

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS.

IN COOPERATION WITH THE UNIVERSITY OF CALIFORNIA AGRICULTURAL
EXPERIMENT STATION.

SOIL SURVEY OF THE EUREKA AREA,
CALIFORNIA.

BY

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[Advance Sheets—Field Operations of the Bureau of Soils, 1921.]



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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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MAP.

Soil map, Eureka sheet, California.

SOIL SURVEY OF THE EUREKA AREA, CALIFORNIA.

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DESCRIPTION OF THE AREA.

The Eureka area is situated in the northwestern part of California, lying on the Pacific Ocean and 65 miles south of the northern boundary of the State. It covers the largest body of agricultural land in Humboldt County, including the alluvial and terrace lands of the lower parts of the valleys of Mad and Eel Rivers and surrounding Humboldt Bay, together with marginal and intervening areas of mountainous country. The area is about 41 miles long north and south and 20 miles wide east and west in its widest part. It is bordered on the west by the ocean and on the north and south by high mountainous areas, which limit the area surveyed quite definitely. On the east it has a very irregular boundary, owing to the inclusion of the valleys of the two main rivers and of considerable areas of mountainous country east of Humboldt Bay. It has an area of 445 square miles, or 284,800 acres.



FIG. 30.—Sketch map showing location of the Eureka area, California

The base map used in platting the soils was constructed by plane-table traverse by the field party, as no map suitable for this purpose was available. A small part of the detail in the mountainous country was obtained from existing maps and from the contour maps of lumber companies.

In the west-central part of the area is Humboldt Bay, which is much the largest and best harbor between San Francisco and the Columbia River. This bay is separated from the ocean by a narrow strip of beach and wind-blown sand. On the north it is bordered by the Arcata Bottoms, which constitute the delta of the Mad River, and on the east and southeast by smaller bodies of low alluvial lands. North and east of these lowlands are terraces of old marine or coastal-plane deposits, and on the south a prominent terrace, Table Bluff, extends westward to the ocean. South of Table Bluff is the extensive delta of the Eel River. This in turn is bordered on the east and south by old marine terraces. The Eel River and its tributary, the Van Duzen River, have flood plains and terraces which extend up these rivers to the east and southeast for considerable distances, even beyond the limits of the survey. The Mad River, above Riverside, which marks the upper margin of the old terraces, has no flood plain, but flows in a gorge.

The bench lands or old coastal-plain and river terraces are mostly from 100 to 500 feet above sea level. The mountains included within the survey, which represent lower parts of the Coast Range in this vicinity, reach an elevation of about 4,000 feet.

The terraces are evidently in the main a marine deposition, but in some localities have been modified and added to by the rivers. At

Eureka they slope gently to the water's edge. Ordinarily, however, they are terminated on the western side by steep or abrupt slopes, many of them precipitous. Broad level stretches of terrace have an elevation of 100 to 300 feet above sea level, but some parts that apparently represent older terraces reach elevations of 500 to 600 feet. These higher parts are eroded and include very little level land.

The lowlands of the area are in part tidal flats and in part river flood plains that lie only a few feet above tidewater. Tidal flats occur around Humboldt Bay, northward from the bay, and on the outer edge of the Eel River delta. It must be understood, however, that the "tidal flats" as here used, refer to these lands as the settlers found them. They have largely been reclaimed and the tide reaches them no more. The river flood plains and delta lands are in two main bodies, the one associated with the Mad River in the northern part and the other associated with the Eel River in the southern part of the survey.

The Eureka area is in the heart of the coast redwood belt, and its famous forests of redwood (*Sequoia sempervirens*) are nowhere excelled. The Douglas fir is also abundant and very valuable. The forest also includes some white fir, cedar, and alder. The forest belt begins a few miles back from the ocean and is most dense on the lands of moderate elevation. The river flood plains, the river terraces, and the lower hills have the heaviest stands of timber. The higher ridges, especially those more distant from the ocean, have less valuable timber, the proportion of oak and laurel increasing. Perhaps half of the timber within the area mapped has been cut.

The drainage of the entire area is toward the west and northwest. In the mountainous part the drainage is well established and the numerous small streams have high gradients. The flood plains of the small streams emptying into Humboldt Bay have poor drainage, and the lowest lying lands on the deltas of the Mad and Eel Rivers are, owing to their low position, also poorly drained. The extreme northern part of the area is drained by Little River, which is rather small. The Mad River drains the north-central part. The Eel River and its large tributary, the Van Duzen River, drain the southern part. Salmon Creek, Elk River, Freshwater Creek, and Jacoby Creek are small streams that drain the central part of the area and enter Humboldt Bay. Salt River near Ferndale is apparently an old channel of Eel River.

Humboldt Bay was discovered in 1849 and settlement started soon afterwards. The influx of population was rapid and Humboldt County was organized in 1853. The settlers were almost entirely English speaking and came from eastern United States and the British Empire. It is said a large proportion came from Maine and Nova Scotia. "The gigantic redwood forests demanded special treatment, so the pioneers were recruited from a timber country. The pioneers of Humboldt came for the most part from a land where almost half of the men went to sea and the other half to the woods."¹ For many years the native Indian population far outnumbered the white settlers and there were many Indian troubles. These culminated in the Indian war of 1862 to 1864 and were settled in 1865. At present the number of Indians in the area is small.

¹ History of Humboldt County, Calif., Leigh H. Irvine, 1915.

Later, Portuguese, Danes, and Swiss came in, and at present they and their descendants form perhaps a third of the population. The first Portuguese came from the Azores Islands about 1875, and another large influx came from the same place about 1905. Danes, coming about 1876, laid the foundations of the dairy business. There are no Orientals in the area. In the cleared and settled parts the population is quite dense and the holdings are small. In the uncleared and the mountainous parts the population is very scattering.

Eureka, the county seat and the largest town, had a population of 12,923 in 1920. It is an important shipping point. The following towns are trading centers and shipping points for their respective communities and have populations as indicated: Arcata, 1,486; Ferndale, 919; Loleta, 320; Port Kenyon, 120; Fortuna, 986; Rohnerville, 350; Hydesville, 200; Alton, 100; Carlotta, 25; South Bay, 150; Rio Dell, 50; Pepperwood, 50; Blue Lake, 441; Freshwater, 150; and Fieldbrook, 75. The sawmill towns are Korbel, Riverside, Bulwinkle, Samoa, Scotia, Newberg, Falk, and Metropolitan.

For many years practically the only way of communicating with the outside world was by boat and all the goods out and in were moved over water. The roads over the mountains were very rough and difficult, but these roads have been gradually improved. The coast branch of the State highway extends into the area from the south. The county roads are plentiful. In the settled sections they are kept in excellent condition and in the mountainous parts they are good, considering natural difficulties. The first railroads in the area were logging roads centering in Eureka. The Northwestern Pacific Railway was gradually extended from the south, reaching Eureka in 1915 and Trinidad, north of the area, later. Transportation by rail is more rapid and regular than by boats, and as a result the railroad carries the bulk of the freight, both outgoing and incoming, where these factors are a consideration. The freight rate from San Francisco to the ports on Humboldt Bay are terminal rates, set by the competition of the boats, and are much lower than the rates to intermediate points.

It is expected that the railroad and State highway will be extended north to reach the main lines of travel in Oregon, and a line of the State highway is in prospect from this area east into the Sacramento Valley.

The fact that this is a great lumbering center assures a good local market for vegetables, berries, fruit, and other products of the farm. Butter is marketed mainly in San Francisco.

CLIMATE.

The climate of the Eureka area is one of the main factors in determining its agricultural development. The proximity to the ocean is responsible for the moist air and the fog and the relatively even temperatures, both summer and winter.

The climate is characterized by a rainy season lasting from October to May and a dry season lasting from June to September. The mean annual rainfall at Eureka is 44.49 inches, of which 2.26 inches falls in the four driest months. The area has a moist, cool climate, but this is due not so much to the rainfall, which is only moderate, as to the humidity and the fog that prevail during the summer, regulating the temperature and lessening evaporation.

The mean temperature in August, the hottest month, is 56° F., and the highest temperature on record, which occurred in June, is 85° F. The moist, cool weather of summer is especially suited to the growth of grasses and many other farm crops. The average date of the latest frost in the spring is February 9 and of the first in the fall November 25, giving an average growing season of 289 days, which is a long season. The latest frost on record occurred on April 7 and the earliest on November 11.

The Weather Bureau station from which these data are obtained is in Eureka, near the ocean. The data are applicable to a large part and the main agricultural part of the area, but the climate changes very rapidly as the distance from the ocean increases. Elevation is also an important factor. The climate of Boynton Prairie, for instance, 12 miles from the ocean and at an elevation of about 2,500 feet, is decidedly different. Very little fog reaches here and the summer temperatures are much higher.

The coast climate, which is so favorable to the growth of grass, does not favor the growing of fruit. Humboldt County grows very fine apples and other tree fruits, but a very small part of the total production is grown within the area surveyed, and that mostly at the points farthest away from the ocean. The climate seems to be especially favorable for dairy cattle.

Wind movements are moderate. The prevailing winds during the summer are from the north. The winds do not blow directly from the ocean. During the winter the prevailing wind is from the south-east, and a southeast wind at any time is expected to bring rain. The following table of climatological data is compiled from the records of the Weather Bureau station at Eureka:

Normal monthly, seasonal, and annual temperature and precipitation at Eureka.

[Elevation, 64 feet.]

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1905).	Total amount for the wettest year (1904).
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December	47.7	70	28	6.42	4.32	8.18
January	47.0	77	20	8.19	4.81	5.24
February	47.4	72	24	8.01	.99	16.10
Winter	47.4	77	20	22.62	10.12	29.52
March	48.4	78	29	5.99	7.28	19.05
April	50.0	75	31	3.43	.78	5.14
May	52.3	78	35	2.25	1.39	1.02
Spring	50.2	78	29	11.67	9.45	25.21
June	54.3	85	40	.91	.12	.55
July	55.6	73	43	.16	.02	.75
August	56.0	79	45	.19	.00	T.
Summer	55.3	85	40	1.26	.14	1.30
September	55.4	82	36	1.00	.38	1.36
October	53.5	84	36	2.37	1.50	2.67
November	51.1	81	27	5.57	3.93	4.41
Fall	53.3	84	27	8.94	5.81	8.44
Year	51.5	85	20	44.49	25.52	64.47

AGRICULTURE.

The Indians who lived in this area before the advent of the white men were not farmers; they depended for a living on hunting, fishing, and gathering acorns and other seeds.

During five or six years following the discovery of Humboldt Bay there was a rapid settlement of the surrounding region, chiefly by mining men, and the agricultural population was very small. The towns which started up drew their population from the great army of men in search of riches in the mines on Trinity River.

Cattle raising was the main agricultural industry for many years, but a rude type of farming existed side by side with it. Potatoes were the first crop to assume large proportions. They were grown on large acreages, mostly in the Ferndale region and the Arcata bottoms, and shipped by boat to San Francisco. This industry declined between 1875 and 1880 on account of poor markets, and at present the production is about one-sixth what it was at the time of greatest expansion of the industry. Potatoes were followed by wheat, oats, and barley, but just about the same time dairying was begun in a commercial way.

In the seventies, when poor marketing conditions made potato raising unprofitable, many of the farmers turned to grain growing and dairying. For the next 20 years considerable quantities of butter were made locally and marketed through San Francisco concerns. It was made up in 2-pound rolls, packed in spruce kegs, covered with brine, and shipped by boat. The barrels and brine were displaced in later years by returnable shipping boxes holding sixty 2-pound rolls.

The desire of farmers to have a central, cooperative creamery took tangible form in 1895, when they organized and built a plant near Ferndale. This venture proved a failure, but nevertheless was followed by many similar attempts. At first the creameries were, in the main, located in the Eel River bottoms, but later they spread, with the expanding dairy district, northward through Eureka to Arcata and the Mad River country. In time a score of these cooperative enterprises had been formed, but competition and insufficient marketing facilities put most of them out of business.

In 1905 a creamery company was organized and, absorbing a plant at Ferndale, erected a new building. A plant was built at Eureka the following year. In 1917 an old building at Arcata was replaced by a new one. This company has grown rapidly, until at present it has about 400 patrons supplying milk, that yields from 2,000 pounds of butterfat per day during the low production period in winter to more than 20,000 pounds during the summer.

Butter, cheese, dried skim milk, and casein are produced. The butter is marketed mainly in California and other Western States, but during a part of the year (the high-production period) considerable quantities are exported to the Orient. An interesting feature of the export business is the competition with Australian butter. In this country the greatest production takes place during the summer, while in Australia our winter is their period of high production, so that when the one is most in need of a foreign market for its surplus it has the least competition from the other

The domestic demand for dried skim milk is very small and the producers have been forced to develop foreign business. Holland and Belgium are at present the main purchasers of this product.

The company already mentioned makes several hundred thousand pounds of cheese annually and is doing much to popularize domestic Swiss cheese. An official of the company stated:

During the year which ended on June 30, 1921, there was manufactured in the plants of this company in Humboldt County 264,051 pounds of so-called "California" cheese and 188,041 pounds of Swiss cheese. During the same period, in the plant of the Grizzly Bluff Creamery at Alton, which is also controlled by this company, there was manufactured 182,268 pounds of Swiss cheese.

The market for cheese is mainly domestic.

Another corporation entered the local field in 1909, when it established a plant at Loleta. This was rebuilt and enlarged during the war. To-day it has about 175 patrons whose herds average 30 cows. Daily receipts of milk vary between 20,000 and 120,000 pounds, depending on the season of the year. This company's main product is evaporated or condensed milk. Quantities of dried milk are also made from skim milk obtained under contract from independent creameries not equipped to manufacture this product. The market for evaporated milk is mainly in the Western States, while the dried milk is almost all exported.

There are two cooperative or "independent" creameries now in operation, one at Arcata and the other near Ferndale. They are very similar in organization and handle about the same volume of business. The plant at Ferndale in October, 1921, had 74 patrons, who were milking about 2,600 cows. The milk is collected daily and the cream made into butter, to be sold locally or in San Francisco.

At the present time dairying is by far the most important agricultural industry in the Eureka area. It is probably carried on here more intensively and with more cows per square mile than anywhere else in the United States. (Pl. XXIX, fig. 1.) The records of the farm bureau show that there are approximately 24,000 dairy cows in Humboldt County, of which about 22,000 are located on less than 200 square miles of the lower, alluvial soils included in this survey. According to figures published by the California Dairy Council, the production of butterfat in the county for the year ended June 30, 1920, amounted to 6,996,072 pounds, or an average of 291.5 pounds per cow.

The dairymen of the Eureka area are of various nationalities. One company reports that its patrons include "24 Portuguese, 21 Americans, 11 Danes, 8 Swiss-Italians, 5 Germans, 3 Italians, and 2 Irish." A very large proportion of the dairymen on the Arcata flat are Portuguese, and there is another group of the same nationality near the old Belmont creamery south of Table Bluff Lighthouse. Around Loleta and the Eel River bottoms approximately half are Swiss, with a number of Danes near the old Sunset Creamery west of Fortuna. Farther east the majority are American born.

The dairy herds vary in size from 1 or 2 cows to several hundred. In general, the smallest herds are maintained by the American-born farmers in the vicinity of Fortuna, who milk 1 or 2 cows in addition to their other farm activities. There are very few purebred herds

anywhere in the area, but the number of grade animals and purebred bulls is increasing. However, there are still too many herds of poor quality, frequently of beef blood. Of the grades and purebred animals, about 60 per cent are Jersey, about 30 per cent Guernsey, with Holstein and Ayrshire making up the remainder. The Holsteins are not popular in this area, as it is believed that they are not suited to local conditions.

Stock beets and carrots are the two main soiling crops grown for feeding dairy cows. Alfalfa is not extensively planted. Corn, clover, vetch, and grain are also grown to a lesser extent for soiling. Some of these are put into the silo for winter feed, but many of the dairymen import considerable quantities of hay and concentrates each season. Dr. W. J. Logan, the county farm advisor, states that between 1,000 and 1,500 tons of hay were shipped into the area last year.

Considerable work has been done in production determinations, particularly by the Ferndale Cow-Testing Association, formed in 1909, and a similar association at Arcata. Testing for tuberculosis is not compulsory, excepting in herds from which the milk is sold for consumption raw. Such herds are not numerous in this area. Many of the owners of large herds do not yet realize the advantages of keeping their herds free from disease, and a majority of the herds are untested.

Some herds are still milked entirely by hand. The more common practice seems to be to use machines in the spring and summer and revert to handmilking when the milk flow drops during the winter.

Very few beef cattle are raised on the valley floor, but their production is carried on extensively in the rougher part of the area. No statistics of this industry are available.

One firm owning considerable cut-over redwood land has 1,000 head, which range in the cut-over land. Their methods of feeding and handling are as follows: As soon as the land is logged off, all refuse is burned. This leaves a bed of ashes, some of it an inch thick. Then the land is sown with small white clover, orchard grass, and Italian rye grass. This makes good pasture, upon which cattle thrive and get fat enough for market. In the winter time they are brought down and fed.

A relatively small number of sheep and still fewer goats are produced. Horses are kept simply for farm use and hogs are kept only in very small herds on the ranches.

The raising of purple vetch for seed, which is shipped to southern California for cover crops, is a new industry begun a few years ago. So far the industry has been developed almost exclusively on the Rohnerville clay loam. When the vetch is grown on the recent-alluvial soils, it forms too much vine and the seed does not ripen evenly. The yields of seed range from 200 to 2,000 pounds per acre, 1,000 pounds being considered a good crop. The season 1921 was unfavorable and the average yield dropped to about 400 pounds an acre. The vetch is best sown in the early winter on well-prepared ground and harvested the following summer. On land that has never grown vetch the yields the first year are light. It is said that it takes several years for the vetch to yield its maximum crops, especially if the soil is run down by long-continued cropping to grain.

Grain growing at present is carried on to a very small extent, in connection with dairying. Fruit growing is a minor industry. A

few orchards, well protected from winds by hedges, are yielding crops that range from poor to fair. They include apples, peaches, plums, prunes, and pears. Small fruits, though grown only locally, are considered very promising. Strawberries are grown commercially by a few, and blackberries, including the Logan variety, and raspberries have been grown experimentally with great success on the soils of the Empire series. At Rio Dell there is a row of English walnut trees 30 years old that are healthy and yield regular crops. It should be noted that they are about 15 miles from the ocean and among sheltering hills. A large nursery near Eureka is devoted mainly to growing ornamentals, flowers, and bulbs, which are marketed principally outside the area.

At present labor is plentiful and of a fair grade. It is said that wages are 20 per cent higher than in the main agricultural parts of the State. This is due in part at least to the competition of the lumbering industry.

Humboldt County had the first farm advisor in California. The farm bureau of the county has 600 members and is a very active organization.

The farms on the valley floor, which are devoted mainly to dairying, are small, averaging about 40 acres. Those on the bench lands are larger, probably twice as large. The ranches in the hill lands and mountains are very large. In addition, there are a great many small holdings of a few acres each, the owners of which get their main income by working in the logging camps, or the mills or by getting out grape stakes, posts, or fuel wood.

The price of land varies greatly. The very best recent-alluvial soils bring from \$300 to \$700 an acre, and occasionally \$1,000 an acre. The rental value is from \$18 to \$35 an acre. The soils of the Coquille series, when thoroughly reclaimed, are valued at \$400 to \$500 an acre. The Empire, Willits, and Rohnerville soils, where fairly level, range in price from \$100 to \$300 an acre. The best of the land suited to purple vetch now has a rental value nearly equal to that of the dairy farms. Rougher land, mountainous land, and the small bodies of Melbourne and Kneeland soils range in price from \$10 to \$30 an acre. Cut-over lands on the Empire soils are now coming on the market at \$20 to \$30 an acre.

Irrigation is practiced in a very small way, but is found profitable, especially on soils that are underlain by gravels and therefore dry out quickly in summer time. So far irrigation has been used only on the Ferndale soils, the water being obtained by pumping from shallow wells.

The value of the cut-over redwood land has not been definitely determined. Very little of this land has been cleared. The extensive flats that are now farm land were either open originally or covered with timber that was easier to clear. The cost of clearing redwood stumpland is enormous. Where the stand was dense the stumps are very large, many of them being from 8 feet to 20 feet in diameter. Since the redwood resists both decay and fire in a remarkable manner, the only way to get rid of a large redwood stump is to blast it out, then blast it to pieces. There remains a large hole to be filled up. It is said that one field at Carlotta cost \$800 an acre to clear. It is thought by some that extensive operations with the very best of equipment might cut the cost down to \$200 an acre, but this has

not been demonstrated. However, much of the land has other stumps than the redwood, all of which come out easier, and some fields have been partly cleared by taking out these and leaving the big redwood stumps. (Pl. XXIX, fig. 2.) Cleared in this way, the stumps do not interfere materially with the growth of pasture grass, and it is possible that berries could be grown profitably with such partial clearing. Another factor to be taken into consideration is the value of the land after it is cleared. Relatively little of the redwood is growing on strictly first-class land; that is, the recent-alluvial soils. There is more on the terrace areas which are of moderate value when cleared. Most of the redwood forest is on hillsides and mountain slopes that would be of little value if cleared. All these factors must be taken into account when any clearing is under consideration.

SOILS.

Eureka area lies within that part of the Pacific coast region which has a moderately heavy to heavy rainfall. The area as a whole is heavily forested, though treeless or prairie areas occur. The soils are well leached of lime and other soluble minerals and are prevalently slightly to distinctly acid in reaction. The arable soils of the area fall naturally into four groups—residual soils, soils derived from coastal-plain and old valley-filling material, soils derived from wind-laid materials, and recent-alluvial soils.

Each of these four groups of soils includes one or more soil series, which differ in essential characteristics, such as color, origin, topography, or structure, and the soil series are subdivided into types, which are similar in all essential features except texture, determined by the relative proportion of mineral particles of the various sizes which go to make up the surface soil.

In mapping, the soil type is the standard unit, but certain variations in the soil type, where of sufficient distinctness, extent, and importance, are shown on the map by means of ruling over the standard color. In addition to the four main groups of soils mentioned above, a number of types of miscellaneous materials, mainly nonagricultural in character, have been mapped.

The residual soils, which are classed in the Kneeland and Melbourne soil series, have been derived from the weathering in place of the consolidated rocks of the region.

The rocks which form the hills in this area apparently belong largely to the Franciscan series, which are probably of Jurassic age.² They consist of sandstone, shales, and conglomerates that have been more or less metamorphosed. Some of the formations are very soft and weather and erode rapidly; others are harder and weather much more slowly, giving a more rugged outline to the hills formed by them. Included with these sedimentary rocks are a number of igneous intrusives, some of which also have suffered great metamorphism. There is very little limestone in the area, but some of the rocks contain calcite seams. The beds of these various rocks have been very much tilted, broken, and warped. In practically no case are the sedimentary rocks horizontal, as they undoubtedly were when laid down; but they are found now at all angles and in places are

² San Francisco Folio, U. S. Geol. Survey, 1914, by A. C. Lawson.

more nearly vertical than horizontal in position. Furthermore, there is very little continuity in the rocks, and fracturing and faulting have taken place in great detail.

The surface soils of the Kneeland series are dark brown or dark grayish brown to dark brownish gray, becoming nearly black when wet. They are deficient in lime, moderately high in organic matter, and usually somewhat compact under natural conditions but friable under cultivation. The upper subsoil, where developed, is brown or dull brown in color, somewhat compacted, similar in texture or slightly heavier than the surface soil. The deeper subsoil is dull yellow or yellowish brown. This is a residual series derived from the weathering of metamorphosed rocks that are apparently mainly sedimentary, with some igneous intrusions. The soils occupy prairie areas on the more gentle slopes or rounded tops of the lower ridges or foothills. As a rule the soil material is rather shallow. The series is represented in this survey by the Kneeland clay loam.

The Melbourne surface soils are brown, ranging from light brown to rich reddish brown, with the immediate surface in places dark brown. The subsoil is yellow or yellowish brown locally, mottled in the lower part with iron stains. The soil material is normally 6 feet or more deep and rock outcrops are rare. The series is derived from sedimentary rocks. In regions of abundant rainfall it is well forested and is well drained. The Melbourne clay loam is mapped in this area.

The coastal-plain and old valley-filling soils are derived from old unconsolidated water-laid deposits which have been weathered and modified since they were laid down. They are extensive, widely distributed, and important. They occupy a series of terraces which are predominantly of marine deposition. Rivers have reworked the materials to some extent and have also built up some terraces, but in the main the terraces in this area have been formed by the ocean. These old deposits have a maximum elevation of 600 to 700 feet. They extend from the northern boundary to the southern boundary of the area; their eastern limit is from 4 to 10 miles inland, and in places the ocean borders them on the west. They have been cut through by streams in several places and the terrace boundaries are very irregular. North of Mad River a terrace adjoins the beach for 7 miles, being terminated by a cliff 100 to 200 feet high. At Eureka and South Bay the terrace deposits slope gently down to Humboldt Bay. At Table Bluff a terrace remnant extends to the ocean. South of Centerville the terrace is terminated by high bluffs that border the beach.

The terrace materials have been derived mainly from the adjacent areas of Coast Range lying east of the area and therefore are composed of the disintegration products of sedimentary, igneous, and metamorphosed rocks, the first named predominating.

The strata composing the terraces are exposed in many places. In texture they range from coarse to very fine, but most of them are fine sandy loam, loam, and silt loam. The colors are various shades of brown and grayish brown to yellowish brown. No true cemented hardpan exists, but very thin seams of iron-cemented material appear in places. Coarse material consisting of gravel and cobblestones occurs on the terraces bordering the Van Duzen River.

There is a striking difference in the color of the terrace soils, those in the northern half of the area being reddish brown and those in the

southern half being grayish. The reddish-brown soils are classed in the Empire series, the dark brownish gray or dark-brown soils in the Rohnerville series, and the lighter brown soils in the Willits series.

The surface soils of the Empire series are predominantly reddish brown, but range from rich brown, pale reddish brown, or somewhat grayish brown to pronounced reddish brown. The content of organic matter is usually moderate to low. The subsoil is yellow or yellowish brown and streaked or mottled with rusty-brown iron stains. The upper part is heavier in texture and more compact than the surface soils. The deeper subsoil or substratum consists of stratified beds of old sedimentary deposits which extend to great depths. The material is mottled with rusty brown and gray, and thin seams of feebly cemented hardpan appear in places.

The topography is smooth and level to gently sloping, with eroded places and sharp escarpments at the terrace margins. Surface drainage is well established. The soils have been produced by the weathering of coastal-plain and old valley-filling materials, which have been derived from rocks of many kinds, but mainly sedimentary and metamorphosed sedimentary rocks. They have developed under a heavy forest cover. The Empire fine sandy loam and two phases are mapped in this area.

The surface soils of the Rohnerville series are very dark brown or dark brownish gray to dark gray in color, becoming nearly black when wet. They are commonly moderately high to high in organic matter. The subsoil is yellow or yellowish brown and mottled or streaked with rusty-brown iron stains. It is lighter in texture than the surface soil. The substratum consists of stratified beds of old alluvial deposits, mostly of fine texture. The series occupies terraces 200 or 400 feet above the flood plains of the rivers. The surface is nearly level or gently sloping, with steep escarpments at the terrace margins in places. The soils were originally covered with grasses, ferns, and low shrubs. They have been produced mainly by the weathering of old coastal-plain material, but to some extent from old stream-laid deposits. They differ from the associated Willits and the Empire soils in their higher content of organic matter and darker color. The Rohnerville series is represented here by two types and one phase.

The surface soils of the Willits series are brown to grayish brown or dull brown and have a moderate content of organic matter. The subsoil is pale yellow to brownish yellow, mottled or streaked with rusty iron stains, noncalcareous, and tends to be compact and heavier in texture than the surface soil. The material below the 6-foot profile consists of stratified deposits. The topography is sloping to rolling and steep, but smooth, except where marked by small landslides. The original vegetation includes grasses, ferns, and low shrubs, with some forest back from the ocean. The series has been derived, through weathering, from unconsolidated coastal-plain and old valley-filling deposits. The Willits clay loam and two phases are mapped in this survey.

The arable soils derived from wind-laid materials are represented in this survey by a single type of the Westport series. This series consists of dark-gray or dark brownish gray sandy materials that have been blown from coastal dunes and from light-textured alluvial

deposits of the larger streams. Much of the parent material apparently represents stream deposits related to the Coquille series, which have been moved by the wind and laid down over heavier textured alluvial deposits.

The recent-alluvial soils have been laid down by moving water in times so recent that the soil materials have not undergone any appreciable change through weathering in place. The different textures and strata in the profile of the soils represent variations in deposition and are not horizons due to weathering. As a group these are the most valuable soils in the area, and the greatest agricultural development has taken place on them. They are practically all cleared and farmed. They are most extensive in the lower valleys and in the deltas of the Mad River and Eel River and bordering Humboldt Bay. Smaller areas are located in the upper valleys of these rivers and of smaller tributary streams. The soils are classed in the Coquille, Ferndale, and Bayside series. The materials have come from rocks of all kinds, with sedimentary and metamorphosed sedimentary formations predominating.

The soils of the Coquille series are brownish gray to dark gray, nearly black when wet, and mottled with lighter gray and with rusty-brown iron stains. The upper subsoil is similar to the soil in color or in places somewhat lighter, and the lower subsoil is normally bluish gray or bluish gray mottled with iron stains. The subsoil is stratified. This series occupies low flat areas of poor drainage. It differs from the Ferndale and Bayside series in being darker and showing mottling in the surface soil. The Coquille series is represented in the Eureka area by the clay loam.

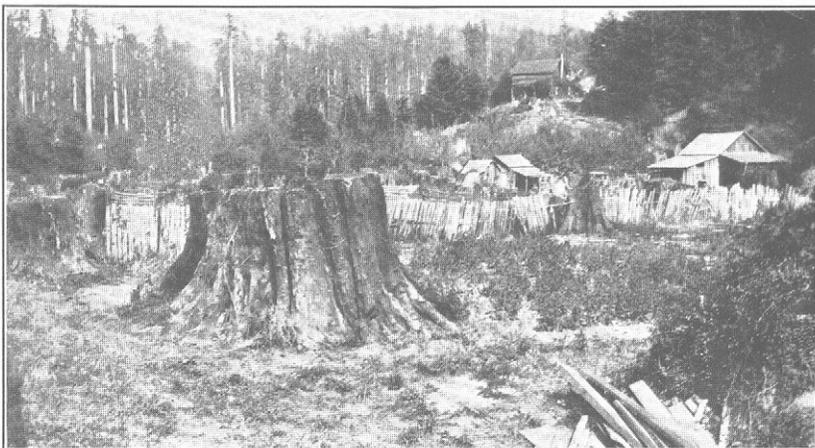
The Ferndale surface soils are brownish gray or grayish brown to dark grayish brown in color. In air-dry samples and dry, bleached field surfaces the color is predominantly gray, but when moist a pronounced brownish tint is developed. The subsoil is light brownish gray, grayish brown, or yellowish brown. There is no mottling except occasionally some in the lower depths. Both surface soil and subsoil have a moderate content of organic matter. The surface is level and smooth, except where interrupted by old stream channels with low intervening ridges. The series is recent alluvial in origin. The materials are derived from rocks of all kinds, including sandstone, shale, and igneous rocks, the latter for the most part of low quartz content. The soils differ from the associated Bayside soils in their better drainage and lack of mottling in the subsoil. Two types and one phase represent the Ferndale series in this area.

The surface soils of the Bayside series are brown to grayish brown, normally without mottling or only slightly mottled. The upper subsoil is of similar or more pronounced grayish color, the deeper subsoil being gray or bluish gray and mottled with light gray, yellow, and rusty brown. The subsoil is usually heavier than the surface soil. The soils have a moderate content of organic matter. The surface soils are true alluvium, but the subsoil in many places consists of older tidal-marsh deposits. The series is intermediate in drainage between the Ferndale soils, which are well-drained grayish-brown soils laid down by streams, and the Coquille soils, which are the poorly drained gray soils laid down as tidal-marsh deposits. The Bayside fine sand and the Bayside loam are mapped in the Eureka area.



S. 11058

FIG. 1.—DAIRY CATTLE ON PASTURE LANDS OF THE EEL RIVER BOTTOMS OCCUPIED BY THE SOILS OF THE FERNDALE SERIES



S. 11481

FIG. 2.—VIEW NEAR FORTUNA, SHOWING LARGE STUMPS IN CLEARING IN REDWOOD LANDS

The miscellaneous materials encountered in the survey include the following; Coastal beach, Dunesand and Riverwash, Tidal marsh and Swamp, and Rough mountainous land. These are largely nonagricultural.

The soils of the Eureka area are low in lime and as a whole have a slight to fairly pronounced acid reaction. This is shown by field tests with litmus paper and by tests made in the laboratories of the University of California, which indicate that the Rohnerville clay loam is distinctly acid and that the acidity of the other soils is less pronounced.

Liming has never been extensively practiced in this area. An application of 3 tons per acre of ground limestone on the Coquille clay loam appears to have given beneficial results. Growing of alfalfa and clovers would probably be promoted by the use of lime, though these are now grown successfully in parts of the area. Most of the crops essential to the dominant type of agriculture yield well under present conditions. Maximum crops of many kinds are grown, including beets, carrots, turnips, and mangels for feed, grasses and grains for pasture, vetches for feed and for market, potatoes, and small fruits.

There is no information in existence to show whether or not the general use of lime would be profitable, even if it could be obtained at a cost that is considered low in other sections of the country. In order that liming might pay at any time, changes in the cropping system so as to give greater prominence to crops that are especially benefited by the use of lime would be necessary, and the changes in crops might also involve considerable changes in the prevailing type of farming. Such fundamental changes should be made only on the basis of conclusive evidence in their favor, and at present such evidence does not exist. It appears therefore that the soils can best be utilized by growing crops suited to prevailing soil conditions, and that present conditions of agriculture would not warrant widespread use of lime.

The soil types of the Eureka area are described in detail in subsequent pages of this report. Their distribution is shown on the accompanying soil map. The table below gives the actual and relative extent of each type mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Rough mountainous land.....	119,360	41.9	Bayside loam.....	9,088	3.2
Empire fine sandy loam.....	21,632	17.1	Ferndale fine sandy loam.....	6,656	2.9
Eroded phase.....	19,328		Gravelly phase.....	1,600	
Light-textured phase.....	7,616		Kneeland clay loam.....	3,328		1.2
Willits clay loam.....	11,456	9.9	Melbourne clay loam.....	2,240	.8
Eroded phase.....	13,312		Tidal marsh and Swamp.....	1,984	.7
Overwash phase.....	3,456		Westport sand.....	1,216	.4
Ferndale silt loam.....	24,064	8.4	Rohnerville fine sandy loam.....	704	.2
Coastal beach, Dunesand, and Riverwash.....	13,248	4.7	Bayside fine sand.....	640	.2
Coquille clay loam.....	12,160	4.3			
Rohnerville clay loam.....	11,200	4.1	Total.....	284,800	-----
Poorly drained phase.....	512				

KNEELAND CLAY LOAM.

The surface soil of the Kneeland clay loam is a dark grayish brown to dark brownish gray clay loam, which is black or nearly black under moist field conditions. It is variable in depth, but is usually from 6 to 24 inches deep. The soil under pasture conditions is rather compact, but under cultivation is friable and easy to till. It has a medium to high content of organic matter, but retains moisture only fairly well. It is deficient in lime and usually acid in reaction. The subsoil where developed is a brown clay loam grading into a yellowish brown or dull yellow material without mottlings, except in some places in the lower depths.

This is a residual soil derived by the weathering in place of the underlying rock. The bedrock occurs at varying depths, in most places from 6 inches to 3 feet, though locally it may lie below 6 feet. Rock outcrops are common. Where the soil is shallow the subsoil is usually lacking, the surface soil resting directly on the bedrock. This rock apparently consists mainly of metamorphosed sedimentaries, with some intrusions of igneous formations.

The most extensive area of the Kneeland clay loam occurs on Kneeland Prairie, in the eastern part of the survey. Smaller areas occupy prairies north of Kneeland Prairie, north and southeast of Korbel, and in the southern part of the area, 2 and 3 miles southwest of Scotia. It occurs as prairies on hilltops or upon the hillslopes at an elevation of 1,000 to 3,000 feet. It is rolling to hilly, with gentle to steep slopes, none of it being level and some of it too steep for cultivation. The surface is smooth or is broken by outcrops of the bedrock. Drainage is well developed to excessive and erosion is active.

In its original state the type was covered with native grasses. A small scrubby oak appears in scattered clumps. Most of this type was at one time used for grain farming, but at present it is practically all in pasture, both beef and dairy cattle being run on it. The quantity of feed produced is rather small, owing to the shallowness of the soil and the lack of moisture in the summer time.

The table below gives the results of mechanical analyses of samples of the soil, upper subsoil, and deeper subsoil of the Kneeland clay loam:

Mechanical analyses of Kneeland clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575625	Soil, 0 to 12 inches	7.3	5.4	5.4	9.2	14.9	28.4	28.3
575626	Upper subsoil, 12 to 24 inches	.0	.4	1.4	13.9	26.3	36.2	21.3
575627	Deeper subsoil, 24 to 36 inches	8.8	6.2	9.8	6.2	16.0	29.5	23.6

MELBOURNE CLAY LOAM.

The surface soil of the Melbourne clay loam is a brown to reddish-brown smooth-textured clay loam, from 12 to 24 inches deep. It is friable, easy to cultivate, has a moderate supply of organic matter, and retains moisture fairly well. It is acid in reaction. The subsoil

is a yellow or yellowish-brown heavy clay loam or clay, which in places is mottled with rusty-brown iron stains and in the lower depths with yellow and gray.

The parent rocks are mainly sedimentaries. They lie in most places below the 5-foot level, but locally approach the surface and may outcrop in spots. In the shallower places the rocks are harder and appear to be either igneous in origin or more highly metamorphosed. The subsoil in these places is reddish and the surface soil may be of more pronounced reddish brown color than typical. In some places the immediate surface of the soil is rich in organic matter and is dark in color, and in small areas this dark color extends throughout the surface soil layer.

Scattered bodies of this type are mapped in the hills east of Humboldt Bay. The largest area lies about 2 miles southeast of Korbekel, and a number of smaller ones are developed south of Korbekel. A number of moderate-sized areas occur at Blue Lake, southeast of Washington School, north of Blue Lake, and east of Arcata. The type occupies small isolated bodies high up on the hillslopes and on the crests of the ridges. The surface is sloping and rolling, grading off to steeper slopes, and is surrounded by the still steeper slopes of the Rough mountainous land. Erosion is active, surface drainage is good, and subdrainage is fair.

The native growth was mostly heavy forest consisting of redwood, Douglas fir, and white fir, with a varied undergrowth of shrubs. A small part of this soil was originally prairie. A good part of the type has been cleared or partly cleared, leaving the big stumps, and is used as pasture or for the production of grain and truck crops. The yields are moderate.

In the following table are given the results of mechanical analyses of samples of the soil and subsoil of the Melbourne clay loam:

Mechanical analyses of Melbourne clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
275634	Soil, 0 to 14 inches.....	1.9	2.7	3.1	6.5	12.1	41.7	30.2
275635	Subsoil, 14 to 36 inches.....	3.4	3.0	3.9	7.9	10.6	32.7	38.8

EMPIRE FINE SANDY LOAM.

The surface soil of the Empire fine sandy loam is a brown to reddish-brown fine sandy loam from 6 inches to 24 inches deep. It is granular and friable, cultivates easily, and retains moisture fairly well during the summer. The organic-matter content is moderate to low, though in virgin areas there may be considerable forest mold at the surface. When the soil is wet the redness is brought out more distinctly. The subsoil is a somewhat compact yellow or brownish-yellow heavy fine sandy loam or loam, streaked and mottled with gray and rusty brown. Both soil and subsoil are noncalcareous.

The substratum consists of stratified materials, yellow, brown, and grayish brown in color, mottled and streaked with rusty brown, and varying in texture from sand to clay loam. In and between these strata there are thin seams of soft, iron-cemented material which restricts the movement of water.

In the vicinity of Eureka the surface soil is mostly a rich brown, shading in places to a reddish brown, but in the neighborhood of McKinleyville, in the northern part of the survey, the soil is distinctly reddish brown and in a few places even a dull red. There are included with this type as mapped numerous small spots, usually less than an acre in extent, that are poorly drained and dark gray in color. The stump pulling and blasting, which have mixed surface and subsoil, and the great fires incident to clearing, which have burned the humus out of spots, also have caused a lack of uniformity in the color of the surface soil in the cleared land. On the mesa east of Blue Lake the soil is gravelly in places, and a few other small areas have similar soil.

This type occurs in the northern part of the area, being derived from an old stratified deposit occupying marine terraces. It extends from the northern boundary of the area, in large bodies, south past Arcata and Eureka to Elk River, where it gives way to the Rohnerville and Willits soils. The type extends up Mad River as far as Riverside, where the terrace materials from which it is derived have apparently been modified by deposition of the river sediments. It is level to sloping and hilly, with a smooth surface. Erosion is active. Surface drainage is generally good, but small spots are poorly drained, generally because of seepage from higher land. Subdrainage is usually restricted. Most of this soil was originally in forest consisting of a heavy growth chiefly of redwood and fir, with an admixture of other trees and an undergrowth of shrubs. However, in the vicinity of Dows Prairie and McKinleyville there were fair-sized prairies.

Most of this type is still timber or stump land. Small parts have been cleared, especially around Eureka, where owners of small tracts have cleared sites for houses and in some cases for gardens and berry patches. The uncleared and the partly cleared stump land is used for pasture. The prairie areas of this type have long been farmed, mostly to grain and grain hay. Yields of grain and grasses are only moderate. This soil seems especially adapted to the growing of berries. Strawberries and blackberries, including the Logan variety, have been tried in a small way, and the results have been very promising, especially on the better-drained areas. Potatoes and most garden vegetables do well on this soil. Much of the uncleared land is practically inaccessible on account of lack of roads.

Empire fine sandy loam, light-textured phase.—The surface soil of the Empire fine sandy loam, light-textured phase, is a pale-reddish or grayish-brown to reddish-brown fine sandy loam, 6 to 18 inches deep. It is somewhat lighter in texture than the typical Empire fine sandy loam, is granular and easy to cultivate, and retains moisture fairly well. It has a moderate to small supply of organic matter, though the content of this constituent in the surface inch or two in virgin areas is fairly high. The subsoil has a yellow, brownish-yellow, or light yellowish brown color, mottled with rusty-brown stains and in places with gray brown in the lower depths. The upper part is compacted and is normally somewhat heavier in texture than the surface soil, although in places the texture is the same. In some areas the lower subsoil is rather sandy, and it may grade into gravel below the 6-foot profile. Both surface soil and subsoil are noncalcareous.

The substratum is stratified, varying in color from yellow or brown to grayish brown and in texture from sand to clay loam. It is mottled with rusty-brown iron stains and also with gray and brown and includes some thin seams of iron-cemented material.

In the areas occurring at Dows Prairie and near McKinleyville the surface soil has a somewhat more pronounced reddish color than near Eureka, and the subsoil is less mottled, the typical mottling appearing in some areas only in the lowest part of the profile. The native forest on this variation was not redwood, but Douglas fir and white fir.

The phase occurs in the north and northern-central parts of the area near the coast. One area extends from about 1 mile north of Dows Prairie School southward to the Mad River, and a smaller one lies immediately north of this. An area covering several square miles occurs at Eureka, extending southward to the Elk River, and a smaller body lies just east of Eureka. The phase occupies terraces associated with the typical Empire fine sandy loam, but lying nearer the ocean. It is level or gently sloping and in a few places rather steep. Erosion is cutting into it in many places. Surface drainage is good and subdrainage is ordinarily good.

Most of this phase around Eureka was originally in forest, but some was covered only with grasses and ferns. That around McKinleyville and Dows Prairie was mostly prairie, with scattered groves of fir and spruce. Most of the forested areas have been cleared and much of the land is farmed. It produces medium crops of grain, but seems better suited to garden truck and small fruit, which do quite well.

On account of the great size of the stumps, the clearing of the land disturbs the soil a great deal and leaves it uneven. When it is leveled off, the plow slice may contain material from any part of the original soil profile, down to 3 or even 6 feet deep. During the progress of logging the brush and bark from the great trees are burned, and the intense heat burns up much of the organic matter in the immediate surface. These fires and the operation of getting out the stumps often cause the cleared soil to differ materially from the virgin soil. In these cases organic manures are needed and should be supplied.

Empire fine sandy loam, eroded phase.—The eroded phase differs from the typical Empire fine sandy loam in being so eroded and steep that cultivation would be difficult and at the present time scarcely profitable. The soil is also shallower than that of the typical soil.

This phase is associated with the typical Empire fine sandy loam, but for the most part lies at higher levels and farther away from the ocean. It occupies the highest levels of the old marine terrace, mainly in the extreme northern part of the area, and reaches in almost unbroken large bodies south nearly to the Elk River. Some detached bodies occur on the mesa west and southwest of Ferndale and in the vicinity of Waddington. The main areas are forested largely with redwood. The area southwest of Ferndale is mostly covered with brush, with some good timber, and some open prairie.

The table following gives the results of mechanical analyses of samples of the soil and subsoil of the typical Empire fine sandy loam:

Mechanical analyses of Empire fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575623	Soil, 0 to 18 inches	0.6	1.1	5.4	29.9	28.2	18.2	17.8
575624	Subsoil, 18 to 72 inches.....	.1	1.8	9.1	31.7	11.5	21.5	24.0

ROHNERVILLE FINE SANDY LOAM.

The surface soil of the Rohnerville fine sandy loam is a dark brownish gray or dark-gray to very dark brown fine sandy loam, with an average depth of 24 inches. When wet the soil is nearly black. It is high in organic matter, has a loose structure, is easy to cultivate, and retains moisture fairly well. It is low in lime, giving an acid reaction. The subsoil to a depth of 6 feet is yellow or brownish-yellow, fine sandy loam well mottled with iron stains. It is compact but contains a relatively large proportion of fine sand and may be of lighter texture than the surface soil. The substratum consists of beds of coastal-plain deposits, the strata having in most cases textures ranging between loam and clay, and being somewhat compact and of yellowish to grayish-brown color.

This type is mapped around the Table Bluff Lighthouse. Two small areas lie just south of Bucksport and a fair-sized one on the western edge of Dows Prairie. The type occurs near the beach, the surface in places is rounded like a low dune, and it seems probable that it owes its origin in part to wind-blown sands from the beach. Surface drainage is good and subdrainage is fair.

This type was originally covered with grasses, ferns, and a few low shrubs. It is utilized for grain growing and pasture and is a fairly productive soil.

The following table gives results of mechanical analyses of samples of the soil and subsoil of the Rohnerville fine sandy loam:

Mechanical analyses of Rohnerville fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575607	Soil, 0 to 18 inches	0.8	1.8	7.4	38.3	12.3	18.2	20.7
575608	Subsoil, 18 to 72 inches.....	.2	1.0	8.6	54.2	9.3	11.0	16.7

ROHNERVILLE CLAY LOAM.

The surface soil of the Rohnerville clay loam is a very dark brown to dark brownish gray or dark-gray clay loam of smooth silty texture, with an average depth of 20 inches. When wet the soil becomes much darker and much of it is nearly black. It is relatively high in organic matter, granular in structure, fairly easy to cultivate, and retains moisture quite well during the dry season. It is decidedly acid in reaction. The subsoil to a depth of 6 feet or more is a clay loam or clay of yellow or yellowish-brown color mottled with rusty-brown iron stains, and in places in the lower subsoil with gray and yellow. Like the soil, it is

noncalcareous. The substratum consists of stratified beds of coastal-plain and alluvial deposits, many feet in depth, mainly loam or heavier in texture, but with occasional streaks of gravelly material.

Gravel is present in the soil and the subsoil in patches too small to show on the map. These gravelly spots occur mainly on the more eroded and steeper parts of the type. Part of the area lying just south of Centerville School has considerable gravel and small stone in the subsoil and some in the surface soil. In a very few places there is an overwash of more recent material, but this is shallow and does not materially change the character of the soil. The area lying at the foot of the slope of Table Bluff, about a half mile southwest of Clark School, is the best example of this variation.

This type occurs on the lower terraces of the Elk River, on Table Bluff, and on all the terraces along the Eel River. There is a large area at South Bay, a moderately extensive one at Elk River School, and two small ones in the vicinity. A fair-sized area is west of Ferndale. Several areas lie near Rohnerville, others at Hydesville and Rio Dell, and still others are scattered through the southern part of the survey. It is interesting to note that this type does not occur in the northern part of the area, where similar terraces are occupied by the Empire soils.

The surface is smooth and is either level or sloping. A relatively small part of the type along terrace fronts is moderately steep to quite steep, but usually tillable. Practically none of it is eroded to such an extent as to interfere with cultivation.

The surface drainage is good and in places too rapid. Subdrainage is restricted on account of the heavy texture of the subsoil; this keeps the soil wet in the spring, and, if the season is wet, it is late before the soil is in condition for cultivation.

The Rohnerville clay loam originally was open country, covered with grasses, ferns, hazel, and shrubs like ceanothus, and wild rose. Because of the ease of clearing this soil, it was one of the very first to be cultivated. It has been under continuous cultivation ever since and has proved to be remarkably durable. Fair crops of grain are still produced on soil that has been cropped continuously, with only meager application of stable manure. However, some farms that were not only cropped but mismanaged have at times been considered nearly worn out. It has been demonstrated that where vetch or other legumes have been grown on the soil for a few years, its productiveness has been restored to a high level.

This is an extensive and very important type. Practically all of the purple vetch grown in the area is on this type. Prior to the introduction of the vetch, which has been grown extensively only two or three years, the principal crops were grains, and considerable grain is still grown. Dairying has not become established on the farms located on this type as it has on the recent-alluvial soils. The farms average large and the farmsteads show thrift. The roads are numerous enough to serve all parts of the country. This type rents for \$10 or more an acre. Some of the best vetch fields rent for \$25 an acre and bring from \$100 to \$200 an acre when offered for sale.

Rohnerville clay loam, poorly drained phase.—The poorly drained phase of the Rohnerville clay loam differs from the typical soil in having poor drainage and in having more gray than brown in the mottling of the subsoil. The texture also varies in a few places,

being more sandy. The soil occupies flat or shallow basin like areas upon which water grasses growing in bunches are conspicuous.

The phase is inextensive. An area of fair size is developed a mile north of McKinleyville in the northern part of the survey, a small area lies just east of Washington School, and two small ones north and east of Hydesville, in the southern part. This phase is kept almost entirely in pasture. Fair crops are grown on a small part of it. The area east of Washington School is in forest.

WILLITS CLAY LOAM.

The surface soil of the Willits clay loam is a brown to a grayish-brown or dull-brown clay loam of smooth silty texture, averaging 10 or 12 inches deep. It is a friable, easily worked soil, containing a small to moderate quantity of organic matter, and little if any lime carbonate. The subsoil is a pale-yellow or brownish-yellow clay loam relatively high in silt extending from the surface soil to the 6-foot depth. It is somewhat compact, mottled and streaked with brown iron stains, and in places in the lower depths with gray. It is, like the soil, noncalcareous. The substratum, i. e., the material below 6 feet, consists of beds of old sedimentary deposits, which extend to great depths. These are for the most part compact, fine textured, and of grayish, brown, or yellowish color. In the southern part of Fortuna the surface soil is light grayish brown to yellowish brown, and the subsoil contains layers that are yellowish brown, dark brown, and rusty brown, and one layer observed was almost black.

This type is developed on the terraces bordering the valleys of Eel, Van Duzen, and Elk Rivers. The largest area, including areas of the eroded phase, extends from about $1\frac{1}{2}$ miles southeast of Rohnerville northwesterly across Table Bluff nearly to the coast. Smaller areas lie in the vicinities of Hydesville, Carlotta, Scotia, and Pepperwood. A few small areas are situated in Butler Valley and its neighborhood on the Mad River. It usually occupies the more sloping and eroded parts of the old river and marine terraces. It is associated with the Rohnerville clay loam, which occupies the more level parts of these terraces, and therefore is a deeper soil. The transition of one soil to the other is very gradual and it is probable that small areas of one type have been included within the other. The surface is sloping to rolling and is usually smooth, but marked in a few places by landslides. Erosion is fairly active. Surface drainage is good, but sub-drainage is restricted by the heavy subsoil. This condition has produced the landslides that mar some of the hillsides.

The original covering consisted mainly of grasses, ferns, and low shrubs. Trees were rare, except on the terraces farthest up the river. This type is used for pasture and the production of grain, vetch, and hay crops. It is only moderately productive. On some of the highest mesas near Rohnerville the land has been cropped to grain so long that yields have dropped very low, and in places the fields are abandoned. The productiveness of these fields could probably be brought back by growing legumes, notably vetch, which would increase the organic content of the soil and improve its tilth.

Willits clay loam, eroded phase.—The eroded phase of the Willits clay loam consists of that part of the Willits clay loam which is too steep or eroded for plowing or for profitable cultivation. Besides

differing from the typical soil in topography, it differs in having a shallower surface soil, the depth of which averages only about 6 inches. This phase, which is extensive, is associated with the typical soil. A very large area lies south and east of Elk River School. Drainage is excessive and erosion is active. The land is utilized for pasture.

Willits clay loam, overwash phase.—A variation from the typical Willits clay loam, occurring mainly in the northern part of the area, has been designated the overwash phase. It consists essentially of an overwash of recent-alluvial material upon the typical subsoil of the Willits clay loam. This overwash, which constitutes the surface soil, has an average depth of 1 foot, but may extend to 30 inches or more. It is a brown or reddish-brown silt loam or silty clay loam, friable and easy to cultivate.

The overwash phase occurs in small coves and side valleys or local alluvial-fan slopes at the base of the hills inclosing these valleys. It has the physical characteristics of the typical Willits clay loam, except that it is lower lying and has been enriched by the recent material deposited on it. Most of it is farmed and produces medium to good crops of grain, potatoes, berries, and truck crops. Much of it is divided into small holdings and furnishes home sites and gardens for men who derive most of their income from work in the mills and woods.

One area of this phase is located at Korbel, and another extends from just south of Arcata to and for some distance up the valley of Jacoby Creek. Other areas occur at Indianola, on Freshwater Creek, on Elk River, at South Bay, at Beatrice, and near the Centerville School.

There are two small bodies of this phase just south of Coffee Creek School west of Waddington, which differ in having a gravelly and sandy subsoil. These occupy small alluvial fans of pronounced slope. The highest part of the alluvial fan at Centerville School has a gravelly surface soil, but the area covered is not large enough to justify mapping. Near Freshwater Corner School there are also included with this phase several small spots which are very high in organic matter, almost mucky, and dark gray to black in color. This variation is no doubt due to poor drainage.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Willits clay loam:

Mechanical analyses of Willits clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575601	Soil, 0 to 12 inches.....	0.7	0.8	1.2	4.1	18.2	46.0	28.0
575602	Subsoil, 12 to 72 inches.....	.3	.9	1.3	4.0	20.5	46.3	27.1

WESTPORT SAND.

The surface soil of the Westport sand is a dark-gray sand, from 6 to 12 inches deep. It contains considerable organic matter, which makes it somewhat loamy, but it is very loose and friable and does not retain moisture. The subsoil is a gray sand or fine sand extending in places to a depth of 6 feet. Locally the lower subsoil is a gray

silty clay loam similar to that of the adjoining Coquille clay loam. In places there is some gravel in the lower depths. Both soil and subsoil are acid. Just south of Bucksport there is a very poorly drained area of this type which has a coating of peat averaging about a foot deep and is indicated on the map by marsh symbols.

The type occupies a number of small areas near the coast between the mouth of Little River and the mouth of the Eel River. Many of them are on the eastern edge of the coastal sand dunes and the others on the eastern edge of Humboldt Bay. The largest body is at Bucksport. The type evidently has been produced by the spreading of the sand that has been blown from the beach and distributed as thin sheets over adjacent soil materials. The surface is flat or marked by low ridges. Subdrainage is very poor; the water table in most places is from 1 to 3 feet below the surface.

The type has a native vegetation of grasses and sedges and is used almost entirely for pasture. The amount of feed produced is not great.

The results of mechanical analyses of samples of the soil and subsoil of the Westport sand are given in the following table:

Mechanical analyses of Westport sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575613	Soil, 0 to 30 inches	0.7	30.5	63.7	0.0	1.0	1.9	2.3
575614	Subsoil, 30 to 72 inches.....	.1	5.8	66.6	23.4	.1	1.1	1.7

COQUILLE CLAY LOAM.

The surface soil of the Coquille clay loam is a dark-gray or dull brownish gray clay loam, of rather heavy texture and high silt content, mottled with lighter gray and with rusty-brown stains, with an average depth of about 12 inches. It is very rich in organic matter. In its virgin condition it is often springy to the tread on account of the great quantity of grass roots in it, and many of the brown streaks appear to be grass stains. This soil is sticky and plastic when wet and likely to form hard clods when dry. If it is handled skillfully, it will mellow up into a fairly friable condition. It retains moisture quite well. When perfectly dry and sunburned the surface is medium gray or light gray in color, but when wet it is dark gray and in certain spots it becomes black.

The subsoil is similar to or slightly heavier than the surface soil in texture. The color of the upper subsoil is frequently somewhat lighter than the surface and that of the deeper subsoil is bluish gray or bluish gray mottled with iron stains. The subsoil contains occasional thin layers of varying textures, usually lighter than clay loam, and varying in color from brown to gray. Here and there it contains a thin layer of peat. Both soil and subsoil are acid.

This type is uniform in color and texture over large areas, except near hills, where deposits of small alluvial fans overlap it. A short distance east of the mouth of Salmon Creek there is a small poorly drained spot that has a surface coating of peat about a foot thick. It is shown on the map by marsh symbols.

The Coquille clay loam is rather extensive. It occurs in large areas around Humboldt Bay, near the mouths of Eel River and Mad River, and in a small area near the mouth of Little River. It represents reclaimed Tidal marsh or the older and better drained areas of Tidal marsh and lies just above tide water. The surface is level and marked more or less with old channels. Under cultivation these gradually disappear. Cracks several inches across and several feet deep are formed in the soil when it first dries out. Both surface and internal drainage are poor, and the water table usually stands only 3 or 4 feet below the surface.

This type is protected from inundation by the tides by dikes from 3 to 10 feet high. But during the rainy season it is pretty certain to be overflowed by fresh water coming down from the higher lands. Drainage is obtained by flood gates where the main water channels cut the dikes. Before reclamation this soil contains large quantities of marine salts. It takes three or four years of natural washing and drainage before grain can be grown, and many years after reclamation salts still remain in a few low places.

The land is used for pasture, for grain, and for soiling crops for cows. It is productive, but is not as high priced or desirable as the more easily handled and better drained soils of the Ferndale series.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Coquille clay loam:

Mechanical analyses of Coquille clay loam.

Number	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575636	Soil, 0 to 18 inches -----	1.2	1.9	1.6	3.3	20.4	42.2	28.0
575637	Subsoil, 18 to 48 inches -----	.9	.9	.1	1.3	1.3	60.4	34.0
575638	Lower subsoil, 48 to 72 inches -----	.1	1.0	.3	1.0	6.8	60.3	29.2

FERNDALE FINE SANDY LOAM.

The surface soil of the Ferndale fine sandy loam is a brownish-gray or grayish-brown fine sandy loam, 10 to 30 inches deep. It is granular and loose in structure, is easy to cultivate, has a very good supply of organic matter, and retains moisture fairly well. When dry, it is light grayish brown or light brownish gray, but when wet it is generally brown, dark brown, or dark brownish gray. The subsoil is usually a little lighter in color than the surface soil, being light brown, grayish brown, brown, or even yellowish brown. The texture is the same as the surface soil, or is heavier, ranging from a fine sandy loam to a clay loam. There are no mottlings, except here and there in the lowest part of the 6-foot profile.

A part of the area of this type lying a mile west of Loleta, which has been formed by very recent overflows, is of a rather sandy texture.

The Ferndale fine sandy loam occupies fair-sized areas on the flood plains of the Van Duzen and Eel Rivers and small areas along Salt River. On the Mad River it appears at intervals from the mouth of the river to Riverside, and there are two small areas farther up the river in the vicinity of Butler Valley. The type is associated with the Ferndale silt loam, but lies at a different level and often

nearer the river. The surface is level or is modified by low ridges and old deserted stream channels. Erosion is doing no damage, except in a few places where the land is being eaten away by the side cutting of the large streams. The drainage is usually sufficient. Parts of the type are subject to occasional overflows during times of high water, but these overflows are of short duration, and the texture of the soil and subsoil is such that the surplus water soon drains out.

This type was originally covered with forest, willows, elder, fir, and spruce predominating, but on the areas which lie farthest away from the ocean redwood was the main growth. All the type has been cleared and is under cultivation, except part of the land on the Van Duzen River above Carlotta and on the Eel River at Pepperwood, and the small bodies at Butler Valley on the Mad River. It is used for the production of crops for dairy cattle. Root crops, corn, small grain, grasses for hay and pasture, alfalfa, and clover are grown.

This is a very productive soil and is highly prized. It is nearly or quite as valuable as the Ferndale silt loam. It becomes dry enough to cultivate earlier in the spring, is always easier to cultivate, and on new land the crops are as large. Under constant cultivation it is not as durable as the silt loam.

Ferndale fine sandy loam, gravelly phase.—The Ferndale fine sandy loam, gravelly phase, varies from the typical Ferndale fine sandy loam in having considerable gravel and some cobblestones scattered through the soil and subsoil. This not only affects the texture and cultural requirements of the soil, but it usually indicates a shallow soil, and porous gravel is likely to be encountered 2 to 4 feet below the surface. This phase generally lies at a lower level than the typical soil and only a little above Riverwash. Three small areas are mapped near Korbelt, two islands occur in the areas of Riverwash south of Fortuna, and several fair-sized areas occur on the flood plain of the Van Duzen River. The surface is level, except where interrupted by old river channels. The type is well drained, except that it is subject to overflow during periods of high water. It varies greatly in value, owing to its variable depth and gravel content and its position in relation to overflow. On the whole, it is much less valuable than the typical soil, and much of it is still uncleared.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Ferndale fine sandy loam:

Mechanical analyses of Ferndale fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575617	Soil, 0 to 24 inches.....	0.4	0.8	1.4	15.5	46.4	26.5	7.5
575618	Subsoil, 24 to 72 inches.....	.0	.1	2.8	34.0	45.0	11.8	6.6

FERNDALE SILT LOAM.

The surface soil of the Ferndale silt loam is a dull brownish gray to dark grayish brown silt loam, 10 to 36 inches deep. Some of the material included with the type is of rather heavy texture, approaching silty clay loam. It has a granular structure and a good

supply of organic matter and retains moisture well. It is moderately easy to cultivate if handled skillfully, but has a tendency to clod if plowed or cultivated when too wet. The subsoil is typically a brownish-gray to grayish-brown somewhat compact silt loam, but includes variations in color ranging from yellowish brown to light brown and dark brown. The texture also lacks uniformity, ranging between fine sandy loam and clay loam. In places beds of stream-laid gravel appear at a depth of 3 or 4 feet. Very slight mottlings are found locally in the lower depths. Both surface and subsoil give acid reaction.

Areas of light-textured subsoil occur near Port Kenyon and on the islands near the mouth of the Eel River and areas underlain by gravel beds south and east of Alton, on Yager Creek, and at and above Carlotta. Some of the fine soil material here is fully 6 feet deep, but much of it rests on gravel at a depth of 3 to 4 feet, and there is more or less gravel in the surface soil. Some of this type near Coffee Creek School, around Waddington, southeast of Waddington, and north of Grant School, is also underlain by porous gravel and dries out quickly in summer time. Where the gravel is below the 6-foot level it does not lessen the agricultural value of the soil but really increases it, as irrigation water can be pumped from this gravel at very little cost.

The Ferndale silt loam occupies large areas on the stream bottoms north and northwest of Arcata and on the Eel River bottoms from Grizzly Bluff to the large flat west of Loleta. Small areas occur on the Mad River as far up as Riverside, on the lower part of the Elk River, on Salmon Creek, on Strongs Creek, on the Van Duzen River, and the Eel River to the boundary of the survey.

The type occupies the higher, better drained parts of the flood plains. For the most part it is level and smooth. In places the surface is marked by numerous old channels or depressions varying from 1 foot to 6 or 8 feet deep. This uneven topography seems to be associated with the presence of gravel not very far below the surface. The Eel River in its meanderings is cutting into this soil in several places and destroying considerable areas each year. Otherwise erosion is not a serious factor in the management of the soil. Drainage is almost invariably good. The type lies above danger of overflow, except near the mouth of Eel River, where it is overflowed occasionally by fresh water during times when an especially high flood meets a high tide.

This type was originally in forest, with spruce and fir predominating on the large areas of the type. Where the flood plain is narrower farther up the river and on the smaller streams, redwood was more plentiful. Most of the type has been cleared and is now under cultivation. Parts of it above Scotia on the Eel River, above Carlotta along the Van Duzen River, and very small parts elsewhere are still in forest or stumps.

The Ferndale silt loam is probably the most important soil type in the area both on account of its productiveness and its large extent. It is everywhere recognized as an exceedingly valuable soil. It is practically all given up to the dairy industry and the crops raised are feed crops. They include roots, corn, vetch, grain and grasses for hay, and pasture. The yields of all these are high under good farm management. Clover and alfalfa also are grown; profitable

though not maximum yields are obtained. Liming would undoubtedly aid in the production of clover and alfalfa, but with the large choice of crops that can be grown very profitably on the soil in its present acid condition it is not clear that it would be profitable to lime the soil.

Settlement on this type is relatively dense and the holdings average small. All parts are well supplied with roads, which are kept in good repair. The land values are the highest in the area. The greater part of this type will bring from \$500 to \$1,000 an acre. Where the soil is shallow or is menaced by the side cutting of the river the value is much less.

The table below gives the results of mechanical analyses of samples of the soil and subsoil of the Ferndale silt loam:

Mechanical analyses of Ferndale silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575639	Soil, 0 to 42 inches	0.2	0.5	0.4	1.3	11.2	63.1	21.6
575640	Subsoil, 42 to 72 inches.....	.0	.1	.0	8.7	55.0	23.4	12.0

BAYSIDE FINE SAND.

The surface soil of the Bayside fine sand is a brown or grayish-brown fine sand, in many places of loamy texture, approaching a fine sandy loam, with an average depth of 1 foot. It is normally without mottling or only faintly mottled. It is granular and friable, easy to cultivate, has a good supply of organic matter, and retains moisture fairly well.

The subsoil varies considerably in texture. The upper subsoil is commonly a brown or grayish-brown fine sandy loam, with thin strata of fine sand. The lower subsoil has a gray or brownish-gray to bluish-gray color, mottled with lighter gray and with brown or rusty-brown iron stains, and a silty loam to clay loam texture. Both soil and subsoil are noncalcareous.

The small bodies of this type located a mile north and one-half mile east of McKinleyville vary from the typical in that the surface soil is dark gray and very high in organic matter, and the subsoil is mostly a fine sand.

The Bayside fine sand is a minor type. It occupies one small area near Bulwinkle, two near McKinleyville, one on Ryans Creek east of Eureka, one at Port Kenyon, and one south of Waddington. It is level to gently sloping and smooth.

Surface drainage is prevailingly good, but subdrainage in most areas poor. The greater part of this type was originally in forest; some of it evidently was prairie. Most of it has been cleared and is farmed. It gives good yields of garden truck, root crops, and grain.

The table following gives the results of mechanical analyses of samples of the soil, subsurface, upper subsoil, and lower subsoil of the Bayside fine sand:

Mechanical analyses of Bayside fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575641	Soil, 0 to 12 inches	0.1	0.5	0.5	43.3	41.8	8.0	4.0
575642	Subsurface, 12 to 24 inches .....	.1	.2	.7	40.7	36.0	12.0	9.1
575643	Upper subsoil, 24 to 54 inches .....	.1	.1	.1	46.7	33.7	7.1	10.7
575644	Lower subsoil, 54 to 72 inches .....	.0	.1	.1	9.3	33.3	40.5	15.6

BAYSIDE LOAM.

The surface soil of the Bayside loam is a brown or grayish-brown loam of silty texture, from 10 to 24 inches deep. It has a friable structure, a moderate to high content of organic matter, is easy to cultivate, and retains moisture well. It is acid in reaction. The subsoil is typically gray, with mottlings of lighter gray or rusty brown, but varies considerably in both texture and color. Locally it is heavier than the surface soil and in a few places is a clay; less frequently it is lighter in texture, being a fine sandy loam. In places it contains several strata of varying texture within 6 feet of the surface. The color varies from gray to brown. The substratum is similar to the subsoil and it extends to an unknown depth.

This type is developed on the flood plains of the small streams, such as Little River, Lindsey Creek, Jacoby Creek, Freshwater Creek, and Elk River. It also occurs as a border soil between the deep alluvial soils of the large rivers, represented by the Ferndale series, and the marsh-land soils represented by the Coquille series. Large areas of this kind lie west of Arcata, west of Janes School, east of Ferndale, south of Port Kenyon, and at the mouth of Salt River. Here the soil has the surface characteristics of the Ferndale series and the subsoil characteristics of the Coquille series. The deposits from the streams in places have formed low, gentle ridges of Ferndale silt loam, and these have inclosed bodies of soil lying lower and consequently having poor drainage. This is true of the area east of Ferndale and some of those northwest of Ferndale.

The surface is level and smooth. The surface drainage is usually sufficient to carry off surplus water, but subdrainage is deficient. The land is often overflowed for short periods during the rainy season.

It could easily be irrigated. Most of this soil was originally covered with forest consisting of oak, elder, willow, spruce, and in some places redwood. A small part of it was open and covered with grasses and sedges.

This type is important because of its inherent productiveness rather than its extent. About nine-tenths of it is cleared and most of this is used for pasture. Perhaps one-third is used for crops, which yield well. Its greatest handicap is its poorly developed drainage.

The results of mechanical analyses of samples of the soil and subsoil of the Bayside loam are given in the following table:

Mechanical analyses of Bayside loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
575615	Soil, 0 to 18 inches-----	0.9	0.3	0.5	9.1	34.9	41.1	13.7
575616	Subsoil, 18 to 72 inches-----	.3	.5	.8	13.3	32.3	23.9	23.1

COASTAL BEACH, DUNESAND, AND RIVERWASH.

Coastal beach, Dunesand, and Riverwash constitute a group of miscellaneous materials of nonagricultural character, which have been shown on the soil map by a single color.

Coastal beach and Dunesand include areas of sand dunes and of smooth shelving or sloping sandy beaches along the coast of the Pacific Ocean. The Dunesand has a typical dune surface and is unstable. The sandy and gravelly beach areas are swept by waves in the time of storm and high tide. A continuous strip extends from the northern boundary of the area south beyond Centerville, broken only by the mouths of the main streams and the outlet of Humboldt Bay. The dunes for much of the distance are low, not over 10 feet high, and the whole strip, including the beach, is from 600 to 800 feet wide. From the mouth of Mad River south to a point opposite Fields Landing the dunes are larger, reaching a height of 100 feet, and they cover a strip of land from one-fourth to 1 mile wide. The dunes are for the most part bare of vegetation; in places a scant covering of stunted trees and shrubs appear.

Riverwash consists of the sands and gravels occupying stream beds and low-lying flood-swept areas along the Mad, Eel, and Van Duzen Rivers, and some of their tributaries. For the most part Riverwash is devoid of vegetation, but in places there is a growth of willows, and annual weeds occur in some of the areas during the dry summer season. On account of its topographic position, its coarse texture, and leachy nature, it has no value for agriculture.

TIDAL MARSH AND SWAMP.

Tidal marsh consists of marsh land most of it lying close to high-tide level. It is traversed by numerous small winding channels and tidal sloughs and is covered by a coarse salt-marsh vegetation. The soil material consists of fine-textured sediments distributed by tidal currents. It normally has a high content of organic matter and is predominantly dark gray to bluish gray in color, much mottled, and similar in character and color to the heavy-textured material of the Coquille series.

Tidal marsh occupies small bodies bordering Humboldt Bay and a few small areas near the mouth of Eel River. Formerly it was much more extensive, but most of it has been reclaimed from its original undrained condition by the construction of dikes and is now mapped as the Coquille clay loam. Indian Island was at one time reclaimed, but the dikes are broken in many places and the land

has reverted to its original state. In its natural condition it is of no value for cultivated crops.

Swamp consists of low-lying areas covered with shallow fresh water the year round. All the soil is rich in organic matter and peat has been formed in a small part of it. In general the texture varies from fine sandy loam to clay loam. The subsoil is a gray or blue-gray fine sandy loam, loam, clay loam, or sandy clay.

Only two small areas of Swamp are mapped; one lies one-half mile north of McKinleyville and the other lies near the mouth of Little River, both in the northern part of the survey. They support a forest growth, mostly of alder and willow, and an undergrowth of water-loving plants, including sedges, ferns, and skunk cabbage. Under present conditions the land is nonagricultural but, if drained and cleared, it could be utilized for crops.

ROUGH MOUNTAINOUS LAND.

The term "Rough mountainous land" is applied to land that is too hilly and steep for profitable cultivation. It consists of the rougher parts of the low mountains within the area and includes most of the hill land east of the main agricultural valleys.

The easily tillable areas have been classified and mapped as individual soil types, but these cover only a small proportion of the mountainous parts of the survey. The rest is mostly nontillable, or is tillable only at great expense, mainly on account of its steepness. On many of the hillsides the soil material is 5 to 10 feet deep and rock outcrops are rare; ultimately such land may be brought under cultivation, but it would not be profitable at the present time. On the other hand, much of the soil is shallow and many of the canyons have very precipitous slopes, making this part strictly nonagricultural.

The elevation of the Rough mountainous land ranges from about 500 feet to a maximum of about 4,000 feet above sea level. The soils consist mostly of residual materials, derived from the weathering of the consolidated rocks of the region, but a little consists of old marine deposits that have been badly eroded.

Practically all the Rough mountainous land is covered with forest, much of which is very valuable, consisting of redwood, Douglas fir, white fir, and lesser growths. Considerable of the land has been cut over, but the stumps remain and young growth is springing up.

The greater part of this rough land lies east of the main agricultural lands of the area, but several large ridges or spurs of the mountains extend well into the area. A large body is mapped east of Humboldt Bay. Within this body are Kneeland Prairie, Boynton Prairie, and other small bodies of tillable land which have been mapped in detail.

Under present conditions this mountainous land has very little value except for forestry. Its value for pasture is very low on account of the dense covering of trees, brush, and fern, and the great cost of clearing would exceed the value of the land for pasture after it was cleared.

SUMMARY.

The Eureka area lies in the northwestern part of California. It covers an area of about 445 square miles, including the largest areas of agricultural land in Humboldt County and a part of the famous redwood belt in this part of the State.

The Mad River and the Eel River are the main streams of the area.

Humboldt Bay was discovered in 1849, and settlement of the region began soon after. The population is largely Anglo-Saxon, with Portuguese, Danes, and Swiss forming about one-third of the population.

Eureka, the county seat, is a city of more than 1,200 inhabitants. The other towns are small.

Transportation is supplied by ocean going boats and by a railroad that enters the area from the south. A branch of the State highway gives outlet for automobile travel.

The climate is mild, even, and moist. The highest absolute temperature is 85° F. and the lowest is 20° F. The climate is especially suited to dairying, the outstanding agricultural industry at the present time. The recent-alluvial soils are exclusively in dairy farms. The cows have a very high average production. Butter is the main product, but cheese and condensed milk are also largely produced. The growing of purple vetch for seed is a new industry that is assuming large proportions.

The farms on the valley floors are small, but those in the rougher parts of the area are large. The price of the poorer land ranges from \$10 to \$30 an acre and of the very best land from \$500 to \$700 an acre, or even more in a few cases.

The residual soils are small in extent and of minor importance. They are classed in the Kneeland and Melbourne series, each series being represented by one soil type. The Melbourne soils are brown and derived from sedimentary rocks. The Kneeland soils are dark brown to dark gray and derived from metamorphosed rocks of both igneous and sedimentary origin. They are shallower than the Melbourne soils and covered with grasses instead of trees.

The coastal-plain and old valley-filling materials have produced the Empire soils, which are reddish brown, the Rohnerville soils, which are dark brown or dark brownish gray, and the Willits soils, which are brown to grayish brown.

The Empire fine sandy loam is extensive, but much of it is still uncleared. It produces only moderate yields of grain and grasses, but seems especially suited to the growing of berries. The light-textured phase of this type is less extensive, but is largely under cultivation. It is utilized mainly for grain and general farming, but appears to be well suited to small fruits and truck crops.

The Rohnerville fine sandy loam is a minor type, but is fairly productive. It is utilized mainly for grain and pasture.

The Rohnerville clay loam is an extensive and important type. Practically all of the purple vetch grown in the area is on this type.

The Willits clay loam is an extensive type, rougher in topography and shallower than the Rohnerville clay loam, with which it is associated. It is used largely for pasture.

The soils derived from wind-laid materials are represented by the Westport sand. This is a dark-gray or dark brownish gray sand of variable depth superimposed over heavier textured alluvial deposits. It is of minor extent and importance and is used mainly for pasture.

The recent-alluvial deposits have produced the Coquille soils, which are dark gray and highly mottled; the Ferndale soils, which are brownish gray or grayish brown and without mottlings; and the Bayside soils, which are brown with mottled subsoils.

The Coquille clay loam is a type of large extent, mainly reclaimed tidal-marsh land. It is productive, but somewhat difficult to cultivate. It is utilized mainly for pasture, the production of grain, and soiling crops in connection with dairying.

The Ferndale fine sandy loam is a valuable soil, although not extensive. It is used in the production of feed for dairy cattle.

The Ferndale silt loam is the most important soil in the area on account of its productiveness and its extent. It is given up almost entirely to the production of feed for dairy stock.

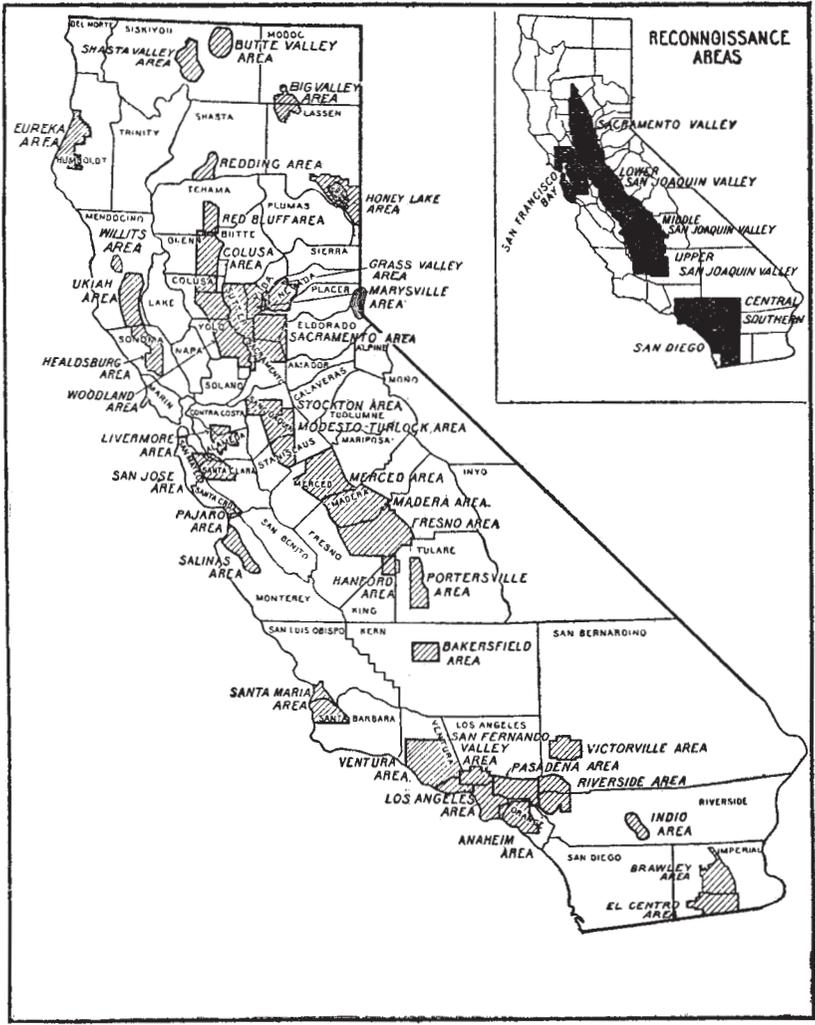
The Bayside fine sand is a minor type, occurring in small scattered bodies. It gives good yields of garden vegetables, root crops, and grain.

The Bayside loam is rather important on account of its inherent productiveness, though at present most of it is used for pasture.

The miscellaneous materials mapped are Coastal beach, Dunesand, and Riverwash; Tidal marsh and Swamp; and Rough mountainous land.

The soils of the area are all acid, but this does not appear to decrease their productiveness or limit their utilization for the crops grown in the area, except perhaps in the case of clover and alfalfa.





Areas surveyed in California, shown by shading.

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