

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, Keilile 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

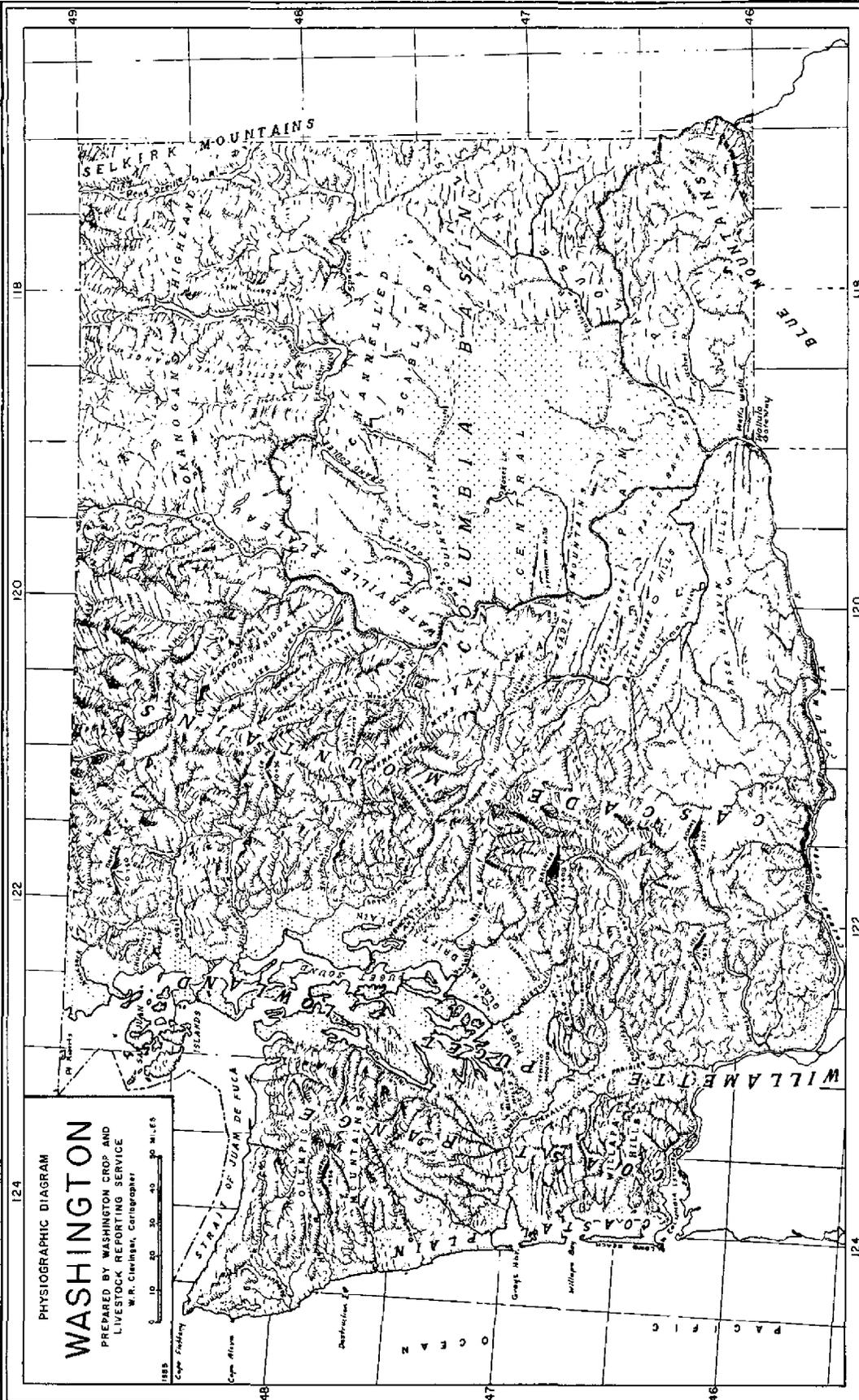
The Blue Mountains are an uplifted and eroded plateau extending into the southeastern corner of Washington. The strata are mainly ancient crystalline rocks which contain some minerals. The highest point of the mountains in the Washington section is Diamond Peak (6,401 feet), on the divide between the 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 Umatilla 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 Benton County

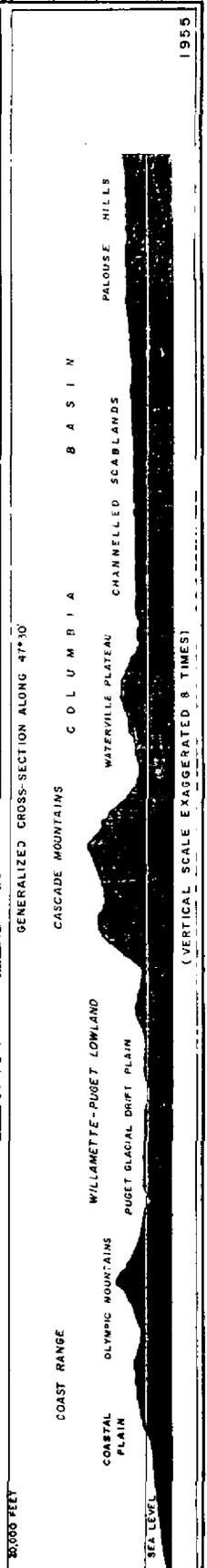
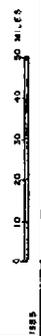
Benton County is largely an upland plateau area traversed by a deep, narrow valley system cut by the Yakima and Columbia Rivers. Two areas of folded and upwarped rock strata, the Rattlesnake Hills and the Horse Heaven Hills, cover most of the county. These hills are rolling and moderate in slope and some areas are of such gradient that they can be tilled with tractor equipment to grow winter wheat.

Elevations of the hills and plateaus are moderate. The Rattlesnake Hills ridges of 3,600 feet are the highest part of the county to the north of Prosser. To the south of Prosser the Horse Heaven Plateau wheat ranching area is 600 to 1,300 feet in elevation. The Horse Heaven Hills rise abruptly above Prosser to over 1,750 feet then slope gradually southward toward the Columbia River Gorge. These hills reach their highest point of 2,196 feet to the south of Kennewick.

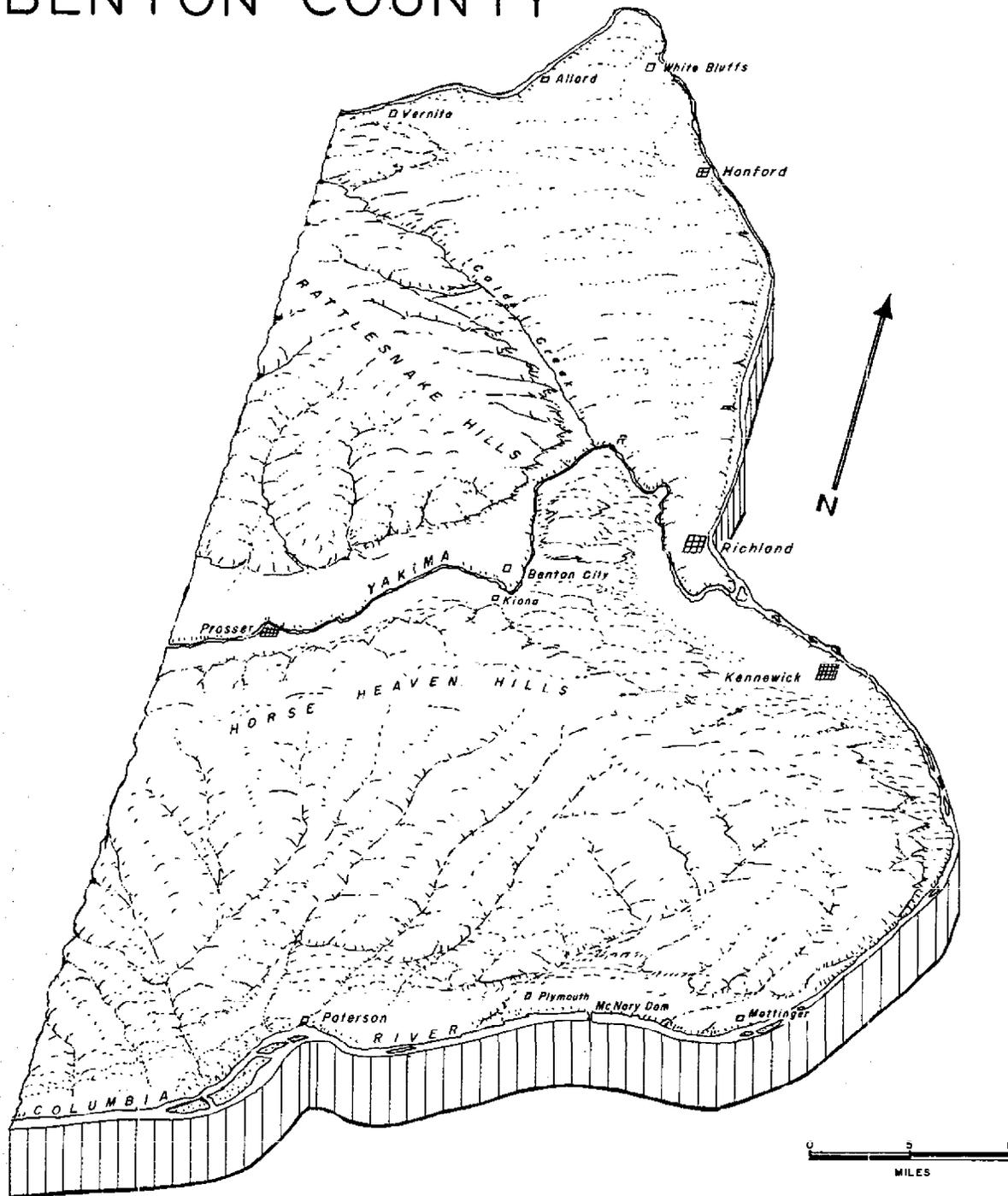
Narrow, bench and bottom lands of the Yakima and Columbia Rivers are the main irrigated farming and populated areas. The Kennewick district is a sloping terrace of 330 to 500 feet elevation. It is irrigated by a canal from the Yakima River which follows a 440 foot contour. Upriver from Kennewick is another level terrace formed at the juncture of the Yakima and Columbia Rivers. Once an irrigated farming district of 370 to 400 feet elevation, it is now within the Atomic Energy Commission Reservation and is the city site of Richland. A third major irrigated lowland is the lower Yakima River Valley from Benton City to Prosser. The terrace on the north bank of the Yakima River is irrigated by the Sunnyside Canal at the 820-825 foot level in the Roza Division, Yakima Irrigation Project. The Prosser irrigated area is from 660 to 820 feet in elevation. It slopes up gradually northward to the Rattlesnake Hills ridges which reach elevations of 3,500 feet.



PHYSIOGRAPHIC DIAGRAM
WASHINGTON
 PREPARED BY WASHINGTON CROP AND
 LIVESTOCK REPORTING SERVICE
 W. R. CLEWINSKI, Cartographer



TOPOGRAPHIC DIAGRAM
BENTON COUNTY



Land Classification and Soils

The land of Benton County is classified by soil scientists into eight general classes. Class I and II lands best suited for farming are localized and make up only a small portion of the total in irrigable plains or benchlands of the Columbia and Yakima Rivers at Prosser, Richland, Kennewick, Benton City and Kiona. There are also small areas of wind deposited soils of fine texture in the plateaus of the Rattlesnake and Horse Heaven Hills. Alluvial river bottom soils of the Yakima soil series under irrigation at Prosser and Kennewick are the best farmlands of the county. Once alkaline and arid, they have been reclaimed by irrigation.

Class III and IV lands, used mainly for dryland grain farming and range land pasture, are larger in area. These include the Ritzville, Wheeler and Portneuf soil series developed under low rainfall conditions on the basaltic plateaus. These soils are used for wheat and are quite extensive in the plateaus of the Horse Heaven and Rattlesnake Hills. The Horse Heaven Hills plateau south of Prosser and Benton City is a large area of Class IV land used for dryland grain farming. These soils are rich in soluble minerals such as calcium and phosphorous but are generally deficient in organic material and nitrogen.

About two-thirds of Benton County is in land classes V, VI, VII and VIII which are either non-agricultural or capable only of dry rangeland pasture use. The Rattlesnake Hills and the north-facing slopes of Horse Heaven Hills, the steep Columbia River Gorge and areas of rough basaltic plateau are rocky, barren areas classified as non-agriculture land or wasteland. A large area of this dry wasteland is included in the Atomic Reservation in the Rattlesnake Hills.

Climate

The climate of Benton County is of the continental desert type which is hot and dry in the summer and cool and moderately damp in winter. The area is one of the driest in the state, being within the extensive arid belt found in the lee of the Cascade Range of eastern Washington and Oregon. Agriculture in the lower Yakima Valley lands is entirely dependent on irrigation. Precipitation is barely sufficient in the Horse Heaven Hills for dryland, summerfallow wheat farming.

Annual temperature averages are somewhat extreme between summer highs and winter lows, and because of desert conditions summer days are hot at midday but cool at night. Local temperature averages are among the hottest recorded in the state. Highs of 115 degrees have been recorded at Prosser. Growing seasons extend from the last week of April to mid-October, generally being over 200 days in length. Daily temperatures in mid-summer will range from 95 at noon to a comfortable 60 degrees at midnight. In midwinter daily temperatures will range from 45 at noon to freezing at night.

Temperature conditions are particularly suitable for fruit growing. Warm Chinook winds flowing down the east Cascade slopes provide ideal weather during budding and blossoming seasons. Winter temperatures are cold enough to keep trees dormant. The Walla Walla Valley and the Lower Yakima Valley have early crop seasons, being the first areas to harvest vegetables, tree fruits, hay and grain.

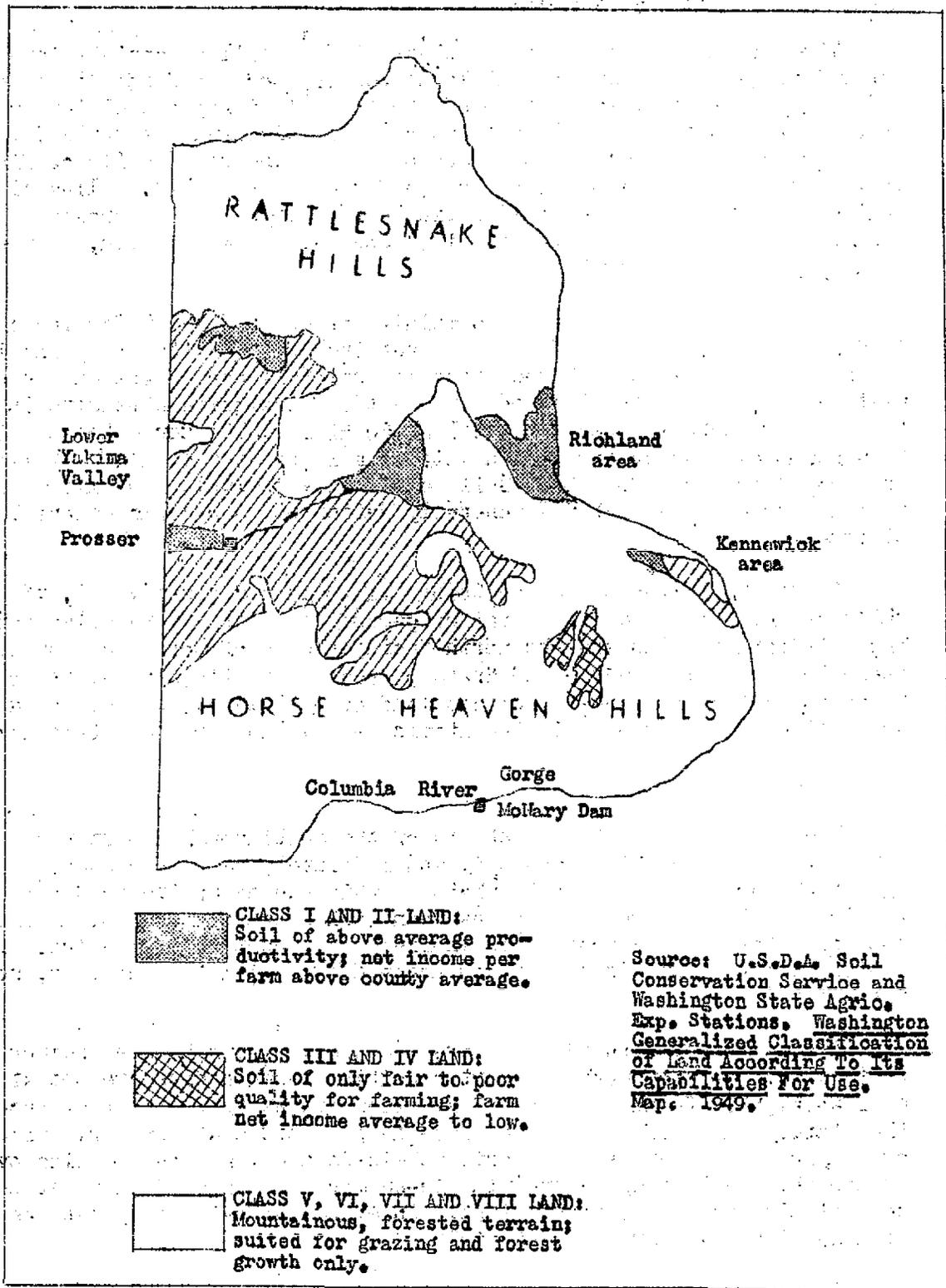


Figure 6.- General Quality of Land in Benton County

Table 6.- Temperature Extremes, Dates of Killing Frost
Benton County

Station and Elevation in Feet	Temperature Extremes Recorded (degrees Fahrenheit)		Killing Frost Average Dates	
	Coldest	Hottest	Last in Spring First in Fall	
Hanford (405)	-27	114	April 17	October 17
Kennewick (392)	-29	115	April 18	October 16
Kiona	-30	114	April 22	October 12
Mottinger	-24	114	March 30	October 29
Prosser (675)	-31	111	April 28	October 14
McNary Dam 1/	0	106	April 6	November 14

1/ One year record only.

Source: U.S. Weather Bureau

Table 7.- Temperatures For Selected Stations, By Months
Benton 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.	
Kennewick (392)	30.7	23.7	41.3	53.3	60.7	62.3	72.6	70.6	64.7	49.6	34.1	33.4	49.8
McNary Dam 1/ (348)	35.7	28.9	45.6	56.4	63.6	66.0	77.7	74.3	66.4	54.5	39.7	37.7	53.9
Prosser (675)	30.8	36.4	45.8	52.9	59.7	62.6	72.6	70.6	62.2	52.5	40.2	33.4	52.0
Richland 1/ (405)	35.3	28.6	46.4	57.5	66.0	67.0	78.5	74.7	67.9	54.3	39.6	38.0	54.5

1/ One year record only.

Source: U.S. Weather Bureau, Climatological Data,
Washington, Annual Summary, 1956

Benton County is uniformly dry and most of its upland and valley bottom lands receive less than 10 inches of precipitation per year. Weather stations along the Yakima and Columbia Rivers record only 6 to 8 inches of rainfall on the average. Although not measured, there is slightly more precipitation in the form of snow in the Horse Heaven Hills dryland wheat farming region. Ground moisture from winter rains and melting snow is conserved in the Horse Heaven Hills through summer fallowing. After a summer of fallowing, wheat sowed in fall finds sufficient ground moisture for growth. Most wheat grown in Benton County is winter wheat using the summer fallow system.

Table 8.- Precipitation for Selected Stations by Months
Benton County

Station and Elevation in Feet	Average Monthly Precipitation (in inches)												Annual Total (inches)
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Kennewick (392)	.96	.80	.52	.50	.49	.63	.20	.14	.29	.72	1.03	1.14	7.47
McNary Dam 1/ (348)	1.96	.81	.26	0	.56	.31	.20	.69	.11	1.27	.26	.91	7.34
Prosser (675)	1.0	.77	.49	.54	.50	.51	.35	.25	.43	.74	1.04	1.14	8.18
Richland 1/ (405)	1.87	1.41	.14	0	.35	.42	.02	.45	.02	.67	.11	.63	6.09

1/ One year record only; not a long-term average.

Source: U.S. Weather Bureau, Climatological Data,
Washington, Annual Summary, 1956

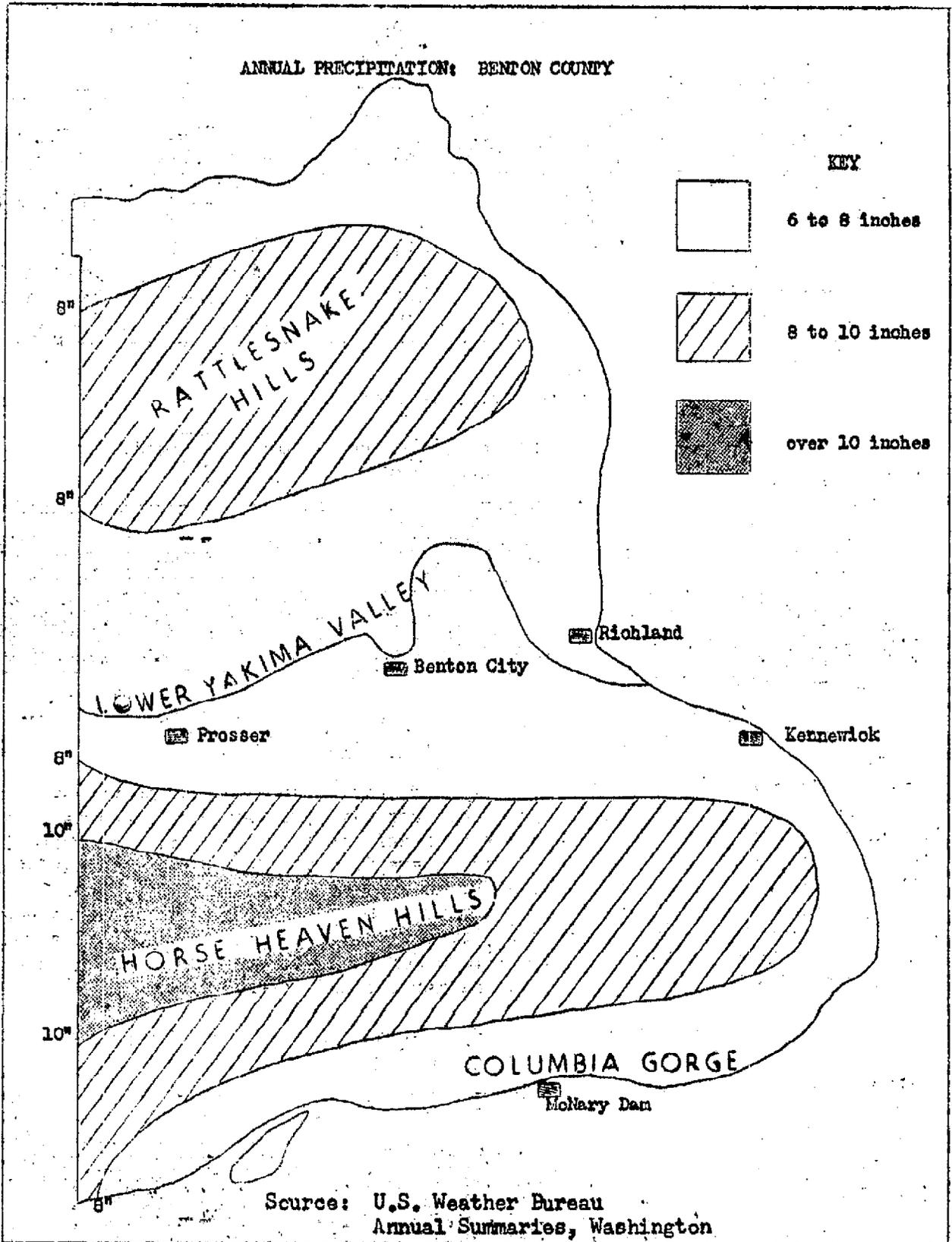


Figure 7.- Distribution of Precipitation
Benton County

There is a seasonal pattern to the precipitation. Westerlies from off the Pacific bring snow and showers in winter storms during November through to March. Spring, summer and fall are quite dry with a high proportion of sunshine. Conditions are generally very dry during all harvesting activity.

Natural Vegetation - Wildlife Resources

Because of dry conditions the natural vegetation of Benton County is of the desert and steppe type. Most of the uplands above the irrigated districts are covered with sagebrush, bunch grass and other plants adapted to a climate which has less than 12 inches of moisture per year. Cottonwood and willows are found only along flood plains of rivers and streams.

Animal life native to the region has been greatly reduced with the advance of civilization. Large herds of wild horses and antelope once ranged in the Horse Heaven and Rattlesnake Hills. Rabbits and rodents have been reduced to prevent losses in agriculture. Man has introduced new species of game such as Chinese pheasants, Hungarian and Chukar partridges and pheasant hunting is today an important use of farmland. Recent statistics by the Washington Game Department show that Benton County's wheat fields and irrigated areas make up one of the five leading pheasant hunting areas of the state and it was reported that 15,700 pheasant were taken by hunters in Benton County. ^{1/} River marshlands along the Columbia and Yakima Rivers also yielded wild fur resources of 550 muskrat and 75 mink pelts to licensed trappers. These marshes also were important for waterfowl hunting.

^{1/} Washington State Game Department. Game Bulletin Reports, 1955. Annual Report on Wild Fur Bearing Animal Trapper's Reports.

Table 9.- Benton County's Rank Compared With
Other Washington Counties

Item Compared	Rank	Quantity	Year
<u>General</u>			
Land area.....	23	1,112,320 acres	1954
Number of farms.....	16	1,483 farms	1954
Land in farms--percent.....	13	53.5 percent	1954
Average size of farms.....	16	401 acres	1954
Cropland harvested.....	9	177,731 acres	1954
Rural farm population.....	16	6,053 persons	1950
Total county population.....	11	51,370 persons	1950
<u>Cash farm income</u>			
Value of all farm products sold....	12	15,379,081 dollars	1954
Value of livestock sold.....	16	2,944,486 dollars	1954
Value of crops sold.....	10	12,432,866 dollars	1954
<u>Livestock on farms</u>			
All cattle and calves.....	19	23,180	1954
Milk cows.....	17	3,630 head	1954
Hogs.....	12	3,142 head	1954
Chickens.....	15	57,039 birds	1954
Horses and mules.....	12	1,145 head	1954
Sheep and lambs.....	8	11,806 head	1954
<u>Dairy and poultry products sold</u>			
Value of dairy products sold.....	18	600,836 dollars	1954
Whole milk sold.....	17	14,822,000 pounds	1954
Value of poultry products sold....	13	729,789 dollars	1954
Chickens sold.....	16	62,641 birds	1954
Eggs sold.....	16	379,412 dozen	1954
<u>Important crops harvested</u>			
Wheat.....	8	113,400 acres	1954
Potatoes.....	3	5,300 acres	1954
Barley.....	10	25,000 acres	1954
Hops.....	2	695 acres	1954
Asparagus.....	2	1,425 acres	1954
Mint.....	2	2,000 acres	1954
Tree fruits.....	5	4,686 acres	1954

Sources: U.S. Census, Agriculture, 1954.
U.S. Census, Population, 1950