlands. Lumbering and manufacture of wood products is the main industry. Farming is largely of the livestock and dairying type on low uplands and drained areas in the lower Chehalis River Valley. Cranberry growing is important and well-adapted to numerous, boggy areas in the Grays Harbor and Willapa Bay sections. The shallow bays are also used for oyster culture. Fishing is common in the rivers and coastal banks.

Coast Range

The Coast Range is an uplifted area of sedimentary and metamorphic rocks divided into the Olympic Mountains and the Willapa Hills. The Olympics tower to nearly 8,000 feet in a dome-like structure, carved deeply by rivers. These mountains have the heaviest precipitation in the state. Snowfields and heavy forest cover the mountains. Most of the wilderness area is within the Olympic National Forest and Olympic National Park, being managed for recreation, wildlife and timber. Farm settlement is limited to some foothill river plains and coastal terraces such as the Dungeness and Port Angeles districts along the Strait of Juan De Fuca. Here in the lee of the mountains, rainfall is moderate and irrigation is practiced by some livestock farmers. The Willapa Hills country is wet, heavily forested and carved into numerous narrow valleys. Logging is the main industry, combined with livestock farming in the upper Chehalis River Valley and along the banks of the Columbia River. Wet climate, hilly topography and the difficulty of clearing stump land retards agriculture.

Willamette-Puget Sound Lowland

A broad lowland, described as a trough or valley, lies between the Coast Range and the Cascade Mountains. The northern part is the Puget Sound Lowland which has been glaciated and occupied by the sea in the lowest section. The continental glacier reached slightly south of Olympia. Under a warming climate it melted and geologists believe it receded about 25,000 years ago, leaving an infertile plain of moraines and outwash gravels, sands and clays known today

as the Puget Glacial Drift Plain. Its rolling surface has numerous lakes and bogs. Most of the major cities--Seattle, Tacoma, Everett, Bellingham and Olympia--have been built on moraines bordering the Sound. Rivers, such as the Nooksack, Skagit, Snoqualmie, White and Puyallup, built up deltas and flood plains over the older gravelly plains. These narrow valleys are more fertile than the older glacial plains and support numerous small dairy, vegetable and berry farms. Most of the gravelly areas are wooded with a second-growth forest and are used for pastures. In the southern part of the Willamette-Puget Sound Lowland, there are two large valleys--the Cowlitz and Chehalis. They drain a low, hilly area with several flat prairies and bottom lands.

Agriculture is handicapped by poor drainage and flooding of the river deltas and plains, by heavy winter rainfall, by cloudy but dry summers, by coarse, gravelly upland soils and by densely wooded land which is costly to clear. Advantages are mild climate and a location close to major markets for farm products such as milk, poultry and vegetables.

### Cascade Mountains

The Cascades are a wide and high topographic and climatic barrier which separates western and eastern Washington. The range is made up of sedimentary, igneous and metamorphic rocks which have been carved by glaciers and streams. High, isolated volcanic cones of lava such as Mt. Adams (12,307 feet), Mt. Rainier (14,408 feet) and Mt. Baker (10,791 feet) appear upon the older Cascade rocks. The Cascade crest varies between 3,000 and 10,000 feet and is higher and more rugged in northern Washington. Roads and railroads have been built across its lower passes in central and southern Washington. The Columbia River has cut a deep gorge and the lowest pass through the barrier. The western slope is wet and heavily forested with Douglas fir. The eastern slope is drier with a less-dense pine forest. Nearly all classified as forest land, most of the area is in Federal ownership in five national forests and Mount Rainier National Park. Tree fruit farming in the eastern slope valleys of Wenatchee, Chelan, Methow, Naches and the Columbia Gorge is most important. Sheep and cattle summer grazing on alpine grasslands is another use. Deep western slope valley bottoms such as the Skagit, Snoqualmie, Nisqually, Cowlitz and Lewis also contain livestock farms. The area is vitally important as a source of timber. Steep terrain, wet climate, short growing seasons and heavy forest vegetation are main handicaps for agriculture.

### Columbia Basin

A low plateau of old lava rocks covered with stream and wind-deposited soils extends in a series of plains, ridges, coulees and hills from the Cascades to the eastern Washington border. The area is basin-like in structure, being higher around its margins and sloping inward to low and level central plains. It has been sharply eroded by the Columbia River and its interior tributaries, the Snake, Yakima, Palouse and Spokane Rivers. The basin has sub-areas created by crustal movements and erosion.

The Yakima Folds are a series of hilly ridges extending from the Cascades eastward into the lower part of the basin. The Yakima and Columbia Rivers have cut gaps through the ridges and built up plains in the troughs between them. The rich, alluvial plain of the Yakima River is an important irrigated valley.

The Waterville Plateau is a tableland of thin soils overlaying basaltic rock at an elevation of 2,500 to 3,000 feet. It has gorges cut by the Columbia River and ancient glacial outwash streams once flowing in Moses and Grand Coulees. It is too high for irrigation and is used for dryland grain and livestock farming. The high plain is often called the Big Bend country.

The Channelled Scablands is a belt of dry terrain carved by ice-age rivers into a series of coulees. Bare rock is exposed in the coulees. Small plateaus between the old river channels have thin soils used for dryland farming. The Grand Coulee of this region has been developed into a major irrigation reservoir.

The Palouse Hills consist of fertile deposits of wind-blown soil overlaying basaltic lava flows. After being deposited in large dunes, the formation was reshaped by streams into an intricate pattern of low, rounded hills which are tilled for wheat, barley and legumes. The hills receive 16 to 25 inches of rainfall and have deep, porous and fertile soils. It is one of the richest farming areas of the Pacific Northwest.

The Central Plains are low and relatively level expanses of soil, deposited by old streams crossing the Channelled Scablands and later by the flooding of the Yakima, Columbia, Snake and Walla Walla Rivers. Climate is desert-like (6-12 inches of precipitation per year). The lower lands of the area, the Quincy and Pasco Basins and the Walla Walla Valley, are irrigated. Quincy Basin is a new irrigation area watered by Grand Coulee Dam.

Agricultural handicaps in Columbia Basin regions are mainly found in its dry, continental climate. Large irrigation systems built since 1900 have overcome much of the need for water on rich valley and basin soils. Dryland farming in higher areas is practiced widely, although occasional variations in rainfall, lack of snowfall, winter-kill, water and wind erosion inflict damage to field crops and to livestock ranges.

### Okanogan Highlands

A portion of the Rocky Mountains, consisting of well-eroded old granites, lavas and sedimentary rocks, extends across north central Washington. These are the Okanogan Highlands, the state's richest mineral area. Summit levels reach 4,000 to 5,000 feet with peaks exceeding 7,000 feet. Prominent north-south valleys are occupied by irrigated tree fruit and livestock farms. These are the Okanogan, Sanpoil, Kettle and Colville Valleys. The Columbia River gorge through the Okanogan Highlands is occupied by the large man-made lake behind Grand Coulee Dam--Roosevelt Lake. High and wetter portions are forested with pine and larch, and are managed for timber and for livestock ranges by the United States Forest Service and the Bureau of Indian Affairs. Cold winter temperatures, short growing seasons, dry valley climates and distance from markets are farming handicaps.

### Selkirk Mountains

The Selkirks, a range of the Rocky Mountain system, extend into the northeast corner of Washington. The rocks are old mineralized granites and metamorphics reaching elevations of over 7,000 feet. The Pend Oreille River Valley

at the base of the Selkirks is an agricultural area of narrow bottom lands settled by livestock farmers. Nearly all of the uplands are in Kaniksu National Forest. While climate is cool and growing seasons are short, the Pend Oreille Valley has an advantage of being closely located to the Spokane metropolitan market area.

### Blue Mountains

The Blue Mountains are an uplifted and eroded plateau extending into the southeastern corner of Washington. The strata are mainly ancient crystalline rocks which contain some minerals. The highest point of the mountains in the Washington section is Diamond Peak (6,401 feet), on the divide between the Grande Ronde, Tucannon and Touchet Rivers. These rivers, and the Walla Walla River, have cut valleys into the plateau. Extensive pine forest and grassland areas are in the highlands within Unstilla National Forest, where rainfall is 30 to 40 inches. The Snake River has cut a deep valley and gorge across the lower parts of the mountains. The area is well developed agriculturally around its northern foothills where wind-blown soils are deep and irrigation systems are used. The Walla Walla and Tucannon Valleys are rich grain, legume and livestock areas grown under irrigation and by dry farming. Grazing is an important use of the high lands by livestock ranchers in the upper valleys.

### Topography of Clallam County

The topography of Clallam County varies from sea level beaches, low terraces and deltas to the alpine peaks of the Olympic Mountains. The largest agricultural lowland is the alluvial, fan-shaped plain of the Dungeness River, which extends from the sandy Dungeness spit in the Strait of Juan de Fuca southward about ten miles to foothills of 500 feet elevation. This flatland is known as Dungeness and Sequim Prairies, a dry area with level and gradual slopes permitting irrigation. Most of the county's 1,068 farms are located in the Dungeness Valley. Low beach terraces created by recent uplift of the earth's crust slightly above sea level are important land farms along the Strait. They are of glacial till materials and are cut by numerous streams. Port Angeles is built on an old beach terrace and its harbor is sheltered by Ediz Hook, a sand spit deposited by ocean currents. Neah Bay and Clallam Bay are other beach terrace settlements.

The valley bottom and low benchlands of the drainage system formed by the Quillayute, Bogachiel and Soleduck Rivers makes up the largest lowland region. It extends from Lake Crescent westward for 50 miles to the Pacific Ocean. The Bogachiel and Soleduck join four miles from the coast to form the Quillayute, the largest river. This lowland belt across the foothills is used by the Olympic Peninsula Loop Highway (U. S. 101) and logging railroads.

The valley bottom has deep layers of gravelly moraines and sandy outwash materials deposited by earlier glaciers. Quillayute Prairie and Forks Prairie are lowlands with farm and town settlements, the town of Forks being located on the latter. Forested for the main part with a few farms, the Soleduck lowland is about 750 feet above sea level at Lake Crescent and 550 feet at Forks.

About three-fourths of the county is made up of hills and mountains created by the uplifting of the earth's crust and its erosion by glaciers,

streams and also by the sea along its western edge. Rocks are varied and complex in formation as a result of the mountain building and erosive forces. Sedimentary rocks--shales and sandstones--are the older rocks and basalts are younger igneous types of rock. The higher part in Olympic National Park has steep ridges with spire-like peaks perpetually covered with snowfields. The highest point on Clallam County is Mount Carrie, elevation 7,020 feet.

### Land Classification and Soils

Because of its mountainous and hilly topography, Clallam County is divided into eight broad classes of land use capability. Terrain drainage, glaciation and other varied processes of soil formation have created forty-one soil types according to the Clallam County Soil Survey. <sup>1/</sup> Many farms in various stream valleys will have two or more classes of land and include several soil types.

Class I and II lands, the best farming districts, are localized to the lower valleys of the Dungeness, Pysht, Elwha and Hoke Rivers. These lands are narrow bottomlands. The Dungeness-Sequim alluvial plain is a broad valley covering about 30,000 acres. Here the Dungeness River and McDonald Creek have deposited materials from which soils of high to medium fertility have been formed. The prairie around Sequim includes the Sequim clay and gravelly loams, Bellingham loams, Clallam loams, Carlsborg loams and muck soils which are farmed successfully when irrigated. The Dungeness River banks and its delta in Dungeness Bay contain some of the most fertile soils in Clallam County. These are Dungeness loam, Pilchuck fine sandy loam and Agnew silty clay loam.

A large area of Class III and IV land extends westward from the Dungeness Valley to the Port Angeles locality on the terraces inland from the Strait of Juan de Fuca. It is crossed by numerous creeks flowing northward from the Olympic Mountains. Major soil types on this coastal terrace are Clallam loam on the lower terrace, Elwha loams on the foothills and Crescent gravelly loams. These soils are of medium fertility found on rolling uplands and foothills. They are covered with a large amount of woodland. Other valley and lowland localities with Class III and IV land are the Quillayute, Soleduck and Bogachiel Rivers. When cleared, drained and neutralized with lime, these bottom lands are fertile. Chehalis loam, a recently deposited alluvial soil by flooding rivers, is the best soil in these western valleys. Higher benchlands along the Soleduck contain over 50,000 acres of Soleduck gravelly loam, a glacial soil which becomes dry in the summer. On these benches are Quillayute and Forks Prairies with Quillayute silty clay loam and Wellman loam, once heavily forested soils, they are now used mainly for hay and pasture by a number of farms.

Over half the county area is classified as Class V, VI, VII and VIII lands, capable of grazing use but considered most useful for forests. This includes most of the hilly and mountainous terrain between 1,000 and 4,000 feet elevation. In most places it is now dense forest or regrowth forest on old logged-off lands. The soils are typed as rough mountainous land with no

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<sup>1/</sup> U. S. Department of Agriculture, Soil Conservation Service, and Agriculture Experiment Station, Washington State College, Soil Survey, Clallam County, 1951.

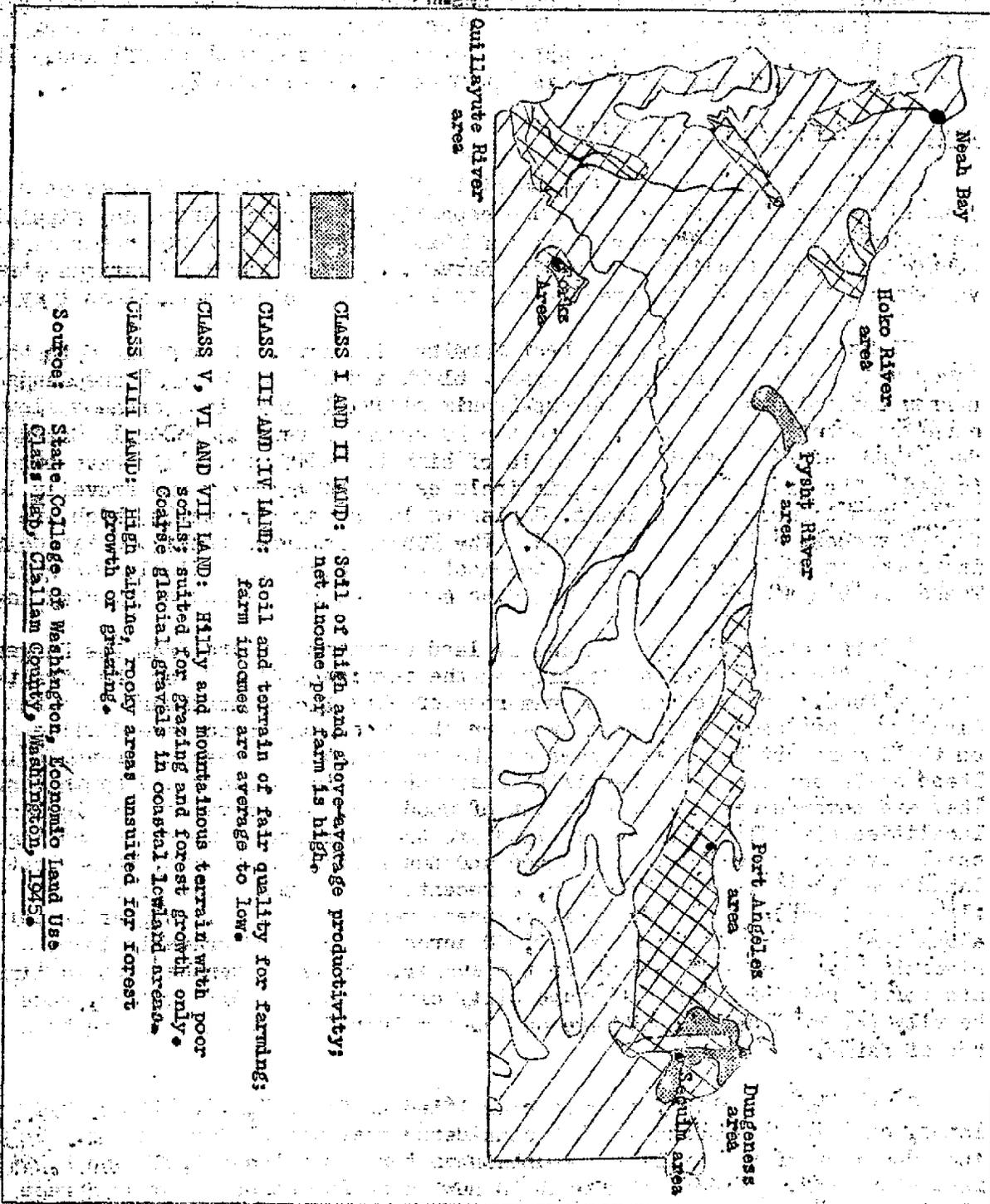


Figure 6.- General Quality of Land in Clallam County

agricultural use. Other nonagricultural soils of more limited extent include the boulder and gravel deposits of river wash, and the silts and sands of tidal marshes and ocean beaches. Class VIII land, the alpine forests of the high, rocky ridges and plateaus in Olympic National Park, covers about one-fifth of Clallam County.

Climate

Clallam County is located in the West Coast Marine Climatic Region of North America. This type of climate extends along the Coast from southeastern Alaska to northern California. Climatologists and geographers describe this climate as one influenced by mild, moist air flowing in from the ocean. The prevailing west winds of ocean air rising over the Olympic Mountains bring cool, cloudy and wet conditions for about nine months of the year. During the summer, the land is warm and the winds from off the ocean are heated and do not drop moisture as frequently as in winter. Thus, there is generally a dry period during July and August with considerable sunshine to mature crops and provide good harvesting conditions for hay and grain.

The lowlands of Clallam County have a climate similar to other parts of the world located on the west margins of continents in the belt of prevailing westerly winds. These include England, northwestern France, Holland, Denmark and Norway in Europe. In the southern hemisphere, the same mild, cloudy and wet climate is found in southern Chile of South America and in southern New Zealand. In world regional and commercial geography, the countries located in the marine climatic regions are noted for heavy forests which yield lumber and paper and for highly productive dairy farms.

Because of changes in elevation from the low valley bottoms of the Dungeness, Soleduck and Quillayute Rivers and the coastal beaches to the alpine areas of the Olympic Mountains, temperature and rainfall conditions vary considerably. U. S. Weather Bureau data from six stations in the lower elevations indicate a moderate climate without extremes in temperature and a wide range of wet to dry precipitation conditions.

Temperature records show that the winters are normally above freezing and the summers are cooler than more inland areas of the state. January averages during a 24-hour period range from 41.2 degrees at Tatoosh Island to 36.7 at Port Crescent. The coldest winter temperatures on record in the lowlands is 4 degrees below zero recorded at Forks in the Soleduck Valley. At this same station the record high temperature for the county, 98 degrees, was also registered.

Frost conditions and growing seasons vary from locality to locality. The Dungeness-Sequim area, the primary farming section, has a growing season of 180 days and Port Angeles is free of killing frosts on an average of 220 days a year.

Table 6.- Temperatures For Selected Stations, By Months  
Clallam County

Station and Elevation in Feet	Average Temperatures (in degrees Fahrenheit)												Annual Average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Clallam Bay (30)	39.1	45.0	43.0	47.3	50.8	54.8	57.0	57.8	54.9	49.8	54.4	43.6	48.0
Forks (350)	38.4	41.6	43.6	47.4	52.3	56.4	59.8	60.8	58.6	51.5	53.6	41.2	49.3
Port Angeles (99)	37.8	47.4	42.2	46.1	53.9	54.8	57.4	56.1	61.3	51.6	53.4	43.6	49.9
Sequim (18)	37.9	39.5	42.8	48.0	52.2	57.0	59.6	60.7	56.5	50.1	43.2	39.2	48.9

Source: U. S. Weather Bureau

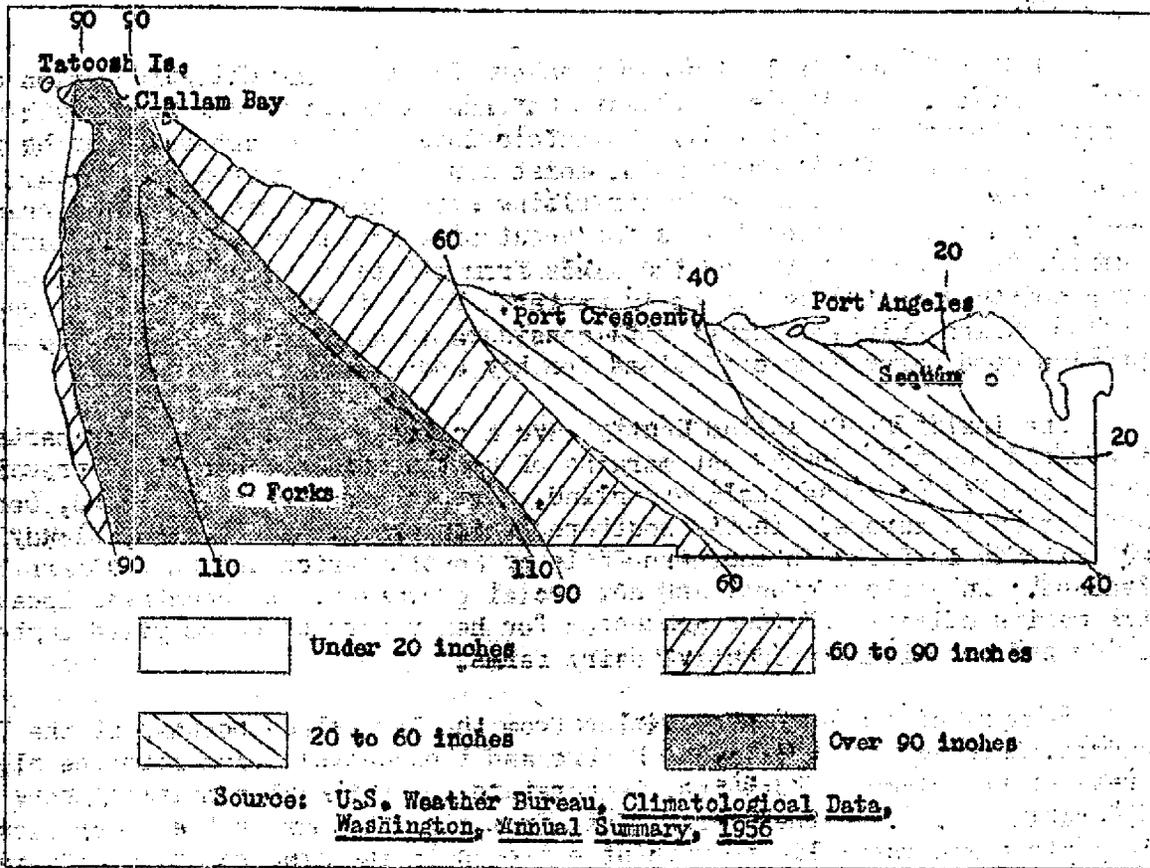


Figure 7.- Distribution of Precipitation, Clallam County

Table 7.- Temperature Extremes, Dates of Killing Frost  
Clallam County

Station and Elevation in Feet	Temperature Extremes Recorded (degrees Fahrenheit)		Killing Frost Average Dates	
	Coldest	Hottest	Last in Spring	First in Fall
Clallam Bay (30)	8	94	April 30	October 23
Forks (350)	-4	98	April 25	October 16
Port Angeles (99)	-1	92	March 23	November 8
Sequim (18)	-3	91	April 21	October 22

Source: U. S. Weather Bureau

Because of the mountainous terrain and varied exposure to the moist prevailing westerly winds, precipitation varies greatly by districts. Stations such as Tatoosh Island, Clallam Bay and Forks in the western section, are located where the westerlies are being forced upward over the highlands of the peninsula. The rising air is cooled rapidly, causing heavy annual rainfall of 117 inches at Forks, 78 inches at Clallam Bay and 77 at Tatoosh Island. Conditions are relatively much drier in the eastern localities of Port Angeles and Sequim. These places are in the lee of the mountains where the westerlies are descending the northeast slopes of the Olympic Range to sea level. As the

air descends it warms, expands and drops little moisture. Port Angeles has only 24 inches of rain per year as an average. Sequim receives slightly more than 16 inches and is the driest point recorded in western Washington. Port Angeles and Sequim usually receive rains when the wind blows periodically from the north and northwest across the Straits of Juan de Fuca. Snowfall is not heavy or common along the Straits or in the lower elevations, but the mountainous portions above 2,000 feet receive heavy winter snowfall.

The summer season is relatively dry. Fogs are common along the coast and over the western section during the summer, reducing sunshine and temperatures. Monthly rainfall data at Port Angeles indicate that April through September is a drier season. July and August are quite dry, creating forest fire hazards and necessitating sprinkler irrigation of crops.

### Forests and Wildlife

The natural vegetation of Clallam County has been modified greatly, but the mountainous section and parts of the coast shoreline still contain large areas of wilderness unchanged by man. Logging and land clearing for farming have removed much of the dense forest of Douglas fir, red cedar, hemlock and spruce from lower valley lands. Even after about 50 years of steady forest cutting, Clallam County has still a rich resource of timber for sawmilling and paper making. This has permitted a continuous source of off-farm and part-time employment for many farm settlers. In most valleys logging operations preceded settlement on farms; they aided in clearing away dense forest cover and lowering the costs of clearing and bringing land under cultivation.

According to a Forest Service survey in 1940, Clallam County contained 1,040,633 acres of forest land. Forest land covered 94 percent of the total county area. <sup>1/</sup> Of this, 932 thousand acres are capable of growing commercial timber. The forests are mixed stands of conifers with a total saw-timber volume of 24.3 billion board feet. Cutting since 1940 has reduced the stands to about 20 billion board feet in 1954. The commercial forest land in 1940 amounted to about 507,000 acres. Most of the remaining commercial timber (logs of sawmill size) is found in the fog belt of the western portion where the rainfall varies from 100 to 140 inches.

The commercial forests are composed of six major types of timber. Western hemlock is the most important species, estimated at a volume of over eleven billion board feet. Douglas fir is second with an estimated stand of five billion feet. Sub-alpine firs of the higher elevations and mountain slopes are third at about three billion feet. Western red cedar ranks fourth at about two billion board feet, followed by about one billion feet of Sitka spruce. Hardwoods--red alder, bigleaf maple and northern black cottonwood--are minor river bottom and low elevation species of commercial value for lumber and pulp wood.

Over half of Clallam County forest land is in public ownership and under management of the Federal and State Governments. About one-fifth, or 178,000

<sup>1/</sup> U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. Forest Statistics for Clallam County, Washington, 1940.

acres, is managed by the United States Forest Service in Olympic National Forest. This land is managed for regulated timber harvesting. About 17 percent, or 159,000 acres, is regulated by the National Park Service in Olympic National Park. This large wilderness area is reserved only for recreation. Its trees and plants and animal life are protected for the benefit of present and future generations who appreciate wilderness land. State ownership, mainly school lands, and lands which were acquired by the county for delinquent general property taxes, amounts to 18 percent of the total forest land, or about 176,000 acres. Indian lands in the Makah, Ozette and Quillayute Reservations, managed by the Department of Interior, Bureau of Indian Affairs, amount to 2 percent, or 18,460 acres. The private ownership of forest lands by lumber, paper and timber companies and by farm operators, amounts to 420,000 acres. The private lands and sales from Olympic National Forest furnish most of the logs used in the local lumber and paper industry.

Lumber production in Clallam County has varied in volume during the 1925-1950 period. 1/ In 1925 there were eight mills which cut a total of 78,000,000 board feet. A peak of lumber production was reached in 1929 when nineteen mills produced 148,845,000 board feet. In 1954, nine mills produced 35,500,000 board feet. As lumber milling declined there was an increase in plywood and paper manufacturing.

A large proportion of Clallam County timber is rafted to other lumber centers on Puget Sound. In 1954 Clallam County was the fourth leading county in the state in volume of logs cut, a volume of 329,635,000 board feet being harvested.

In contrast to many counties of America which do not have high mountains, Clallam County has four life zones. Each of these constitutes a different climatic and biological environment caused by differences in elevation. A journey from sea level at Port Angeles to the summit of Mount Carrie (7,020 feet) is somewhat comparable to one made from the Straits of Juan de Fuca to the Arctic Coast of Alaska. There are changes in climate from temperate zone to Arctic which results in differences in plants and animals adapted to each zone.

The varied and rich game and fur animal resources of Clallam County are important to farm families as a source of supplementary income as well as outdoor recreation. According to the Washington State Game Department, Clallam is a leading sport fishing, hunting and fur trapping area. 2/ The Neah Bay, Cape Flattery and Straits of Juan de Fuca area is a popular salt water fishing ground for salmon, halibut and Dungeness crabs. The Soladuck River is one of the main steelhead streams of the state, yielding about 1,500 to 2,000 per year to fisherman. Clallam County is visited by hundreds of sportsmen each season; about 2,000 deer and 216 elk were bagged during 1955.

1/ West Coast Lumbermen's Association, 1953-1954 Statistical Yearbook, Portland, Oregon.

2/ Washington State Department of Game, Game Bulletin, Olympia, Wash. These bulletins published quarterly each year give statistics on hunting and fishing by counties.