Number 15 Series 1924

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In Cooperation with the University of California Agricultural Experiment Station

SOIL SURVEY
AUBURN AREA, CALIFORNIA

BY

STANLEY W. COSBY, University of California, in Charge
and E. B. WATSON and W. G. HARPER
U. S. Department of Agriculture

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1928

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SOIL SURVEY

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SOIL SURVEY OF THE AUBURN AREA, CALIFORNIA

By STANLEY W. COSBY, University of California, in Charge, and E. B. WATSON and W. G. HARPER, United States Department of Agriculture

AREA SURVEYED

The Auburn area comprises the western half of Placer County and a very small part (about 6 square miles) of Nevada County, Calif. The limits of the area on the south, west, and most of the north coincide with the boundaries of the county, but on the east the area extends to the Tahoe National Forest. On the northeast, in the vicinity of Gold Run, the boundary joins with that of the earlier soil survey of the Grass Valley area.

FIG. 1.—Sketch map showing location of the Auburn area, California

The area is 611 square miles in extent and includes practically all of the arable land in Placer County. Three general physiographic divisions are represented within its boundaries: (1) The plains of Sacramento Valley; (2) the lower foothill region between Rocklin and Auburn; and (3) the upper foothill and mountainous region extending over the eastern part of the area where the elevation is higher.

The valley region is made up of smooth or gently rolling plains, dissected by numerous small streams draining toward the west. Many small hills and ridges of older material are scattered irregularly about these plains, particularly along the base of the foothills. The lowest point in the area, with an elevation of less than 30 feet above sea level, is in the southwestern corner.

An abrupt transition occurs between the valley and lower foothill region, both in the soil material and in the surface relief. The foothills are rolling and many of them are steep sided. In virgin areas they are covered with a growth of brush, oaks, and pines. This growth is in marked contrast to the practically treeless plains to the westward. Except for the deeply cut canyons of North Fork American River and Bear River, the streams draining this region are small and intermittent and are mostly headwaters of streams which flow west across the valley floor. Doty Creek, Coon Creek and the stream flowing down Auburn Ravine are small and have narrow channels. Elevations in this part of the area range from about 300 feet above sea level on the west to approximately 2,000 feet along the eastern edge.

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The third division, the most rugged and mountainous in the area, includes rounded or flat-topped ridges between the deep canyons of North Fork American River and Bear River and their tributaries. The canyon walls are steep, and in many places the valleys are a thousand or more feet in depth. The highest point in the area with an elevation of more than 4,000 feet above sea level, occurs northeast of Iowa Hill. The mountains east of this area attain a maximum elevation of about 9,000 feet above sea level.

Excepting persons engaged in mining and those living in the small towns and settlements along the railroad and on the shores of Lake Tahoe, the inhabitants of Placer County live in the region covered by this survey. The census gives a rural population of 14,232 in 1880, and subsequent records show that the population has remained nearly stationary in number during the last 40 years. There has been an increase in the total number of farms during that period, but a decrease in their average size. The marked increase in the proportion of farms operated by tenants is probably caused by the development of the orchard industry in the foothill region. Principally because of this change in agriculture, the oriental population has increased from 1,435 in 1890 to 1,893 in 1920.[1]

Placer County had an urban population of 2,608 in 1910 and of 4,477 in 1920. The latter figure, with the 14,107 rural inhabitants, places the total population of the county at 18,584 at the last census in 1920.

Most of the towns in the area are situated along the railroad. Roseville, with a population of 4,477, is the largest. It is located in the southern part of the valley region and is a railroad division town with shops, icing station, and plants of the Southern Pacific Railroad and kindred interests, including the Pacific Fruit Express. Lincoln, 10 miles north of Roseville, has a population of 1,325. It was formerly a shipping point for large quantities of grain and hay produced in the valley region, and is now the location of one of the largest clay products and pottery plants in the West. Sheridan, situated on the railroad in the northern part of this section, was also a large shipping point during the days of grain growing but at present has no important activity.

Auburn, the county seat of Placer County, has a population of 2,289. It is the second largest and probably the oldest city in the area. It was established in 1846 as American Dry Diggings and was renamed Auburn in 1850. Starting as a mining town, it has become one of the important shipping points for fresh fruit grown in the foothill region. Newcastle, Penryn, Loomis, and Rocklin are also shipping points for fruit crops. The towns of Colfax, Gold Run, Applegate, Iowa Hill, Yankee Jims, Foresthill, and Michigan Bluff are in the eastern part of the area in the upper foothill and mountain region. The last four are small villages, remnants of thriving centers of business during the height of gold-mining activities.

[1] These figures and those in succeeding paragraphs where other authorities are not specifically mentioned are from United States census reports.

An adequate system of roads and highways, including the concrete-paved Lincoln Highway, provides means of transportation and travel.

This area joins with, or includes, portions of a number of earlier surveyed areas in this part of the State (*4*, *5*, *6*, *and 7*).[2]

CLIMATE

Climatic conditions in the Auburn area range from semiarid in the valley section on the west to a cooler and more moist climate in the mountainous eastern part. Marked differences within short distances are caused by a modification of the general air drainage by surface features.

The climate of the valley region is characterized by a long, dry summer season with occasional disagreeable hot and dry north winds alternating with cooler evening breezes from the south, and by a rainy season during the winter months. The average annual rainfall for this district is about 20 inches.

The lower foothill section of the area has a somewhat higher rainfall than the valley and has very marked local variations in temperature, depending largely on the surface features. The depressions and stream valleys are subject to low temperature, particularly during the night, due to the downward-moving currents of cool air, whereas the ridges are markedly warmer. Because of these conditions, the ridges are locally known as the "foothill thermal belt," and the earliest ripening fruits are produced here.

The upper foothill and mountainous region in the eastern part of the area has the shortest frost-free season and the highest rainfall. The last spring frost occurs in May and the earliest fall frost in October. During the winter months considerable snow falls, the quantity depending on the elevation. The greatest precipitation is recorded between elevations of 3,500 and 6,500 feet on the western slopes of the Sierra Nevada range, where the rain-bearing southern and southwestern winds release their moisture.

The high Sierra is probably the region of greatest snowfall in the United States; and along the summit of this range nearly all of the annual precipitation occurs in this form. The winter accumulation of snow is of great economic importance, as it is the source of much of the water supply for municipal and irrigation purposes and for power generation in the numerous hydroelectric plants. The snow melts during the warm summer months, and by fall there is generally little left except in the more protected spots on the higher northern slopes.

[2] Italic numbers in parentheses refer to literature cited, p. 38.

The climatic data for Auburn, Placer County, are given in the following table:

Normal monthly, seasonal, and annual temperature and precipitation at Auburn, Placer County

[Elevation, 1,360 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1912)	Total amount for the wettest year (1906)
	° F.	° F.	° F.	Inches	Inches	Inches
December	47.0	85	18	5.61	1.21	15.39
January	45.6	85	12	7.01	3.75	13.44
February	48.1	85	20	5.35	.27	7.79
Winter	46.9	85	12	17.97	5.23	36.62
March	51.7	88	23	5.30	2.91	12.54
April	56.5	90	28	2.77	1.66	2.64
May	62.7	102	32	1.46	.90	4.75
Spring	57.0	102	23	9.53	5.47	19.93
June	70.8	108	34	.42	.45	1.61
July	76.8	110	36	.01	0	0
August	75.9	110	41	.01	0	0
Summer	74.5	110	34	.44	.45	1.61
September	71.0	106	36	.52	1.72	.25
October	64.6	100	26	1.78	1.21	Trace.
November	55.0	95	25	3.63	2.53	2.22
Fall	63.5	106	25	5.93	5.46	2.47
Year	60.5	110	12	33.87	16.61	60.63

AGRICULTURE

There is no recorded history prior to 1848 for the area covered by this survey, and although numerous travelers between Johnson's ranch on Bear River and Sinclair's on North Fork American River give accounts of camping en route, no settlements were established before this date. On May 16, 1848, a party of prospectors found gold in Auburn Ravine near the present site of Ophir (1).

For six or eight years after the discovery of gold, mining was practically the sole activity of the inhabitants in this area. The earliest attempt at fruit growing was made in 1846, when some peach and almond seeds were planted on the recent alluvial soils along the north side of Bear River. These trees thrived and proved so successful that other plantings followed. Soon the good river-bottom lands and well-watered ravines were utilized for farming. Barley, being in demand for feed and giving good yields, became the first important crop in the valley region.

The county assessor reports that in 1856 there were 5,884 acres of land under cultivation. There were nearly 5,000 fruit trees, many small fruits, and the total yearly production of hay was more than 70,000 tons. There were nearly 73,000 head of cattle, 1,400 sheep, 1,500 horses, and 5,543 swine in the county at that time.

Until 1874 agriculture was carried on largely on the plains, but later the smooth, rolling, granitic foothills which border the plains were found to be productive. The warm, sandy soils of the Holland, Sierra, and Siskiyou series were found capable of producing good-quality fruits and vegetables that ripened early in the season.

The agricultural development of the county progressed in the foothills and on the plains as rapidly as the population of the county increased, as a supply of water for irrigation was developed, and as better transportation facilities were provided. Large demands for fruit, with correspondingly higher prices, combined with favorable climatic conditions, gave fruit growing an impetus. Plantings of deciduous and citrus fruits and vines were made extensively through the lower foothill section, though recent plantings have been made mainly on areas where water is available for irrigation.

The wide variation in the soils of the county has given rise to a diversity of agricultural enterprises, of which fruit growing is the most important. The shipment of fresh fruit to eastern markets is the most important industry in this area.

Data furnished by C. K. Turner, horticultural commissioner of Placer County, indicate that the production of cherries and apricots is decreasing and that the production of all other varieties of fruit is steadily increasing. In 1923, 1,757,265 boxes of peaches, weighing 21½ pounds a box, were shipped. This constituted the largest shipment of fruit. Plums were second, followed by pears, table grapes, and cherries, in the order named. Cannery peaches, juice grapes, persimmons, summer apples, quinces, apricots, nectarines, figs, and pomegranates complete the list of fresh fruits shipped from this area.

The orchards of the foothill region include a large number of varieties of fruits within one orchard. In an orchard of average size, comprising about 60 acres, a planting may consist of several varieties of plums, peaches, and cherries on the higher lands, and of one or more varieties of pears, persimmons, and quinces on lower places. Many of the growers have also planted nuts, citrus fruits, pomegranates, and various other fruits. Thus the average orchard demands varied methods of cultivation and the harvesting season is long. Such orchards present an irregular and spotted appearance in contrast to the uniform plantings in other orchard sections of the State. Developed orchard land in the foothill region sells at prices ranging from $300 to $1,100 an acre, depending on location and improvements. Undeveloped land sells at prices ranging from $50 to $150 an acre.

Peach growing is a very important and well-established industry. Approximately 10,000 acres are devoted to peaches, and in 1923 the yield was 69,497,197 pounds. Plantings are made largely on the well-drained, sandy, residual, granitic soils of the foothills. Small plantings on the soils of the Columbia, Whitney, and Rocklin series have proved satisfactory. The important varieties of peaches grown are Elberta, Levy, Triumph, Salwey, St. John, Phillips Cling, Lovell, and J. H. Hale. More than half the fruit is shipped fresh to eastern markets; the remainder is canned. Cultural and irrigation practices are similar to those used in the production of prunes. Tree pruning is done during the dormant season and systems of both long and short pruning are in practice. Oak root fungus, peach blight, curl leaf, crown gall, and the peach twig borer often affect the peach

trees of this section. Spraying with lime-sulphur and arsenate of lead at the pink stage, and with arsenate of lead when the fruit is small, is recommended for the control of the peach twig borer, and a fall spray of Bordeaux mixture or lime-sulphur is recommended for control of peach blight.

Table plums have proved very productive in this part of the State. During the last few years plums have been grown on approximately 6,800 acres, from which 50,000,000 pounds of fresh fruit were picked and shipped out of the area in 1923. About 1,500 acres of plums are planted on soils of the Aiken series. More than 20 varieties of plums are grown in the orchards of the county, because of the varied demands of the markets, the desire for a longer harvest season, and because certain of the varieties need cross pollination (*3*). The principal European varieties produced are Diamond, Grand Duke, Giant, California Blue, Tragedy, Pond, and President; the principal Japanese varieties and hybrids of mixed parentage are Burbank, Climax, Beauty, Santa Rosa, Gaviota, Wickson, Formosa, Kelsey, and Duarte.

The soils in the orchards are usually plowed during February or early March and cover crops are sometimes grown.[3] Bur clover is the chief native cover crop, though *Melilotus indica* and vetch are the ones commonly planted. Barnyard manure is the most commonly used fertilizer, although commercial fertilizers, used only experimentally, give some good results. Pruning practices differ, but the most common method used is a modification of the short-pruning system.

Pears do well on a number of different soils but are commonly planted in the lower, poorly drained parts of orchards where heavier soils and subsoils and cooler temperatures prevail. A few plantings have been made on the Aiken soils of the Foresthill divide in the upper foothill and mountainous part of the area. In 1923, 26,211,050 pounds of pears were shipped from the area as fresh fruit. Bartlett is the chief variety grown, but Wilder Early, Lawson, (*Comet*), Anjou, Beurre Hardy, Beurre Bosc, and Winter Nelis are extensively planted. Cultural practices are similar to those used in growing peaches and plums. Pear blight is a menace, and the only means known at present to prevent its spread is to cut out and destroy affected parts and disinfect the wounds. Three applications of arsenate of lead spray are recommended for the control of the codling moth. The blister mite and pear scab also do considerable damage.

In 1923, 1,442,650 pounds of cherries were shipped out of the area. Cherries ripen early and are among the first fruits shipped to eastern markets, where they bring a high price. They are usually marketed in 11-pound, fancy-packed boxes (*2*). Plantings are generally made on the soils of the Aiken, Holland, Sierra, and Siskiyou series, which are well drained and suitable for cherry production. The earlier ripening fruits are grown in the vicinity of Newcastle and Penryn, on sandy soils derived from granites. The following varieties are raised in the county: Republican (*Lewelling*, *Black Oregon*), Napoleon, Bing, Black Tartarian, Lambert, Burbank, Centennial, and Nonpareil. Mazzard and Mahaleb rootstocks are most commonly used. Bacterial gummosis, which causes some loss

[3] Most of the data on fruits and cultural practices included in this chapter were supplied by the Placer County farm adviser.

in cherries, may be controlled by whitewashing the tree trunks and cutting out affected parts. The varieties on Mahaleb rootstocks are said to be practically immune from the disease.

Apples do well on the medium heavy, deep, well-drained soils of the Aiken series. Some apples of good quality are produced on the Foresthill divide and it would seem that this fruit, provided some irrigation water is applied, would do well on most of the agricultural lands of the mountain section.

Oranges, especially Washington Navel, are produced on the Holland, Sierra, and Aiken (shallow phase) soils. Oranges are gradually being replaced by deciduous fruits in the greater part of the foothill section, because an excessive June drop causes low yields.

Walnut and almond growing is an established industry in this area. The 1920 census shows that the 31,830 trees in the county in 1919 produced 182,275 pounds of nuts. Walnut and almond trees thrive principally on the Holland, Sierra, and Siskiyou soils in the foothill section, and on the Placentia, Rocklin, Whitney, Madera, and Honcut soils in the valley region. The plantings in the valley are principally in the vicinity of Roseville. Cultural practices for nuts are similar to those for fruits.

Placer County ranks first in the State in the production of persimmons. This fruit, a comparatively recent addition, is being extensively planted as it is suited to the soils and climate, and a market is available. The chief varieties grown are Hachiya, Tanenashi, and Hyakume.

Figs, quinces, lemons, apricots, nectarines, and pomegranates are planted in small numbers and are marketed along with more extensively produced fruits.

Placer County is widely known for its production of grapes. In 1923, 5,453,300 pounds of table varieties, and 18,150,000 pounds of juice grapes were shipped. In addition to the Flame Tokay, the principal variety of table grape, Cornichon, Malaga, Muscat, Rose of Peru, Black Morocco, Sultanina (Thompson Seedless), and other varieties are grown. Grapes are grown largely on the Siskiyou, Holland, and Placentia soils, but small plantings are on the Aiken, Madera, Honcut, Rocklin, and San Joaquin soils. Grapes do best on the deep, friable, medium-textured soils of the first three series, but many vineyards are producing well on soils with clay loam or clay subsoils and even on soils in which a hardpan is present at a depth of 30 or 36 inches. Clean culture is practiced almost entirely, and very little fertilizer is applied. Pruning is done during the winter or early spring, before the buds begin to swell.

There are between 75 and 100 acres of strawberries in Placer County. Strawberries are grown mainly on granitic soils of the foothill section and on the Placentia, San Joaquin, and Madera soils of the valley lands. Strawberries thrive on most of the soils of the area where irrigation water is applied.

Wheat ranks first in importance among the cereals grown in the area. The production of this crop reached its highest point during the period of the World War, when twice as much was raised as at the present time. In 1919, the 23,449 acres planted to wheat yielded 212,509 bushels. Wheat, with other grains, is raised in the valley

region in the western part of the area, mainly on soils of the San Joaquin, Placentia, and Rocklin series. Smaller plantings are made on the Whitney, Madera, Kimball, and Honcut soils. The Kimball, Honcut, and Placentia soils are considered best for wheat production. During years of light, intermittent rainfall, when excessive amounts of water are not held above the hardpan, wheat produces well on the soils of the San Joaquin series. About half the farmers use tractors, and the rest use large plow outfits drawn by horses and mules. Wheat is generally harvested in July. About 50 per cent of the wheat crop is marketed through the farm bureau elevator at Lincoln. White Australian, Baart (Early Baart), and Bunyip are the most important varieties grown. Oats, chiefly the common red variety, are raised extensively for both grain and hay. In 1919, 110,169 bushels of this grain were produced from 8,131 acres.

Barley was the first crop to be grown extensively in Placer County and was produced on a large scale until about 1890. In 1919, there was a yield of 15,610 bushels from the 1,473 acres planted. Barley is commonly harvested late in June.

Rice growing was developed to some extent during the World War period, but at the present time no rice is raised in this area. Although corn and grain sorghums are produced to some extent, they are unimportant commercially.

Alfalfa is the most important forage crop grown in the area. It is grown principally on Kimball loam, with smaller acreages on the deep soils that can be irrigated. Three cuttings are usually secured in a season. In 1919, the 773 acres of alfalfa produced 1,405 tons of hay, most of which was fed locally. Clover, timothy and clover, and certain grasses are grown to a small extent for hay.

Livestock raising has been one of the leading industries on the unirrigated lands in this area. Sheep are increasing in numbers and cattle are decreasing. Both are grazed in the mountainous districts during the summer months, generally in the national forests. They are brought to the valley during the fall and are fed on the grain stubble until native grasses provide adequate pasturage. It is frequently necessary to supplement the feed with a ration of alfalfa or corn during the winter. Winter and spring lambs are marketed either locally or in the coast cities. Shearing is done between March 10 and April 10. A merino cross which gives 7 or 8 pounds of good quality wool annually is commonly considered the best dual-purpose sheep for this region. Sales of wool, mohair, and goat hair in Placer County in 1919 amounted to $79,793. Beef cattle are marketed mainly in San Francisco and the coast cities. Shorthorn is probably the most important breed of beef cattle.

Dairying and poultry raising are lesser industries of the plains and foothill sections of the area. Small dairies supply the demands of local towns, and some cream is shipped out of the area. Dairy products, exclusive of those for home use, brought $135,910 in 1919, and poultry and eggs produced in the county were valued at $232,782.

Turkey raising has been of considerable importance in the western part of the area during recent years. Many farmers, finding a continued production of wheat on the San Joaquin soils to be unprofitable, have taken up turkey raising to utilize profitably these hardpan soils. Turkeys are herded on grainfield stubble, where

they feed mainly on grasshoppers and fallen grain. A herder is necessary with turkeys in order to keep away coyotes and other predatory animals. The turkeys are marketed in coast cities in the fall and winter months.

SOILS

In the Auburn area the soils may be grouped according to three general physiographic divisions—the valley region, the lower foothills, and the upper foothill and mountain region. In the valley region the soil materials have been subjected to processes of deposition, weathering, and erosion, and a number of old soils developed from sedimentary material and having comparatively mature profiles have resulted. In addition, one soil developed from residual material was differentiated. Patches of alluvial deposits formed by streams during comparatively recent times occur in this region.

The soils of the lower-foothill region are predominantly those developed from materials accumulated by residual decay of the various country rocks, igneous in origin. The soils of this region have undergone considerable erosion, particularly in the localities of the softer granitic rocks, although the streams are deeply intrenched and very little recently deposited alluvium is present.

The upper foothill and mountain region comprises mainly nonarable lands, and consists of rough, steep-sided ridges, separated by deep canyons. On the main ridge, extending from Applegate to Gold Run, the soils have developed mainly from residual material derived from old sedimentary and metamorphosed sedimentary rocks. The surface is somewhat more irregular than on the Foresthill ridge, the material of which was derived from the later andesitic flow which generally overlies the sedimentary rocks in this region. On the comparatively flat tops of ridges the soils are deeply weathered.

The soils of the area are grouped in a number of soil series. Each series includes soils that are similar as to origin, mode of formation, color, profile, relief, and drainage conditions. Each series is divided into soil types, the unit of mapping. The types of soil differ from each other in the comparative amounts of sand, silt, and clay particles in their surface soil. In soil types variations which are important but which are too small in extent to be considered as distinct types are recognized and mapped as phases of the established types.

Owing to the progress which has been made in soil classification and mapping, or to differences in degree of detail attempted in the various surveys, the soil names used in the present survey do not in all cases agree with names used in earlier soil surveys in describing adjoining or included areas. These apparent conflicts in soil classification are noted and explained under the discussion of the soil series involved.

Effects of varied climatic conditions accompanying changes in altitude are reflected in the profiles of the soils surveyed. The Whitney soils, occurring in the valley district, are shallow and have no distinct horizon development. The Aiken, Sierra, Holland, and Siskiyou soils, occurring in the more elevated areas of the foothill region, are of somewhat greater depth, and the horizons are more clearly developed. The Aiken and Sites soils, particularly where the

former occur in the upper foothill and mountain areas, have the well-developed profiles of a mature soil. These mature soils consist of a surface layer rich in organic matter and darker in color than the underlying, deep, friable soil, which is underlain by a heavier-textured, more compact subsoil which gradually merges with the disintegrating bedrock.

The soils of the Aiken series range in color from deep red to somewhat dull brownish red. The subsoils are of similar or more pronounced reddish color, are generally more compact, and tend to be slightly heavier in texture. The subsoils rest on the browner disintegrating basic igneous bedrock, consisting of diabase, andesite, basalt, and similar rocks from which these soils are derived. In the shallower areas some gritty material and angular fragments of the parent rock occur on the surface and are embedded in the soil, but in general these soils are of clay loam texture and contain none of the angular, coarse grit characteristic of soils derived from granitic rocks. The Aiken soils occur on rolling, hilly, and mountainous areas, covered with virgin vegetation of native grasses and oaks in the region of lower rainfall and with a heavy forest growth in areas of higher precipitation. (Pl. 1, A.) Surface drainage is well established. Both surface soil and subsoil are leached of lime, and small shotlike iron concretions and pellets occur in a few localities.

In the soil survey of the Sacramento area, the soils of this series were classified and, to a large extent included with, the soils of the Sierra series. The latter series now includes only red soils derived from the weathering of granitic formations. The soils of the Aiken series are of more pronounced reddish cast and have been developed through the disintegration of a variety of basic igneous rocks.

The soils of the Sierra series have light-red, red, or pronounced reddish-brown surface soils which become noticeably red when moist. The subsoils are similar in color or more reddish, are compacted in the more maturely developed areas, and are of the same or slightly heavier texture. These soils are shallow in many places, and the underlying granitic bedrock is weathered to varying depths. Angular quartz grit and mica particles occur throughout the soil. The soils of the Sierra series are found in rolling or hilly areas; their surfaces are smoothly rounded and typical of areas of weathered granitic material; drainage is in general good although some poorly drained areas are in the lower ravines, valleys, and depressions. These soils are noncalcareous, contain a low or moderate quantity of organic matter, and are covered with an open forest and brush growth with parklike spaces of native grasses.

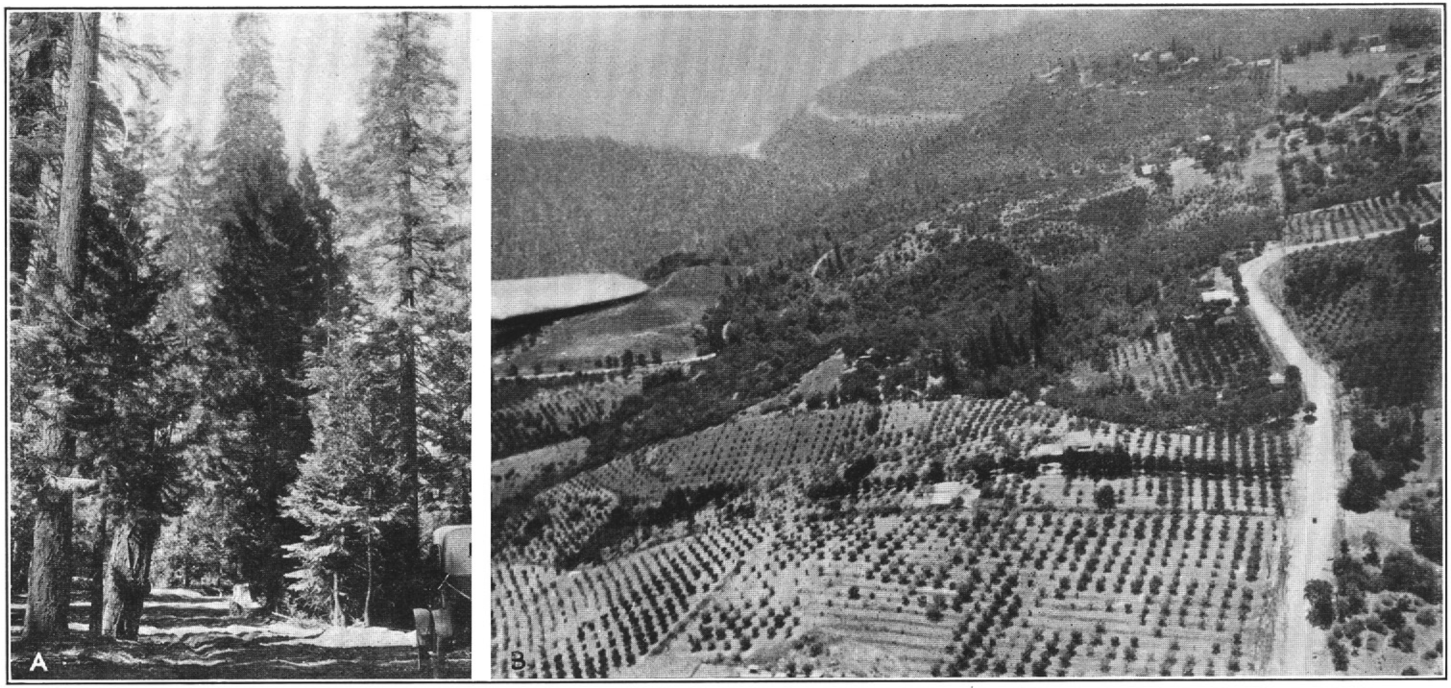
The surface soils of the Holland soils are brown or slightly reddish brown, admixed with grayish-brown material. The subsoils are of similar or heavier textures, show little or no compaction, and vary in color from light brown to distinct brownish red. The soil material contains considerable angular quartz grit and mica particles. The upper layer of the parent granitic bedrock is generally weathered to a considerable depth. These soils occur on rolling or hilly surfaces which generally have the smoothly sloping or domelike configuration distinctive of weathered granitic formations. Drainage is generally good in these soils, although there are many small, low,

poorly drained depressions. These soils are noncalcareous, contain moderate quantities of organic matter, and in a virgin state support a growth of native grasses, brush, and open or moderately heavy forest. As mapped in this area, they include a large part of the Sierra soils mapped in the former soil survey of the Sacramento area (*5*). At that time (1904) the Holland series had not been created, but the browner areas of the Sierra soils of this earlier survey are now identified as members of the Holland series.

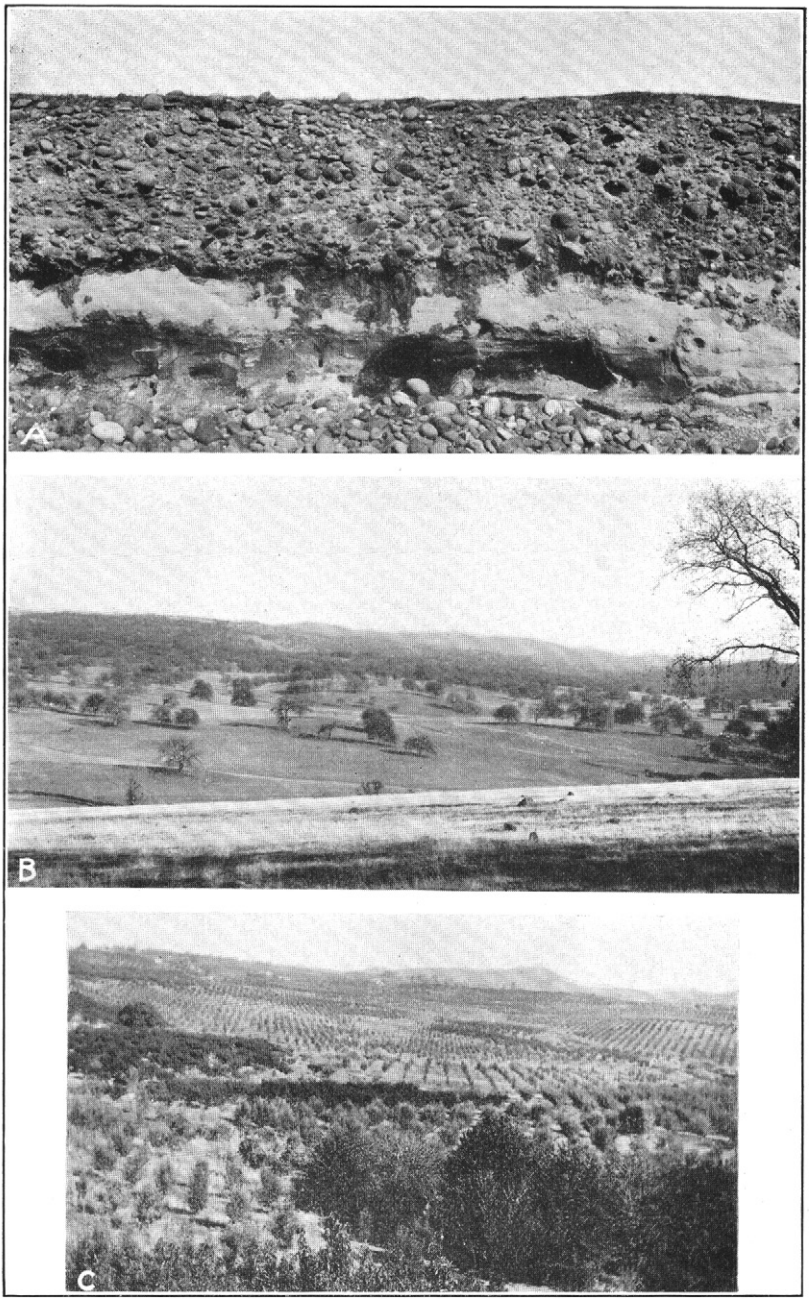
The surface soils of the Siskiyou soils are light gray or gray and may have a distinct brownish cast in recently plowed or cultivated fields. The subsoils are similar in color or slightly browner than the surface soils, show little compaction, and are similar in texture. This series represents the least oxidized and weathered development of the residual granitic soils. These soils contain large quantities of angular quartz grit and small quantities of organic matter. They occur on rolling or hilly areas and under conditions of moderate rainfall. In virgin areas they are covered with native grasses and brush and scattered pines and oaks. They are noncalcareous and are, in general, well drained. They were included with the lighter colored variations of the Sierra series in the earlier survey of the Sacramento area, the lighter grayish granitic soils of this region not having been recognized as representing a distinct series at that time.

The surface soils of the Sites soils range in color from pale red or somewhat yellowish red to deep red. The subsoils have the same or somewhat heavier texture, similar color, and are in many places slightly compact. These soils are residual in origin and were derived mainly from sedimentary and metamorphosed sedimentary rocks which underlie the subsoil. Fragments of these rocks are found throughout the soil material in the more mountainous areas. Drainage is in most places good or excessive. The soils of the Sites series occur on smooth, rolling, or steeply sloping surfaces. They have a cover of brush and trees and small areas support a growth of native grasses. As mapped, areas of the Sites soils include some variations and small undifferentiated patches of the Aiken soils. These soils are noncalcareous and have only a small supply of organic matter.

The surface soils of the Whitney soils are brown, ranging from somewhat light reddish brown to grayish brown; they are friable and are generally of medium or moderately light texture. The subsoil material is similar in color, structure, and texture to the surface material, but does not show the development of structural horizons. However, there is an abrupt contact of the subsoil and the underlying substratum material which consists of partly consolidated, stratified, light-gray, fine-textured sediments. In many places these sediments are fractured and disintegrated in the upper part of the layer, and it is down these fractures and weathered fissures that water and plant roots penetrate most readily. Numerous roots are present in the softer parts of the sedimentary mass. The Whitney soils are found on the more rolling areas of the valley margin. They include brown residual soils derived from the light-gray, old, partly consolidated, sedimentary deposits of the Ione and related geologic formations which underlie the later valley sediments. Under virgin conditions, they are covered with a growth of native grasses and scattered oaks. They are noncalcareous, are well drained, have a moder-



A.—Typical forest growth on Aiken clay loam near Foresthill. B.—Aerial view of orchards on Aiken clay loam, shallow phase, near Auburn



A.—Exposed section of Tuscan stony loam in stream bank near Whitney. B.—Native vegetation of scattered oaks on rolling Aiken clay loam in the lower foothill belt. C.—Orchards on Holland sandy loam near Auburn

ate or good supply of organic matter, and although of medium or slight depth are among the better soils of the valley division of the Auburn area.

The soils developed from old transported materials occur, with very minor exceptions, only in the valley region, where they predominate. In common with the other parts of the great interior valley, this land has been raised and tilted at various times during its geologic history. Irregular erosions and depositions of soil material are the result. The later deposits were laid around and over the eroded remnants of the earlier ones and were again subjected to erosion. This has given rise to soils of varying age and parent materials, which merge into each other so that a large area of one may include smaller patches and areas of any, or all, of the others. These soils range from old soils with cemented hardpans, represented by the San Joaquin, Madera, Alamo, and Tuscan series, through the less mature Rocklin and Hovey soils to the more youthful Corning, Placentia, and Kimball soils with their heavier subsoils and somewhat mature profiles but with no hardpan.

The surface soils of the San Joaquin soils are red, yellowish red, or pronounced reddish brown. The subsoils are commonly heavier in texture, more compact, and deeper red than the surface soils. A red, or reddish-brown, indurated, iron-cemented hardpan of varying thickness is present at varying depths but commonly between 2 and 3 feet below the surface. The substratum below the hardpan is typically permeable and resembles the material above it. The soils of the San Joaquin series include mature soils whose material has been transported from a variety of sources and is derived mainly from granite rock materials. This material has been highly weathered and oxidized, leached, and otherwise modified. The soils of this series contain little organic matter. They lie on flat or gently rolling valley plains of "hog-wallow" configuration. Because of the impervious layer, underdrainage is poor and during periods of rainfall the soils become saturated and boggy. In the depressions, the soils are either darker or grayer in color and are somewhat heavier in texture than on the mounds. The San Joaquin soils are free of alkali and are treeless, supporting only a growth of native grasses and weeds that mature and dry up in the heat of summer.

The surface soils of the Madera soils are brown, ranging from light brown or grayish brown to chocolate brown. The subsoils are compact, are similar in color or slightly redder and are of similar or heavier texture than the surface soils. Within 6 feet of the surface, a reddish-brown or mottled gray and brown iron-cemented hardpan, which may contain seams or incrustations of lime carbonate, occurs. The substratum below the hardpan is generally permeable and similar to the subsoil materials above it. The Madera soils show a development similar to that of the San Joaquin soils. They occur on old, modified, alluvial fans and valley plains, with gently undulating surfaces, or on smooth-surfaced strips or terraces along streams. Surface drainage is generally better than on the associated San Joaquin soils, but the underdrainage is restricted by the hardpan layer. These soils have a natural vegetation of native grasses and annuals, with scattered valley and live oaks in the more favorable spots.

The surface soils of the Alamo soils range from medium gray to dark, dull gray, the color becoming markedly darker or black when the soil is moist. The texture is heavy and an exceedingly compact though checked adobe structure is evident in some places. The subsoil is of similar color and texture but becomes somewhat columnar with depth. Within 6 feet of the surface, and generally at a depth of 2 or 3 feet, a brownish-gray, indurated, iron-cemented hardpan is present. The substratum below the hardpan is permeable and somewhat similar to the layers above it. The Alamo soils were developed under the poor drainage conditions of a soil with a cemented hardpan. They occur principally in association with soils of the San Joaquin series in lower lying depressions where drainage is poor. Under virgin conditions these soils support a growth of early-maturing native grasses and plants. They are noncalcareous or only slightly calcareous and contain moderate or small quantities of organic matter.

The surface soils of members of the Tuscan series are red or reddish brown. They contain little organic matter, are noncalcareous, and, at a slight depth, are underlain by gray or reddish-brown, impervious, cemented or partly consolidated deposits of rounded, basic, igneous gravel embedded in finer interstitial material. Subangular or rounded andesitic and basaltic cobbles and bowlders occur in many places scattered over the surface or embedded in the soil. (Pl. 2, A.) On account of the presence of the impervious subsurface layer, subsurface drainage is restricted. The soils of this series are derived from old transported materials and have their source mainly in basaltic and andesitic rocks and tuffs. They occur generally on treeless and barren valley plains and plateaulike areas, and are associated with areas of scabland from which they are differentiated by their slightly greater agricultural value. In the earlier soil survey of the Sacramento area (1904) (*5*), the soils of this series were mapped as members of the Salinas series. The basis of classification for the soils of the Salinas series has since been revised.

The surface soils of the Rocklin soils are brownish red or red, are rather friable, and contain varying amounts of waterworn quartzitic fine gravel and granitic grit. The subsoil, which in many places becomes heavier in texture and somewhat compact at a depth between 2 and 3 feet, rests on fine-textured partly consolidated light-gray sediments. These soils apparently have developed from an old deposit of material similar in character to that from which the San Joaquin and Placentia soils have developed, but which was laid down in a thin sheet over the Ione or related geologic formations. The Rocklin soils occur on the valley plains and low rolling hills. They are generally treeless but support a growth of native grasses and plants. They contain a small or moderate quantity of organic matter, are noncalcareous, and are moderately well drained.

The surface soils of the Hovey soils range in color from dark gray to very dark dull brown or black. They contain much organic matter, are noncalcareous, and much of the heavier-textured soil has an adobe structure. A rather abrupt transition occurs between the surface soil and subsoil. The latter consists of gray or light brownish-gray, heavy-textured material containing a moderate amount of lime in the form of accumulations or concentrations in irregular seams and zones. Within 6 feet of the surface a substratum of light-gray,

partly consolidated, fine-textured sediments, slightly calcareous in the upper part, is present. Soils of the Hovey series have developed from a thin deposit of old transported material over the light-gray sediments of the Ione or similar geologic formations. They probably receive their lime from the surface materials which have originated mainly in near-by basic igneous rocks. These soils are found on "inlets" or indentations of the valley region between the higher plateaus of scabland, which are capped with an andesitic tufaceous breccia and have gently sloping or rather flat surfaces. Surface drainage is fairly well developed, except in the low, flatter places, but subsurface drainage is restricted by the heavy texture and compact substratum of these soils. Under virgin conditions these soils support a growth of native grasses and, where they adjoin areas of scabland, a scattered growth of oak.

The surface soils of the Corning soils are light red, dull red, or pronounced reddish brown. The subsoils are of similar or more pronounced red color, are of very compact consistence, have a heavier texture, and tend toward a columnar structure. They are underlain by reddish or yellowish-brown compact substratum material consisting of waterworn gravel embedded in material which commonly contains more clay than the upper part of the subsoil. These soils consist of comparatively mature and well-oxidized old transported soil materials that have been derived from a great variety of rocks. They occur on low but conspicuous knolls and ridges of the eroded remnants of old alluvial terraces and fans. They are noncalcareous, contain little organic matter, and have no marked development of cementation. Their rolling or hilly surface provides good surface drainage, but the underdrainage is impeded in places by the compact subsoil and substratum. Most areas of the Corning soils are treeless, although in some places there are some valley and live oaks and some brush.

The surface soils of the Placentia soils are pronounced reddish brown, brownish red, or red. The subsoils are heavier in texture, similar or redder in color, very compact, and, where exposed to dry atmospheric conditions, have developed a checked columnar structure. Both the surface soils and subsoils are noncalcareous and contain a moderate or small quantity of organic matter. A characteristic feature of the Placentia soils is the large quantity of angular grit and particles of mica present. These soils are formed by the weathering and maturing of old transported materials and are found in valley plains and eroded remnants of elevated terraces and alluvial fans. Surface drainage is well developed, but underdrainage is somewhat restricted by the compact subsoil. These soils are covered with a growth of native grasses and scattered trees, principally valley and live oaks. The Placentia soils are not extensive and were included with the San Joaquin and Madera soils in the earlier and less detailed surveys of the Sacramento and Sacramento Valley areas.

The surface soils of the Kimball soils are light red or dull brownish red and include some reddish-brown material. The subsoils are of similar or more pronounced red color, are generally heavier, more compact, and may become columnar upon being exposed to a dry atmosphere. Some gravel and grit may occur in the subsoil but not in sufficient quantities to modify the drainage conditions. The Kimball soils contain little organic matter, are noncalcareous, and

hold moisture well. The substratum is lighter or more yellowish in color, is compact, and varies in texture from clay to sand and fine gravel. Like the San Joaquin soils, these soils are derived mainly from granitic rock materials, but they have less maturely developed profiles and no hardpan. In general, the surface is smoothly sloping or gently rolling, but some of these soils occur on old, eroded, elevated terraces. The Kimball soils are generally covered with a growth of native grasses and scattered trees.

In the earlier soil surveys of the Sacramento and Sacramento Valley areas, the soils of this series were, owing to close association and relationship, included with the San Joaquin and Madera soils. In the present survey they have been differentiated in greater detail.

The recent alluvial soils of the Auburn area are of very small total extent. They occupy the narrow flood plains of various streams, particularly where the gradient has flattened to some extent as the streams leave the more or less narrow channels of the foothill region and emerge into the flatter areas of the valley. The largest and most typical areas of these soils are on both sides of Bear River, in the northern part of the valley section. These areas have been mapped as Columbia soils. Smaller accumulations of recently deposited alluvium have been classified either in the Honcut or Hanford series, depending on the character and origin of the material. The soils of these series have been built up so slowly that the subsoils have been subjected to some aging in place and have reached a slightly mature stage of development. Some of the soils which have been included in the Hanford series are markedly modified by artificial means and include varying amounts of "slickens" or the finer materials washed down the waterways from the scenes of placer and hydraulic mining operations.

The surface soils of the Columbia soils are light brownish gray, light grayish brown, or buff. The coarser textured soils are lighter in color, are somewhat micaceous, but contain much less mica than is characteristic of the Hanford soils. The subsoils are stratified in many places and vary in texture but are otherwise similar to the surface soils. Both surface soils and subsoils have a low or moderate content of organic matter and are friable and noncalcareous. In places, at a depth below 6 feet, the subsoils are underlain by a gravelly and porous substratum. The soil material, which was derived from a wide variety of rocks, has been deposited recently by stream action and shows no marked structural development. The surface of these soils varies from level to somewhat irregular, and sloughs and lagoons occur in places. These are subject to overflow, and the lower land is somewhat poorly drained. The Columbia soils support a dense and somewhat tangled growth of shrubs, vines, willows, and other trees.

The surface soils of the members of the Hanford series are medium or light brown, micaceous, friable, and moderately well supplied with organic matter. These soils may continue to a depth of 6 or more feet without distinct layers. In general, the subsoils are slightly lighter in color and in a few areas they comprise strata composed of material of varying texture. These are recent-alluvial soils, the materials having been deposited in the form of alluvial fans and stream flood plains. The material originated from crystalline

rocks rich in quartz and mica, which give these soils many of their structural characteristics. In general, the Hanford soils are well drained and noncalcareous, although the drainage may be restricted in places because of surface conditions. Where this land is poorly drained, the surface soils are darker in color. These soils support a growth of native grasses, together with oak, pine, and other trees, and brush.

The surface soils of the Honcut soils are red or reddish brown in color. The subsoils are of similar or lighter color and are somewhat heavier in texture. Both the surface soils and the upper part of the subsoils are friable and permeable and in many places contain some angular or subangular fine gravel. The lower part of the subsoils is heavier in texture, is more yellowish, and shows some maturity of structural development. These soils consist of recently deposited alluvium derived mainly through the erosion of the red soils of the Aiken series and their underlying basic igneous rocks. The Honcut soils occur in the rougher and more hilly regions, on gently sloping alluvial fans, and stream flood plains of small extent. They are noncalcareous and contain a fair or medium supply of organic matter. Drainage is well established, although in the heavier soils the underdrainage is somewhat impeded by the heavy subsoils. This land generally supports a growth of native grasses, oaks, and other trees,

The several miscellaneous, nonarable kinds of material include riverwash, placer diggings, scabland, rough stony land, and rough mountainous land. In addition to the five classes of nonarable, miscellaneous materials, 18 series of soils were mapped in the Auburn area. The series include 22 soil types and 9 subordinate phases. The following table gives the acreage and proportionate extent of the various soil types, phases, and miscellaneous materials. Their distribution is shown on the soil map which accompanies this report.

Acreage and proportionate extent of the soils in the Auburn area, California

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Aiken clay loam	11,968		San Joaquin gravelly loam	10,944	2.8
Shallow phase	34,048	12.0	San Joaquin loam	19,776	5.1
Yellow-subsoil phase	896		Corning gravelly loam	4,608	1.2
Aiken stony clay loam	25,664	6.6	Kimball loam	9,024	2.3
Holland sandy loam	39,488	11.1	Placentia sandy loam	13,952	3.9
Rock-outcrop phase	3,968		Brown phase	1,344	
Sierra sandy loam	3,648	.9	Honcut clay loam	4,736	1.3
Columbia fine sandy loam	1,344		Yellow-subsoil phase	192	
Shallow phase	512	.5	Hanford sandy loam	2,176	.6
Coarse-textured phase	128		Alamo clay	1,344	.3
Columbia silt loam	256	.1	Hovey clay	1,216	.3
Sites stony loam	16,512	4.2	Tuscan stony loam	2,432	.6
Siskiyou coarse sandy loam	7,232	1.9	Rough mountainous land	78,336	20.0
Whitney fine sandy loam	10,304	2.6	Rough stony land	15,040	3.8
Madera loam	5,504	1.4	Riverwash	960	.2
Rocklin fine sandy loam	14,464		Placer diggings	5,440	1.4
Brown phase	2,304	4.4	Scabland	17,984	4.6
Gravelly phase	384				
San Joaquin fine sandy loam	22,912	5.9	Total	391,040	

AIKEN CLAY LOAM

The surface soil of Aiken clay loam consists of brownish-red or red, somewhat friable, granular clay loam from 10 to 24 inches deep. Under virgin conditions the surface 1-inch or 2-inch layer is darker

or browner in color and contains a large quantity of organic matter. The surface is generally slightly heavier in texture, and in most places is red, slightly compact, heavy clay loam. Both surface soil and subsoil are noncalcareous, contain medium or small quantities of organic matter, and in places contain admixtures of small, rounded fragments of weathered rock and some iron concentrations or shot-like pellets, one-sixteenth of an inch or less in diameter. The lower part of the subsoil, particularly where the soil is deeper, gradually becomes heavier in texture until it approaches clay. It rests, at a depth varying from 30 inches to more than 6 feet, on reddish or yellowish-brown fractured or disintegrating basic igneous bedrock.

The most extensive areas of Aiken clay loam are on the ridge in the vicinity of Foresthill and in the neighborhood of Iowa Hill, in the upper foothill or mountainous region of the area. Two patches of small extent northwest of Auburn and one near Dog Bar Bridge have also been mapped. The last three are associated with extensive areas of Aiken clay loam, shallow phase. Drainage on this soil is well developed.

In the foothill section, most of this soil has been planted to fruit trees, mainly plums, cherries, and pears. Under proper irrigation practices, these have thrived. The chief problem in the irrigation of this soil is its slowness in absorbing water. It has a high water-holding capacity when it is properly irrigated. In the vicinity of Foresthill a few plantings of pears and apples have been made on this soil and, although still very young, the trees indicate that fruits suited to the more rigorous climate of that section could be successfully grown.

Some areas of Aiken clay loam near Foresthill contain much angular or subangular stone and bowlders. The stones vary in size from a few inches to more than 2 feet in diameter and would interfere with cultivation if the soils were developed. At present none of this stony land has been cleared or cultivated, but it supports a good growth of brush and trees. (Pl. 2, B.) These stony areas are shown on the map by stone symbols.

Aiken clay loam, shallow phase.—Most of the Aiken clay loam in the lower foothill region is shallow, bedrock being present not more than 30 inches below the surface. Such soil has been separated as a shallow phase and is indicated on the accompanying map by cross-lines.

Shallow Aiken clay loam is similar to the typical soil in color, texture, and structure. Ordinarily there is no distinct subsoil development, although there may be a layer of clay loam, ranging in thickness from 2 to 8 inches, resting on the fragmental, disintegrating bedrock. Aiken clay loam, shallow phase, is found in rolling or hilly areas in the vicinity of Auburn, northwest to the edge of the foothills east of Sheridan, and north to the neighborhood of Dog Bar Bridge. Several isolated areas are on the western end of the Foresthill divide, between Colfax and Gold Run, and on the ridge between North Fork American River and Bear River. In a few places, particularly a few miles north of Lincoln, numerous seepy conditions have produced a darker color and slightly heavier texture in the soil.

In the foothill region Aiken clay loam, shallow phase, constitutes one of the more important orchard soils, and despite its shallowness

approximately 35 per cent of it is planted to fruit trees, principally varieties of shipping plums, cherries, and pears. (Pl. 1, B.)

Aiken clay loam, yellow-subsoil phase.—Two areas of soil along Bear River between Gautier Bridge and Combie Bridge have somewhat lighter textured surface soils and lighter colored subsoils than typical Aiken clay loam. These areas probably belong to a distinct series of soils, but owing to their small extent and lack of importance they have been mapped as the yellow-subsoil phase of Aiken clay loam.

The surface soil varies from 6 to 24 inches in depth. It consists of brownish-red, yellowish-red, or pronounced reddish-brown friable loam, underlain by brownish-yellow or yellow slightly compact loam mottled somewhat with grayish stains. The lower part of the subsoil gradually becomes heavier and more yellow and contains weathered fragments of the underlying bedrock which occurs at a depth ranging from 10 inches to about 6 feet but commonly at a depth varying from 12 to 24 inches below the surface.

Under virgin conditions, Aiken clay loam, yellow-subsoil phase, is brushy and wooded with pines, oaks, manzanita, and ceanothus, though in a few open and parklike spots there is a covering of native grasses. The surface is rolling or hilly. Surface drainage is well developed, but subsurface drainage is somewhat restricted. The soil is moderately or poorly supplied with organic matter and is noncalcareous. Probably less than 5 acres of this soil is cultivated, the greater part of it being utilized for grazing.

AIKEN STONY CLAY LOAM

The surface soil of Aiken stony clay loam, to a depth ranging from 6 to 16 inches, is red or brownish-red rather friable clay loam containing many angular rock fragments. Under virgin conditions, the soil is covered by a very thin layer of darker-colored soil material which contains more organic matter. This layer is destroyed when the soil is disturbed, either by cultivation or by erosion. A heavier textured subsoil occurs in a few places, but in general the surface soil rests on fragmental, weathered basic igneous bedrock. Numerous outcrops as well as loose rock fragments characterize the surface of this soil.

Aiken stony clay loam is extensive in this area but is of low agricultural value because it is shallow and stony. It comprises numerous areas in the vicinity of Auburn, lying north and northwest of that city, and extending to the neighborhood of Bear River. Smaller areas are also mapped on a few of the higher knobs or hills between Clippergap and Lander and east and south of Newcastle. This soil occurs on rolling or steep-sided hills and ridges in association with other soils of the Aiken series and with areas of rough stony land. The chief value of Aiken stony clay loam lies in its utilization for pasture and grazing. It supports practically no brush and only a scattered growth of pines and oaks. About 10 per cent of it is planted to orchards. Despite the shallowness of the soil, fruit trees grow fairly well if they are given careful attention and irrigated properly.

The following table gives the result of mechanical analysis of a sample of the surface soil of Aiken stony clay loam:

Mechanical analysis of Aiken stony clay loam

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
376282	Surface soil, 0 to 12 inches	*Per cent* 3.6	*Per cent* 5.5	*Per cent* 4.7	*Per cent* 8.3	*Per cent* 26.5	*Per cent* 29.0	*Per cent* 24.0

HOLLAND SANDY LOAM

The surface soil of Holland sandy loam consists of grayish-brown or reddish-brown friable sandy loam from 10 to 30 inches deep. Under virgin conditions the soil between depths of 1 and 5 inches below the surface is loose and granular, rich in organic matter, and darker or grayer in color. The subsoil is either slightly heavier in texture or more compact and contains less organic matter than the surface soil. At a depth varying from 18 to 48 inches, but generally at about 24 inches, light-brown or reddish-brown decomposed granitic bedrock, partly weathered to a considerable depth, is commonly present. Outcrops are common, and some fragments of unweathered rock are scattered on the surface. This soil is noncalcareous. Drainage is in general good, although many small areas occurring in small depressions are poorly drained. Because of the presence of angular quartz particles and mica this soil is distinctly gritty.

Holland sandy loam is the predominant soil of the "granite" section of the lower foothill region. This granite section extends from the canyon of North Fork American River, in the southern part of the area, northward and northwestward to the western edge of the foothills in the vicinity of Lincoln and Sheridan. Land of this kind has a rolling or hilly surface and is lower in elevation and somewhat smoother than areas of the Aiken soils to the north and east. Under virgin conditions it is covered with a growth of brush and trees, mainly oak and "digger" pine, and numerous open parklike spaces support a growth of native grasses. The greater part of this soil is under cultivation. It is planted mostly to orchards of peaches, plums, cherries, and pears. (Pl. 2, C.) Like Sierra sandy loam, this soil matures the fruit early in the season and must be irrigated oftener than the Aiken soils.

A number of variations of minor extent have been mapped with areas of this soil. These include areas in poorly drained depressions in which the soils are heavier textured and the subsoils are mottled; dark-colored soils whose color is due to mineralogical characteristics; and very small patches of soil of other series. The poorly drained depressions are small but numerous and are important as they restrict the use of the land to crops that are tolerant of such conditions.

Holland sandy loam, rock-outcrop phase.—Throughout its occurrence in this area, Holland sandy loam has numerous rock outcrops. Where these are more common than usual and have considerable economic importance with reference to the value and utilization of the land, the soils have been differentiated as Holland sandy loam, rock-outcrop phase. In general, the soil immediately adjoining the outcrop is of good depth and has the same profile as the typical soil. The outcrops, however, interfere with cultural operations and occupy space that might have been planted to trees. Many of the growers

believe that the presence of outcrops helps in the production of earlier fruits as the rock heats up during the day and moderates the temperature of the earth during the night. A large part of this phase of soil, perhaps 30 per cent, has been planted to orchards with good results.

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

Mechanical analysis of Holland sandy loam

No.	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*	*Per cent*
576241	Surface soil, 0 to 5 inches	8.5	11.1	11.1	22.9	23.2	14.2	9.5
576242	Subsoil, 5 to 25 inches	14.9	9.5	10.5	21.6	20.5	11.5	11.3

SIERRA SANDY LOAM

The surface soil of Sierra sandy loam consists of red or light-red sandy loam with rich reddish-brown variations. It is more or less friable and ranges in depth from 8 to 18 inches. Under virgin conditions the surface soil, to a depth of about 1 inch, is brown, rich in organic matter, and friable or granular. The red, slightly compact subsoil varies in texture from sandy loam to clay loam. It rests on the substratum of reddish, decomposed, granitic bedrock which in most places occurs at a depth varying from 18 to 30 inches below the surface. This soil contains a large quantity of angular quartz grit and mica particles. Underlying this at varying depths, in places as much as 40 or more feet, is the unweathered bedrock, principally granodiorite. In some areas of this soil numerous outcrops of this rock are found, and some fragments are scattered on the surface. This soil has, in general, well-developed surface and subsurface drainage, although in a few somewhat seepy depressions the movement of the surface and subsoil water is restricted. Sierra sandy loam contains little organic matter below the undisturbed surface layer. In a native state, it is covered with wild grasses and brush, with a scattered growth of oaks and pines.

Sierra sandy loam occurs on rolling or rounded hills and ridges in the foothill division, in the vicinity of Newcastle. A few small areas are south of Penryn. This soil is associated with the soils of the Holland series. Although of small extent, Sierra sandy loam is highly desirable for orchards and, with the Aiken and Holland soils, comprises the greater part of the foothill lands devoted to fruit growing. Because of its coarser texture, it is better suited to the growing of early fruits, particularly peaches, than are the Aiken soils. It has a lower water-holding capacity than the latter, and irrigation water must be applied in smaller quantities and at more frequent intervals.

The following table gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Sierra sandy loam:

Mechanical analysis of Sierra sandy loam

No.	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*	*Per cent*
576296	Surface soil, 0 to 1 inch	17.6	11.5	9.6	14.7	20.2	15.5	11.6
576297	Subsurface soil, 1 to 14 inches	14.7	13.1	10.2	16.3	17.4	14.1	14.5
576298	Subsoil, 14 to 24 inches	9.2	15.0	7.8	23.2	19.6	10.0	16.1

COLUMBIA FINE SANDY LOAM

The surface soil of Columbia fine sandy loam consists of light grayish-brown, loose, friable, light-textured fine sandy loam ranging in depth from 6 to 24 inches. The subsoil is slightly lighter in color, is more or less stratified, and ranges from coarse sand to heavy silt loam or clay loam in texture. Both the surface soil and subsoil contain considerable organic matter and fine particles of quartz and mica, and both are noncalcareous.

This soil occurs in several patches in the valley region north of Sheridan, on the flood plain of Bear River. The surface is smooth or gently sloping and, because of the low elevation, the land is subject to overflow. It has a fluctuating water table which varies according to the amount of water in the near-by river channel. Under virgin conditions this land is covered by a dense growth of vines, brush, and trees, principally cottonwood and willow, with some native grasses.

Some time ago levees were constructed along Bear River, and for a number of years areas of this soil lying north of the river have been planted to hops. Recently these fields have been interplanted with deciduous fruit trees, principally the canning varieties of peaches. At present the greater part of the Columbia fine sandy loam is planted to young orchards of peaches, prunes, and pears. Prunes and pears make a less satisfactory growth than peaches.

Columbia fine sandy loam, coarse-textured phase.—Varying river currents have deposited small areas of coarse-textured material in this locality. Because of their small extent and comparative unimportance, these areas have been mapped as the coarse-textured phase of Columbia fine sandy loam. This soil consists of light-gray or light grayish-brown sand or coarse sand varying in depth from 8 to 18 inches, underlain by a subsoil of similar material but somewhat stratified. Both surface soil and subsoil are noncalcareous and contain little organic matter. This phase represents a soil intermediate in texture between Columbia fine sandy loam and the associated riverwash and has a lower agricultural value than the former. Some orchards, principally of peaches, have been planted on this soil, but the greater part of it is still uncultivated and utilized only for grazing.

Columbia fine sandy loam, shallow phase.—Along the southern margin of its occurrence north of Sheridan, the material of the Columbia fine sandy loam has been deposited as shallow overwash on soils of the Kimball series. These areas have been separated and mapped as Columbia fine sandy loam, shallow phase. The soil consists of an alluvial deposit of light grayish-brown fine sandy loam or fine sand, about 27 inches deep, which overlies the brownish-red, or

red, compact, clay loam of the soils of the Kimball series. Under virgin conditions this soil supports a growth of native grasses, some brush, and scattered trees. The greater part of it is utilized for grazing, but some is planted to grain and some to peaches for canning. Where the overwash of the Columbia soil is of considerable depth peaches have done well, but in the shallower areas, because of the heavy, compact subsoil, they do not thrive.

COLUMBIA SILT LOAM

The surface soil of Columbia silt loam consists of light-brown or brown, friable silt loam, ranging in depth from 8 to 18 inches. In some places the material is rather light textured, approaching fine sandy loam. The subsoil is somewhat lighter in color, is in many places stratified, and ranges in texture from sandy loam to heavy silt loam. Both surface soil and subsoil are noncalcareous and contain a moderate or good supply of organic matter.

This soil occurs in small areas on both sides of Bear River, northwest of Sheridan, It occupies smooth or gently sloping areas of stream-bottom land, and, like the fine sandy loam of this series, is now protected from overflow by a system of levees. It is, however, subjected to a fluctuating water table, depending on the water conditions in the river. Where the water table is comparatively high, the subsoil shows slight mottles or strains of dark brown or rust brown.

This soil was probably the first in the area to be planted and cultivated. For a long time it has been planted to hops, but these are now gradually giving way to orchards of prunes, pears, and peaches.

Probably because of the shallow root system of these trees, the canning varieties of peaches produce especially well in spite of the high water table.

SITES STONY LOAM

The surface soil of Sites stony loam is light-red or red fine-grained loam or silty loam, from 18 to 36 inches deep. In some areas the soil is brownish red or light yellowish red and contains a large quantity of angular rock fragments. In virgin areas the upper layer, from 1 to 3 inches deep, is browner, contains more organic matter, and is more friable and granular. A red or yellowish-red subsoil, heavier and more compact than the surface soil, rests on the fractured and disintegrated sedimentary bedrock which lies at a depth varying from 24 inches to more than 6 feet, but generally within 30 or 40 inches of the surface.

Sites stony loam occurs on rolling or steep-sided hills and ridges in the upper foothill and mountainous region between Ackerman School north of Auburn, and Gold Run in the northern part of the area. Areas also extend eastward on the Foresthill divide to the settlements of Yankee Jims and Todds Valley. These soils have been developed under a rainfall of 40 or more inches and have been subject to erosion, particularly where the land is cleared. The soil is noncalcareous and drainage is good. This soil is associated with large areas of rough mountainous land, from which it has been differentiated on the bases of its smoother surface and greater agricultural value.

A few small variations, because of their small extent and unimportance, have been included with this soil in mapping. Some of

these areas have developed where erosion has exposed the subsoil and lighter colored, heavier textured surface soils have resulted. Other areas are more shallow than typical because of the slower weathering of a more resistant bedrock. A very small area of soils with red surface soils derived from sedimentary formations occurs in the vicinity of Lincoln.

Occurring in the upper foothill and mountainous section Sites stony loam has been found unsuited to the production of early table fruits. In more favorably situated areas, this soil has been planted to late-maturing varieties of plums and other table fruits which are marketed after the bulk of production has ceased on the earlier soils in other parts of the county. Pears and apples do well and most of the plantings during early mining days were made on more favorable areas of this soil. Apples have been found to do better than pears on the shallower Sites soils, but it is believed that with irrigation during the drier summer months both fruits could be successfully grown.

SISKIYOU COARSE SANDY LOAM

The surface soil of Siskiyou coarse sandy loam consists of light brownish-gray or light grayish-brown, gritty, coarse sandy loam from 18 to 30 inches deep. In virgin areas the surface soil, to a depth of an inch or two, is darker in color, friable and slightly granular, and contains larger quantities of organic matter. Recently cultivated soil is browner, but the dry surfaces of clean-cultivated areas are distinctly gray. This color is accentuated by the concentration of light-colored quartz particles on the surface. The subsoil is similar to the surface soil in color and texture. It is underlain, at a depth varying from 24 to 40 inches, by light-brown or light reddish-brown semicompact disintegrated granitic bedrock.

Siskiyou coarse sandy loam occurs in the gently rolling or hilly section in the southeastern part of the area. Drainage is well developed, and the land supports a growth of brush, chiefly ceanothus, scrub and poison oak, and some scattered digger pines and valley oaks. A few parklike areas are grown up with native grasses. Outcrops of the underlying rock are common and some loose rock fragments are scattered over the surface. The soils of this series are noncalcareous and contain little organic matter. Some small areas of undifferentiated Holland sandy loam have been included within areas of Siskiyou coarse sandy loam.

Some orchards have recently been set out on Siskiyou coarse sandy loam in this area, but the chief agricultural uses of these soils have been the production of nursery stock and vineyards of juice grapes. About 15 per cent of this soil is under cultivation, the greater part of it being utilized for grazing.

The following table gives the results of mechanical analyses of samples of Siskiyou coarse sandy loam.

Mechanical analysis of Siskiyou coarse sandy loam

No.	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*	*Per cent*
576247	Surface soil, 0 to 2 inches	19.3	17.1	10.8	15.6	15.2	12.1	10.3
576248	Soil, 2 to 24 inches	29.6	19.6	7.8	10.2	13.8	9.2	9.9

WHITNEY FINE SANDY LOAM

Whitney fine sandy loam has a surface soil consisting of brown, grayish-brown, or somewhat reddish brown fine sandy loam from 6 to 20 inches deep. The subsoil is similar in color or slightly lighter than the surface soil and in some places may be more compact and somewhat heavier in texture. A substratum of light-gray, partly consolidated fine sediments occurs at a depth ranging from 12 to 36 inches. Both surface soil and subsoil contain moderate or small quantities of organic matter and are noncalcareous. The soil is free from the waterworn gravel and angular grit so common to the old transported soils of the valley section. Under virgin conditions, this soil supports a growth of native grasses, with scattered valley and live oaks on the higher elevations and along stream banks.

Whitney fine sandy loam occurs in two general localities on rolling surfaces in the southern part of the valley region. One general locality is west of Whitney and the other is along the southern boundary of the county south and west of the town of Roseville. In general, drainage is good, but a number of poorly drained depressions occur in the lower, flatter areas west of Whitney. The soils in these depressions are slightly heavier in texture and grayer in color than typical Whitney fine sandy loam.

Whitney fine sandy loam commonly includes small undifferentiated areas of redder soils developed from old transported materials of the San Joaquin, Rocklin, and other associated series of soils.

The areas of this soil lying west of Whitney are mostly under cultivation to grain and hay. Crops give good yields in favorable seasons and are grazed in poorer years. Areas in the vicinity of Roseville, where water has been available for irrigation, are generally considered suitable for orchards and have been planted to peaches, apricots, and other fruits. A large quantity of water is pumped from the bed of Linda Creek and some from wells for use on these plantings. Unplanted areas are utilized for grazing cattle.

The following table gives the results of mechanical analyses of samples of the surface soil, subsoil, and substratum material of Whitney fine sandy loam.

Mechanical analysis of Whitney fine sandy loam

No.	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*	*Per cent*
576228	Surface soil, 0 to 12 inches	0.0	2.0	3.0	15.8	42.5	22.5	13.7
576229	Subsoil, 12 to 24 inches	0.0	2.9	3.7	16.0	42.3	20.4	15.2
576230	Substratum, 24 inches+	1.1	2.5	2.0	2.7	36.2	47.5	8.2

MADERA LOAM

Madera loam has a surface soil, from 8 to 30 inches deep, of brown, light-brown, or grayish-brown friable loam which becomes gradually heavier in texture with increasing depth. The subsoil consists of brown or light-brown moderately compact material which is in most places heavier in texture than the surface soil. At a depth varying from 24 to 54 inches but generally about 40 inches below the surface, a reddish or yellowish-brown hardpan cemented

with iron and silica is present. This is not so indurated as is the hardpan in the San Joaquin soils and probably represents a less mature development. The hardpan is of varying thickness and is less firmly cemented with depth. At a depth ranging from 40 inches to more than 6 feet, it is underlain by light-brown or light yellowish-brown gritty clay loam. This soil is poorly supplied with organic matter and is noncalcareous except in a few places where a slight accumulation of lime has been deposited in the cracks and fractures of the hardpan.

Madera loam occurs irregularly along the minor intermittent streams and drainage ways of the valley section. Most areas are on the first bench or terrace above the stream channel. Although Madera loam occupies the position of a recently deposited soil, it is a mature transported soil which in places has been somewhat modified by having recent-alluvial materials superimposed over the resorted old surface soils. Areas of this soil have a smooth configuration and in a virgin condition support a growth of native grasses and scattered oak and willow trees. Surface drainage is fairly well developed except in a few depressions, but subsurface drainage is restricted by the impervious hardpan.

One area of the soil, north of Rivervale School, is slightly mottled with rust-colored iron stains and contains some small iron concretions or pellets. In an area west of Roseville, the hardpan is less firmly cemented, and the surface soil has been modified by inclusions of recently transported material. The small area south of Whitney is not typical in that the hardpan layer rests directly on light-gray sediments such as underlie the associated soils of the Rocklin series. This area is utilized for grazing.

From an agricultural viewpoint, Madera loam has a greater value than the older transported soils, such as the San Joaquin soils, which adjoin it, and where the areas are of sufficient size they have been more extensively cultivated. Grain, grain hay, and a few fruits are the chief crops. Water for irrigation is available for the area of Madera loam on the southern side of Linda Creek, west of Roseville, and the land here has been extensively planted to grapes and deciduous fruits.

ROCKLIN FINE SANDY LOAM

The surface soil of Rocklin fine sandy loam consists of a layer, from 6 to 36 inches deep, of light-red or pronounced reddish-brown, friable, fine sandy loam that becomes decidedly sticky when wet. Conspicuous amounts of angular quartz grit and some water-rounded gravel are present throughout the surface soil. The subsoil is of similar or redder color, of similar or slightly heavier texture, and in many places is somewhat compacted. In some of the shallower areas, the subsoil development is not apparent, the surface soil resting directly, at a depth varying from 12 to 48 inches below the surface, on a substratum of light-gray, partly consolidated, fine-textured sediments. Rocklin fine sandy loam contains a small or moderate supply of organic matter and is noncalcareous, though a small amount of lime may occur in seams in the upper part of the substratum.

This soil occurs extensively in the vicinity of Roseville and Whitney, and in other gently rolling or slightly hilly places in the valley region. In general, Rocklin fine sandy loam has a smooth surface, but in a few localities where it is associated with soils of the San

Joaquin series low hummocks or hog wallows have developed. The material in lower-lying depressions is generally browner than that in the more elevated patches, and drainage is somewhat restricted. This soil has better surface and subsurface drainage than the soils of the San Joaquin series, but its drainage is somewhat inferior to that of the associated areas of Whitney fine sandy loam. Rocklin fine sandy loam has been developed by the weathering and maturing of old stream-transported material deposited in a thin layer over the markedly different light-colored materials of the Ione formation. In the virgin condition it is generally treeless and supports a growth of native grasses and other vegetation. Scattered live and valley oaks grow on some of the deeper better drained soil.

The greater part of this land is utilized for grazing, about 20 per cent is planted to various grain crops, and a very small area near Roseville is set out to vineyards and orchards.

Rocklin fine sandy loam, brown phase.—A number of small areas of soil in the valley region are typical of Rocklin fine sandy loam in all respects except in color, being brown or grayish brown instead of red. The material in these areas has been differentiated as Rocklin fine sandy loam, brown phase. The soil has a somewhat higher content of organic matter than typical Rocklin fine sandy loam. It occurs on many of the lower-lying areas along shallow stream ways and apparently has been modified by the addition of some recently deposited soil material.

Rocklin fine sandy loam, brown phase, is associated with areas of typical Rocklin fine sandy loam and has similar surface relief and drainage conditions. Like Rocklin fine sandy loam, its chief utilization is for grazing, though it is used to less extent for growing grain.

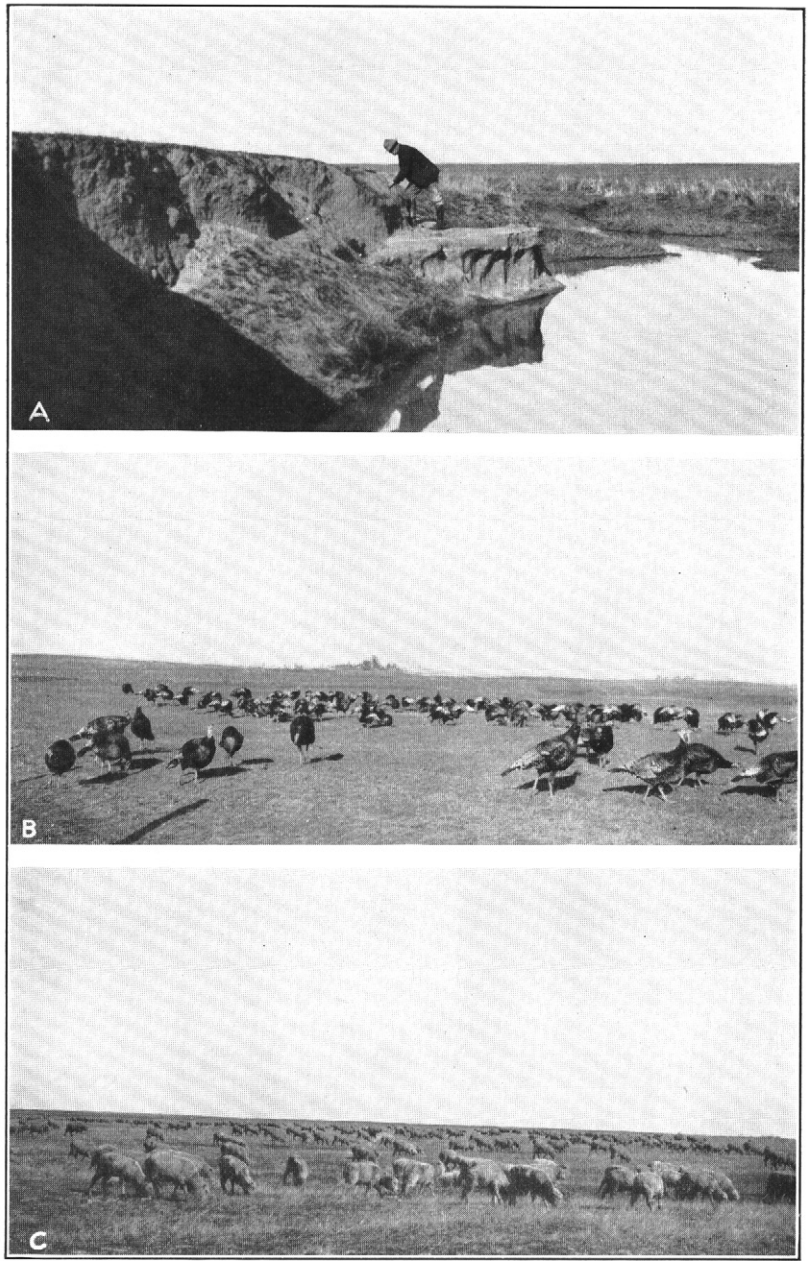
Rocklin fine sandy loam, gravelly phase.—Along the eastern margin of the valley region at the base of the foothills there are numerous areas of gravelly soils which have been mapped as Rocklin fine sandy loam, gravelly phase. The surface soil consists of brown or reddish-brown friable gritty loam or sandy loam, from 4 to 18 inches deep, and contains large quantities of water-rounded gravel and stones. The surface soil may rest directly on the substratum, but in most places there is a subsoil of heavier textured material containing less gravel and in places attaining a thickness of 8 inches. The substratum consists of the characteristic light-gray partly consolidated, stratified sediments.

Rocklin fine sandy loam, gravelly phase, occurs in a number of small areas in the indentations lying between the ridges of scabland northeast of Roseville. These areas are flat or gently rolling and have fairly well developed drainage. Under virgin conditions they are generally treeless and covered with a growth of native grasses. None of the soil is under cultivation.

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

Mechanical analysis of Rocklin fine sandy loam

No.	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*	*Per cent*
5762655	Surface soil, 0 to 21 inches	2.5	6.1	5.6	15.4	40.5	19.0	11.6
5762666	Subsoil, 21 to 38 inches	.9	9.3	3.9	6.8	17.2	42.8	20.0



A.—Hardpan layer in San Joaquin fine sandy loam exposed in stream cut. B.—Turkeys in the Sacramento Valley near Sheridan. C.—Sheep grazing on San Joaquin soils west of Roseville

SAN JOAQUIN FINE SANDY LOAM

The surface soil of San Joaquin fine sandy loam consists of light-red, brownish-red, or yellowish-red, friable, fine sandy loam from 6 to 18 inches deep. The subsoil is commonly somewhat heavier in texture and redder or more yellowish than the surface soil; it is compact and generally shows a columnar structure on dry exposed surfaces. At a depth ranging from 10 to 48 inches, but generally between 24 and 36 inches below the surface, a brownish-red or reddish-brown indurated hardpan cemented with iron and silica is present. (Pl. 3, A.) This hardpan layer is in most places about 12 inches thick and is underlain by a semicompact, brownish or reddish lower subsoil layer similar in texture to the material above the hardpan. The soil above the hardpan is noncalcareous and contains little organic matter. Both surface soil and subsoil contain noticeable quantities of angular granitic grit and varying quantities of water-rounded quartzitic gravel.

San Joaquin fine sandy loam is found in the flat or gently rolling parts of the valley region. Several areas are west of Roseville and Lincoln and in the vicinity of Sheridan. The surface is marked by small hummocks seldom more than 18 inches in height. The slightly intrenched stream ways have only slightly modified the adjacent soils. Under virgin conditions this land is covered with native grasses and a few valley oak trees. Because of the impervious subsoil and the flat, hummocky surface, drainage is restricted, and after periods of heavy rainfall these soils are saturated and boggy above the hardpan.

San Joaquin fine sandy loam is typical of the soils of this series, except in the extensive area mapped along the southern bank of Pleasant Grove Creek about 4 miles northwest of Roseville. In that locality the typical hardpan layer, from 6 to 14 inches thick, rests directly on partly consolidated gray sediments.

Most of this soil has been utilized at some time for the production of grain and hay, but at present more than 80 per cent of it is used for grazing land. Plantings of grapes and deciduous fruits are fairly successful where the hardpan layer occurs at a considerable depth or has been properly broken up, and adequate water for irrigation is available. Slightly more than 10 per cent of the San Joaquin fine sandy loam is sown to grain, principally wheat, with average yields between 6 and 12 bushels to the acre.

SAN JOAQUIN GRAVELLY LOAM

The surface soil of San Joaquin gravelly loam is light-red or brownish-red loam of rather sandy texture. It contains much water-rounded gravel, principally quartzite, and ranges in depth from 4 to 20 inches. The subsoil is heavier in texture, is more compact, contains very little gravel, and is generally red or brownish red. Below a depth ranging from 18 to 48 inches, but in most places at about 27 inches below the surface, a brownish-red or reddish-brown hardpan occurs. This hardpan is cemented with iron and silica and ranges in thickness from 12 to 18 inches. The material below the hardpan varies from grayish, partly consolidated sediments to semicompact brownish or reddish material similar to that above the hardpan. This soil is noncalcareous and contains little organic matter.

San Joaquin gravelly loam occurs in extensive areas in the vicinity of Sheridan and in smaller areas associated with the fine sandy loam of the same series at Lincoln, northwest of Roseville, and in other parts of the valley region. This soil occurs on low ridges and gentle slopes where the surface is marked by numerous hog-wallows and shallow drainage ways. In the virgin condition, this soil supports a growth of native grasses and a few scattered oaks in the deeper soil along stream channels. The extensive area of San Joaquin gravelly loam near Sheridan has a hardpan underlain by gray stratified sediments. Although this soil occurs on more sloping land than either the fine sandy loam or loam of this series, it has poorly developed surface and subsurface drainage and becomes saturated during periods of heavy rainfall.

Orchard plantings on this soil have generally been unsuccessful. Most of the San Joaquin gravelly loam land is utilized for raising turkeys and grazing cattle and sheep. (Pl. 3, B and C.) About 15 per cent of it is sown to grain.

SAN JOAQUIN LOAM

The surface soil of San Joaquin loam consists of brownish-red or light-red light-textured loam from 6 to 18 inches deep. The subsoil is similar in color or somewhat yellower or redder; it is compact and heavier in texture, resembling clay loam or light clay. Below a depth varying from 1 to 4 feet below the surface is a hard, grayish-brown or brownish-red hardpan cemented with iron and silica. This ranges in thickness from 6 inches to several feet, but is commonly from 1 to 3 feet thick. The material underlying the hardpan is similar in its general characteristics to the layers above the hardpan, being of moderately heavy texture, gritty, rather reddish in color, and somewhat compacted. The entire soil is poorly supplied with organic matter and is noncalcareous, although in a few places a slight accumulation of lime is retained in fractures of the hardpan.

This soil occurs in several extensive areas along the western and southern boundaries of the valley region. It occupies the lower, nearly flat and slightly hummocky areas of the valley floor. Many shallow, meandering drainage channels traverse the areas of this soil but have not eroded the surface to any extent. The native vegetation consists of grasses, with an occasional oak or willow tree along the stream ways or where the hardpan has been fractured or softened. The flat surface and the hardpan have impeded drainage, and saturated and boggy soils result after periods of even moderate precipitation. In a few localities, notably near Riego in the southwestern corner of the area, the surface is more rolling, and the areas of greater gradient are better drained.

At the present time about 15 per cent of this soil is under cultivation to dry-farmed wheat and other small grains. During the World War period of higher prices, a greater area was under cultivation. The land is now used primarily for grazing sheep and cattle during a part of the year, and for raising turkeys. Near Riego a number of shallow-rooted crops, including strawberries, cantaloupes, and vegetables, have been succesfully raised where irrigation was carefully practiced.

Several orchards and vineyards have been planted on San Joaquin loam, but where the hardpan was not broken previous to the planting, they have generally been unsuccessful.

CORNING GRAVELLY LOAM

Corning gravelly loam has a surface soil, from 4 to 14 inches deep, of light-red or pronounced light reddish-brown friable loam containing large quantities of water-rounded stone and gravel. In places the soil is of lighter sandy texture, but it is sticky and loamy when wet. The subsoil consists of brownish-red or red slightly compacted material, commonly of heavier texture and containing a smaller quantity of gravel than the surface layer. The substratum occurs at a depth ranging from 10 to 30 inches below the surface. It is formed of waterworn gravel embedded in brownish-red, compact, gritty sandy loam or clay loam. Little organic matter is contained in the surface soil and subsoil, and both are noncalcareous. The substratum is somewhat mottled in places indicating irregular oxidation, and the surface soil and subsoil materials are sticky when wet and apparently rich in colloids.

Corning gravelly loam occurs in various parts of the area. The most extensive occurrences are east of Roseville, and on the higher ridges and rolling hills east of Sheridan. Small areas are in the vicinity of Gold Run and elsewhere in the upper foothill and mountainous region. Because of its rolling or sloping surface, this soil is well drained. Under virgin conditions it supports a growth of native grasses and weeds in the valley section and some trees and brush in the foothill region. In the foothills and more elevated parts of the area, gold-bearing gravel is present. This soil in several such areas has been somewhat modified by mining operations.

The greater part of this land is utilized for grazing. About 5 per cent of it is planted to grain crops. A few fruit trees have been set out, and where water is available for irrigation they have done well.

KIMBALL LOAM

The surface soil of Kimball loam is light-red, brownish-red, or pronounced reddish-brown loam, from 12 to 27 inches deep. It commonly contains a large quantity of very fine sand and silt. The subsoil is of similar or redder color, is very compact, is commonly columnar in structure, and tends to be somewhat heavier in texture than the surface soil. Below a depth varying from 30 inches to more than 6 feet, but usually at about 42 inches below the surface, is a coarser textured, more friable, lighter colored substratum of fine-grained sediments. This soil contains little organic matter, and the soil materials are noncalcareous.

Kimball loam occurs on flat or gently sloping areas and low terraces adjacent to most of the streams in the valley section. It has a smooth configuration but because of its position is moderately well drained. In a virgin condition it supports a growth of native grasses and scattered trees, mainly live and valley oaks.

In a number of areas the color of the surface soil is browner than typical, and the texture is somewhat heavier. This is particularly true of the areas along Doty, Pleasant Grove, and Linda Creeks and along Auburn Ravine south of Rivervale School and east of Central

School. This browner soil varies in color from reddish brown to grayish brown and is generally clay loam. It contains more organic matter than the typical Kimball loam but is free of lime.

The greater part of this soil is utilized for growing grain, but a small irrigated area, 3 miles south of Sheridan, is producing good stands of alfalfa. Numerous small plantings of deciduous fruit trees have been successful on this soil in the vicinity of Roseville, where water for irrigation is available from Linda Creek.

The following table gives the results of mechanical analyses of samples of the surface soil and subsoil materials of Kimball loam

Mechanical analysis of Kimball loam

No.	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*	*Per cent*
576212	Surface soil, 0 to 18 inches	0	0.7	1.2	8.4	36.6	34.4	18.9
576213	Subsoil, 18 to 72 inches	0	0.0	2.6	18.2	31.8	27.8	20.4

PLACENTIA SANDY LOAM

The surface soil of Placentia sandy loam consists of brownish-red or reddish-brown gritty sandy loam from 10 to 30 inches deep. The virgin profile shows an upper layer, from 1 to 6 inches thick, of brown, more friable material with a moderate or good supply of organic matter. The subsoil is red or light reddish brown, generally somewhat heavier in texture than the surface soil; it is very compact and develops a columnar structure on exposure to dry atmosphere. A large quantity of angular quartz grit and mica particles throughout the entire soil mass is characteristic of this soil. Both surface soil and subsoil are noncalcareous and contain moderate or small quantities of organic matter. Although of sandy and gritty texture, the surface soil and subsoil materials are rich in colloids and are decidedly sticky when wet.

Placentia sandy loam occurs in numerous areas in the eastern part of the valley region, especially north of Lincoln and in the vicinity of Roseville. It occupies gently rolling ridges and hills and eroded plains. Under virgin conditions it supports a growth of native grasses and scattered oaks. Surface drainage is well developed, but subsurface drainage is somewhat restricted by the heavy compact subsoil. Most of this soil has at some time been planted to grain, although at present only about 30 per cent is so utilized, the remainder being used for grazing. In the vicinity of Roseville, particularly where irrigation is practiced, numerous orchards and vineyards have produced well.

Placentia sandy loam, brown phase.—Along Linda Creek, in the vicinity of Roseville, several areas of soil have been mapped as Placentia sandy loam, brown phase. Had they been more extensive they would have been differentiated and probably mapped as Ramona soils. They are similar in structure to typical Placentia sandy loam but differ in color, being brown or grayish brown throughout the entire soil profile or only slightly lighter or more yellowish in the subsoil. They contain larger quantities of organic matter than typical Placentia sandy loam occur on rather flat-topped terraces or gentle ridges, and are well drained.

Most of the Placentia sandy loam, brown phase, is planted to orchards and vineyards or is occupied by the houses and gardens of the residents of Roseville. A small area east of that town is used for grazing.

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

Mechanical analysis of Placentia sandy loam

No.	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*	*Per cent*
576231	Surface soil, 0 to 5 inches	5.8	6.8	6.7	21.6	40.1	11.2	7.8
576232	Subsoil, 5 to 27 inches	6.6	11.3	7.1	15.7	33.1	13.5	12.9
576233	Subsoil, 27 to 72 inches	9.2	7.2	5.5	7.2	21.7	19.4	30.1

HONCUT CLAY LOAM

The surface soil of Honcut clay loam, to a depth ranging from 12 to 27 inches, consists of light-red, brownish-red, or pronounced reddish-brown clay loam, containing some small angular rock fragments. The subsoil is commonly heavy clay loam, is somewhat compact, and is more brownish or yellowish in color. Both surface soil and subsoil are noncalcareous and contain a moderate or good supply of organic matter. The surface varies to some extent in texture and small undifferentiated areas of Honcut loam and Honcut clay may be included with Honcut clay loam.

Honcut clay loam occurs in narrow strips along stream ways and valley floors throughout the valley and upper foothill and mountainous sections and in the northern part of the lower foothill division of the area. Occurring on the narrow bottoms and flatter areas of the valleys, Honcut clay loam has smooth or gently sloping surfaces and fairly well developed surface and subsurface drainage. Under virgin conditions it is covered with a more or less open growth of oaks and pines, and parklike spaces are grown up with native grasses.

In the foothill district and eastward, deposition is progressing at a comparatively slow rate, and the subsoils have weathered to some extent, as is indicated by their heavier textures, compact structure, and lighter, more yellowish colors.

Throughout the valley and in the lower foothills, the areas of soil mapped as Honcut clay loam are less maturely developed than the typical soil. They are reddish brown or rich brown in color and contain larger quantities of organic matter. The subsoils are brown, slightly compact, and noncalcareous. Surface and subsurface drainage are fairly well developed. Most of these areas are used for grazing and for the production of grain and hay. In the vicinity of Roseville some very profitable orchards and vineyards have been planted on this soil.

Honcut clay loam, yellow-subsoil phase.—A few areas of Honcut clay loam along the highway south of Gautier Bridge and in the vicinity of Rock Creek Reservoir have weathered to a greater extent and have been mapped as Honcut clay loam, yellow-subsoil phase. The surface soil, to a depth ranging from 12 to 36 inches, consists of red or brownish-red heavy silt loam or clay loam, containing considerable

organic matter. The subsoil is rather compact yellowish-brown or brownish-yellow heavy clay loam or clay, with gray and rust-brown mottles in the lower part. This soil is found on flat areas in stream bottoms and has restricted or poor subsurface drainage, although the surface drainage is in most places good. In the virgin condition it is covered with a growth of native grasses and scattered oak trees, with a few willows along stream channels. A few deciduous fruit trees have been set out on this soil but have not thrived, chiefly because of the heavy subsoil and poor drainage. Some alfalfa and clover have been planted and are doing well. Corn and shallow-rooted crops may be expected to produce well where climatic conditions are suitable.

HANFORD SANDY LOAM

The surface soil of Hanford sandy loam consists of brown or light grayish-brown friable sandy loam, from 10 to 24 inches deep. Some areas of light-textured material and probably small undifferentiated areas of Hanford sand have been included in mapping. The subsoil is similar in color to the surface soil but contains some reddish-brown mottles and is commonly stratified. It ranges from coarse sand to heavy silt loam, with the finer material predominating. Both surface soil and subsoil contain large quantities of angular quartz grit and mica particles, both are noncalcareous, and both have a moderate supply of organic matter.

This soil occurs in narrow strips along most of the stream ways whose courses lie, for the most part, in the granite section of the lower foothill region. Its chief occurrences are along Auburn Ravine near Lincoln, along Linda Creek in the vicinity of Roseville, and eastward along the tributaries of that stream. The greater part of this soil in this area was considerably modified during the gold-mining period. In mining operations along the streams, a very large quantity of fine soil material was sluiced away and interstratified with or superimposed over the Hanford sandy loam material. This material is still working downstream, but the natural addition of newly transported soil material to areas of Hanford sandy loam is very slow, and the lower layers have, coincidently, been somewhat modified and matured by aging and weathering.

This soil has a smooth or gently sloping surface with slightly intrenched stream and drainage ways. Surface drainage is well developed, but in the lower, flatter areas subsurface drainage is commonly poor or restricted.

Under virgin conditions this soil is grown up with brush and trees, including oaks, pines, and willows. A few plantings of alfalfa near Lincoln, and of vegetables, grapes, and alfalfa near Roseville have proved fairly successful. In the foothill region its occurrence as very narrow strips and the climatic environment of this soil seem to be the chief factors in restricting its agricultural development.

ALAMO CLAY

The surface soil of Alamo clay consists of gray clay, from 4 to 12 inches deep, which when moist appears almost black. The soil contains moderate or large quantities of organic matter and commonly has a pronounced adobe structure. The subsoil is of similar

color, of similar or heavier texture, is somewhat more compact, and, at a depth varying from 20 to 48 inches below the surface, is underlain by a grayish-brown, brown, or reddish-brown hardpan cemented with iron and silica. The hardpan is generally from 1 to 3 feet thick and is similar to that of the San Joaquin soils. The material under the hardpan is brownish gray, slightly compact, and slightly lighter in texture and more friable than the subsoil material just above the hardpan.

Areas of Alamo clay occur in the southwestern part of the valley area. The soil occupies shallow, flat-bottomed depressions which are poorly drained. It is noncalcareous.

Alamo clay is of small extent and is utilized in the same way as the adjoining soils. Some of it is planted to grain and grain hay, but about 80 per cent is used for grazing land. Its heavy texture and poor drainage make cultural operations difficult, but on account of its high water-holding capacity, small grains usually give higher yields on this soil than on the lighter textured associated soils.

HOVEY CLAY

The surface soil of Hovey clay consists of dark-gray, very dark dull-brown, or black clay, from 12 to 24 inches deep. The structure is generally adobe, and the material contains a small quantity of very small angular rock fragments and grit. The supply of organic matter is medium or good, and the soil is practically noncalcareous. The subsoil is light gray or light brownish gray, is markedly calcareous, is of moderately heavy or heavy texture, but is somewhat friable or granular. It is underlain, at a depth ranging between 18 and 60 inches but generally at a depth of about 40 inches, by light-gray partly consolidated stratified sediments. This substratum is similar in character to corresponding layers in other soils of the area, except that to a depth of a few inches lime accumulations are found in crevices and fractures.

Areas of Hovey clay occur in the coves or indentations between the ridges of scabland lying between Rocklin and Whitney in the valley region. The surface is smooth or gently sloping, becoming steeper in the vicinity of the higher ridges of scabland. The lower, flatter areas have restricted drainage because of their heavy texture, compact substratum, and level surfaces. Native vegetation consists of grasses and scattered oaks and other trees along shallow drainage ways. About 50 per cent of this soil has been utilized in recent years for growing grain and hay, but at present most of it is devoted to grazing livestock, principally sheep.

TUSCAN STONY LOAM

The surface soil of Tuscan stony loam is from 10 to 24 inches deep and consists of grayish-brown or brownish-red loam containing large quantities of water-rounded basaltic and andesitic gravel and stone, varying from 1 to 8 inches in diameter. This is underlain by more or less firmly cemented brownish-gray or grayish-brown gritty material containing large quantities of waterworn stone firmly embedded in it. This material may prevail to a depth greater than 6 feet, but a gray or light-gray cemented substratum of tufaceous material commonly occurs within 4 or 5 feet of the surface.

Tuscan stony loam occurs in a number of small areas along the western margin of the foothills, adjoining areas of scabland. In the virgin condition, it is covered with native grasses and is treeless except for scattered oaks along the edge of scabland areas where moisture is more plentiful. This soil has very little agricultural value, being utilized solely for the scant grazing which it affords during the spring and early summer months. Its shallowness and the large quantities of stone present preclude other utilization under present conditions.

ROUGH MOUNTAINOUS LAND

Rough mountainous land includes lands which have a comparatively high elevation and which are predominately nonarable because they are so steep. The soil, predominantly residual in origin, is generally shallow and is often subjected to excessive erosion and drainage.

In the Auburn area this material is mapped in the upper foothill and mountainous region. Much of the rough mountainous land supports a dense growth of brush, principally manzanita and ceanothus, but the cover of the smoother areas of deeper soil is generally chiefly of pines, cedars, and firs. This soil includes some undifferentiated areas of soils of the Aiken and Sites series.

ROUGH STONY LAND

Rough stony land includes areas of rough land, characterized by a large number of surface stones and rock outcrops. Such areas differ from rough mountainous land in that they are entirely nonarable and have comparatively lower elevations and flatter surfaces. Rough stony land is mapped in the foothills in extensive areas along both Bear and North Fork American Rivers. It supports a growth of pines, oaks, and brush and affords some pasturage.

RIVERWASH

Riverwash includes the comparatively barren areas of sand, gravel, and bowlders occupying flood-swept stretches along streams of fluctuating volume.

In this area riverwash is mapped along Bear River, and on a tributary of that stream in the vicinity of Little York. The largest area of riverwash is north of Sheridan in the valley region and consists of material laid down by Bear River as its current is retarded by the flatter gradient of the valley. In general, this land is barren of vegetation, but along the sides of partly filled channels which cross the gray-white sands, and in narrow strips between flood channels, a growth of cottonwood, willow, brush, and vines is commonly found. Farther up the channels of both Bear and North Fork American Rivers in the upper foothills and mountainous region are numerous strips of riverwash, all too narrow to differentiate on the map.

PLACER DIGGINGS

The term "placer diggings" is applied to the débris resulting from placer, hydraulic, and dredger operations in deposits of gold-bearing sand and gravel. In these mining operations the finer soil

materials were washed out and carried to points farther down the rivers and streams, leaving only the unsightly heaps and ridges of gravel and cobbles in the eroded region.

In the Auburn area this material has varied characteristics, depending on whether it is the result of dredger work along the larger stream courses, the product of placer work on the shallower areas of gravel, or the result of hydraulic washing of elevated gravel deposits. Some of this material left by the placer work has been covered with a growth of grasses and brush and scattered young pine and oak trees which afford scant grazing for livestock. With this exception, placer diggings are of no agricultural value.

SCABLAND

Scabland is made up of very slightly weathered volcanic material. The surface is comparatively flat, such as that of elevated table-lands or ridges. The material contains large quantities of angular rock and stone, and there are small areas of very shallow soil.

In this area numerous flat-topped ridges and hills occurring in the southern part of the foothill region have been mapped as scabland. These include the eroded and slightly weathered remnants of one or more flows of volcanic rock. The largest area of scabland is a roughly triangular-shaped area in the vicinity of Newcastle, Lincoln, and Roseville. This land is treeless but supports a growth of native grasses on the patches of soil between the fragments of andesitic rock. Scant grazing is available for sheep during the spring and early summer months.

IRRIGATION AND DRAINAGE

IRRIGATION

The extensive fruit-growing industry of the foothill section of the Auburn area is dependent upon an adequate supply of water for irrigation during the summer months. Water is collected in numerous reservoirs located along streams and in other favorable localities in the mountains to the east and is distributed through a system of ditches, pipes, and flumes. Before the water is distributed for use in orchards and fields, it is utilized in the generation of electrical power at a succession of plants. Records furnished by the Pacific Gas & Electric Co. show that the acreage under irrigation has been nearly doubled during the last seven years, and a continued expansion is indicated for the next few years by the larger supply of water available and the increasing demands of the growing orchard industry.

Irrigation is usually begun early in May, the water being applied through furrows which in the more level areas are plowed straight down the row and in the steeper places are circled about the base of each tree. Irrigation is continued at intervals of 10 or 15 days until just before the fruit is picked. Irrigation down the slope results in considerable waste of water through run-off and in a very slight lateral penetration from the sides of the furrow. This condition is particularly aggravated by the slow rate of absorption of the soils of the Aiken series. On the Aiken soils, small flows of

water are usually applied for four or five days at a time, but the different texture and structure of the soils of the Sierra, Holland, and Siskiyou series permit them to absorb the water more readily, and water can be applied in larger quantities during shorter periods.

Because of the shallowness of the soils of this region, greater care should be exercised in irrigation. Under present practices many of the areas on the upper slopes receive an insufficient amount of water, and excessive amounts collect in the depressions and valleys.

Some irrigation is practiced in the vicinity of Roseville in the valley region, water being obtained by pumping either from wells or from the bed of Linda Creek. Thus a small quantity of water is supplied during the spring and early summer, and with proper cultural practices it is apparently sufficient for profitable yields. Of late years an irrigation district has been planned to cover this locality, from the county line north to the vicinity of Whitney. The water is to be obtained from American River in the vicinity of Folsom outside of this area.

DRAINAGE

In the matter of drainage the area covered by this survey is divisible into three regions. The upper foothill and mountainous region may be described as having both good regional and good local drainage; the lower foothill region is well drained, although there are many small local areas of restricted or poor drainage; and in the valley region, where the surface is comparatively flat and there are irregular areas of hardpan soils, regional as well as local drainage is poor. It is notable that the region of highest precipitation has the best drainage and the region of lowest rainfall has the poorest.

In the upper foothill and mountainous region the surface is such that run-off is rapid; streams and natural drainage ways arrive at flood stage within a few hours after a rain and subside with equal rapidity.

Although the slopes are generally steep and regional drainage is good, there are within the lower foothill region numerous small areas of poor drainage. There is hardly a farm upon which there are not one or more areas of wet land, ranging in size from less than an acre to 2 or 3 acres. This condition is caused largely by seepage zones and springs which occur not only in the depressions between hills, but here and there on rather steep hillsides. Many of these springs are at the base of granite outcrops. Seepage from these spots causes considerable inconvenience in tillage operations. Where the land is not too wet more resistant varieties of fruits are grown. Little has been attempted in the way of drainage. These patches, if drained, would not only increase the tillable area but would also permit a more uniform planting and greatly facilitate cultural operations.

In the valley region the natural drainage is deficient. Although receiving considerably less rainfall, this region remains wet much later in the spring than the foothill area. The larger streams traversing this region, such as Coon Creek, Doty Creek, Auburn Ravine, Pleasant Grove Creek, and Linda Creek, are perennial at their sources but become dry early in the season. Along the western boundary of the area the slopes are so flat that land adjacent to these streams is overflowed during flood periods. In those places where hardpan lay-

ers occur, drainage conditions are aggravated by the presence of these layers. Rain water falling on such lands is held in the surface soils above the hardpan, and even a moderate rainfall is sufficient to saturate the soil. This condition obtains almost continuously throughout the rainy season or until such time as the growth of vegetation and evaporation remove the excess moisture.

Tillage operations are frequently delayed until so late that spring plowing is not satisfactory. During winters of low rainfall the best results are obtained from fall plantings, whereas wet winters usually result in the drowning out of fall-planted crops. Those soils which have been excessively wet during the winter often dry out and are hard and intractable in the late spring and summer. Some effort has been made along Bear River and in the extreme western part of the area to protect the lands from overflow by levees along the larger streams. Most of this work, however, has been west of the Auburn area.

Aside from a few shallow surface ditches, usually little more than plow furrows leading to the roadsides, no artificial drainage of importance has been undertaken in this area.

SUMMARY

The Auburn area includes the western part of Placer County and a very small part of Nevada County, Calif. The total extent of the area is 611 square miles or 391,040 acres.

The area possesses a wide range of topographic, climatic, and soil conditions which differ in the valley region, the lower foothill region, and the upper foothill and mountainous region, each of these regions having more or less distinct characteristics of soil, topography, and drainage.

The rural population has remained nearly stationary during the last 40 years. The average size of the farms has been reduced to one-half what it was in 1880, and the number of farms has been doubled. The farms operated by tenants have increased during this time from less than 5 per cent of the total number to more than 33 per cent.

Numerous towns are located throughout the area, and an adequate system of railroads and highways provides good transportation facilities. Most of the fresh fruits grown in this area are marketed in eastern cities. Other agricultural products are sold either locally or in Pacific coast markets.

Climatic conditions range from the hot, arid summers and annual precipitation of about 20 inches in the valley region to the cooler summer months with a rainfall of more than 40 inches in the upper foothill and mountainous region. In the mountainous region a large part of the annual precipitation occurs in the form of snow. The lower foothill region is characterized by climatic variations dependent upon topographic features and natural air-drainage currents, the upper parts of the ridges being warm and the colder air currents passing down to the lower places.

Agriculture followed mining developments attendant on the discovery of gold near Auburn in 1848. The earliest extensive plantings were on the soils along the streams of the valley and in the lower

foothills. Agricultural development kept pace with the increase in population and transportation facilities, and, because of the diversified conditions of the different regions, the kinds of crops grown varied in the different parts of the area. The valley region early became noted for the production of grain and for dry farming, and the lower foothill region has developed an extensive production of table fruits, particularly plums, cherries, and peaches. Because of the short frost-free season, and the mining activities, the eastern part of the area has been only slightly developed agriculturally.

The soils of the valley region are derived predominantly from maturely developed, old, transported materials from varied sources; those of the lower foothills are almost exclusively residual developments from underlying igneous bedrock; and those of the upper foothill and mountainous region are the somewhat eroded residual soils developed predominantly from altered sedimentary and basic igneous rocks.

The soils of the area are divided into three main groups—residual, old transported, and recent transported soils, with an additional group of five nonagricultural materials. The soil groups have been separated into 18 series, 22 types, and 9 phases.

Irrigation is necessary for the production of fruits in the foothill region. An extensive system has been developed in connection with power generation, the water being collected in numerous reservoirs in mountainous areas of the eastern part of the county. Irrigation ditches are the development and modification of old systems used in mining days.

Regional and local drainage are good in the upper foothill and mountainous region of high annual precipitation; good regional and poor local drainage prevail in the lower foothill region; and typically poor or restricted regional and local drainage exist in the valley region where the lowest rainfall occurs.

LITERATURE CITED

(1) ANGEL, M.
1882. HISTORY OF PLACER COUNTY, CALIFORNIA. 416 p., illus. Oakland, Calif.

(2) DURUZ, W. P.
1922. HARVESTING AND HANDLING CALIFORNIA CHERRIES FOR EASTERN SHIPMENT. Calif. Agr. Expt. Sta. Circ. 232, 19 p., illus.

(3) HENDRICKSON, A. H.
1922. FURTHER EXPERIMENTS IN PLUM POLLINATION. Calif. Agr. Expt. Sta. Bul. 352, p. 247–266, illus.

(4) HOLMES, L. C., and NELSON, J. W.
1916. RECONNOISSANCE SOIL SURVEY OF THE SACRAMENTO VALLEY, CALIFORNIA. U. S. Dept. Agr., Bur. Soils, Field Oper. 1913, Rpt. 15: 2297–2438, illus.

(5) LAPHAM, M. H., ROOT, A. S., and MACKIE, W. W.
1905. SOIL SURVEY OF THE SACRAMENTO AREA, CALIFORNIA. U. S. Dept. Agr., Bur. Soils, Field Oper. 1904, Rpt. 6: 1049–1087, illus.

(6) STRAHORN, A. T., MACKIE, W. W., HOLMES, L. C., WESTOVER, H. L., and VAN DUYNE, C.
1912. SOIL SURVEY OF THE MARYSVILLE AREA, CALIFORNIA. U. S. Dept. Agr., Bur. Soils, Field Oper. 1909, Rpt. 11: 1689–1740, illus.

(7) WATSON, E. B., and HAMMON, J. B.
1924. SOIL SURVEY OF THE GRASS VALLEY AREA, CALIFORNIA. U. S. Dept. Agr., Bur. Soils, Field Oper. 1918, Rpt. 20: 1689–1724, illus.

[PUBLIC RESOLUTION—No. 9]

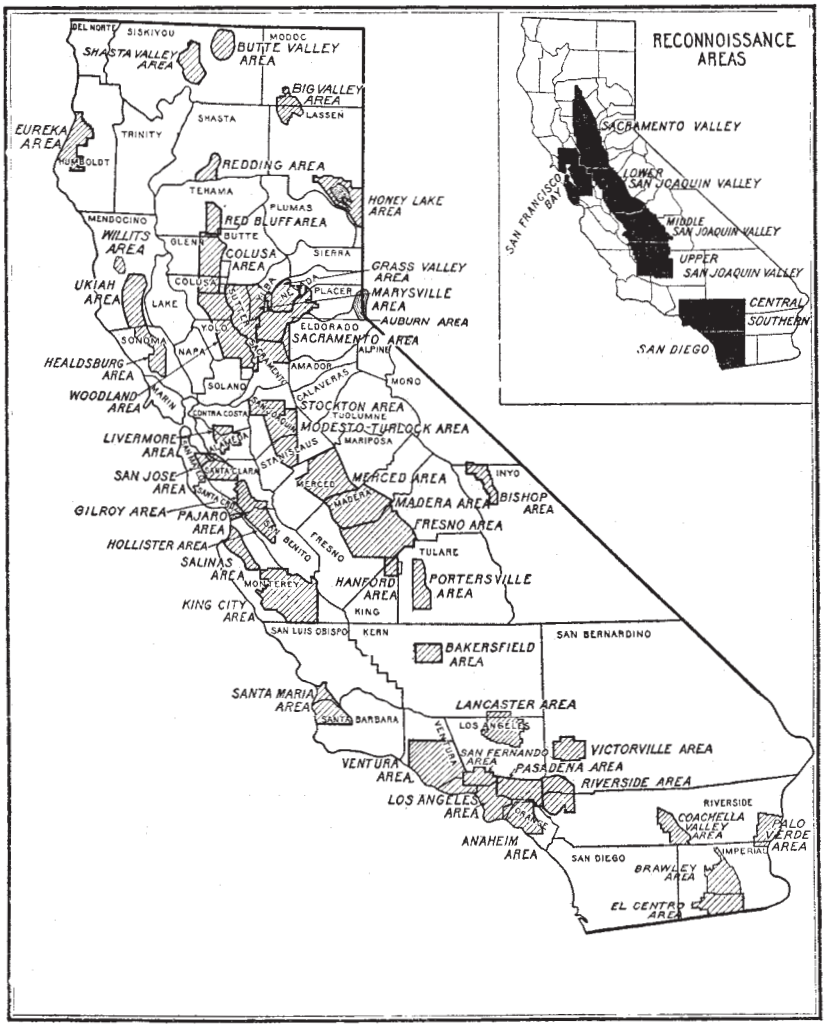
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

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 Divisions 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, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in California, shown by shading

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