



Issued June 2, 1913.

U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS—MILTON WHITNEY, Chief.

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# SOIL SURVEY OF THE MEDFORD AREA, OREGON.

BY

A. T. STRAHORN, L. C. HOLMES, E. C. ECKMANN,  
J. W. NELSON, AND LAWRENCE A. KOLBE.

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MACY H. LAPHAM, INSPECTOR IN CHARGE WESTERN DIVISION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1911.]



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1913.

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., October 3, 1912.*

SIR: During the field season of 1911 a soil survey was made of the Medford area, Oregon, for the purpose of obtaining such information relative to the individual characteristics of the soils and their crop adaptabilities as would lead to a further development of the agricultural resources of the country.

I have the honor to transmit herewith the manuscript report and map covering this area and to recommend their publication as advance sheets of field operations of the Bureau of Soils for 1911, as provided by law.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. JAMES WILSON,  
*Secretary of Agriculture.*

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### MAP.

Soil map, Medford sheet, Oregon.

## SOIL SURVEY OF THE MEDFORD AREA, OREGON.

By A. T. STRAHORN, L. C. HOLMES, E. C. ECKMANN, J. W. NELSON,  
and LAWRENCE A. KOLBE.

### DESCRIPTION OF THE AREA.

The Medford area covers about 544 square miles, or 348,160 acres, lying in the central and west-central parts of Jackson County, Oreg. This county is one of the southernmost tier of counties of the State and the third county eastward from the Pacific Ocean.

Outside the area surveyed the extent of arable or level land included within the county is limited. In the southwestern part of the county the Siskiyou Mountains—a local name for a portion of the

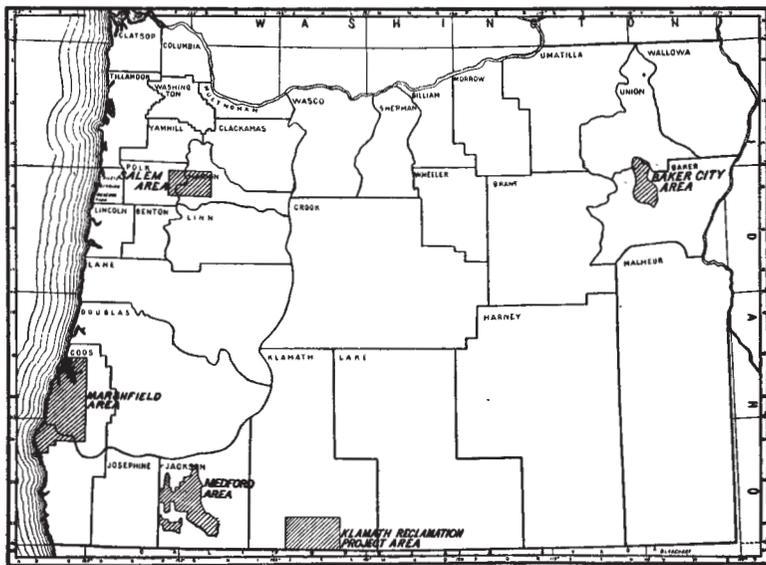


FIG. 1.—Sketch map showing areas surveyed in Oregon.

Klamath Mountains—rise to elevations of over 7,000 feet above sea level and to the north and east the Cascade and Klamath Ranges form an extensive rugged mountainous area with Mount McLaughlin or Pitt, with an altitude of 9,760 feet, as the culminating point.

The Medford area consists of two parts. The larger one embraces the long and generally narrow lowland belt known locally as the Rogue River Valley. The lesser part is of minor extent and importance. It includes a portion of the Applegate Valley lying south and

west of and separated from the main part of the area by nonagricultural mountainous tracts not included within the survey.

The Rogue River Valley trends nearly north and south, its southern end lying just south of Ashland and its northern end in the neighborhood of Trail. It widens gradually from its southern end northward for nearly two-thirds of its length, reaching a maximum width of about 8 miles. A few miles farther north it begins to narrow. Two rather important but rapidly narrowing embayments extend eastward from the main valley.

In general the valley lies in the shape of a bow convex toward the west. Rogue River, which rises in the Cascade and Umpqua Ranges upon the east and north, enters it at its northern end, flows southward to near its point of maximum width, and then turns abruptly westward. It leaves the main valley at Raygold and, escaping through a narrow gorgelike valley in the western range, enters the Pacific Ocean 30 miles north of the Oregon-California boundary. This narrow valley for several miles below the main valley, with the adjacent mountain lands and local valleys of tributary streams, is included within the survey.

The southern part of the main valley is traversed by Bear Creek, which joins the Rogue River near Raygold. This stream, with Little Butte Creek, constitute the largest tributaries of Rogue River within the main part of the area. The former drains an extensive mountain region southeast of the area surveyed. The floor and gentle slopes of its valley constitute the largest extent of such topography and the principal agricultural lands of the survey. Little Butte Creek rises far back in the Cascades near the foot of Mount McLaughlin and traverses the eastern part of the area, which it enters near Brownsboro, whence it pursues a westerly course to the Rogue River.

The lesser part of the Medford area covers about 37 square miles, embracing an irregular strip some 12 miles long and in its widest part  $6\frac{1}{2}$  miles wide. It comprises practically all the farming land in the valley of the Applegate River in Jackson County. Applegate River drains a considerable area of the Siskiyou Mountains and following a northwesterly course joins the Rogue River beyond the western limit of the survey, which coincides with the Jackson-Josephine County boundary line. The survey here includes small areas in the valleys of tributary streams and a relatively large proportion of the adjacent rough hilly and mountainous country.

The Medford area, then, embraces the soils of the stream bottoms, of the slightly elevated floors of the valleys, and of the adjacent hill and mountain slopes. The elevation of the larger part of the area ranges from 1,000 to 2,000 feet, while upon the mountain slopes elevations of 3,000 to 4,000 or more feet are reached.

Those portions of the area having a more or less rough topography have been represented upon the map accompanying this report by a system of hachures.

West of Bear Creek the slopes of the Siskiyou Mountains rise abruptly from the valley floor and are covered with a fair to dense and almost impenetrable growth of forest. East of this creek the area is bounded by a series of low rounded hills and knolls or by long sloping ridges descending from the mountains to the lower lands. These lower slopes are usually treeless, only the higher elevations supporting a forest growth. Below Raygold the level valley land is merely a narrow bench lying between the channel of the river and the steep wooded slopes of the bordering mountains. At intervals throughout the area the mountains retreat sharply and small intermountain valleys lie along the many small streams that drain the more distant parts of the region. North of the Rogue River the country is more rolling and the streams numerous, but small. Here lie the two prominent landmarks of the valley, the immense flat-topped buttes or mesas, known as Upper and Lower Table Rocks.

Originally nearly all of the floor of the central valley, except what is known as the "Desert," was covered with a growth of pine, oak, laurel, manzanita, and ceanothus, while along the stream bottoms occurred a heavy growth of cottonwood, willow, alder, and brush. Many of the streams are still fringed with a growth of trees and brush, but the larger part of the level lands in the valley have been cleared and the native growth replaced by cultivated fields and orchards, only a few small woodlots remaining to indicate the presence of the former forest.

Prior to the discovery of gold in California this portion of the West was known only to occasional roving bands of Indians or to hunters or trappers of the Hudson Bay and rival fur companies. With the increasing search for gold in California and the beginning of immigration into the Northwest, prospectors, hunters, and explorers slowly penetrated southern Oregon. The first to come were prospectors, who ascended the Sacramento River and, following up its smaller tributaries, eventually found their way over the summit of the Siskiyou Mountains and into the Rogue River Valley, where gold was found in paying quantities. When the news reached the outside world it started a tide of immigration from several points and by many diverse routes. Some came over the mountains in the southeast from the Klamath country, others from the north up the Willamette Valley and across the Umpqua River and its inclosing mountain ranges, while a considerable number came up the California coast by boat to Crescent City on the northwestern coast of California and then inland to the Rogue River.

In their search for gold the miners followed along the base of the mountains, washing the gravels in the stream beds. The discovery of large quantities of placer gold in what is now Jackson Creek led to the founding of Jacktown in 1851. This name was later changed to Jacksonville, and after the formation of Jackson County it became the county seat. The increasing settlement of the Northwest demanded some means of communication and transportation between the northern and southern sections, and to meet this the Ben Holliday stage line was established in 1863. This line ran from Sacramento, Cal., to Portland, Oreg., and was operated under a Government subsidy, as it carried the mail on a regular schedule. The Southern Pacific Railroad, constructed in 1887, followed in part the stage route.

With the miners and prospectors came the home seekers, who invariably located along the smaller streams in the valley. Some of the first farmhouses built in the region are still to be found, particularly in the creek bottoms south of Ashland. These pioneers combined farming with stock raising, the extensive foothill and mountain country affording abundant pasturage and the moist bottom lands yielding heavy crops of either native grass or grain hay.

The principal towns in the area are Medford, Ashland, Central Point, Jacksonville, and Gold Hill. Other smaller towns and settlements are Talent, Phoenix, Woodville, Eagle Point, Brownsboro, Trail, and Applegate.

Medford, with a population of 8,840, according to the census of 1910, occupies a nearly central position in the area. In volume of railroad freight business for 1909 and 1910 this city ranked second in the State. The Portland-San Francisco Line of the Southern Pacific Co. passes through the city and affords the only transportation outlet to distant markets. The Rogue River Valley and the Pacific & Eastern Railways end at Medford.

Ashland, with a population of 5,020, is situated in the southeastern part of the area, on the main line of the Southern Pacific, of which it is a division point. It lies on a sloping bench above Bear Creek, extending up on to the slopes of the Siskiyou Mountains. This city is the second largest town in the valley and is the center of the peach belt of the area.

Central Point (population, 1910 census, 761) is a town of some importance as a fruit-shipping center and is located on the main line of railroad about 4 miles north of Medford.

Jacksonville (population, 1910 census, 785), the county seat of Jackson County, is located at the base of the mountains about 6 miles west of Medford and is connected with the latter place by the Rogue River Valley Railway. Its location is such that it can have no extensive tributary orchard district.

Gold Hill (population 423) and Woodville (population 468) are small towns in the western part of the area, the commercial centers for surrounding agricultural districts and for an extensive mountainous region to the north. Talent and Phoenix are small towns along the Southern Pacific Railroad between Medford and Ashland, and from these points is shipped the larger part of the small fruits grown in the area. Eagle Point is a small town on the line of the Pacific & Eastern Railway, about 12 miles from Medford, while Applegate, Brownsboro, and Trail are small settlements without railway communication in the outlying portions of the valley.

The main Portland-San Francisco line of the Southern Pacific Co. traverses the area from the northwest to the southeast, and at the present time affords the only means of railroad transportation between this valley and distant parts of the country. The Pacific & Eastern Railway, with Medford as its southern terminus, is a line of some 35 miles in length built into the timber regions of the Cascades northeast of this valley. This road when completed will connect with the main line of the Great Northern Railroad by way of the Deschutes Valley in northern Oregon. A short line, the Rogue River Valley Railway, connects Medford with Jacksonville, having those points for its eastern and western termini.

With the exception of the shipments of lumber and fruit, this valley has practically no exports, but ships in annually a large quantity of foodstuffs and other commodities, the greater part of which might well be produced at home.

Deposits of coal are known to exist in the eastern part of the valley, and at the present time one mine, about 4 miles from Medford, is producing a very good grade of this mineral. The cities and more thickly settled rural sections of the valley are lighted by electricity generated by the waters of Rogue River at a power plant at Raygold.

#### CLIMATE.

The climate of this area is best described as moderate. The summer days are warm, but seldom hot, and the highest temperatures are greatly modified by the low humidity of the air and by the ever-present breeze. The summer nights are always cool and comfortable. The winter temperatures are not severe, the lowest temperature recorded in the valley being about 3° below zero. The average minimum temperature during the winter months is about 31° F.

Statistics of temperature and precipitation are given in the following table, compiled from the records of the Weather Bureau at Ashland and Jacksonville:

*Annual temperature and precipitation at Jacksonville and Ashland.*

Year.	Temperature.				Precipitation, Jacksonville.		
	Jacksonville.		Ashland.		Annual.	Greatest monthly.	Least monthly.
	Mean maximum.	Mean minimum.	Mean maximum.	Mean minimum.			
	° F.	° F.	° F.	° F.	Inches.	Inches.	Inch.
1889.....	92						
1890.....	84	30			27.72	8.46	0.00
1891.....	87	30			27.92	7.69	.01
1892.....	85	32			16.78	3.69	.00
1893.....	84	25	88	31	28.40	6.87	.00
1894.....	86	28	90	30	29.92	6.58	.04
1895.....	84	29	86	28	20.73	6.12	.00
1896.....	90	32	93	32	28.78	5.90	.00
1897.....	89	30	91	30	22.86	5.59	.00
1898.....	88	27	90	27	17.84	4.82	.03
1899.....	86	30	88	30	33.63	6.73	.09
1900.....	88	33	87	33	26.43	4.87	.00
1901.....	91	28	90	28	30.37	10.20	.02
1902.....	88	29	85	31	32.64	9.63	.15
1903.....	86	27	84	27	32.77	10.64	.25
1904.....	90	30	88	29	41.70	10.57	.16
1905.....	91	30	89	32	17.06	3.59	.00
1906.....	95	32	92	32	29.09	7.14	.00
1907.....	87	29	85	31	35.26	9.58	.38
1908.....	91	30	90	31	19.05	5.41	.04
1909.....	89	28	85	34	38.46	11.11	.04

*Seasonal means of temperature and precipitation at Ashland.*

	Temperature.	Precipitation.
Winter mean.....	39	8.3
Spring mean.....	51	5.1
Summer mean....	67	2.2
Fall mean.....	53	4.6
Annual mean....	52	20.2

The temperature conditions, as shown by the data given for Ashland and Jacksonville, are fairly representative of the valley portions of the area, but from the orchard standpoint the important feature is the variation in temperature due to local topographic features, which render portions of the valleys more or less immune from late spring frosts and other portions very liable to low temperatures during the spring months.

Without entering into an extended discussion of the causes of local frost, it may be stated that it is largely a matter of air drainage. Given a locality where the movement of air is unrestricted and it will be found that killing frosts late in spring are very rare. In a locality where this condition is reversed damaging frosts are very common. These conditions exist in varying degrees throughout this valley, and the matter of affording some protection to the orchards has become one of the established orchard practices. Upon the hill and mountain slopes which face the open valley there is an unrestricted movement of the cooler air toward the lower levels, with the formation of a slightly warmer belt extending some distance up the slope. In this belt killing spring frosts are almost unknown. In the smaller intermountain valleys, such as Pleasant Valley in the extreme northwestern part of the area, where the movement of air is restricted, the cold air settles into the valley and dangerous frosts are frequent. In the level floor of the main valley of the area traversed by Bear Creek the cold night air finds its lowest level and here killing spring frosts are common, and the profits from fruit crops depend almost entirely upon the vigilance of the orchardist in combating the low temperatures.

The precipitation occurs largely during the fall, winter, and spring months. During the remainder of the year the rains come only as a few light, scattering showers. Upon the surrounding mountains, outside the area surveyed, the precipitation is largely in the form of snow, and the higher elevations are covered with snow throughout the greater part of the year. Some snow falls in the valleys nearly every winter, but the fall is light and soon disappears.

There is seldom a day without a pleasant breeze, but winds of sufficient violence to cause damage to the crops are unknown.

#### AGRICULTURE.

Agricultural development of the area began shortly after the influx of the miners and prospectors, and consisted in small, scattering farms along the numerous streams, where water was abundant and the soil, as a rule, more easily handled than the heavier, sticky soils of the valley floor. The gradual increase in the population led to the utilization of the treeless rolling lands east of Bear Creek and of the occasional timber-free lands along Jackson Creek, where it was found that profitable yields of grain could be grown. As these lands were taken up the forest lands in the vicinity were cleared and placed under cultivation. Mills located along the larger streams produced flour for home use, and any surplus met with a ready sale in the various mining settlements situated along the foot of the mountains. Around the farmhouses fruit trees were planted, not with the idea of

profit, but to supply the home. Not a few of these old trees may yet be found in various parts of the valley, still bearing fair to heavy crops of fruit annually.

The extension of the cultivated area was slow. Home markets had to be depended upon, as the shipment of produce to outside points was difficult and the slow growth of population did not call for any great increase in the crop production. Grain (wheat and oats) was the principal crop at this time, the yields varying from 25 to 50 bushels per acre, without irrigation, and for many years this was practically the only crop produced on the cleared land. The land was cropped annually and the continued strain on the soil resulted in diminishing yields, until the production hardly returned operating expenses.

This was one of the conditions which led to changes in the methods of farming and in the crops. Grain was sown only every other year, the land being used for pasture in the meantime. Considerable areas of the level lands were sown to alfalfa, which might, after several years, be plowed up and the land again sown to grain. Small orchards appeared and the returns from the fruit induced further plantings, so that the orchard has played a large part in the rural development of the main valley of the area, making it essentially a one-crop section.

Wheat has been mentioned as one of the extensively grown crops in the early development of the region, and although the yield per acre is much less than formerly, in some sections of the area it is still grown profitably. Upon the sloping hillsides and upon the alluvial soils, closely underlain by sands and gravels, where the moisture conditions are none too good, a yield of a ton of wheat hay to the acre is exceptional. Upon some of the heavier alluvial soils adjacent to the stream courses the moisture is generally sufficient throughout the season and the yield of wheat hay not uncommonly runs from 3 to 5 tons to the acre. On the soils of the valley floor, when not too closely underlain by hardpan, 2 to 3 tons of grain hay may be expected in seasons of average rainfall.

In addition to the grain hay produced on lands devoted solely to that crop, there is a considerable tonnage produced in the orchards, where it has been sown as an intertilled crop. The yield naturally varies considerably with the type of soil, but in comparing orchard and nonorchard soils the yields secured in the orchards are roughly about two-thirds of those secured on the other lands, as that fraction is about the relative area of soil sown to grain when there are trees on the land.

The heavier alluvial soils, referred to above, are generally well supplied with moisture, have a good content of organic matter, and the yield of hay from year to year is showing but little decline.

Upon the remaining soils, however, the conditions are not so favorable, and as this crop must be always given a place in the agriculture of the valley some means should be taken to maintain the yield at as high a figure as possible. The principal reasons for the decline in the average crop returns lie in the poor quality of the seed, insufficient preparation of the soil, an exhaustion of the organic matter in the soil, and diminished power of the soil to retain its moisture through the long, dry summer. The weakened vitality of the seed and the inferior plants resulting from its use are due to run-down seed from the same strain saved from one year to another. This defect may be remedied by obtaining new seed, preferably from sections of the country where grain is grown under dry-farming conditions.<sup>1</sup>

That a thorough preparation of the soil is a necessary factor in the production of any crop seems generally to be too well known to call for comment, but the fact remains that a larger proportion of farmers in this section entirely overlook this phase of the question. It has been demonstrated repeatedly that continued shallow and inefficient plowing and cultivation invariably result in decreased yields, and, that, within certain limits, deep plowing and thorough cultivation will result in at least maintaining an average yield, if not actually increasing it. The benefits of deep plowing lie in deeply burying the grain stubble or other surface vegetation and placing it where it may become decomposed and be of use to the following crop; in the turning up and aeration of the deeper soil, thus liberating new stores of plant food; and in forming a loosely structured surface soil, of ample depth, which materially assists in the retention of moisture for the use of the succeeding crop.

The continuous cropping of the soil to grain returns practically nothing to the soil and results in the gradual exhaustion of the organic matter originally present. Except in the immediate creek-bottom soils, the quantity of organic matter in the soil is low and the decline in crop yields has been fairly rapid. This may be remedied either by growing a green crop to be plowed under in the spring or by establishing a crop rotation, with grain every third or fourth year. A winter crop, to be turned under in the spring, will entail an expense which is to be made up by the succeeding crop. Although this is a departure from the established methods of dry farming, it has been tested sufficiently to indicate that the practice is well founded, and it will no doubt spread to sections where the yield of grain is declining or has already reached a point where its production is hardly profitable.

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<sup>1</sup> The department has been carrying on investigations with a view of securing or developing varieties of grain which will produce heavy yields under dry-farming conditions. Information upon this subject may be secured by writing to the U. S. Department of Agriculture at Washington, D. C.

With a decrease in the quantity of organic matter in the soil comes the inability of the soil to retain moisture, and with the remedying of the defect this power will be regained.

The production of oats and barley has not received the attention that has been given to wheat. This is partly due to the fact that the former does not give quite as heavy yields as wheat and is supposed by many not to be adapted to this valley, while the latter is not so well liked on account of the beards. There is no reason why oats should not return fairly profitable yields, provided a good strain of seed is secured, and it is probably for this reason that the impression that the crop is of little value to this section has arisen. Barley does not make a very desirable hay, but it is a valuable feed and should receive wider attention among those who desire to raise some of the small grains.

Fair crops of corn may be produced in this area. This crop is largely grown between the trees in young orchards, where the yield is sufficient to materially assist in meeting the running expenses until the trees come into bearing. For the best results care must be taken to secure seed adapted to the local climatic conditions. The hot season here is comparatively short, the nights cool, and a variety which will mature quickly is necessary.

Alfalfa ranks next to wheat in acreage and yield of hay, the returns varying largely with the nature of the soil, the care taken in getting a stand, and in the subsequent treatment of the field.

An ideal seed bed for alfalfa is one where the soil has been worked until it is as mellow as a garden plot, with all of the weeds and grass completely removed. A finely worked soil affords room for an extensive root development the first year, and enables the soil to retain moisture for the needs of the plants. The latter feature is an important one, especially where there is no irrigation. It is practically possible to secure a finely worked seed bed on any of the soils of the valley floor, and in addition to affording favorable conditions for the young plants the complete removal of the weeds and grasses would remove what is otherwise a serious handicap to nonirrigated alfalfa in this valley. The rate of seeding should be from 12 to 20 pounds to the acre, the lesser quantities being used in connection with the lighter soils, where the moisture conditions may be somewhat deficient. Not more than one cutting should be made the first year, while if the plants have made a good growth three cuttings may be secured during the second season.

In the spring the alfalfa field should be thoroughly disked and in some cases cross-disked. This is a practice which is not any too common in the valley, but which could be followed advantageously, as it not only tends to discourage the growth of grass and weeds, but

stirs up the surface soil and divides the crowns of the plants, promoting a greater growth the following summer.

A practice common in the area is that of pasturing stock on the alfalfa during the fall, and sometimes through the winter. This results in injury to the crowns of the plants and in a decreased yield the following season. If the practice is continued, the life of the crop will be very much shortened.

Only a small proportion of the alfalfa grown in this valley is irrigated, these fields lying in the creek bottoms, where water is available from adjacent streams. On these soils the yields will run from 2 to 5 tons to the acre, 4 tons being a fair average. On the soils of the valley plains similar yields may be expected, with favorable moisture conditions, although the average yield is probably not over 3 tons to the acre. The Medford gravelly fine sandy loam and loam have proved admirably adapted to alfalfa without irrigation, the yields running from 4 to 6 tons to the acre and being maintained regularly year after year. Alfalfa, either loose or baled, is in good demand here and sells readily for \$8 to \$20 a ton, depending upon the supply and the season of the year.

Two forage and hay crops which have been largely overlooked in the past are timothy and vetch. The former always commands the top price in the hay market and in yield closely approaches alfalfa, well cared for fields averaging close to 4 tons to the acre annually for the past 4 years. This crop is adapted to the heavy alluvial soils in the creek bottoms and to the clay loams on the floor of the valley. The adobes and the lighter-textured soils will return good yields if irrigated, but otherwise the moisture conditions are not favorable and the returns will be rather light. In this area the larger part of the vetch is not planted for forage, but to be used as green manure in the spring for the orchards. As it is a winter crop, there is always a sufficient supply of moisture, and it will succeed on any soil in the valley where trees may be planted. Bacterial inoculation of the soil may be necessary in order to secure a good stand. Cultures for this purpose may be obtained from any of the leading seed houses on the Pacific coast.

In the production of the truck crops and vegetables opportunities have been very much neglected, the larger part of these products being shipped into the valley. The Medford Chamber of Commerce has collected data regarding these shipments and the figures are given below. The data cover only the quantities shipped in by freight and do not account for the large quantity of produce, particularly small fruits, which come into the valley by express.

*Agricultural products shipped into and out of the Rogue River Valley from July 1, 1910, to June 30, 1911.*

Articles.	In.	Out.	Articles.	In.	Out.
	<i>Carloads.</i>	<i>Carloads.</i>		<i>Carloads.</i>	<i>Carloads.</i>
Potatoes and onions.....	84	1	Fruit <sup>1</sup> .....	8	96
Hay.....	225	62	Vegetables.....	35	.....
Oats and barley.....	48	2	Canned goods.....	12	.....
Flour and mill feed.....	432	.....	Total.....	847	416
Eggs and butter.....	3	.....			
Apples.....	.....	255			

<sup>1</sup> Kind not specified.

There is absolutely no reason why the products imported should not be grown within the valley. The soils and climatic conditions are favorable, the only requirements being a more extensive development of irrigation facilities and a movement to divert a part of the energy of the farms along new lines. There will always be a certain quantity of early fruits and vegetables shipped in from other sections of the Pacific coast, as the local climate does not favor an extremely early production of fruits and vegetable products. Aside from these early shipments, however, the valley could well afford to be a shipper of this class of produce, rather than an importer.

The development of a water supply for the lower lying soils along the streams is a comparatively simple matter, and with few minor exceptions all of these soils are adapted to a wide range of vegetable crops. Upon the higher soils the development must wait upon a comprehensive scheme of irrigation which will furnish water to the whole valley. When this is done there will be, in the aggregate, several thousand acres of land admirably adapted to this type of agriculture.

The principal development of the trucking industry is associated with the lower soils adjacent to Bear Creek, where a few small farms are given over entirely to truck products. Another phase is found in the growing of a variety of annual truck crops between the trees in the young orchards. This is not always a wise procedure, but may be the only way in which the owner may provide a living until the trees come into bearing.

With the exception of some very early shipments from outside points, all of the berries needed might well be grown within the valley. Strawberries do well upon the heavier granitic soils near Ashland, upon all of the soils on the floor of the valley except the adobes, and upon the lighter members of the soils of the agate series. Their production is successful upon the soils of the creek bottoms, but they mature here somewhat later than on the higher soils. The brambleberries do well upon all of the soils mentioned, but probably



PEAR ORCHARD ON MEDFORD GRAVELLY CLAY LOAM SOUTH OF MEDFORD.

[The laborers are filling pots with crude oil, preparatory to smudging ]



PEAR ORCHARD ON MEDFORD GRAVELLY CLAY LOAM SOUTHEAST OF MEDFORD.

[The cordwood piled in orchard is to be used as fuel in protecting trees from frost.]

best upon the various clay loams or upon the lighter soils which may have a rather heavy subsoil at not too great a depth. All of the berries require irrigation to insure profitable yields.

A glance at the figures given in the table on page 16 shows that during the last fiscal year 84 carloads of potatoes and onions were shipped into this valley. The valley could produce more of these crops than is needed for home consumption, and there is in the valley a great variety of soils capable of producing fair yields of these crops. With proper care the largest yields will be secured on the moderately heavy soils along the creeks. Very good yields may be secured on the higher lying soils, where the gravel content is not too high and the texture not too heavy. Several years ago this area was an exporter of potatoes, but for various reasons the yield declined until there was little profit, and the idea that the crop was not adapted to the valley became a fixed one. Aside from the suitability of the different soils upon which they may be grown, the proper selection of the seed and a rotation of crops will solve the problem of successful growing of this crop.

The history of the development of the fruit industry in the West shows failures to have been due almost entirely to the improper selection of the land for orchard purposes. There are, of course, other contributory causes, such as improper climatic conditions, unfavorable transportation or market conditions, and the prevalence of plant diseases. The latter may be but temporary, or may be controlled as the growers gain experience; but with an orchard on unsuitable soil there is little that can be done except to remove the trees and put the land into crops to which it is better adapted. All of this means a loss to the grower, and in the aggregate the loss to the country through this cause has been enormous.

In selecting an orchard site care should be taken to secure a soil of sufficient depth. From the description of the different types of soil in the present area it will be seen that many of them may be very shallow and underlain by either bedrock or hardpan. When the bedrock is within 4 feet of the surface the soil is most certainly not adapted to the best development of an orchard. With a sufficient supply of irrigation water soils of this depth may do fairly well when the texture is heavy, but otherwise only shallow-rooted crops should be planted. When hardpan is present within 4 feet of the surface the adaptability of the soil to fruit trees depends upon whether the hardpan can be broken up sufficiently to afford good drainage and room for root development, and whether it is underlain by material which will afford nourishment for the trees. If these conditions can be attained by blasting, then the presence of hardpan need be no hindrance to the planting of trees. In selecting the orchard site a

thorough test of the soil, by using a soil auger or a spade, should be made.

The drainage of the soils adapted to trees is generally good, and the number of instances where it has been found necessary to install drainage systems are few. The matter of the occurrence of alkali salts in injurious quantities is of no importance in this area.

Assuming a favorable depth of soil and good drainage conditions, the next question to be considered in the selection of orchard sites in this area is the relation of the variety of the trees to the type of soil. In planting pears in this valley the only soils not well adapted to their commercial production are the very coarse textured granitic soils along the base of the mountains lying west of the valley of Bear Creek, the lighter soils of the Agate series, and some of the recent alluvial soils where the subsoil is too light and porous. The Bartlett pear is less subject to differences in the nature of the soil than any other variety, and, except on the soils just mentioned, it will be found to do well on any of the types in the area. The Winter Nelis must be confined to the heaviest types, such as the clay adobes. The Anjou is better suited to the heavier soils, while the best success with the Comice has been had on the heavy clay loam soils in the valley floor.

Apples do best on a deep, well-drained, rather heavy loam. Bearing this in mind it is interesting to note that in this valley apples not only succeed upon the alluvial loam soils, but also thrive on many of the clay loams and adobe soils, the latter usually being of clay texture. The planting of apples on these very heavy soils is not advised, as the yields are not regular and it is harder to keep the trees in a healthy growing condition. (See Pl. IV.) Generally speaking, this fruit should be confined to the moderately heavy soils along Rogue River and tributary streams, on similar-textured soils of the Agate series, providing the subsoil is not too gravelly, and upon the moderately heavy soils of the Sites series.

Although it can not be denied that the apples produced in this valley are exceptionally fine in size, color, and flavor and that good yields are secured, it is a question whether or not they should be largely superseded by pears. The control of pests and diseases calls for more work than with pears, the time of harvesting the crop is later, and picking is often seriously interfered with by the fall rains, while pears are out of the way long before that time. The bearing is more irregular, though that condition could be largely remedied by heavy thinning. The feeling is growing that more attention should be given to pears, and each year sees fewer plantings of apples. At the present time the ratio of the acreage in apples and pears is about 4 to 1.

Peaches should be confined to the lighter loose-textured soils on the slopes of the mountains or hills, which include such types of soil as the Siskiyou coarse sandy loam, the Barron coarse sand, and the members of the Sites series. They will also be found to do well on the lighter members of the Agate series, providing subsurface drainage can be secured by blasting the hardpan.

Not many vineyards are found in the area, principally because the tree fruits have been more profitable, and it is unlikely that grape growing will ever assume much importance. This fruit thrives on the medium-textured soils of the Sites and Tolo series and should be largely confined to those soils. The Tokay, Muscat, and Mission grapes do well, and many of the eastern varieties find a congenial location on the hillsides in the valley.

There is room for the planting of more cherries, as this fruit does very well on soils adapted to the peach and will thrive on somewhat heavier soils.

During the early period of development of the fruit-producing industry when the spring climatic conditions were favorable a heavy crop resulted in overstocking the market, with a consequent decline in prices and little or no profit to the growers. This and other attendant conditions gave orcharding a sudden check, and for several years it was regarded with disfavor. In other years early spring frosts killed the blossoms and young fruit, eliminating all profit for the year. Furthermore, market conditions were unsatisfactory, the local demand being limited, and once supplied the rest of the fruit had to be shipped to distant points and sold through commission merchants. In such cases the enterprise proved largely speculative, the grower sometimes receiving a profit, but more often being called upon to face a deficit and meet the transportation charges on the fruit.

There were no methods in force for controlling fruit pests or disease, which operated to reduce the profit to the grower, either by destroying the trees or in causing the production of an inferior grade of fruit.

The output from the better-kept orchards subsequently demonstrated that the valley is capable of producing large yields of high-grade fruit with reasonable assurance of profit from year to year. The progressive growers have taken steps to insure fairly regular yields and to receive prices justified by the grade of the fruit. This fight has not been an easy one. The conservatism of some of the growers, the efforts of commission men to prevent cooperative selling, the persistence of insect pests and diseases, and damage from late spring frosts all offered problems for solution. All these hindrances have been largely overcome, and from a district of a few poorly cared for and barely profitable orchards there has been developed a

planted area of some 60,000 acres of well-cared-for trees, making this valley one of the highly specialized fruit sections of the West.

The larger percentage of the plantings in the valley are of very recent date, and it is estimated that of the 60,000 acres mentioned only about 4,500 acres are in bearing. Within five years, or by 1916, the bearing orchard area of this valley will be not far from 33,000 acres, and it is believed the extension will continue rapidly until such time as the portions of the valley adapted to the culture of fruit are fully taken up.

The principal varieties of pears grown are the Bartlett, Anjou, Howell, Comice, Bosc, and Winter Nelis. The principal varieties of apple are the Yellow Newtown, Spitzenburg, Jonathan, Winesap, and Ben Davis; of peaches, the Hale, Triumph, Early and Late Crawfords, several varieties of the clings, and the Salway. These varieties are named in the relative order of their importance in point of area.

The young trees—1 or 2 years old—are obtained from local or outside nurserymen, the cost at the present time ranging from 7 to 25 cents per tree. Planting is done either by the owner of the land or, in the case of the larger orchards, by gangs of men under the supervision of a foreman. It is very seldom that the planting is done by the nurseryman. The cost of planting is given as 7 to 10 cents per tree. In many of the older orchards the trees were planted too close for the best results and later plantings have been on the basis of 70 trees to the acre for pears and 50 for apples. All of the recent planting has been on the rectangular system, which gives with the number of trees mentioned from 25 to 29 feet between the trees, allowing plenty of room for their development and such cultural operations as pruning and spraying. Harvesting is not interfered with, and it is possible to use "fillers" to good advantage.

The pruning of the young trees is so carried on as to produce a tree without a central growth, which is well balanced and open to give light and air free access and circulation. After the tree has been formed the annual pruning is only for the purpose of cutting out suckers or other growths which might interfere with future growth and fruiting. Summer pruning, although not commonly practiced in this valley, is carried on to some extent, the idea being to restrict the growth and to force the setting of fruit.

Spraying of the larger and smaller fruits is necessary in order to control the various pests. This is usually carried out very well by the orchardists, but where laxity exists the treatment of the trees is rigidly enforced by agents of the State Board of Horticulture.

The treatment of the orchards varies somewhat, depending upon the winter treatment of the land. Where no green cover crop is sown between the trees the ground is usually plowed in the fall, and

in the spring the soil is thoroughly worked up by successive harrowings. When a cover crop is planted the ground is plowed in the spring and then harrowed. During the summer the only cultivation is an occasional harrowing to subdue any weeds which may have sprung up. The care which is given to this part of the orchard work varies with the individual owners, and although there are numerous examples of slack and inefficient work, yet, on the whole, the cultivation of the orchards is well done and compares favorably with that in other deciduous fruit sections of the West.

With the close of the season the treatment of the orchards varies with the individual owners. Up to within the last two or three years no attention was paid to the matter of a winter cover crop and growers were content with the growth of such weeds as might spring up voluntarily. Now that the need of returning organic material to the soil and the benefits derived from the use of a winter cover crop are being understood, there is an increasing acreage of orchard land sown each year to some crop which will withstand the winter climate and afford a large quantity of green material to be turned under in the spring. The benefits derived from an annual fall seeding of the orchard are many and are hardly appreciated by those who use it. It returns to the soil a large quantity of organic matter to replace that used by the preceding crop and by the clean cultivation during the summer. The mechanical condition of the soil is greatly improved, as clay soils are made more friable and sandy soils become more loamy. The moisture-retaining power of the soil is increased and in the spring the surface dries out more rapidly, allowing earlier cultivation of the orchard. If the cover crop is a leguminous one, not only is the soil benefited by the addition of organic matter, but the supply of nitrogen is maintained at no additional expense.

The seeding of the cover crop should be done in the fall before the winter rains set in, regardless of whether the crop has been harvested or not. Unless the orchard has a good surface mulch, the land should be thoroughly disked. The seed may then be sown with a drill or may be broadcasted and then lightly harrowed. In the spring the winter's growth should be plowed under as soon as the moisture condition of the soil is favorable, as a delay may result in the plants becoming too woody to decay easily. Plowing should be as deep as the nature of the soil will allow, so as to place the green material where it will be of the most use to the plants. On the heavy adobe soils of the valley it will not be possible to bury the plants more than 6 or 8 inches, but on the lighter soils the plowing should be carried down to 10 or 12 inches with no great difficulty. Numerous diskings and harrowings should follow, shallow at first, so as not to expose the mass of decaying vegetation, and increasing

in depth until the surface 4 or 6 inches of the soil is worked into a finely pulverized condition.

For this valley the common vetch and the winter oat have given the best results, as they withstand the winter climate and give a large quantity of green material to be plowed under. They should be sown early enough in the fall to enable them to make a good growth before the cold weather sets in. After that time they make but little progress, but will start early in the spring and make some growth before the time for plowing. Unless some leguminous crop has been grown on the land before sowing the vetch, the seed should be inoculated with a culture of bacteria, or it will be difficult to secure a good stand.

The question of whether the growing of intertilled crops in an orchard is detrimental to the trees is a debatable one, but as several years elapse between the planting of the trees and their coming into bearing, during which time there is no revenue, many growers, particularly those having small holdings and little surplus capital, are compelled by the necessity of securing a living to utilize the vacant ground between the trees in the production of other crops. Two systems are in use in this valley, depending upon circumstances. In the apple and pear orchards peach trees are usually planted in the center of the squares as "fillers." These trees usually come into bearing in the third year and are allowed to remain until the larger trees begin to yield and the room is needed for their growth and for cultural operations, spraying, and harvesting. This practice probably causes the minimum of damage to the larger trees. The other method is to grow various annual crops in the vacant soil, either with or without the peach fillers. There is no doubt that the future value of an orchard may be seriously impaired by the indiscriminate growing of such crops, but from the thrifty appearance of many of the smaller orchards in the valley it is evident that with judicious planting there will be no material detriment to the development and productiveness of the trees. The cereals are often grown between the trees and are probably more used than any other crop. A strip of soil at least 6 feet in width should be left unseeded on each side of the rows of trees and kept well cultivated throughout the growing season. Strawberries may safely occupy a portion of the orchard and will yield a good profit to the grower. As this fruit is not profitable after the third or fourth year, it may be plowed out at that time and be succeeded by some of the smaller annuals. Bramble berries, melons, and shallow-rooted vegetables may also be grown. On the moderately heavy soils of the valley cantaloupes have been one of the most profitable of the intertilled crops used, the yields not uncommonly meeting the running expenses of the orchard and leaving a handsome surplus for the grower. In one or

two instances alfalfa has been used, but it is very doubtful whether any deep-rooted crop can be considered as desirable for this purpose.

The laws of the State relative to the control of orchard pests and diseases, importation of nursery stock, seeds, etc., and the shipping of infected fruits are very explicit, and ample provision is made for the necessary officers to enforce the regulations. Jackson County has rigidly enforced the laws on these subjects, and the fruit grower in this valley is assured of a degree of protection for his trees and fruit equaled by very few of the fruit sections of the West. As a result the trees in this valley are in a remarkably healthy condition and the product of the orchards is of a very high grade.

A former agent of the Department of Agriculture is in charge of all of the horticultural inspection and quarantine work in this county, and has under him a force of 66 men. Six of these are paid inspectors, who devote all of their time to watching the orchards. The other 60 men are voluntary observers serving without pay, acting very much as secret-service men to the head office. They observe conditions in their vicinity and report on matters which seem to require inspection by one of the paid agents. These appointments are not made public, the idea being that these men will give better service if they feel that they may report trouble without arousing the enmity of a neighbor who has been derelict in caring for his trees. The reports of these men are taken up by the paid inspectors, investigated, and the trouble remedied. The orchard plantings are scattered over such a large area that it is practically impossible for the paid force of inspectors to see all of the trees as often as is desirable, and by means of these voluntary observers many things are caught which would otherwise work more or less harm to the district in which they occur.

A most striking example of the efficiency of this work is in the practical eradication of blight from this valley. This disease, which is due to a bacteria entering the tissues of the apple and pear trees, made its appearance in California about 1899, and the entire pear-producing section was swept by the trouble, causing a loss of many thousands of dollars to the growers in that State. The disease traveled slowly northward, entered this valley in 1906, and by 1907 had gained such headway that the growers became seriously alarmed. An agent was assigned to the valley, and steps were taken to check its ravages. The work has been so well done that instead of hundreds of acres of dead or dying trees there are but few cases of infection to be found in the valley, and under the present system of inspection the pear blight, it is believed, will never again do any material damage to the orchards.

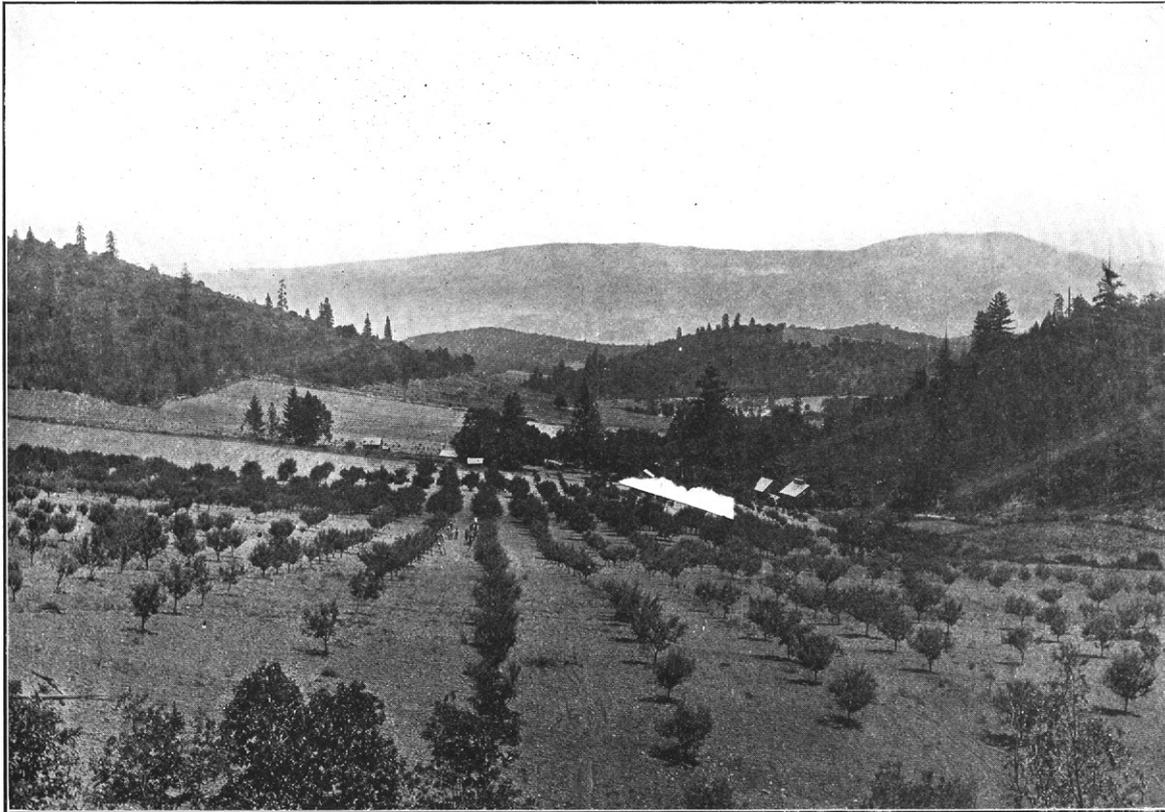
All of the fruit shipped out of the valley or offered for sale in the local markets is subject to inspection, and if found undesirable is

destroyed; and the owner or person offering it for sale becomes subject to the penalties prescribed by law for offering such fruit for sale or shipment. Nursery stock, seeds, or fruit shipped in from other portions of the State or from outside States is also subject to inspection, and if found infected may be either destroyed or fumigated. Absolute quarantine measures exist against the importation of plants or seeds from various sections of the country where certain plant troubles are known to exist.

The general climatic conditions of this area are indisputably favorable to the growing of fruit, and failure of fruit adapted to a moderately temperate climate must be laid to other causes. Some danger of injury from frosts where not protected by artificial means, however, exists. The scheme of affording orchards and vineyards some protection against low temperatures during the period between the blossoming and the setting of the fruit has only recently been put into extensive and effective practice, but the advantage of such work was understood centuries ago. Pliny recommended the burning of damp material to form a smudge above the vineyards, and in the sixteenth century a French agriculturist, Olliver de Serres, recommended the use of smudges in the vineyards of France. At one time the practice of smudging was obligatory in certain provinces of Germany. The practice seems to have fallen into disuse for a considerable time and was later revived in the grape sections of southern France. The idea spread to this country and seems to have been first successfully used in southern California, where the citrus orchards were protected from frost both by smudging and heating. The practice gradually spread to other sections of the country, until at the present time it is a well-established practice in many fruit-producing sections of the West.

Early efforts along the line of smudging were designed to produce a dense cloud of smoke by burning damp or tarry material. This practice is still used to some extent, but the present tendency is to prevent injurious temperatures in the orchard by the use of numerous small fires, and the term "heating" or "firing" is commonly used in place of the word "smudging." (See Pls. I and II.)

In this valley the work of the past four seasons has demonstrated that orchard heating is very efficient and that the expense of a few dollars per acre for frost protection is a very cheap insurance. Cordwood, coal, crude oil, and distillate have all been used in this valley, with the greater acreage protected by the first two. Within the last two years it has not been possible to secure a grade of crude oil that was free from water and difficulty has been experienced in igniting the oil and keeping the fires burning, but recently a better grade has been obtainable, and the ease of handling this material will probably cause its more extensive use. Distillate is always free from water, but its greater cost has prevented its extensive use.



YOUNG APPLE ORCHARD ON TOLO LOAM, LOWER MOUNTAIN SLOPES SOUTHWEST OF MEDFORD.



APPLE ORCHARD, THE TREES BEING REMOVED TO MAKE ROOM FOR THE SETTING OF PEARS.

[This emphasizes the need for a knowledge of soils in selecting orchard sites. Apples are not a commercial success on low-lying heavy soils in this region.]

In using cordwood the wood is dovetailed in piles in the vacant squares between the trees. Coal, crude oil, and distillate are burned in sheet-iron containers. The number of fires necessary to prevent damage to the trees depends not only upon the severity of the temperature, but upon the age of the trees and their condition during the days preceding. When wood is used, from 30 to 50 piles to the acre are prepared, while with the other fuel preparation is made for 50 to 150 fires to the acre. When it becomes necessary to fire, only about one-half of the total number are lighted, the balance being reserved for more severe temperatures. When all of the fires have been burning, it has been found possible to raise the temperature of the orchards from 6 to 10 degrees. This increase has so far been found more than sufficient for the purpose.

The cost of firing depends upon the number of fires used, the length of the time of firing, and the nature of the fuel. A careful estimate of the cost in this valley on 1 acre for one night with the fires burning for four hours gives the following figures: Crude oil, 50 fires to the acre, \$3; distillate, \$6; coal, \$5. This cost includes all items of labor, fuel, and interest on the cost of the pots. When wood is used the cost runs from \$2 to \$4, the difference being due to the varying cost of obtaining this fuel.

In order that the orchardists may know when to start the fires and so avoid waste of fuel by unnecessary firing or to delay firing too long and run the risk of losing the crop, advance information of atmospheric changes are absolutely necessary. The Weather Bureau sends out frost warnings, which are a valuable aid to the growers. In this valley the Weather Bureau warnings are supplemented by local observations taken by the man in charge of the horticultural inspection of this county. The efficiency of this work is evidenced by the fact that during the last four seasons not a single error has been made in the predictions of frost.

For more detailed information upon frost and the protection of orchards from frosts the reader is referred to the publications listed below.<sup>1</sup> The various Government publications may be had through the United States Department of Agriculture. The publication "Better Fruit" may be had by writing to the publisher of that periodical. Publications of the Oregon Agricultural Experiment Station are supplied by the director, Corvallis, Ore.

The productivity of the orchards varies with the age of the trees, cultural operations, and the adaptation of the soil to the varieties of fruits grown. The output of some of the orchards where all of the conditions have been favorable runs into astonishing figures. On one 7½-acre Bartlett pear orchard the yield for the last three seasons

<sup>1</sup> Yearbook, U. S. Dept. of Agr., 1909; Monthly Weather Review, vol. 38, pp. 412-413, 1437-1441; Monthly Weather Review, December, 1908; Bulletin V, U. S. Weather Bureau; Bulletin L, U. S. Weather Bureau; Better Fruit, Oct., 1910, and Nov., 1911; Bul. 110, Oregon Agr. Exp. Sta.

has been approximately 12 carloads annually. This is equivalent to about 6,000 boxes. Winter Nelis pears have yielded as high as 435 boxes to the acre. Spitzenburg apples have yielded 520 boxes to the acre, and the Newtown Pippins as high as 592 boxes. These yields are not mentioned to give the idea that all of the orchards in the valley bear as heavily as the figures given or that the yield is maintained from one year to another, but are given only to show what is actually possible. Not only are these yields obtained, but, what is more significant, the fruit from these orchards is generally of a higher grade than from orchards where the yield is much lower. Orchards which are returning little or no profit to the owners are not hard to find, and somewhere between these extremes is a yield which is a fair average for the valley and which is large enough to yield handsome returns on the cost and care of the orchards. With favorable soil conditions and good care pears should yield from 5 to 12 boxes of fruit to the tree and apples should give similar yields.

The time at which an orchard will come into bearing depends on a number of factors. It is difficult and almost impossible to give any definite figures. With favorable soil and cultural conditions pears will begin to bear from the fifth to the eighth year, depending upon the variety, while apples will come into bearing in 6 to 8 years. If the trees are not given the proper care or the soil is not suited to the trees, the bearing age may be postponed several years.

Incomes from bearing orchards vary not only with the yield but with the quality of the fruit and the condition of the markets where it is offered for sale. In much of the literature used to advertise the West mention is usually made of the highest profits which are secured by various growers. These figures are almost invariably true in special cases, but they leave the impression that these returns are commonly received by all of the persons engaged in the growing of fruit. In so far as this valley is concerned, a well planted and cared for orchard will net yields on an average from \$250 to \$500 an acre, and no person engaging in the business of growing either apples or pears should entertain hopes of securing returns much in excess of these figures.

The cost of bringing an orchard to the bearing age, exclusive of the cost of the land, buildings, etc., is about the same for either apples or pears, and data collected by the Medford Chamber of Commerce show that the cost of planting and caring for an orchard for six years ranges from \$100 to \$115 an acre. These figures do not take into account any profit which might be received from intertilled crops, merely indicating the expense on which prospective orchardists should figure.

Until within the last three years the growers have marketed their fruit through various selling agencies and had no hand in the selling of their crop. This condition did not prove satisfactory to the

growers and there has now been formed the Rogue River Fruit and Produce Association, which not only places the fruit in the various markets, but furnishes pickers and packers, supervises the picking and packing, furnishes the boxes, and attends to the shipping.

Market conditions, including prices, distribution, and extension of the markets, may be regarded as good, certainly better than they have been in the past, and with the present selling organization and the development of additional transportation facilities the means of disposing of the fruit will be in better shape than ever.

No matter how perfect the average run of the fruit may be there will always be a certain percentage of the product of the orchards below grade which it will not pay to ship. At the present time this fruit is a total loss to the growers in this valley, and one of the urgent needs is a plant or several small plants to work this material up into vinegar, cider, canned goods, or dried fruit.

The price of land in this area depends upon location, improvements, and soil conditions. For relatively unimproved land, used for pasture, grain, or for uncleared land, the prices, aside from the factor of location, are governed largely by its potential value when carrying bearing orchards rather than its earning power for general farm purposes. Prices asked range from \$50 to \$500 an acre. The cheapest land occurs on the steeply sloping brush and timber covered hillsides, where the expense of clearing and handling is high. On the level floor of the valley the nonorchard lands sell for from \$200 to \$600 an acre, and when improved the cost mounts rapidly, ranging from \$500 to \$1,100 an acre, the latter figure having been exceeded in one or two cases. The latter price has been paid for an apple orchard in bearing, and, assuming normal yields and crop prices, the cost was not exorbitant, as an average bearing orchard will pay a fair rate of interest on that investment. The prevailing high prices for good orchard lands have resulted largely from the fact that a class of people of ample means have been attracted to this valley by the returns received from well-cared-for orchards. They have been able to pay good prices for land which suited them and were not concerned with making the land yield an immediate revenue. While this is all right if the valley is to be developed exclusively along the line of fruit production, it will result in a decidedly unbalanced development. No one-crop country, however profitable the yields may be, is entirely safe from periods of depression, and where other agricultural development is most restricted the depression is most severely felt. Such a condition has arisen in other one-crop sections, and there is no reason to suppose that this valley enjoys any special immunity. These statements are not made with any intent of discouraging a normal development of the fruit industry, for it is one of the most valuable resources of the valley, but merely to call attention to the one-sided development which is now going on.

As has already been stated, the soil and climatic conditions of this region are well adapted to the profitable production of other crops, and the endeavors of those interested in the welfare of the valley should be to create a more diversified system of agriculture.

The fear is entertained by many that the continued planting of apples and pears will lead to an overproduction of these fruits. That an overproduction of apples is unlikely to occur is evident from two facts. Government statistics show that the apple crop has been steadily decreasing. Furthermore, there is a strong demand for choice fruit, not only in the domestic markets but in various foreign markets as well. Fruit of inferior quality sometimes meets with periods of depression, but for the high-grade fruit such as is produced in this valley the market demands are ample. The same is true of the pear. That the fruit grown in this valley is of superior quality is not merely the opinion of a few interested persons, but it has been conclusively proven by repeated first awards at fruit fairs and expositions and by the still more convincing evidence of top prices in practically all of the markets of the civilized world. For fruit of this grade there is no such thing as an overproduction.

#### SOILS.

The area surveyed may be considered in four geological divisions: (1) The districts included within the western part of the area, made up of a group of old metamorphosed eruptive rocks of complex structure, greenstones, with included areas of unaltered granites and small bodies of slate and limestone; (2) the middle part of the area, along its axis north and south, composed of unmetamorphosed sedimentary rocks of Cretaceous age, consisting of shales and sandstones, with some conglomerate; (3) the districts included within the eastern part of the survey, covered with a later sheet of basaltic rock; and (4) the stream valleys, covered with a mantle of alluvium.

In the central valley of the area and in the local mountain valleys this alluvium occurs as broad level to sloping sheets, but throughout the northwestern region traversed by Rogue River, in the Applegate Valley, and in the valleys of some of the minor streams the alluvial deposits are narrow and bounded by steep escarpments.

The valley of Bear Creek, constituting the main part of the central valley of the area, has been eroded in the comparatively soft shales and sandstones along the line of outcrop of beds.

The metamorphic and unaltered granitic rocks, therefore, occur only along the western side of the valley. The Siskiyou Mountains, bordering the valley of Bear Creek upon the west, the mountainous areas in the vicinity of the Applegate Valley, and the area adjacent to Rogue River west of Raygold are of this character.

Much of the area of shale and sandstone rocks occurring in the valley district has been removed by erosion or obscured by later

deposits. From Ashland northward along the western side of the valley they appear only in occasional patches. Above Ashland they are exposed at the base of the Siskiyou Mountains over a large part of the valley. Along the eastern side of the valley they are of more frequent occurrence. Erosion of the relatively soft rocks of this group has here given rise to the rolling, hilly country lying at the base of the basaltic mountains and extending nearly to Eagle Point. These sedimentary rocks, which dip gently eastward, are probably continuous beneath the alluvial covering of the entire valley belt.

The areas of basaltic rock occur well up on the eastern slope of the valley, but uneroded remnants, indicating wider distribution in places, closely approach the valley or appear as isolated knobs or tablelands. Conspicuous examples of this may be seen in the Upper and Lower Table Rocks.

The water-laid or alluvial deposits are widely distributed over the valley area. Some of these deposits lie near the mountain foot slopes, and have their source in material eroded from the adjacent mountain sides and deposited by torrential streams. They occur as broad, alluvial fans, traversed by intermittent streams, sloping gently from canyon mouths to the more nearly level valley floor. Such material, commonly designated as alluvial cone or alluvial fan deposits, is not locally extensive, but is typically developed in certain places along the western side of the valley.

The floors of the valleys are generally occupied by old alluvial deposits lying well above the present flood plains of the streams. Some of the older deposits are coarse in texture, though the fragments which have been transported a considerable distance are well rounded. These early, coarser, alluvial deposits have quite generally become cemented or partially consolidated. Some of the material of this kind has been removed from the valley by erosion, but owing to its compact or cemented condition it is less easily eroded than other alluvium, probably of later age. Remnants of the deposits in various parts of the valley indicate its more extensive occurrence in former times.

Some of the older sedimentary material, probably deposited, however, subsequently to that described above, is of dark color, and in the main represents the finer material carried to the valley floor by mountain streams, the coarser load of which has been dropped upon more abrupt alluvial fan slopes.

In the vicinity of the channels of the larger streams occur small areas of recent alluvial deposits confined to present flood plains and lower alluvial benches. These deposits form long, narrow areas parallel to the stream courses, are sometimes subject to overflow, and represent the most recent work of aggradation by the streams.

All of the three groups of alluvial deposits, when occurring near hill or mountain slopes, are subject to admixture of unsorted colluvial

material derived from the higher slopes, and transported by creep or slipping, washing by rains, or other agencies.

The characteristics of the soils of the area vary with the kind of material from which they have been derived and with the agencies active in their formation. The unit of classification is the soil type. Forty-three distinct types are recognized in the present survey and the extent and distribution of each indicated in color on the accompanying map. Certain minor phases of some of the soil types have further been shown by the use of symbols or hachures. The soil types are grouped under a number of soil series with a few additional types of miscellaneous material. Each soil series possesses certain salient differences in origin, mode of formation, topography, color, or in character of underlying material, or in all or several of these features that distinguish it from other series. In any single series, however, the individual soil types have like characteristics of the above order, but differ from other types in texture, which is determined by the proportion of mineral particles of different sizes.

The general character of the soil series established in the area may be briefly summarized as follows:

The residual soils, those derived by decay of rocks in place, are confined mainly to the hilly and mountainous districts. They include those classed under the Siskiyou, Tolo, Sites, Aiken, Olympic, Climax, and Brownsboro series.

The Siskiyou series is represented by a single soil type, the Siskiyou coarse sandy loam. This is derived from the granitic rocks occurring along the western side of the valley from Ashland southward and in small areas north of this place. This type occupies the moderate to steeply sloping sides and foot slopes of the Siskiyou Mountains, is covered with a dense growth of brush and timber, and, on account of the irregular topography, is largely nonagricultural.

From Ashland northward the granite is succeeded by a series of rocks (greenstones) thought to be both intrusive and effusive in origin. Occasional inclusions of slate and limestone are also present. The decomposition of these rocks has given rise to the Tolo series of soils. This series occupies the greater part of the slopes of the western mountains from near Ashland northward to beyond the limits of the present survey. Occasional bodies of soils derived from sandstone and granite are associated with this series, but they occupy only a very small area. The Tolo series is represented by a single type, the greater part of which is covered by an almost impenetrable growth of forest and underbrush. The type has a rugged topography, and for the most part is nonagricultural.

Upon the eastern side of the Bear Creek Valley and extending from the southern extremity of the area northwestward to Coker Butte the country consists of a series of low, rounded hills and intervening



ORCHARDS ON MEDFORD GRAVELLY CLAY LOAM IN THE SLOPING VALLEY SOUTH OF MEDFORD. PEARS IN FOREGROUND;  
APPLES IN BACKGROUND.



swales and ridges. It has been formed by the erosion and weathering of a thick mass of grayish sandstone and conglomerate. This same formation occurs also at intervals along the base of the mountains forming the western border of the valley from the southern boundary of the area northwest to a point opposite Central Point, and is found rather extensively distributed in that part of the area north of the Rogue River. The decomposition of this sandstone and conglomerate has given rise to soils of the Sites series. These vary in texture from a sandy loam to a loam, are prevailingly reddish or yellowish-brown in color, and are often of shallow depth. Rock outcrop is not uncommon, and fine water-worn gravel is a constituent of several of the types. These soils may be treeless or carry a fair to heavy growth of brush and timber, the stand of vegetation being somewhat indicative of the depth of the soil. The drainage conditions are generally good.

From the northern end of Roxy Ann Ridge, in the eastern-central part of the area southward, weathering of lava rocks has given rise to the Climax clay adobe, the soil representative of the Climax series. This soil is found on the steep mountain slopes and is mainly residual in origin, though it includes some colluvial and alluvial foot-slope material. It is dark brown to black in color and carries varying quantities of small subangular rock and gravel.

The weathering of the basaltic rocks has also given rise to three other series of soils, embracing five types and occurring mainly in the northern part of the area. One of these, the Olympic series, forms the larger part of the mountainous area referred to. The topography is rugged, the soils lying upon the steep hill and mountain slopes and frequently extending over the crests of the lower elevations. Rock outcrop and fragmental masses of rock are not uncommon, and the bedrock is frequently close to the surface, rendering areas of the soils nonagricultural.

Associated with the above series are the Aiken and Brownsboro series. In origin the soils of these series are similar to those of the Olympic. The main point of distinction is in the color of the soil, the Olympic soils being dark brown to light brown, those of the Brownsboro series yellow to light brown, and those of the Aiken series bright red to reddish brown. In topography and agricultural value the three series are very similar.

The soils of the alluvial fans and alluvial foot slopes include the soils of the Barron, Hanford, Clawson, Phoenix, Meyer, Coleman, Coker, Medford, and Bellavista series. Some of these are so closely associated with the alluvial stream-laid soils of the river flood plains and terraces as to necessitate a somewhat arbitrary separation, while others are associated with the soils of the residual series and include more or less undifferentiated residual material. In several of the soils, particularly those of the Barron, Clawson, Phoenix, Meyer, and

Coker series, the surface material is generally thin and overlies shale and sandstone rocks, the deeper subsoils being of residual origin and derived from the latter source.

The Barron series, which is represented by two members of coarse texture, occurs along the base of the Siskiyou Mountains from Ashland southward. The surface material is derived mainly from granitic rocks. The subsoil is mainly of residual origin from underlying shale. The surface of these soils has a pronounced slope, a smooth to slightly rolling contour, is cut by numerous stream channels draining the higher lands, and to a large extent is covered with a moderate to heavy growth of oak, pine, and fir, with laurel and underbrush.

The soils of the Clawson and of the Hanford series occurring in this group are also derived mainly from granitic material. Each of these series is represented by a single soil type. The Clawson soil is characterized by a subsoil which is in part residual from underlying shales. It differs from the soils of the Barron series in the darker color of the surface soil and in drainage conditions. The soil of the Hanford series is derived from stream-laid deposits and is closely associated with the soils of the river flood plains and terraces, but occurs only as an inextensive body along the course of Ashland Creek below the point at which it emerges from the Siskiyou Mountains.

The Meyer series of soils is derived mainly from material washed from basaltic rocks, but includes some material from shale and sandstone. The subsoils are in part residual from shales and sandstones, which usually lie at shallow depths, and the soils as mapped include numerous areas of considerable extent in which the surface material is of residual origin. This series is represented by two members which occupy the lower mountain slopes and hilly and rolling land east of Bear and Neal Creeks from the southern boundary of the area northward to sections 26 and 27, in T. 37 S., R. 1 W. Several additional small bodies also appear in the western side of the valley not far from Medford. The slope is moderate to steep, outcrops of shale and sandstone are common, and small quantities of waterworn gravel are included in the soil. The depth of the soil is extremely variable, and this, together with the often abrupt slopes, renders portions of this series nonagricultural. These soils are practically treeless, but suffer little from erosion.

A single type represents the Coker series. It is derived from material from volcanic rocks. The largest body of this soil occurs in the relatively level country just north of Coker Butte. Numerous smaller bodies are found in various parts of the area to the north. The surface is generally uniform, treeless, and poorly drained in many places. The soil has a pronounced adobe structure, may carry some waterworn gravel, and, when near the slope of the hills or mountains, is sometimes closely underlain by bedrock of basalt, the soil and subsoil being in such places in part residual.

The Phoenix series, represented by two types, differs from the Coker series essentially in the usual occurrence of shale and sandstone substrata, the deeper subsoil being generally of residual origin from this source.

The Coleman series is represented by a single soil type which consists of typically developed alluvial fan deposits derived predominantly from the quartz-free greenstones.

A number of soil types ranging in texture from gravelly fine sandy loam to clay adobe have been placed in the Medford series. They occupy areas of moderate extent near Central Point, Talent, and Jacksonville, and north of this town. The soils and subsoils are of dark color, are derived from a variety of rocks, and consist mainly of alluvial deposits of minor intermittent streams. The surface is usually gently sloping or flat and in mode of origin and topographic position they do not differ materially from the recent soils of the river flood plains and terraces occupying the axis of the valley into which they merge. Some of the types carry subangular gravel and in the vicinity of the areas occupied by the Agate series cemented gravel and hardpan strata may be present in the subsoil.

The Bellavista series is represented by a single type, occupying inextensive areas. It is of minor importance and is not strictly typical of this series, but has been correlated with the soils previously mapped under this name in other surveys.

The alluvial soils of the area fall into six series, embracing 11 types. The alluvial division may be separated into two groups—those derived from old and those from recent alluvium.

Of the older alluvial soils the oldest and most extensive are those of the Agate and Antelope series. These soils appear to constitute what is left of the earliest alluvial filling of the valley, and traces of the former extent of this deposit are of widespread occurrence either as one or the other of these widely distributed series of soils or as layers of cemented gravels underlying a considerable portion of the floor of the valley. The largest continuous body made up of the soils of these series, embracing some 16,000 acres south of the Rogue River and upon the eastern side of the lower Bear Creek Valley, is locally known as the "Desert," the name arising from the fact that this section is practically treeless, while the surrounding land was originally more or less heavily timbered. Detached bodies of these soils are generally spoken of as "little deserts," the locations being designated by the name of some nearby topographic feature or ranch. Portions of the soils of this series sometimes carry a scanty growth of brush, and on the lighter members fair stands of timber and brush are not uncommon.

The surface is gently to sharply sloping, generally marked by numerous low "hog-wallow" mounds and accompanying depressions, and traversed by numerous small, poorly defined drainage ways. The surface soil of the Agate series is reddish to yellowish-brown, and that of the Antelope series dark-brown to black. The soils generally contain considerable quantities of small to medium waterworn gravel, and in the surface depressions waterworn gravel and boulders of volcanic material are commonly abundant. They are, with very few exceptions, underlain by a thin stratum of dense ferruginous hardpan. The subsoil is a heterogeneous mixture of waterworn cobbles, coarse and fine gravel, and finer material, compact and very often firmly cemented to unknown depths. It is known that parts of this consolidated gravelly subsoil are not as firmly cemented as other parts; that at times it is more deeply buried than usual, and that occasional portions of the subsoil approach a fine sandy loam in texture. The very gravelly nature of the soils of this series and the usual cemented nature of the subsoil prevent any very close examination of the subsoil conditions for the larger part of the area covered.

The recent alluvial soils in the area occupy irregular, narrow areas along the larger streams in the main valley and along the small streams in some of the local valleys. The areas are often bordered by terraces from 10 to 30 feet in height, rising to the main part of the valley floor.

Along the Rogue and Applegate Rivers and Reese, Bear, and Little Butte Creeks and their branches the Salem series is developed. These soils are composed of erosion products derived from a vast mountainous region north, south, and east of the Medford area survey, where the rocks are mainly volcanic and eruptive. The surface of the Salem types is smooth to rolling, broken by occasional swales and shallow stream courses. With the exception of one type, beds of waterworn gravel, carrying some finer material, underlie the surface soil at varying depths below 2 feet. The color of these soils varies from a light-brown to black, the lighter color being associated with the lighter textured types.

Recent alluvial soils occurring along upper Bear Creek and its tributaries have been mapped as the Neal series. The material has been washed from a region of varied rocks and soils. West of Bear Creek the material seems to come mainly from the granitic rocks and sandstone, while to the east it has been washed from areas of shale, sandstone, and volcanic rocks. The members of this series have a smooth to slightly eroded surface, are rarely overflowed, and are fairly well drained. Nearly all the areas of the Neal soils are under cultivation.

A fine sandy loam is the only soil correlated with the Evans series. This occupies the lower land bordering Evans and Pleasant Creeks, in the extreme northwestern part of the area, and consists of the alluvial deposits from those streams. The Sams loam, representing the Sams series, occurs in two irregular bodies of soil of considerable extent along the streams draining local valleys in the northern-central part of the area. Riverwash includes undifferentiated material occupying a low position along the larger streams. It is flooded annually and is of no agricultural importance.

The type designated as Rough stony land includes all of those parts of the area in which rock outcrop, boulders, or masses of loose rock are so abundant as to render the soil valueless for anything but grazing or forestry. The main occurrence is on the crests of the mountains and higher hills, but not all of the higher elevations are of this type. In the eastern part of the area surveyed the higher elevations are generally too rocky to be of much agricultural value, while in the western and northern mountains rock outcrop is relatively rare, and soil of considerable depth is generally to be found upon the slopes and crests of the various ridges and peaks.

In the following table are given the name and extent of each of the soils mapped in the Medford area:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Tolo loam.....	15,936	25.2	Olympic clay loam.....	3,264	0.9
Stony colluvial phase.....	71,744		Salem fine sandy loam.....	3,264	.9
Rough stony land.....	58,816	16.9	Brownsboro coarse sandy loam...	3,136	.9
Agate gravelly loam.....	17,024	7.1	Medford loam.....	2,560	.7
Deep phase.....	7,680		Antelope clay adobe.....	2,432	.7
Olympic clay adobe.....	23,040	6.6	Neal fine sandy loam.....	2,368	.7
Climax clay adobe.....	17,216	4.9	Meyer silty clay loam.....	2,240	.6
Siskiyou coarse sandy loam.....	12,160	3.5	Neal silty clay loam..	1,984	.6
Sites fine sandy loam.....	11,392	3.3	Riverwash.....	1,920	.6
Meyer clay adobe.....	8,960	2.6	Evans fine sandy loam.....	1,920	.6
Sites sandy loam.....	7,872	2.3	Barron sandy loam.....	1,792	.5
Barron coarse sand.....	6,528	1.9	Antelope clay.....	1,792	.5
Coker clay adobe.....	6,080	1.9	Sites loam.....	1,536	.4
Dark colored phase.....	448		Neal clay adobe.....	1,280	.4
Medford gravelly clay loam.....	6,400	1.8	Aiken clay.....	1,152	.3
Coleman gravelly loam.....	5,888	1.7	Medford clay adobe.....	768	.2
Salem clay loam.....	4,736	1.4	Aiken clay adobe.....	768	.2
Sams loam.....	4,672	1.3	Clawson loam.....	768	.2
Phoenix clay adobe.....	4,544	1.3	Phoenix clay loam adobe.....	576	.2
Agate gravelly sandy loam.....	4,416	1.3	Bellavista fine sandy loam.....	576	.2
Salem clay adobe.....	4,352	1.2	Medford gravelly fine sandy loam.	320	.1
Sites gravelly fine sandy loam.....	4,288	1.2	Handford coarse sandy loam.....	192	.1
Salem gravelly sandy loam.....	3,904	1.1			
Medford fine sandy loam.....	2,456	1.0	Total.....	348,160	.....

## SISKIYOU COARSE SANDY LOAM.

The Siskiyou coarse sandy loam consists of 12 to 18 inches of a gray to dark-gray sandy loam, carrying a large quantity of fine, angular rock fragments and coarse sand, underlain either by a compact red clay loam or by more or less altered granite. Where the clay loam subsoil is found it is usually of considerable depth, but ultimately rests upon the granite bedrock.

This soil occupies the mountainous portion of the area in the southeast of Ashland, and occurs not only upon the slopes, but frequently extends to the top of the higher peaks. It is residual in origin, being derived from the underlying granite.

On the lower slopes of the mountains a portion of this type has been cleared and planted to orchards, but the larger area of the soil is covered with a heavy growth of pine, fir, laurel, and brush. The rugged topography renders this larger part unfit for agriculture, and it is valued only for the timber which it supports. The more level portions of the type are excellently adapted to peaches and cherries, and many of the small fruits do fairly well.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

*Mechanical analyses of Siskiyou coarse sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25692.....	Soil.....	22.0	18.6	8.8	19.2	10.3	13.8	7.4
25693.....	Subsoil.....	11.8	14.6	7.7	18.0	11.0	14.3	22.7

## TOLO LOAM.

The Tolo loam has a light-brown color and a rather fine loam texture, but as mapped it includes patches of material ranging in texture from a fine sandy loam to a heavy clay loam and in color from light grayish brown to red. In a more detailed survey a number of these materials would have been recognized as separate soil types. The typical subsoil is a compact red or reddish-brown clay.

The surface soil may be underlain at any depth below 6 inches by bedrock and rock outcrop may mark the surface, though this is not usual. Fragments of rock of varying size are present, and on the lower slopes angular or subangular gravel is more or less abundant in both soil and subsoil.

An extensive body of this soil occupies the mountainous part of the area from Ashland northwestward to its boundary. It is also the prevailing type in the isolated portion of the survey embracing the region of the Applegate Valley. It includes areas of undif-

ferentiated soils of the Tolo and of the Sierra series, the latter of widespread occurrence in the Sierra Nevada Mountains in California and distinguished from the typical Tolo soils by a pronounced red color. The Tolo loam occupies the tops, the steep to precipitous sides, and the more gentle lower slopes of the mountain ranges.

This is a residual soil derived from a variety of intrusive and eruptive altered volcanic rocks, with small bodies of slate and limestone. The altered volcanic rocks are largely greenstone.

An extremely rugged topography of the country in which the Tolo loam is developed precludes, in large measure, its development for agriculture, and except for a few clearings made by lumbermen or fires it is now covered with a dense growth of forest trees and brush. Where of sufficient depth and not too sloping it will be found adapted to pears, apples, and grapes, both European and American varieties. (See Pl. III.)

*Tolo loam, stony colluvial phase.*—The Tolo loam, stony colluvial phase, is somewhat variable in profile characteristics, but usually consists of 6 to 18 inches of a grayish-brown or dark-brown to reddish-brown loam, resting upon a subsoil of rather heavy clay loam of red to reddish-brown color and carrying a large quantity of subangular gravel and stone. The immediate surface soil is generally free from gravel or rock.

This phase of the Tolo loam occurs in a few small areas along the base of the western mountains, in the vicinity of Ashland north-westward into Pleasant Valley. It also covers considerable areas in the neighborhood of the Applegate Valley.

The slope of the surface is pronounced but generally uniform. Small mountain watercourses draining the higher lands flow through the areas. The deeper strata, and occasionally the surface soil, carry more or less gold, and numerous areas have been worked over in placer mining since the opening of the valley. In places the soil has been cut away to a depth of many feet when mining operations were profitable, leaving huge piles and windrows of cobbles and boulders. When gold was not found in sufficient quantities, only the surface soil was worked, leaving the surface where mining operations have been conducted badly eroded and strewn with gravel.

The soil is colluvial in mode of formation, the material being transported by slides, creep, and wash from the adjacent mountain slopes where the typical Tolo loam is the prevailing soil. Originally a heavy growth of trees and brush covered the areas, but in the mining sections the native timber has been largely removed. A few areas have been cleared for cultivation. It is well drained, and where not too rough or stony well adapted to pears and apples. With irrigation it would give good crops of small fruits and alfalfa.

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

*Mechanical analyses of Tolo loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25661, 25663.....	Soil.....	5.2	7.2	3.7	8.9	11.5	43.9	19.5
25662.....	Subsoil.....	2.0	3.1	1.5	3.0	5.8	33.0	51.8

SITES SANDY LOAM.

The Sites sandy loam consists of a reddish brown to light-brown sandy loam soil, from 6 inches to 6 feet or more in depth, usually carrying small quantities of fine, water-worn gravel and becoming darker in color with increasing depth. The texture, except where influenced by adjacent types of soil, is uniform throughout the soil profiles. The soil is underlain by the grayish to reddish-brown sandstone associated with this series.

As with the fine sandy loam of this series, the depth of the soil is extremely variable, and careful investigation should precede any development work. Upon the crests of the higher knolls and along the steeper hillsides rock outcrop is not uncommon. At times such outcrops consist of several feet of rock exposed in vertical walls.

Bodies of this soil are encountered throughout the area from the southeast extremity northwestward to the boundary of the survey north of the Table Rocks. An irregular body in Sams Valley is the largest continuous body in the area. Small areas occur a little distance south of Eagle Point and the remaining areas in the hilly region southeast of Ashland.

North of the Rogue River the Sites sandy loam occurs as a sloping, rolling bench, forming a distinct terrace above the adjacent alluvial soils and increasing in elevation northward until it merges into the steep mountain sides. Southeast of Ashland it occupies the crests and slopes of several prominent ridges west of Emigrant Creek, and occurs also in the lower lands along the several intermittent streams draining that portion of the valley.

This type is derived from the decomposition of the underlying sandstone. Much of the soil is in place, but on the steeper slopes and on the lower elevations some of the soil material is of colluvial origin.

A portion of this soil carries a fair growth of trees and brush, but large areas are treeless and covered only with a scanty growth of grass. The stand of native vegetation is, as a rule, a very good indication of the depth of the soil. Where fair stands of trees are found

a good depth of soil may be expected, and with a decrease in the size and numbers of the trees and brush a decreasing depth of soil may be expected.

Here and there areas of this soil are devoted to grain farming or used for pasture, and an occasional planting of fruit trees may be found, but the larger part of this soil is yet undeveloped. Where of sufficient depth this type will prove adapted to peaches, apples, pears, cherries, and small fruits.

The following table gives the average results of mechanical analyses of samples of the soil of the Sites sandy loam:

*Mechanical analyses of Sites sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25650, 25651.....	Soil.....	2.3	11.2	12.5	21.8	12.8	20.5	18.8

SITES GRAVELLY FINE SANDY LOAM.

The Sites gravelly fine sandy loam consists of a reddish brown to light brown very gravelly fine sandy loam, varying in depth from 6 inches to 6 feet or more. The gravel in the soil is small and water worn and generally forms the larger part of the soil mass. The texture remains much the same throughout the section, any variation found being due solely to difference in gravel content. The color may continue uniform from the surface downward or the reddish tinge may become more pronounced with increasing depth.

The soil is underlain at any depth below 6 inches by a hard, grayish sandstone in which are embedded small water-worn pebbles. The upper stratum of this rock usually is somewhat decomposed, and when exposed rapidly weathers into a very gravelly soil. Rock outcrop is not common. The type appears as small bodies east of Bear Creek, occurring from a point 3 miles northeast of Ashland northwestward to the vicinity of Coker Butte.

The Sites gravelly fine sandy loam occupies the crests of low hills, knolls, and ridges which form the more or less elevated portions of the valley just east of Bear Creek. It also occurs as a single body of sloping or rolling topography north of Lower Table Rock in the northern part of the area. The surface varies from slightly to sharply rolling and is occasionally very steep in places where eroded by streams. The drainage is good and in some places excessive.

This type owes its origin to the decomposition of the underlying pebble-embedded sandstone.

Where the soil is shallow the native vegetation consists of a scanty growth of grass; where of considerable depth larger types of vegetation, such as brush and trees, are found.

The larger part of this type is not under cultivation, but is used for pastures. It affords inferior grazing during the winter and spring months. Here and there where soil of sufficient depth has been encountered orchards of apples and pears have been planted. Not many of these trees have reached a bearing age, but where proper care and attention has been given them they are vigorous and healthy. Such orchards will doubtless prove profitable. The deeper soil is not only adapted to apples and pears, but should prove one of the valuable peach soils of the valley.

Extension of the orchards on this type should be preceded by a thorough examination of the land to determine the depth of the soil, and no plantings are advised where there is less than 4 feet of soil above the bedrock. Where the rock is closer the risk is too great, considering the investment required to bring an orchard to the bearing age. The natural conditions are unfavorable to irrigation and it will be almost impossible to retain sufficient moisture in the soil to supply the needs of the trees.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Sites gravelly fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25653.....	Soil.....	5.8	8.1	6.9	17.0	14.8	23.1	24.5

SITES FINE SANDY LOAM.

The Sites fine sandy loam consists of a light reddish-brown or light grayish-brown fine sandy loam varying in depth from a few inches to 6 feet or more, the color and the texture of the soil being very uniform throughout the section. The fine water-worn gravel characteristic of several members of this series occurs in this type only in areas bordering upon the gravelly types.

The soil rests directly upon the bedrock, a grayish, compact, fine-grained sandstone. The upper part of this rock may not be decomposed, although in many places a foot or more of thoroughly disintegrated rock intervenes between the soil and the solid rock stratum.

The depth of the soil is exceedingly variable, not only for the type as a whole but within very short distances. Often only 10 or 15 feet marks the division between a soil several feet in depth and one less than a foot in depth and of no agricultural value. Outcropping ledges of rock are numerous.

South of the Rogue River this type is rather widely distributed. Along the western side of the valley it occurs in small scattered bodies on the lower slopes of the Siskiyou Mountains and bordering hills from near Central Point southeastward to near the southern extremity of

the area. East of the axis of the main valley it occurs as small bodies in the rolling country east of Bear Creek and extending from Talent northward nearly to Eagle Point. The soil here lies on the crests of knolls and ridges and on the lower undulating slopes below. The surface is devoid of minor irregularities, is traversed by numerous streamways, and the slope varies from moderate to steep. Drainage is good and sometimes excessive.

The underlying sandstone is the parent material of this type, the soil having been formed in place through the agencies of weathering.

Practically all of this soil was at one time covered with a growth of brush (ceanothus and manzanita) and oak, laurel, and pine. Some of this has been removed, but much of the type still carries its covering of native vegetation. Not all of the cleared land is devoted to agriculture, as portions of it are absolutely worthless, owing to the nearness of the underlying sandstone. Scattering orchards and farms are to be found on this type, but the larger part is not under cultivation. When of sufficient depth the soil is well adapted to peaches, cherries, grapes, pears, and small fruits.

The following table gives the average results of mechanical analyses of samples of the soil of the Sites fine sandy loam:

*Mechanical analyses of Sites fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25655, 25656.....	Soil.....	1.3	9.0	13.7	22.0	14.1	20.9	19.1

SITES LOAM.

The Sites loam consists of from 1 to 6 feet or more of a dark-reddish brown to dark-brown loam, usually of uniform texture and free from gravel. The soil may be underlain at any depth below the first foot by the sandstone common to this series of soil.

This type occurs in rather small bodies east of Bear Creek from Talent northward to Coker Butte. The surface is rolling, without irregularities, save occasional shallow drainage ways, and is generally treeless.

This soil is residual in origin, being composed of material derived through decomposition of the underlying sandstone.

It is only partially developed and is not well adapted to irrigation, but where of sufficient depth will be found adapted to the production of pears, apples, peaches, truck crops, and small fruits.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Sites loam:

*Mechanical analyses of Sites loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25647.....	Soil.....	3.0	6.8	6.5	18.8	16.0	24.2	24.7
25648.....	Subsoil.....	.9	3.0	4.0	16.6	16.1	25.5	34.0

AIKEN CLAY.

The Aiken clay consists of 6 inches to 2 feet of dark-red or reddish-brown clay, underlain usually by a dark-red to a purplish-red clay or by bedrock. The clay subsoil, if present, may be of any thickness, at times extending to more than 6 feet below the surface. The soil is of residual origin, being derived from basaltic rocks. Locally there is an admixture or a veneer of colluvial material of similar character.

This type of soil is developed in the north-central and northeastern parts of the area as a few widely separated bodies of small extent lying well up on the slopes of the mountains. The topography is uneven, the soil often shallow, and marked by boulders and rock outcrop. It is not at present cultivated and has little agricultural value.

Mechanical analyses of samples of the soil and subsoil gave the following results:

*Mechanical analyses of Aiken clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25696.....	Soil.....	2.5	5.5	3.5	8.1	5.9	37.8	36.8
25697.....	Subsoil.....	2.5	4.2	2.5	5.9	5.6	20.8	58.8

AIKEN CLAY ADOBE.

The Aiken clay adobe consists of a bright to dark purplish red clay, from 6 inches to 6 feet or more deep, possessing a pronounced adobe structure and underlain by parent basaltic rock at any depth below 6 inches. Much of this type is very shallow. Rock outcrop is common and the surface frequently carries a considerable quantity of angular basaltic boulders. It is mainly residual in origin, but includes some colluvial material.

This type, as mapped, is confined to a few small bodies in the northern and northeastern parts of the area. It is also found throughout the entire hilly and mountainous country in the eastern part of the area as very small patches in areas of other recognized

types. These patches are for the most part too small to be shown on a map of the scale used in this survey.

On account of the uneven topography and the nearness of the bedrock to the surface, the Aiken clay adobe is of little agricultural value. It is nonirrigable and not at present cultivated.

The following table gives the results of a mechanical analysis of a sample of soil:

*Mechanical analysis of Aiken clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25698.....	Soil.....	2.7	3.4	2.5	5.4	4.5	19.1	62.6

OLYMPIC CLAY LOAM.

The surface soil of the Olympic clay loam consists of 12 to 24 inches of light-brown heavy, sticky clay loam. The subsoil is a clay loam to clay, light brown to dark brown in color, and of uniform texture. Bedrock is seldom found within 6 feet of the surface and then only near the contact with the Rough stony land.

This type of soil occurs in rather small bodies on the lower slopes and depressions of the hilly and mountainous portions of the north-eastern part of the area surveyed. Its southern limit lies in the vicinity of the northern end of Roxy Ann Ridge. A large proportion of the type lies north of Rogue River. It is very closely associated with the clay adobe of this series and consists mainly of colluvial material derived from the clay adobe member, the two at times being hardly separable. The character of the surface ranges from smooth to rough.

Practically none of this soil is under cultivation, and it is still covered with forests consisting of a fair to heavy growth of oak, pine, and brush. The areas are not favorably situated for irrigation. They are fairly well drained, and much of the land is suitable for the production of pears and small fruits.

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

*Mechanical analyses of Olympic clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25644.....	Soil.....	1.5	4.1	3.9	11.5	12.6	36.1	30.3
25645.....	Subsoil.....	1.0	2.7	3.0	10.2	12.6	30.9	39.6

## OLYMPIC CLAY ADOBE.

The Olympic clay adobe consists of a grayish-brown to dark-brown clay, from 1 to 6 feet or more deep, and showing an adobe structure. Fragments and outcropping ledges of rock are common, and over a considerable area of the type the bedrock lies close to the surface and, except upon lower slopes, it is always within the 6-foot profile. The texture is very uniform throughout the soil profile, while the color, although in most places uniform to the underlying rock, sometimes becomes yellowish with increasing depth.

This type is widely distributed in the mountainous and hilly regions of the northern and northeastern parts of the area, where it usually occurs in bodies of considerable extent. The topography in general is very uneven, the soil lying on the crests and steep slopes of the higher mountains and hills and upon gently rolling slopes of lower elevation. Except where broken by masses of rock outcrop and by occasional erosions along some of the minor streamways, the surface in detail is very uniform.

The formation of this type is due to the weathering and decomposition of basaltic rocks, with additional accumulations of colluvial material from the same source.

All of this soil originally carried a fair to dense growth of trees and brush, the larger part of which still remains. Some cleared areas are either sown to grain for hay or are used for pasture. A few young orchards are to be found on various areas of this type and where they are on soil of good depth should succeed. This soil will be found best adapted to pears. The type is poorly adapted to irrigation.

Average results of mechanical analyses of samples of this soil are given in the following table:

*Mechanical analyses of Olympic clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25716, 25717.....	Soil.....	0.9	2.2	2.0	5.3	4.6	27.8	57.2

## CLIMAX CLAY ADOBE.

The Climax clay adobe consists of from 1 to 6 feet or more of black clay, having a pronounced adobe structure and in many places a high content of small angular gravel. Outcropping masses of rock are not uncommon. The soil may rest at any depth below 1 foot upon the bedrock, which consists of dark-colored lavas.

This type occurs as a continuous but irregular body extending from the vicinity of Ashland northward to the extremity of Roxy

Ann Ridge. Other small isolated bodies lie in the extreme south-eastern part of the area.

The type occupies the crests and steep slopes of the hills and mountains along the eastern side of the Bear Creek Valley and the more gently sloping colluvial slopes and fans extending nearly to Bear Creek. Some erosion has occurred upon the higher, steeper slopes, but otherwise the surface is fairly uniform.

This type is both residual and colluvial in mode of formation. On the crests and upper slopes of the mountains the soil is residual, having been formed in place by decomposition of the underlying and outcropping lavas. On the lower slopes the soil owes its present position to colluvial agencies, which have transported the residual soil material to lower levels.

The larger part of the treeless portion of this type is used for grazing. Grain hay is sometimes produced, but on account of the pronounced adobe structure of the soil, which favors the rapid loss of moisture, the yields are uncertain. As yet this soil has no bearing orchards, but a large number of young trees have been planted within the last two or three years. Where the soil is of sufficient depth it will be found adapted to pears. Apples will yield fair returns, but the soil is a little heavy for the best results.

A mechanical analysis of a sample of the soil gave the following results:

*Mechanical analysis of Climax clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25641.....	Soil.....	1.5	4.9	4.1	9.3	8.0	29.5	42.4

BROWNSBORO COARSE SANDY LOAM.

The Brownsboro coarse sandy loam consists of a yellowish to light yellowish-brown loam of rather coarse sandy texture, usually carrying angular and in places rounded rock fragments. It varies in depth from a few inches to 6 feet or more, and is underlain by volcanic rocks, usually basaltic, the average depth to which is probably less than 3 feet.

The type occurs as small scattered bodies in the mountainous portions of the area north of Eagle Point, in the vicinity of Brownsboro, and west of the Rogue River in the extreme northeastern part of the area in the vicinity of Trail. It generally occupies a position just below the rough stony land. The surface slope is usually steep.

Owing to the generally shallow depth of the soil and the steep slope, this type is one of the least valuable farming soils in the area. It is excessively drained, and can not be irrigated.

The following table gives the results of a mechanical analysis of a sample of the soil of this type:

*Mechanical analysis of Brownsboro coarse sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25695.....	Soil.....	10.9	20.5	10.3	15.0	6.1	27.9	9.1

BARRON COARSE SAND.

The Barron coarse sand consists of a light gray or grayish-brown sand of sticky loamy character, usually from 12 to 24 inches in depth, but in some places extending to the depth of 6 feet or more. The surface soil carries large quantities of fine, angular rock fragments of the size of fine gravel, and is underlain by a yellowish or yellowish-brown sticky clay loam, extending to a depth of 6 feet or more. Bedrock seldom comes within 6 feet of the surface, and then only along the terrace bordering the alluvial bottom soils.

This type is found in the southern part of the area, between the Siskiyou Mountains on the west and the axis of Bear Creek Valley, where it occurs as a bench or terrace formation above the creek-bottom soils. The surface is uniform to slightly rolling and dissected by numerous small streams which drain the outer slope of the mountains.

In origin this soil is colluvial-residual, the surface material being wash from granitic rocks and the subsoil being derived from the disintegration of shale in place.

Near Ashland this soil is partly under cultivation, being planted to apples, pears, peaches, cherries, and small fruits, to which it is well adapted. With further development it should make one of the valuable orchard soils of the valley.

The following table gives the average results of mechanical analyses of the soil:

*Mechanical analyses of Barron coarse sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25625, 25626.....	Soil.....	22.4	22.6	9.1	16.5	11.4	12.1	5.9

BARRON SANDY LOAM.

The Barron sandy loam consists of 12 to 30 inches of a gray to light-brown sandy loam without gravel. Beneath this surface material a yellowish or yellowish-brown clay loam is found in many places

extending to a depth of several feet, although beds of partially decomposed shale may underlie the clay loam at any depth below 3 feet.

This type occurs in two rather small areas in the southeastern part of the survey just below the main slope of the Siskiyou Mountains. The topography ranges from moderately sloping to hilly and sharply rolling. In places the surface has been dissected by intermittent streams.

The surface soil of this type is largely granitic in origin, having been derived through wash from adjacent mountain slopes. The subsoil has resulted from the decomposition of the underlying shale. A very small part of this soil is used for the production of hay and orchard fruits. The larger part is covered with a heavy growth of trees and brush. The soil is adapted to such fruits as peaches, apples, and pears, and to grain. With irrigation it would be suited to alfalfa, small fruits, and vegetables.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Barron sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25627.....	Soil.....	8.3	10.1	6.0	12.5	10.1	29.5	23.5

CLAWSON LOAM.

The Clawson loam consists of a black, heavy, sticky loam, extending to a depth of 3 to 6 feet and carrying numerous fine angular granitic fragments. In the lower lying areas it frequently tends toward an adobe structure. Where this soil is less than 6 feet in depth it is underlain by beds of shale, or, rarely, at higher elevations, by granitic rocks. The surface material is mainly colluvial in origin, i. e., has been formed of material washed from the higher lying to the lower slopes of the Siskiyou Mountains. The deeper material directly overlying the shale probably includes some residual material from this rock.

With the exception of one small body lying about 4 miles southeast of Ashland in the vicinity of Clawson the larger part of the type occurs within the city limits of Ashland.

The surface is sloping to undulating, but drainage is deficient, as the soil receives seepage water from higher lying land. This defect must be remedied before the type becomes adapted to cultivation. When drained it is a fair truck and pear soil and gives good results with alfalfa or the grasses.

## HANFORD COARSE SANDY LOAM.

The Hanford coarse sandy loam consists of 6 feet or more of a grayish brown or light-brown sandy loam, carrying a large quantity of fine angular and subangular granitic fragments of the size of coarse sand and fine gravel. Granitic boulders and cobblestones may be present in varying quantities.

This type is alluvial in formation, the material of which it is composed having been laid down by the flood waters of Ashland Creek. It occupies the bottoms of this stream, but it is now rarely overflowed and is fairly well drained. The surface, which is sloping, is somewhat gullied in places, but in general the type is well adapted to irrigation. In its native condition it carries a growth of cottonwood, willow, and alder, and other brush.

Practically all of this type lies within the corporate limits of the city of Ashland. Where not used for building sites it is devoted to the production of truck crops.

The following table gives the results of a mechanical analysis of a sample of the soil of this type:

*Mechanical analysis of Hanford coarse sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25624.....	Soil.....	20.5	19.8	9.0	19.7	11.4	13.0	6.5

## PHOENIX CLAY LOAM ADOBE.

The Phoenix clay loam adobe consists of a dark-brown to black heavy clay loam of characteristic adobe structure, becoming tenacious when wet and baking and checking when dry. The surface material, which in many places carries some waterworn gravel, extends to a depth of 12 to 30 inches. It is underlain by a yellowish-brown heavy clay reaching to depths of 6 feet and more. This stratum rests in turn upon beds of more or less decomposed shale.

Two small bodies, situated about  $3\frac{1}{2}$  miles southeast of Medford, represent the extent of this type in the area.

The soil owes its origin mainly to alluvial wash from the higher slopes and is made up of material derived from volcanic rocks and sandstone. The deeper subsoil is, however, probably derived in part from the weathered products of the underlying shale.

The surface slopes strongly to the west, is uniformly smooth and undulating, and is traversed by numerous shallow streamways which give good drainage. Irrigation is practicable without expensive preparation of the surface.

At present the type is covered with a scanty growth of oak or is devoted to dry-farmed grain. Where the soil is of sufficient depth it

will be found adapted to pears, small fruits, and, with irrigation, to alfalfa.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Phoenix clay loam adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
25672.....	Soil.....	<i>Per cent.</i> 3.5	<i>Per cent.</i> 7.4	<i>Per cent.</i> 5.5	<i>Per cent.</i> 9.2	<i>Per cent.</i> 5.3	<i>Per cent.</i> 38.4	<i>Per cent.</i> 30.7

PHOENIX CLAY ADOBE.

The Phoenix clay adobe consists of 12 inches to 6 feet or more of a dark reddish-brown to nearly black sticky clay, of a pronounced adobe structure. The soil includes a gravelly phase indicated on the soil map by gravel symbol. Along the boundaries with the higher lying soils derived from volcanic rocks slight quantities of loose rock may occur on the surface, but rock outcrops are rare. The grayish sandstone commonly underlying the soils of this series may occur at any depth below 12 inches, but the depth of the soil probably averages a little more than 4 feet.

This type occurs in the rolling hilly country east of Bear Creek as scattered bodies of soil lying on the lower slopes of the hills. The surface is of moderate slope, devoid of minor irregularities. The areas are traversed by minor streamways.

The soil is derived in part by the weathering in place of sandstone, but includes a greater proportion of fine alluvial material derived from soils occupying higher elevations, where the underlying formations are either sandstone or volcanic rock.

A portion of the type is planted to apples and pears. Most of these orchards are not yet in bearing, though some of the most valuable orchards in the valley are found on this soil. The type should preferably be devoted to the production of pears rather than apples, as the texture of the subsoil is too heavy to allow the best development of the latter fruit. (See Pl. IV.)

In general drainage is fairly well developed, but there are some small areas where the conditions would be materially improved by artificial drainage.

Below are given the results of a mechanical analysis of a sample of soil of Phoenix clay adobe:

*Mechanical analysis of Phoenix clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
25657.....	Soil.....	<i>Per cent.</i> 0.9	<i>Per cent.</i> 2.4	<i>Per cent.</i> 2.2	<i>Per cent.</i> 4.1	<i>Per cent.</i> 5.7	<i>Per cent.</i> 21.4	<i>Per cent.</i> 63.1

## MEYER SILTY CLAY LOAM.

The Meyer silty clay loam consists of a light-brown to grayish-brown, sticky, silty clay loam usually extending to a depth of 12 to 30 inches and in places to greater depths. It is underlain by a yellowish or yellowish-brown clay loam similar in texture to the surface soil or by beds of sandstone or shale. Outcrops of rock or shale are rare and occur only where this type forms a terrace above the creek bottom soils. Water-worn gravel may be found in some of the lower lying soil bodies, but is not of common occurrence.

This type consists predominantly of alluvial and colluvial foot-slope deposits, but includes some residual material derived from the weathering of the underlying sandstone and shale. The alluvial and colluvial material is derived from higher lying bodies of the clay adobe of the same series or from other soils resulting from the breaking down of volcanic rocks.

The type is of small extent, occurring as a few small, widely scattered areas on hillsides in the southeastern part of the area. The surface is practically treeless, moderately to steeply sloping, and fairly uniform.

A part of this type is planted to pears and when of sufficient depth is well adapted to this fruit. Other areas are used only for grazing or for the production of crops of dry-farmed grain. This type is rather moist and for this reason is better adapted to the pear than to the apple, peach, or cherry. The various small fruits will give good returns on this soil if properly cared for.

Below are given the results of mechanical analyses of samples of the soil and subsoil.

*Mechanical analyses of Meyer silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
24247, 25702.....	Soil.....	1.8	3.7	3.0	7.9	8.0	52.1	23.3
24248.....	Subsoil.....	4.6	6.5	5.0	10.4	11.7	34.9	26.9

## MEYER CLAY ADOBE.

The Meyer clay adobe consists of 6 inches to 6 feet or more of a light-brown to nearly black clay of a more or less pronounced adobe structure. The texture of the soil is uniform throughout its entire depth, but the color grades into yellow with increasing depth. Grayish sandstone or brown to gray shales, the upper strata usually decomposed, underlie the disintegrated soil material. In local areas there are in the deeper subsoil accumulations of lime occurring as beds of a soft, fine-grained, whitish deposit, varying in thickness

from 1 inch to a foot or more. Rock outcrops, consisting of sandstone at the higher elevations and shale in places where this type lies as a terrace or bench above the creek bottoms, are numerous. Waterworn gravel is sometimes present over small areas.

The depth of the soil is exceedingly variable even within short distances, and any attempted development of this type should be preceded by careful determinations of the depth of bedrock.

This soil occurs principally in the southeastern part of the area along the eastern side of Bear Creek Valley, where it appears as irregular and interrupted bodies extending from a point about 4 miles south of Ashland to the vicinity of Medford. Two other small bodies lie near Medford as low knolls rising from the floor of the western side of the valley.

This soil occupies the greater part of the rolling and broken treeless portion of the valley north and east of Ashland. The slopes are moderate to steep, and the surface is often broken by perpendicular cliffs of sandstone and more or less eroded by the numerous streams draining the higher elevations.

This soil is the result of a mingling of residual material from the underlying sandstone and shale with colluvial and alluvial material from more elevated soils derived from volcanic rocks.

The greater part of this soil is not developed as farms and is used only for grazing. Within the last year or two some pear orchards have been set out near Ashland. With proper care this fruit should do well on this type of soil. South of Medford the larger part of the type is planted to pears, and the thrifty appearance of these trees indicates that it is well adapted to this purpose. At the present time this type is without facilities for irrigation.

The average results of mechanical analyses of samples of soil are given in the following table:

*Mechanical analyses of Meyer clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25703, 25704.....	Soil.....	1.3	3.1	3.3	6.4	6.3	27.6	51.8

COKER CLAY ADOBE.

As typically developed, the Coker clay adobe, to a depth of 4 to 6 feet, consists of a dark-brown clay with a pronounced adobe structure. The texture is uniform throughout the entire depth of the soil, but the color in many places becomes a yellowish-brown as the lower portions are approached. Small quantities of subangular and waterworn gravel may occur throughout the soil profile, being most abundant in the vicinity of soils of the Agate series.

The soil may be underlain by rock at any depth below 4 feet, although over the greater area of the type rock is not to be found within 6 feet of the surface. The soil consists of alluvial and colluvial material derived from the volcanic rocks forming the Roxy Ann Ridge or adjacent elevations. The soil materials have been transported mainly by sheet wash and intermittent streams.

An important area of this type lies in the valley floor about  $1\frac{1}{2}$  miles north of Coker Butte. Less extensive areas are found in the Sams Valley district. The slope of the surface is moderate to rather steep, the latter condition existing near the base of the Table Rocks.

In the northern part of the area this soil carries a fair growth of trees and brush, but elsewhere it is treeless. It is usually fairly well drained. The surface is usually suitable for irrigation.

Parts of the Coker clay adobe have been developed, principally as orchard lands. Pears are very profitable and apples fairly so, although the soil is rather heavy for the latter fruit.

*Coker clay adobe, dark-colored phase.*—The dark-colored phase of the Coker clay adobe consists of 30 inches to 6 feet or more of a heavy dark-brown to black, sticky clay of adobe structure and uniform texture. The color of the upper part of the soil in places becomes lighter with depth. When wet the soil is sticky and waxy, and it bakes and checks upon exposure to hot dry weather. At varying depths below 30 inches the soil is underlain by basaltic rock, the upper part of which is decomposed. Over most of its area, however, the rock lies more than 6 feet below the surface. A few areas have a very shallow covering above the rocks and in one or two places outcrops occur.

The principal bodies of this phase of the soil lie on the floor of the valley just north of Coker Butte. Smaller areas are scattered over the rolling lands in the Eagle Point country and one area occurs near the base of the Upper Table Rock. The surface usually has a good slope, is uniform to slightly rolling, and is traversed by a few minor streamways. Over the most of the type drainage is somewhat deficient, the movement of subsurface waters taking place slowly, owing to the dense relatively impervious character of the soil and subsoil. The conditions generally would be considerably improved by the construction of drainage ditches.

This phase, like the typical soil, includes both alluvial and colluvial material derived from weathering of basaltic rocks and transported from nearby hill and mountain slopes. The more northern bodies, which are mainly of colluvial origin and include the more pronounced slopes, are not farmed and are covered with a fair growth of trees and brush. The areas occupying the valley floor are usually treeless. In the vicinity of Coker Butte the land is largely planted to pears, to which crop the soil is well adapted, providing it is of sufficient depth.

Some plantings of apples have been made, but this fruit has not proved very satisfactory, on account of the unfavorable drainage conditions.

Average results of mechanical analyses of samples of the typical soil are given in the following table:

*Mechanical analyses of Coker clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25642, 25643.....	Soil.....	0.9	4.2	4.5	9.6	5.8	30.2	44.7

COLEMAN GRAVELLY LOAM.

The Coleman gravelly loam, to a depth of 12 to 24 inches, consists of a grayish-brown to light brown or brown loam, carrying considerable quantities of subangular gravel, seldom larger than an inch and one-half in diameter. It is underlain by a yellowish-brown, sticky clay loam, with less gravel than in the surface soil. In places the gravel content of the surface soil is excessive, forming 70 per cent of the mass.

This type occurs as an alluvial fan deposit along Coleman and Griffen Creeks in the west-central part of the area and in the narrow local mountain valleys along Kane, Foots, Evans, Thompson, and other creeks traversing the western and northwestern mountainous parts of the survey.

In the body of this soil along Coleman Creek the surface appearance is that of an old delta fan, as the topography is a low, broad ridge, with the stream flowing along the crest. In the body along Griffen Creek the delta formation is less pronounced, and in the northern bodies the soil is simply an alluvial filling of local intermountain valleys. It is derived mainly from erosion of soil material of the Tolo series. The surface is sloping, sometimes slightly uneven, well drained, and generally well adapted to irrigation.

Originally all of this soil carried a heavy growth of pine, laurel, oak, and brush, and much of the original stand still remains.

Portions of the soil have been cleared and devoted to the production of hay and fruit. The structure of the soil favors rapid loss of moisture from uncultivated areas and the yield of hay is not heavy. With efficient cultivation the moisture is retained very well and the type is adapted to small fruits, peaches, apples, and pears. This soil is very deficient in organic matter and one of the first requisites is its incorporation in the soil by the use of green or stable manure, or both.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

*Mechanical analyses of Coleman gravelly loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25638.....	Soil.....	5.0	6.9	4.9	13.4	17.0	32.4	20.5
25639.....	Sub soil.....	3.0	4.7	3.6	11.9	12.6	32.5	31.6

MEDFORD GRAVELLY FINE SANDY LOAM.

The Medford gravelly fine sandy loam consists of 10 inches to 2 feet of light-brown slightly micaceous fine sandy loam, carrying varying quantities of waterworn or subangular gravel, underlain by a dark-brown to black heavy, compact loam, in which occur quantities of small, whitish, angular fragments of granite. Below 6 feet the material is commonly a gray, sticky clay loam.

Only a single body of this type occurs in the area. It borders Jackson Creek and extends in a northeasterly direction from the town of Jacksonville to Hanley Butte.

This type is derived mainly from material forming the soils of the Tolo series, with an admixture of granitic material washed from the mountainous sections drained by Jackson Creek and its tributaries. The type owes its formation to earlier work of these streams. The surface is gently sloping. The area is not at present subject to erosion or overflow.

Practically all the type is in alfalfa, of which the yields vary from 2 to 5 tons per acre. The production is dependent upon the season and the care given the fields. This soil will also be found well adapted to apples, pears, and small fruits.

The following table gives the results of a mechanical analysis of a sample of soil of Medford gravelly fine sandy loam:

*Mechanical analysis of Medford gravelly fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25714.....	Soil.....	5.8	8.3	4.9	19.1	13.9	39.0	8.6

MEDFORD FINE SANDY LOAM.

The Medford fine sandy loam, to a depth of 12 inches or more, consists of a fine sandy loam carrying an appreciable quantity of coarse particles. It is light-brown or medium brown to depths of 12 to 30 inches, shading to dark-brown as the lower depth is

approached. The subsoil is generally of coarser texture than the soil, and in small areas may be a coarse black loam or coarse sandy loam. The coarser particles are granitic, angular, and vary in size from coarse sand to fine gravel.

This type occurs as a single extensive body just west of Jackson Creek, extending from near Jacksonville northward to the backwater formed by the Raygold Dam in Rogue River. The surface slopes strongly toward the creek and is often uniform over considerable areas, though it may be slightly rolling and dissected by minor streamways.

This soil is the result of former deposition by numerous streams tributary to Jackson Creek of material derived largely from granitic soils in the mountainous region to the west.

It is largely planted to grain and fruit, but here and there small areas of land still carrying a heavy growth of pine, oak, and laurel remain. The soil is not well adapted to grain and alfalfa, on account of excessive drainage, but is well suited to peaches, cherries, and apples. Pears do fairly well, but the heavier soils of the area are better for this fruit.

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

*Mechanical analyses of Medford fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25710.....	Soil.....	2.5	6.9	5.0	19.0	21.8	35.6	9.0
25711.....	Subsoil.....	12.4	13.3	5.0	12.5	11.3	31.9	13.5

#### MEDFORD LOAM.

The Medford loam consists of a brown and dark brown slightly sticky loam, from 16 to 40 inches in depth, underlain at varying depths below 16 inches by a yellowish brown to black sticky clay loam, in many places carrying fine light colored, angular granitic fragments. In the vicinity of the heavier soils of the same series the deeper subsoil is generally black.

This soil occurs as an irregular body just east of Jackson Creek, extending from east of Jacksonville northward to about 2 miles beyond Central Point. It is alluvial in origin, being composed of material washed from the adjacent mountains and deposited by the minor streams traversing this region.

The surface is smooth, with a slope northward. The type is well drained.

The larger part of the land is in alfalfa, to which crop it is well adapted. The crop is grown without irrigation and gives very uni-

form yields from year to year. Some of the fields are averaging practically 5 tons per acre, in three cuttings, but the average for the type as a whole is about 4 tons per acre. This soil is also well adapted to apples and pears.

Mechanical analyses of samples of the soil and subsoil gave the following results:

*Mechanical analyses of Medford loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25706, 25708.....	Soil.....	7.2	7.2	3.7	11.8	15.3	41.2	13.3
25707.....	Subsoil.....	2.9	4.7	3.2	9.6	12.9	38.6	28.3

MEDFORD GRAVELLY CLAY LOAM.

The Medford gravelly clay loam consists of very dark brown to black sticky clay loam usually from 18 to 24 inches deep, though in places extending to a depth of 6 or more feet. It is underlain by a yellowish brown heavy clay loam or, in local areas, clay. Practically all of the soil carries some subangular gravel the quantity of which is excessive in small spots. The subsoil also contains small amounts of similar gravel, while cemented layers characteristic of the Agate and Antelope soils may occur wherever this type adjoins soils of these series. In such places the difference between the Medford gravelly clay loam and the soils of the Agate series is rather obscure.

This type appears in the floor of the valley west of Bear Creek, at intervals from about a mile south of Talent northwesterly to the town of Central Point. It consists of old alluvial deposits transported by intermittent streams.

The surface, which is smooth to slightly rolling, slopes in a general northerly direction at the rate of from 40 to 80 feet to the mile. The areas are not subject to overflow or erosion and are irrigable. The drainage is good to fair and is retarded only in those portions where there may be a cemented subsoil.

Originally this type was covered with a fair growth of oak and pine, but nearly all of it has been removed and the land brought under cultivation. It is devoted to pears, apples, small fruits, grain and alfalfa. (See Pl. V.) It is adapted to all of these crops, but better success with the apple is possible on other soils.

MEDFORD CLAY ADOBE.

The Medford clay adobe consists of a heavy black clay with a very pronounced adobe structure, about 6 feet in depth. This type seldom carries any gravel either in the surface or in the subsoil, and the color and the texture remain uniform throughout the depth of

the soil. It occurs as three rather small bodies occupying portions of the valley plain in the central part of the area south of Central Point and northwest of Medford. The surface slopes to the north, is uniform, and favorable for irrigation. Although the surface slope is ample, drainage is deficient, as the soil is very compact and tenacious, and the internal movement of moisture is greatly retarded. The areas are not at present subject to overflow.

The Medford clay adobe consists of old alluvial material deposited by former minor streams. The materials were derived largely from adjacent areas of the Medford gravelly clay loam.

All of this type is under cultivation. It is used for the production of apples, pears, and alfalfa. It is rather too heavy for apple growing and would be greatly improved for pear production if some means were provided for better drainage of the subsoil.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Medford clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25671.....	Soil.....	1.3	2.4	2.2	10.9	13.7	36.9	32.6

BELLAVISTA FINE SANDY LOAM.

The Bellavista fine sandy loam consists of 6 feet or more of a light gray to light-brown fine sandy loam, carrying small to large quantities of rounded and waterworn fragments of pumice and fine-grained basaltic rock. The structure and texture of this soil is uniform throughout its entire depth. This type owes its formation to material derived from pumice, volcanic ash, and massive basaltic rocks, transported and deposited by the Rogue River at an earlier stage, with admixture of some later alluvial material derived by erosion of the basaltic slopes of the Upper Table Rock.

The areas have a sloping to nearly level surface, are well drained, and free from overflow. They occur as a terrace lying somewhat above the more recent alluvial soils of the Salem series.

Only two bodies of this soil occur in the area surveyed. The larger is found just south of the Upper Table Rock. This area is entirely occupied by orchards of apples and pears, from which profitable returns are received. The smaller forms a small part of a river terrace east of Rogue River, about a mile above the mouth of Little Butte Creek. This area is at present covered with a forest growth. The soil is deficient in organic matter and is rather porous and leachy. With good cultural methods and favorable moisture conditions it would probably prove suitable for the production of

peaches and the various truck crops. Green manuring and the application of stable manure are necessary steps in building up the productiveness of such soils.

Below are given the results of a mechanical analysis of a sample of soil of the Bellavista fine sandy loam:

*Mechanical analysis of Bellavista fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25694.....	Soil.....	3.8	4.6	3.4	17.9	19.4	39.8	11.3

AGATE GRAVELLY SANDY LOAM.

The Agate gravelly sandy loam consists of a reddish to yellowish-brown sandy loam, ranging in depth from a few inches to 2½ feet. The soil carries varying quantities of small waterworn gravel and occasional surface deposits of cobblestones and gravel of volcanic origin, with an admixture of subangular siliceous fragments. The deeper subsoil is somewhat variable, consisting for the main part of a mass of more or less firmly cemented waterworn gravel and finer material. The subsoil may carry occasional strata or lenses of fine sandy loam to sandy loam, which are usually unconsolidated or feebly cemented. The cemented gravel subsoil is sometimes overlain by a deposit of yellowish-brown cemented soil, which has a fairly well-defined shaly structure, varies from an inch to a foot or more in thickness, and may occur at any depth below the surface. The consolidation of the subsoil materials of this type and the other members of the series has probably been brought about by iron in solutions.

At the line of contact between the soil and subsoil there is, with scarcely an exception, a thin layer of a dark red ferruginous hardpan, one-eighth to one-fourth inch in thickness, impenetrable to plant roots or water.

The principal body of this soil occurs just east of Bear Creek, extending from near Central Point northwestward nearly to the Rogue River. Other smaller bodies lie to the west of Bear Creek, near the towns of Tolo, Central Point, and Medford.

The surface of the type slopes uniformly except where broken by "hog wallows" and a few shallow, poorly defined watercourses. The surface accumulation of gravel is usually concentrated in minor depressions of this character. The type terminates in an abrupt terrace along Bear Creek, which descends to the recent alluvial soils along that stream.

The material from which the type is derived constitutes a part of the early sedimentary deposits of the valley. A part of the soil material was derived from varied rocks of the adjacent mountain ranges to the north, east, and south, but much of it, particularly that constituting the deeper subsoil, has come from unknown sources.

The larger part of this type carries a good growth of manzanita, ceanothus, oak, and pine, while the remaining area is covered with a scant growth of native grasses.

Little of this type is under cultivation at present, but the area cultivated is slowly increasing with the development of small 20-acre to 40-acre farms.

One of the distinctive features of this member of the Agate series is the relatively heavy growth of timber and brush which it supports, as compared with the treeless condition of the other type of the series. As the average depth to the hardpan and cemented gravel is not over a foot, the growth of the trees would indicate that the thin layer of iron hardpan is more or less broken up and that portions of the underlying gravel bed are not firmly cemented. It is also possible that the layer of consolidated gravel is rather thin and is underlain by a mass of finer textured soil, although the very gravelly nature of the soil prevented any extensive exploration of the subsoil during the progress of the survey.

The agricultural value of the type depends upon the depth, continuity, and degree of cementation of the indurated hardpan. Where this subsoil stratum has a thickness of several feet, as is sometimes the case over large areas, the use of the soil for orcharding is questionable. Blasting the subsoil under these conditions would form a deeper reservoir for the soil moisture, but would probably not open up the material so that the drainage would be improved, and with irrigation the accumulation of water in the cavities would likely damage the trees. When such conditions as have been outlined above exist, the soil should be used for shallow-rooted crops. Where the subsoil is found to be less firmly cemented, or in areas lying near the stream terraces, in which place the drainage conditions are better, the type will be found adapted not only to a wide range of shallow-rooted crops, but also to alfalfa and tree fruits, especially peaches, apples, and cherries.

The soil is deficient in organic matter, and one of the first requisites will be to supply this by sowing crops to be turned under as green manure. For fall sowing vetch, or a mixture of vetch and winter oats, will be found very desirable.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of this type:

*Mechanical analyses of Agate gravelly sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25618.....	Soil.....	6.9	12.2	9.4	18.8	13.8	28.0	10.9
25619.....	Subsoil.....	14.3	16.7	7.6	11.5	8.3	26.0	15.6

AGATE GRAVELLY LOAM.

The Agate gravelly loam consists of 6 inches or less to 1 foot of light reddish-brown loam, underlain by a thin strata of iron hardpan resting upon cemented sand and gravel.

The soil carries considerable quantities of small to medium water-worn gravel, while varying quantities of medium to large rounded gravel and boulders of volcanic origin also occur upon the surface, usually most abundantly in the numerous depressions. The thin layer of iron hardpan common to the soils of this series is always present in this soil as typically developed. The gravelly subsoil which carries but little fine interstitial material is usually firmly cemented. Near the base of the mountains in the eastern part of the survey narrow bodies of this type are underlain by the country rock within 6 feet of the surface.

This type occupies the main body of the generally treeless valley plain lying north of Medford, locally known as the "desert." It occurs principally as an irregular body of soil extending from sec. 15, T. 36 S., R. 2 W., eastward to Antelope Creek. Other smaller detached bodies occur at intervals from below Medford northward nearly to Trail.

The main body has a rather uniform slope to the west and northwest. Surface drainage is only fairly well developed and subdrainage is practically inhibited by the structure of the subsoil. The surface is marked by innumerable mounds and depressions or hog wallows, and the larger intermittent streams have carved out broad, meandering troughs of varying depth in their course across the area. The outlying bodies of this type occupy ridges or knolls slightly elevated above surrounding soils of other series, and the hog-wallow surface may be typically developed or the surface may be very uniform.

The material giving rise to this type is of sedimentary formation constituting remnants of an early valley deposit, the material being derived from adjacent mountainous ranges and from more distant sources.

The typical soil supports only a scanty growth of grasses. Considerable leveling is necessary to put the land in condition favorable for irrigation. A large part of the typical soil is not under cultivation. In its present condition it is practically worthless, save for the scanty pasturage afforded sheep during the spring months. Its future development depends entirely upon providing facilities for root development, storage of moisture in the subsoil, and subsoil drainage. If these can be obtained by deep blasting in the subsoil, then the soil will be adapted to as wide a range of crops as may be grown on the deep phase, described below.

*Agate gravelly loam, deep phase.*—Areas of the Agate gravelly loam in which the depth of surface soil above the hardpan or cemented subsoil is sufficient to have a marked effect upon the value of the land for farming have been separated and shown on the map by means of a distinctive ruling over the type color. The depth of soil ranges from 2 to 4 feet, the material being identical with that forming the surface of the typical soil, but the subsoil differs somewhat from that of the latter. The iron hardpan may be absent and the indurated gravel and sand underlying the soil may be less firmly cemented in some places.

In origin the type and its deep phase are similar. In vegetative covering they differ, the latter supporting a fair growth of trees and brush.

As this would indicate the deep phase is much the better soil as compared with the typical in its present condition. In the vicinity of Medford much of it is set in orchards of pears and apples which give profitable returns. Peaches, small fruits, truck crops, and alfalfa succeed with irrigation. Within the last two years portions of the desert have been developed under irrigation, and plans to extend the area supplied with water have been perfected.

Below are given the results of mechanical analyses of samples of the typical soil and subsoil of the Agate gravelly loam:

*Mechanical analyses of Agate gravelly loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25616.....	Soil.....	5.5	9.7	4.9	8.7	7.2	46.5	17.8
25617.....	Subsoil.....	14.0	13.6	6.7	6.9	3.9	21.4	33.6

ANTELOPE CLAY.

The Antelope clay consists of a grayish brown to black sticky clay from 6 inches to 4 feet deep, sometimes carrying a small quantity of waterworn gravel, and underlain by a thin layer of iron hardpan and

brown to yellowish brown beds of cemented waterworn gravel and sand. The underlying cemented material is similar to that found beneath the Agate series, but the surface material has probably been modified by an admixture of alluvium washed from higher levels.

This type has a small area and restricted distribution. It occurs usually as narrow or irregular bodies on the slopes in the vicinity of smaller stream courses, generally descending from parts of the higher valley plain covered by soils of the same series.

The Antelope clay is treeless. It has a slightly sloping surface sometimes marked by "hog wallows," but it is not eroded or subject to overflow. At present none of this soil is under cultivation. When of sufficient depth it will be found adapted to apples, pears, and small fruits. Leveling is usually necessary to fit the land for irrigation. Where the hardpan and cemented gravel lie close to the surface blasting must be resorted to before the land can be used profitably for farming.

The following table gives the average results of mechanical analyses of samples of the soil of this type:

*Mechanical analyses of Antelope clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25620, 25621.....	Soil.....	2.1	7.2	6.9	12.0	6.8	24.6	40.0

ANTELOPE CLAY ADOBE.

The Antelope clay adobe consists of a dark-brown to a black sticky clay from 1 to 6 feet or more in depth, baking and checking upon exposure to dry weather in the characteristic manner of adobe. The surface material is underlain by the cemented gravel beds and ferruginous hardpan of the Agate series which may be overlain by a brown to yellowish brown clay subsoil. The surface material of this type is alluvial and is derived from higher lying bodies of soils, mainly of the Agate series.

In general the surface drainage is fair and the underdrainage restricted, but there are small areas that are too moist for cultivation and would be benefited either by enlarging the natural drainage ways or by the construction of ditches and underground drains. The surface is sloping, usually smooth, and favorable to irrigation.

This type occurs in narrow areas along small streamways bordering or traversing that portion of the area lying north of Medford and locally known as the "desert." The areas are generally treeless.

The larger proportion of the type is of sufficient depth to be suitable for the production of tree fruits. It probably is better adapted to

pears and small fruits than to apples. Upon the areas of more shallow soil blasting is necessary in preparing the land for deep-rooted crops.

The results of a mechanical analysis of a sample of soil are given in the following table:

*Mechanical analysis of Antelope clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25623.....	Soil.....	1.5	6.1	5.5	10.3	5.8	31.6	39.1

NEAL FINE SANDY LOAM.

The Neal fine sandy loam, to a depth of 1 to 6 feet or more, consists of a brown to dark-brown, slightly micaceous fine sandy loam. The texture of this material is variable, being either much heavier or lighter than normal in small bodies and frequently carrying thin strata or lenses of fine gravel or coarse sand. In one or two places where the drainage has been particularly rapid the soil sometimes carries quantities of granitic boulders.

Below the surface soil the material may be either a clay loam, shale rock, or, very rarely, waterworn gravel. The clay loam is dark yellowish-brown, sticky and compact, and usually is underlain by a gray to brown shale, the upper portions being usually much decomposed. The clay loam part of the subsoil may extend to a depth of several feet or may be absent, the shale lying directly below the surface soil.

This type occurs in narrow inextensive bodies occupying the region adjacent to Bear Creek and its several tributaries southeast of Medford.

The surface has an effective slope in line with the country drainage, is generally somewhat uneven, and frequently traversed by minor drainage ways. The drainage is fair to good and the type is rarely overflowed. The Neal fine sandy loam is alluvial in origin.

Formerly this type was covered with a heavy growth of brush and larger trees. Some of this growth still remains, particularly along the streams, but the larger part has been cut and the land placed under cultivation.

The principal crops are wheat and alfalfa. The former is cut for hay and yields about 4 tons per acre. Where the alfalfa has been given proper care the yields range from 3 to 5 tons per acre, in three cuttings. This type is also adapted to tree fruits, such as apples and pears, providing means are taken to prevent injury by spring frosts.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Neal fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25632.....	Soil.....	0.1	0.3	1.2	27.1	26.4	25.9	19.2

NEAL SILTY CLAY LOAM.

The Neal silty clay loam consists of 12 to 30 inches of dark-brown to black rather sticky clay loam, slightly micaceous and of uniform texture, underlain by a yellowish-brown or black, sticky loam or clay loam. Gravel is rare and is found only in those portions of the soil adjacent to gravelly types of the Sites series.

Areas of this type occur in the lower bottoms bordering Bear, Emigrant, and Neal Creeks as far north as Medford. The areas are seldom subject to overflow. Their surface is level to slightly rolling, with a gentle slope along the line of drainage. The surface is usually smooth and is favorable to irrigation.

The Neal silty clay loam is alluvial in formation, the material having been eroded from adjacent more elevated soils and deposited by former floods in the neighboring streams.

The native vegetation consists of cottonwood, willow, vines, and brush, but the larger part of the areas have been cleared and placed in cultivation. Alfalfa and wheat occupy the larger proportion of the cleared area, but small fruits, truck crops, and orchard fruits are also produced. This type is well adapted to pears and fairly well to apples, but both will require protection from spring frosts.

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

*Mechanical analyses of Neal silty clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
25628.....	Soil.....	0.0	0.3	0.7	9.0	15.1	52.2	22.5
25629.....	Subsoil.....	.1	.6	1.7	8.2	10.4	41.9	37.2

NEAL CLAY ADOBE.

The Neal clay adobe consists of a black, sticky clay from 1 to 3 feet in depth, with a pronounced refractory adobe structure. The soil is underlain by a stratum of yellowish-brown, sticky clay, which may extend to a depth of 6 feet or more, or by beds of shale. The clay is always underlain by shale at some depth, if not within the

limit of the profile, and in places the surface material rests upon the rock.

This type is of recent alluvial origin. It is found as small, elongated bodies in the lower lands along both the perennial and intermittent streams of the area from Medford southeastward, but it is rarely overflowed. The surface is uniform, with little or no slope, and the drainage is generally deficient. The areas usually support a growth of trees or brush.

A few areas of this soil have been set in pear orchards, but the larger part is in native grass or is sown to wheat for hay.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Neal clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25635.....	Soil.....	0.3	1.3	1.4	4.9	4.4	36.9	50.4

**SALEM GRAVELLY SANDY LOAM.**

The Salem gravelly sandy loam consists of a very gravelly sandy loam of rather fine texture, light brown to dark brown in color, from 1 to 4 or more feet deep. The gravel, which is much water-worn, varies in size from less than 1 inch to 2 or 3 inches in diameter. Such coarse fragments of the rocks form as much as 50 per cent or more of the surface material. The texture of the finer surface material varies somewhat, approximating a loam in places where the drainage has been imperfect.

The deeper subsoil—i. e., the section below the surface material—consists of beds of loose cobblestones and smaller gravel and some finer interstitial material, or the same material firmly cemented. The subsoil of the latter character exists from near the mouth of Sams Creek westward beyond the Jackson County line. Above the mouth of Sams Creek the indurated material does not appear within 6 feet of the surface.

The Salem gravelly sandy loam occurs in the lower lands along Rogue River, either bordering the stream or lying a short distance back from its banks. It is of alluvial origin and derived mainly from basaltic material. It is not often subject to overflow.

The larger proportion of the type is covered with a dense growth of trees and brush, though in the western part of the area, where the cemented gravel approaches the surface, the vegetation consists of a scanty growth of grass. The surface is somewhat undulating or irregular, often gullied, and requires leveling for irrigation.

The type is not extensively utilized, but in the western part of the area portions of this soil are under cultivation, the land being used both for grain and orchard fruits. Where of sufficient depth and favored by good moisture conditions this type will be found adapted to apples and pears, as well as to alfalfa and the grains.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Salem gravelly sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25682.....	Soil.....	7.0	20.1	14.9	24.4	8.2	17.9	7.5

SALEM FINE SANDY LOAM.

The Salem fine sandy loam consists of a brown to grayish-brown fine sandy loam, from 18 inches to 4 feet in depth, and usually slightly micaceous. Small quantities of waterworn gravel are present in some places. The color of the section above the subsoil is uniform, but the texture is rather variable, owing to the assorting power of running water. Thin layers of lighter or heavier material may occur at varying depths, and occasional strata and pockets of washed gravel may be present.

The soil rests directly upon beds of waterworn gravel and larger cobblestones, the separation between the soil and subsoil being sharp and distinct. The subsoil may consist of practically clean gravel, but away from the stream bank there is usually a moderate admixture of sand and silt. Within 6 feet of the surface this gravel is not cemented, but at varying depths below it occurs as a firmly cemented mass, which extends to undetermined depths.

This type occurs as long, narrow bodies lying along Rogue River from Trail southwestward to the Lower Table Rock. Small bodies also occur along the lower course of Little Butte Creek. The surface is sloping and generally slightly undulating, the depressions being long and narrow and roughly paralleling the course of the streams. The type is rarely subject to overflow and the drainage is good.

The soil is alluvial in formation, the material being derived from the mountainous region north and east of the boundaries of the present survey. The formations in this region are almost entirely volcanic and consist of basaltic rocks, pumice, and volcanic ash.

The entire area occupied by this soil was formerly covered with a dense growth of cottonwood, willow, ash, and underbrush. North of the Upper Table Rock the larger part of this native vegetation still remains, but to the south the timber and brush have been to a large extent removed and the land placed under cultivation. This

cleared section is largely occupied by apple and pear orchards, and a smaller part devoted to alfalfa and pasture. This type is well adapted to the fruits mentioned and should also give good yields of the smaller fruit and truck crops, though at present the distance from markets precludes its development as a trucking soil. It occupies a favorable position for irrigation but requires some leveling. The more leachy porous bodies have a low moisture-retaining power and require irrigation for effective development.

A mechanical analysis of a sample of soil gave the following results:

*Mechanical analysis of Salem fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25680.....	Soil.....	1.0	7.5	10.1	34.3	13.1	25.0	8.6

SALEM CLAY LOAM.

The Salem clay loam consists of a very sticky clay, from 18 inches to 6 feet or more in depth, and in poorly drained areas somewhat compact, showing a tendency toward an adobe structure. In the vicinity of the Rogue River the prevailing color of the soil is dark brown; in those bodies along the tributary streams, such as Little Butte, Antelope, Yankee, and Bear Creeks, the color, with scarcely an exception, is black. A small quantity of waterworn gravel occurs in the soil and subsoil in some places.

The subsoil, which is a loose gravel like that underlying the Salem fine sandy loam, may lie within 4 feet or less of the surface, but under a considerable proportion of the type it is found at depths greater than 6 feet. It is probable that the deeper portions of this gravel is cemented, as in the other types of the series, but no exposures of sufficient depth were found to determine this fact.

This is a widely distributed type occurring in small areas scattered along the Rogue River from Trail southward to the Bybee Bridge, along Little Butte Creek and its tributaries, and in the vicinity of Antelope and Bear Creeks.

The soil is alluvial in formation and composed of materials washed from the volcanic rocks occurring in the upper parts of the drainage basins of these streams. It is seldom subject to overflow, is generally well drained, and is well adapted to irrigation farming.

The type originally carried a heavy growth of trees and brush, which, except along the immediate streamways, has been largely removed. The cleared land is used for the production of grain, alfalfa, pears, and apples. It is very well adapted to alfalfa, the yields ranging from 3 to 6 tons per acre for three cuttings. It is also well suited to the other crops mentioned, the only disadvantage in

fruit production being the occurrence of spring frosts, which, owing to the low elevation, are more frequent than on many of the soils used for orcharding.

The average results of mechanical analyses of samples of soil are given in the following table:

*Mechanical analyses of Salem clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25685, 25686.....	Soil.....	0.5	1.9	2.9	17.3	16.1	39.8	21.4

SALEM CLAY ADOBE.

The Salem clay adobe to a depth of 6 feet or more consists of a heavy, sticky, black clay, sometimes containing a few gravel with a pronounced adobe structure. The color and texture are uniform throughout the entire depth of the soil. The gravel subsoil characteristic of this series is seldom found within 6 feet of the surface. This type is not found in the Rogue River bottoms, except near the mouths of Little Butte and other tributary creeks, but it occurs in numerous more or less extensive bodies of alluvial soil bordering the streams throughout the drainage system of the valley, from Medford northward to the Rogue River and eastward to the boundary of the survey.

About 2 miles north of Central Point, in the bottom lands along one of the tributaries of Bear Creek, a body of this soil is found approaching Peat in texture and structure. Here the drainage conditions have been particularly poor, favoring a rank growth of tule, which has resulted in the accumulation of a mass of semidecayed organic matter in which the mineral content is extremely low.

The surface of the type may be smooth or somewhat uneven where eroded by former streams, and the drainage is as a whole somewhat deficient. Where the drainage conditions are controlled pears may be grown with success, and in the level areas alfalfa will do fairly well. Only a small proportion of this soil is under cultivation. Alfalfa is the principal crop, yielding from 3 to 5 tons per acre.

A mechanical analysis of a sample of the soil of the Salem clay adobe gave the following results:

*Mechanical analysis of Salem clay adobe.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25688.....	Soil.....	0.6	3.6	4.5	7.9	5.1	20.4	57.9

EVANS FINE SANDY LOAM.

The Evans fine sandy loam consists of 3 to 6 feet of buff to dark-brown micaceous fine sandy loam, in many places carrying small quantities of small water-worn gravel, underlain by beds of washed sand and gravel.

This type is alluvial in formation and is derived from materials washed from the Tolo soils and from the granitic and volcanic rocks of the adjacent mountain ranges.

Only a single body of soil was encountered in the survey. It lies in Pleasant Valley, where it occupies the lower bottoms and low terrace lands along Evans and Pleasant Creeks. Only lower lying parts of the area are subject to overflow, and the type is in general well drained. The surface varies from smooth to slightly eroded, the latter condition prevailing where former overflows have removed the surface soil or where small intermittent streamways traverse the area. Much of the type requires leveling for irrigation.

This soil is only partly under cultivation, most of it being covered with a growth of trees and brush. It is adapted to alfalfa, peaches, and truck crops. Protection from frost must be afforded the fruit trees. Irrigation will be required for the best results, though in favorable locations the rainfall will be sufficient for most crops with careful cultivation.

The following table gives the results of a mechanical analysis of a sample of soil of Evans fine sandy loam:

*Mechanical analysis of Evans fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25705.....	Soil.....	1.5	3.4	4.0	41.7	28.7	16.7	4.1

SAMS LOAM.

The Sams loam to a depth of 2 to 6 feet or more consists of a dark grayish brown to light-brown loam, underlain where the surface soil is less than 6 feet in depth by a light or dark-brown heavy loam or light clay loam. Gravel is rarely present in either the soil or subsoil and is found only in a few instances along the boundary between this type and members of the Sites series. In a considerable proportion of this type the surface loam material extends to a depth of several feet, the heavier subsoil occurring in the southern extension of the type, where the drainage has been somewhat restricted.

The Sams loam is of alluvial origin, the material of which it is composed coming mainly from greenstones and sandstones and in places

to some extent from basaltic rocks, transported and deposited over local valley plains by minor streams.

This type is confined to that part of the area north of the Rogue River known as Sams Valley. The surface is generally uniform and the slope even and favorable to distribution of water for irrigation. The general level is somewhat lower than that of the surrounding types and the boundary is plainly indicated by a low terrace or by the slopes of knolls and hills. It is usually well drained and free from overflow.

Practically all of this type is cleared and devoted to the production of hay. Where not cultivated, the type is not very retentive of moisture and yields of either native hay or alfalfa are somewhat less than is generally secured on the other alluvial soils in the valley. Some young orchards and one or two bearing orchards of pears are found on this type, and the soil is well adapted to this fruit. Apples should do well on the areas of deep soil. With irrigation the yields of all crops, and particularly of hay, would be materially increased.

The following table gives the average results of mechanical analyses of samples of the soil of this type:

*Mechanical analyses of Sams loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
25689, 25690.....	Soil.....	1.6	3.0	2.2	8.5	22.3	47.9	14.1

#### ROUGH STONY LAND.

This class of soil material includes all of those areas in the survey where the quantity of rock in the surface soil is so large as to prevent its use as farming land. The rock may occur either as loose masses in the soil or as outcropping ledges of the bedrock. The surface is usually steeply sloping and in many places precipitous.

The nature of the rock varies widely in different parts of the area. In the southeastern part and at intervals in the northwestern section granite outcrops occur on the higher elevations. Sandstone and conglomerate are the common rocks at the lower elevations east of Bear Creek, and throughout the remaining area eruptive or intrusive volcanic rocks. With a few local exceptions, the Rough stony land, if utilized at all, is fit only for pastures or for forestry.

#### RIVERWASH.

Riverwash consists of deposits of sand, gravel, and cobblestones lying immediately along the channels of the larger streams. The greater part of this formation is but a foot or two above the normal water level of the streams and is subject to frequent overflow. With

the exception of a few cottonwood trees or alder brush along the outer edge of the areas there is no vegetation. This type has no agricultural value.

#### IRRIGATION.

Irrigation was first practiced on areas lying along the smaller streams by the early settlers, who constructed small ditches to convey water to their pasture or grain lands. The flow of these streams was very irregular, depending upon the rain and snow in the adjacent mountains, but usually sufficient to materially increase the yields of hay and grain.

Excepting this early development, which was of relatively little importance, the progress of irrigation has been slow. This is due to several causes. With a few minor exceptions, the sloping hillside lands are naturally supplied with sufficient moisture by seepage from higher lands to mature the tree fruits and to insure in many places fair yields of the cereals and small fruits. The soils of the valley floor as a rule retain moisture readily, especially if cultivated, and those along the streams are abundantly supplied with moisture by the drainage of the country. With these natural advantages, the need for a supply of irrigation water has not been pressing. The development along this line has also been retarded by the fact that the diversion of water from the larger streams would be costly.

Wherever irrigation has been practiced in connection with fruit growing, however, the results have amply justified the expense, not only in the quality and quantity of the crop, but also in the health and vigor of the trees. This is plainly shown by the condition of several of the smaller orchards in the valley where irrigation water has been supplied during the growing season. But the development of irrigation systems will not only be valuable in the production of the crops at present grown. An even greater benefit will follow in that it will be a potent factor in building up a better balanced system of agriculture than that now existing in the area. Those commodities not now produced in the needed quantities are the ones which wait upon the development of irrigation.

Water for the irrigation of at least a considerable proportion of the lands of this area can be secured by the diversion of the flow of some of the perennial streams, the utilization of the flood waters of the smaller streams by storage works, the installation of pumping plants, and possibly by the development of an artesian water supply.

The Rogue River is the largest perennial stream in the area, but the construction of irrigation works owing to natural obstacles has been considered too costly, and the undertaking has been further hampered by the fact that a large part of the flow of the stream is claimed by water filings made for the development of power plants. The only

water diverted from this stream is through a small canal—the Table Rock Ditch—which starts in sec. 6, T. 36 S., R. 1 W., and supplies water to the lands south and southwest of the Upper Table Rock. Here and there a few small pumping plants lift water from the river to irrigate small bodies of land near the stream. A company has constructed a dam across the river at Raygold, where electricity is generated for use in the valley. A pipe line has been constructed by this company to convey water to farms in the vicinity of Tolo. This supplies about 300 acres of land.

The most extensive irrigation project in this area takes its water supply from the north fork of Little Butte Creek, certain rights being held on Fish Lake by the city of Medford as a source of its water supply. It is proposed to supply water by several lines of distributing canals to the valley and lower hillside lands extending as far south as Talent. At the present time one canal known as the Hopkins Lateral furnishes water to portions of the plains known as the "Desert," to the country west of Agate, and to small farms west of Bear Creek between Medford and Central Point. Water is now furnished to about 3,000 acres of land, and the ultimate extension of the system will carry water to about 55,000 acres.

In the southern part of the area a location on Emigrant Creek seems to be well adapted to the construction of a storage reservoir, and a movement is now on foot to impound water at this point and carry it by hillside ditches to the sloping hillside lands opposite Ashland.

Along Little Butte Creek several of the smaller farms and orchards are irrigated by that stream, the water being carried through gravity canals or lifted by pumping plants. Along a number of the smaller creeks, Little Butte and Evans Creeks, and the Applegate River, a number of small private canals irrigate adjacent lands.

In the level portion of the main valley the depth to the ground water varies from 10 to 40 feet, depending upon the elevation and slope of the surface. It is not probable that the quantity of water in the subsoil is sufficient to irrigate any considerable portion of the lands of the valley, but there is undoubtedly enough to afford a supply for many of the smaller holdings. In one or two instances where the water is close to the surface the construction of a large open pit has resulted in developing sufficient water to supply as much as 80 acres of orchard.

Either a gasoline engine or an electric motor is used to operate the pump, and the cost of securing water by this means has been justified by the increased yields of fruit. Under favorable conditions the profits from the production of small fruits, vegetables, and alfalfa may warrant supplying irrigation water in this way.

Where land is irrigated by the electric and power company through its pipe line the annual charge is \$5 an acre. The canal company makes an initial charge of \$50 an acre for a water right and an annual water tax of \$2.50 an acre for maintenance.

If the lands in this area are ever extensively irrigated some unfavorable soil conditions may be expected to arise in certain sections of the valley through the gradual accumulation of water in the subsoils of the lower lands. The larger part of the subsoil of the valley is a heavy clay loam or clay, through which the movement of water is naturally slow, and unless great care is exercised in restricting the quantity of water used for irrigation a gradual and permanent rise in the level of the standing water in the subsoil is to be expected. This unless corrected will result in the creation of conditions unfavorable to the production of all deep-rooted crops. The lands on the hillside slopes are largely able to free themselves of any excess of water, by reason of their position, but their natural drainage may result in the flooding of the lower lands, with disastrous results to whatever may be planted there.

The changes in the moisture conditions of the soil and the accompanying evils noted above may be easily remedied by artificial drainage and should not deter the carrying out of any effective project to bring irrigation water to the lands of this valley. In several instances the natural moisture conditions of the soil have proved unfavorable, but the installation of tile drains has remedied the trouble, and the extension of these systems to the irrigated lands will prevent any of the dangers outlined above.

#### SUMMARY.

The Medford area covers about 544 square miles or 348,160 acres of valley and adjacent hill and mountain land in the central part of Jackson County in southern Oregon. The principal stream in the area is the Rogue River, which rises near the northeastern corner of Jackson County and crosses the northern part of the area surveyed. Its principal tributary is Bear Creek, which flows through the main part of the level or gently sloping valley lands included in the survey.

Medford, which is located centrally in the area, is the principal town. Other locally important towns are Ashland, Central Point, Jacksonville, Gold Hill, Talent, and Phoenix.

The main line of the Southern Pacific Railroad between San Francisco and Portland affords transportation facilities for the area to outside points. The Pacific & Eastern Railway extends some distance northeastward beyond the limits of this survey, and when completed will connect with one of the transcontinental lines of the northwest.

The climate is moderate and characterized by mild temperatures, low wind movement, and a large number of clear days.

This area was first settled by miners who drifted northward from the gold fields of California. They were soon followed by settlers coming both from the north and south, who settled along some of the valley streams. As the population increased the level lands were cleared and placed under cultivation, and finally many of the timbered slopes of the hills and mountains were cleared and used for agriculture.

Apples and pears are the principal crops of the valley, and the excellence of these fruits has made the region widely known both in this country and in foreign markets. Some of the smaller fruits, hay, and vegetables are also grown, but the production of these is not sufficient to supply home demands, and large quantities are shipped in annually.

The soils of the area are numerous and fall principally into two classes, residual and alluvial. All of the mountain and foothill soils are largely residual, but include some colluvial material and vary in texture from a fine sandy loam to a clay adobe. The average texture of these soils is a clay loam. Where of sufficient depth and where the topography is not too rough many of them are among the most valuable soils in the area. The soils on the uniformly sloping floor of the valley are usually alluvial and range in texture from fine sandy loams to clay adobes. The average texture of these soils is about a heavy loam. Nearly all of them carry gravel, many are underlain by hardpan. The drainage conditions are in general good. The larger part of these soils is under cultivation, and with the present rate of increase in the population of the valley it will be but a few years until their entire area will be utilized.

Practically all of the soils, except those occurring in a treeless district known as the Desert, were covered with a heavy growth of trees and brush. In the lower lands the larger part of this vegetation has been removed, but much of the hill and mountain slopes are still wooded.

Irrigation is not extensively practiced, its development having been retarded by the cost of installing satisfactory systems and by the attitude of the farmers toward such undertakings.

The prices asked for orchard lands, although apparently high, are justified by the returns secured, when orchards are given the proper care. The price of land not set in fruit trees is high and has tended to restrict the agricultural development of the valley to the production of fruit.

[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

(On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.)

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