SOIL SURVEY OF THE BLACKFOOT AREA, IDAHO.

By W. E. M'LENDON.

LOCATION AND BOUNDARIES OF THE AREA.

Bingham and Fremont are two of the easternmost counties of Idaho, the latter bordering the Yellowstone National Park on the east and Montana on the north. The area surveyed includes practically all of

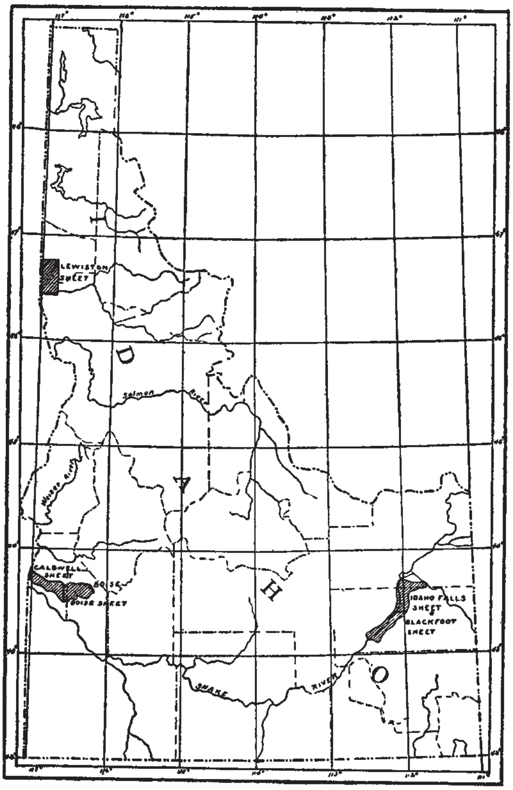

FIG. 51.—Sketch map showing location of the Blackfoot area, Idaho.

the irrigable lands of the Snake River Valley for a distance of about 50 miles, taking in a strip along the southern boundary of Fremont County and extending in a general southwesterly direction nearly across Bingham County. The valley proper, to which the eastern and western boundaries of the area have been made to conform as nearly as possible, lies mostly on the east side of the Snake River and varies from 5 to 20 miles in width, reaching its maximum width in the northern part of the survey.

The area is bounded on the north by an old abandoned channel of the Snake River, now used as a large feeder canal; on the east by the foothills of the Caribou, Blackfoot, and Port Neuf ranges of mountains, and on the west by an extensive area of lava fields and broken lands, very little of which is susceptible of irrigation. The southern boundary was taken across the valley some 8 miles southwest of Blackfoot, the county seat of Bingham County, going as far south as the agricultural interests seemed to justify.

The survey comprises an area of about 428 square miles, which is about half of the irrigable lands of the northern Snake River Valley. To the north of the surveyed area the irrigable part of the valley extends up the North Fork for a distance of some 30 miles. Because of the limited time available for work in the valley the northern half, although important agriculturally, could not be included in the survey.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Very little is known of any settlements in the valley prior to 1863. At this time a ferry was put in operation across the Snake River on the Lander trail, which was one of the pioneer ways across the mountains to the West. On account of the interference of ice with the operations of the ferry during the winter months it was abandoned in 1865, and in its stead a toll bridge was built 9 miles farther south, where the town of Idaho Falls now stands. The Ogden-Butte stage line, which had crossed the river far to the south, now came to this bridge to cross. Stockmen and travelers largely patronized the bridge, as may be inferred from the fact that the daily toll receipts reached a maximum of $2,600.

A post-office had been located at the ferry, and when the ferry was abandoned the post-office was moved down to the bridge, continuing business under the name of Eagle Rock. The name was afterwards applied to the small town that sprang up at this place, which subsequently became known as Idaho Falls. Eagle Rock was the oldest permanent settlement in the valley.

The Utah and Northern Railroad (now the Oregon Short Line) was completed as far north as Blackfoot in the fall of 1878, reaching Eagle Rock the next spring, and by the middle of summer the terminus was far beyond the northern limits of the survey. When the railroad came there were but a few agricultural settlers in the valley. They were located along Willow Creek and at the junction of the North and South forks, where the water came sufficiently near the surface to enable the production of some hay and pasturage. Most of their time was spent in hunting and trapping, though in a limited way some attention was given to producing hay and cattle. The hay was at that time worth $20 a ton in the stack.

Realizing the future of the section for agricultural purposes, local business men began the construction of the first irrigation canal in the area, 12 miles of which was completed during the winter of 1879 and spring of 1880. This canal was taken out of South Fork, near its canyon, and extended in a westerly direction across the valley. It was first incorporated as the Snake River Water Company, later as the Anderson canal, and is now known as the Peoples' Progressive canal. In the same winter some Mormons settled at Menan and Rexburg, and began improvements. The following spring they extended an invitation to their Mormon friends in Utah and other sections of the country to come and settle in the valley. As a result settlers began to pour in, some taking up land along the Anderson canal, and others at Menan, Rexburg, Lewisville, and other points. Agricultural communities rapidly sprang up, canals were built, and in a few years nearly all the land had been filed upon, either as homesteads or forest claims, or had been bought outright. From this time on the agricultural development was very rapid. At first only small patches of potatoes and alfalfa were to be seen. Later the small grains were grown, with surprising success, and now may be seen section after section of wheat and alfalfa. At least 50 per cent of the area surveyed is now under actual cultivation.

In 1891, for speculative purposes, the name Eagle Rock was changed to Idaho Falls. The following year Bingham and Fremont counties were organized. They had formerly composed a portion of old Bingham County.

CLIMATE.

The climate of the area is arid, with a very wide range of temperature, a low relative humidity, and a light annual precipitation. Though not of very frequent occurrence, the temperature sometimes reaches 100° F. in the summer, and falls as low as 37° F. below zero in the winter. On account of the dryness of the atmosphere, neither of these extremes causes much inconvenience. July is the hottest and December the coldest month of the year. The winters are generally long and cold, with correspondingly short summers. As a whole, the climate would be classed as moderate, pleasant, and healthful.

Violent windstorms rarely visit this section, but strong winds are quite common, and may be expected at almost any time. In the summer local wind and dust storms, accompanied by lowering temperature, are common. These winds are very drying. They have also had much to do in forming the soils of the area, being solely responsible for the sandy formations, as well as effecting minor modifications in other types. The mountains east of the area afford very little protection against these winds, as they are from the opposite side of the valley. The lack of protection by the mountains, with the altitude, is the principal cause of the uncertainty of weather conditions, both as regards rapid variations of temperature and the erratic occurrence of frosts during the summer months.

The annual precipitation amounts to almost 9 inches, but the greater part occurs in the winter, fall, and spring, and agriculture without irrigation is impossible. The spring rains help to some extent to bring up the small grain. Most of the winter precipitation is in the form of snow, and is much heavier in the mountains than in the valley. It is from the melting snows accumulated in the mountains that the streams of the area are fed.

The occurrence of frosts during the growing season has been a determining factor in the agricultural interests of the valley, as is plainly shown by the limited number of crops grown. Such frosts occur every summer, but are rarely severe enough to do more than slight injury, though occasionally the growth of even the alfalfa crop is severely checked.

An idea of the weather conditions of the area can be had from an inspection of the following tables, compiled from Weather Bureau records at Blackfoot and Pocatello, the former lying in the area. The conditions given for the latter station, while not exactly representative of the whole area, are sufficiently close to answer all practical purposes. The first table gives the normal monthly and annual temperature and precipitation, and the second the dates of first and last killing frosts in fall and spring, respectively.

Normal monthly and annual temperature and precipitation.

Month.	Blackfoot.		Pocatello.		Month.	Blackfoot.		Pocatello.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° F.	Inches.	° F.	Inches.		° F.	Inches.	° F.	Inches.
January	23.7	0.52	19.1	0.48	August	67.2	0.60	77.7	0.27
February	27.2	.55	23.0	1.03	September	56.9	.23	59.0	.26
March	34.2	.40	34.3	.67	October	45.4	1.20	48.7	1.41
April	45.5	.66	46.8	1.92	November	34.3	.79	33.0	.76
May	55.3	1.40	58.0	.74	December	23.3	.71	26.0	1.30
June	64.1	.38	65.0	.12	Year	45.5	8.14	46.9	9.04
July	69.1	.70	71.9	.08					

Dates of first and last killing frosts.

Year.	Blackfoot.		Pocatello.	
	Last in spring.	First in fall.	Last in spring.	First in fall.
1898	June 5	Sept. 29		
1899	June 6	Aug. 22		Oct. 2
1900	July 5	Sept. 19	Mar. 28	Sept. 27
1901	June 6	Sept. 10	Apr. 1	Nov. 2

PHYSIOGRAPHY AND GEOLOGY.

The area lies almost wholly within the alluvial plains of the Snake River, which is still lowering its channel, giving rise to a series of more or less well-defined terraces, with a difference in elevation of from 5 to 20 feet. The lower terraces border the river channel, and in places are still subject to overflow in seasons of extreme high water. These terrace lines are best developed on the west side of the river and from Idaho Falls south on the east side. The northern part of the area is quite level, except for the general slope of the valley, which here is both south and west, on account of the combined influences of the main river channel on the west and South Fork on the north. The surface between the terrace lines is generally level, but remnants of old stream channels are to be found in places, giving the surface a somewhat broken aspect. The higher terraces around and to the west of Idaho Falls were never overflowed by the Snake River. They are usually rolling, and sometimes even rough and broken. Especially is this the case in the immediate vicinity of Idaho Falls, where the underlying basalt outcrops in places and the surface is so rough and broken that none of it has yet been brought under cultivation. A more extensive area of similar hillocky and broken character is found in the northwestern corner of the area. Here the basalt hills rise to a height of at least 75 feet above the surrounding valley, and are only partially covered with soil. Because of the fact that the whole area of about 4 square miles can not be irrigated and is unfit for agricultural purposes, it was mapped as rock outcrop and shown by symbols without color. Other smaller areas of broken land are found on the higher terraces about 3 miles north of Blackfoot.

Starting just south of Blackfoot and extending in a northeasterly direction along Blackfoot River to its canyon, and thence more nearly north to within a mile of the small town of Ammon, is an extensive æolian sand formation, in which is developed a series of ridges, hillocks, and dunes of various heights, with intervening narrow swales, running in the direction of the longest axis of the sand area. The average height of the ridges ranges from 10 to 20 feet, but some of the larger dunes are at least 50 feet high. The sands are partially protected from the action of the winds by sage brush and growth of like character, but not sufficiently to keep the sand from moving to some extent. The northern extremity of this sand area is being gradually moved farther north each year, and it is here that most of the large and newly formed dunes are found. From Shelley north along the Snake River smaller areas are now in process of formation.

The elevation of the valley ranges from 4,600 feet at Blackfoot to nearly 4,900 feet in the northern part of the area, giving a slope of about 6 feet to the mile. Much of this fall is made in the Snake

River by a series of rapids, the intervening stretches of water running much more slowly. This condition is due to projecting dikes of the underlying basalt, occurring at intervals throughout the valley, over which the river usually drops several feet within a very short distance. The existence of these dikes is further substantiated by the great difference in the depth of standing water in different parts of the area. North of a line running nearly due east and west of the basaltic hills southwest of Lewisville the water table comes within 15 to 20 feet of the surface, while a short distance south of this line water can hardly be had at any reasonable depth. These barriers are also responsible for the extensive alluvial deposits built up by the Snake River.

The geology of the area is somewhat complicated and not well understood. However, the relations of the soils to the rock formations from which they are derived can be traced out with a fair degree of accuracy.

The eastern boundary of the area surveyed is the eastern edge of the vast basaltic lava field extending far to the west and south. Basalt is now the underlying rock throughout the area and outcrops in several places, either as long, narrow ridges, or as a series of rough, broken hillocks only partially covered with soil. Such areas are nonagricultural and are represented on the accompanying soil map as rock outcrop. The Snake River has eroded a valley through the basalt, and in shifting its course from one side of the valley to the other has built up immense gravel beds of various depths. Over the gravel has been deposited a veneering of fine earth, constituting the alluvial soils of the area. The gravel is principally basaltic and varies from 1 to 6 inches in diameter. The gravel near the surface is generally smaller than that found in lower depths. Where a limited amount of gravel occurs on or near the surface is found the gravel phase of the principal type of soil mapped as Yakima loam. Typical Riverwash is simply the gravel without the soil covering. All the areas of residual soil occur on the higher terraces, which have never been overflowed by the Snake River.

The alluvial soils have been influenced by the large amount of material brought down from the mountains east and north of the area by the Snake River and its tributaries. These mountains are composed of both sedimentary and eruptive material, the latter generally of the potash-feldspar series of rocks, rather than of the soda-lime series as in the case of the basalt. This is a chemical difference which has not played an important part in the physical properties of the soil. It is a noticeable fact that the soils of the area, whether residual or alluvial, derived from one series of rocks or from the other, bear a striking resemblance to one another both as regards physical properties and crop production.

SOILS.

But three soil types were recognized in the area, the names and extent of which are given in the following table:

Areas of different soils.

Soil.	Acres.	Per cent.
Yakima loam	241,216	88.0
Yakima sand	31,104	11.4
Riverwash	1,792	.6
Total	274,112	

YAKIMA LOAM.

The Yakima loam, as classified and mapped in the Blackfoot area, is a gray to brownish friable loam from 2 to 6 feet deep, underlain by a gravelly loam, or by waterworn gravel from 1 to 4 inches in diameter. In the lighter phases of the type the soil has a somewhat ashy appearance and feel, while the brownish and more loamy areas are found where irrigation has been practiced for a number of years. The soil is loose and easily tilled, and bakes very little on exposure after irrigation.

There are a few variations in the type of sufficient importance to call for special treatment in this report. The least desirable phase of the type is represented by a friable loam containing from 10 to 30 per cent of gravel about 1 inch in diameter to a depth of 2 feet, underlain by a gravelly loam or gravel, as in the typical profile. The gravel present in this variation makes the soil more droughty than usual, and principally for this reason not a very large proportion of the gravelly areas have yet been brought under cultivation. There are a few small areas where the gravel content is much higher than 30 per cent, but such areas generally occur in old stream ways, and are too narrow to be shown on a map of the scale used without greatly exaggerating them. The gravelly areas are indicated on the soil map by the gravel symbol.

The residual soils of the area are very similar to those laid down by the river, but are generally 6 feet or more in depth and underlain by basalt.

The Yakima loam forms an almost continuous mantle throughout the area, even representing the subsoil of the sandy types of soil. The largest gravelly area is found in the northern part of the survey on both sides of the county line. Other areas of considerable extent are found east of Basalt and Shelley; southwest of Blackfoot on the Indian reservation, and around the small town of Bryan, extending along the upper boundary of the sheet. The residual phase occupies the upper terraces around and to the west of Idaho Falls. Areas of Yakima loam found among the sandy areas are generally covered with a veneering of sand. Otherwise they are the same soil as found elsewhere in the valley.

The physiography of the area, as previously given, represents the physiography of this soil, excluding such physical features as are developed in the sand areas. The gravelly subsoil, the slope of the valley, and the elevation of the area above the river channel afford an almost perfect system of drainage, and it is hardly probable that artificial drainage will have to be resorted to unless there is gross carelessness in irrigation. As yet the underground water table has not been materially affected by irrigation.

This soil is composed chiefly of basaltic material, with slight modifications in the areas of alluvial formation by material brought down from the mountains by the Snake River and its tributaries. The processes which gave rise to the soil as now exhibited in the area are still going on. The soils formed in place are gradually deepening by reason of the decomposition and disintegration of the underlying basalt, while the formations built up by the Snake River are being torn down and carried to other parts of the valley. In this way some of the higher terraces are giving way to others nearer the level of the present river channel.

Upon this soil type practically all the farming of the area is carried on. The principal crops grown are alfalfa, wheat, potatoes, oats, barley, and sugar beets. Alfalfa gives only two cuttings a year, with a total yield of from 3 to 7 tons per acre, averaging about 3½ tons. Wheat yields 30 bushels, potatoes 150 bushels, oats 60 bushels, and barley 40 bushels per acre. Nothing definite could be learned of the yield of beets, as the first crop was still in the field at the time of the survey, but indications are that it will be fairly heavy. The yields of the different crops stated above have all been greatly exceeded, which fact gives some idea of the possibilities of the land under the best methods of culture. Apples, currants, cherries, and raspberries are grown to a limited extent for home use. The apple industry is growing rapidly, and may be extended to a commercial basis within the next few years.

The crops now grown do unusually well when given the best of care. Other crops adapted to the climate of the area would in all probability do equally well. Alfalfa and fruit trees are better adapted to the gravelly areas than are the field crops.

The table on the following page gives mechanical analyses of the soil and subsoilof this type.

Mechanical analyses of Yakima loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9138	3½ miles W. of Idaho Falls.	Silty loam, 0 to 72 inches.	0.41	Tr.	0.38	0.32	1.30	17.90	74.92	4.60
9134	2 miles S. of Ammon.	Fine sandy loam, 0 to 36 inches.	1.26	0.30	1.72	3.22	22.02	29.14	27.20	16.20
9136	3 miles SW. of Idaho Falls.	Fine sandy loam, 0 to 48 inches.	1.66	Tr.	.50	.60	12.98	35.02	34.00	16.60
9137	Subsoil of 9136....	Silty loam, 48 to 72 inches.	1.07	1.64	4.70	2.44	10.50	23.52	41.40	15.60
9135	Subsoil of 9134....	Fine sandy loam, 36 to 72 inches.	1.23	.60	1.90	3.30	23.80	29.10	23.30	18.00

YAKIMA SAND.

The Yakima sand is a gray to dark-gray sand, from 1 to 6 or more feet in depth, underlain by a subsoil composed of the same material as the Yakima loam. The texture varies from a fine to a medium coarse sand, very loose, incoherent, and easily moved by the winds. The soil is naturally well drained, and free from alkali.

The largest area extends from Blackfoot in a northeasterly direction to within a mile of Ammon. The next largest area lies on the west side of the Snake River, 2 miles north of Shelley. Other smaller areas are found west and north of Idaho Falls.

This type occurs in ridges, hillocks, or dunes of varying heights, with intervening narrow swales where the sand is usually shallow or entirely wanting. Areas where the sand was less than 1 foot deep were mapped as Yakima loam. In places these sands are still being moved by the winds.

The materials from which this soil is derived, as with the Yakima loam, are principally basaltic. The sand formation as now found is due to wind action, mainly along the exposed bluffs of the Snake River, though smaller areas have been built up on exposed surfaces far away from the river channel. All the finer soil particles are carried away by the wind, leaving the coarser sand particles to be drifted into ridges and dunes, and gradually moved inland. Such areas, now being formed along the Snake River, though generally small, illustrate how, by long-continued wind action, even very large areas can be built up. It is very probable that the Snake River was flowing nearer the east side of the valley when the large sand areas found there were being formed.

Except on the level areas, no attempt has been made to farm these sands. The rougher parts can not be irrigated. Alfalfa, if once established, does fairly well, but the shifting nature of the sand makes it a very difficult matter to establish this crop. As a whole, the type is of little agricultural value, and should be allowed to remain covered with sagebrush, so as to afford protection against the transporting action of the winds. The intervening areas of loam, even if covered with a few inches of sand, can be advantageously farmed.

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

Mechanical analysis of Yakima sand.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9139	3½ miles NE. of Firth Station.	Gray medium sand, 0 to 72 inches.	0.68	1.08	18.12	23.14	38.84	11.56	3.70	2.28

RIVERWASH.

The Riverwash encountered in this area is a very gravelly loam or coarse gravel, with the interstices filled with fine sand and silt. It is found as washed areas along the Snake River, or in old, abandoned stream ways. From Basalt south along the river are several small areas, most of which are still subject to overflow. The only other area of any size is found in the northern part of the survey, almost paralleling the Burgess canal. This area occupies an old course of South Fork, and is no longer subject to overflow. Whether overflowed or not, none of the areas mapped as Riverwash are of any agricultural value. The areas of this type, in the aggregate, amount to about 2½ square miles.

WATER SUPPLY FOR IRRIGATION.

All the irrigation water of the area, except a very limited quantity from Blackfoot River and Willow Creek, is taken from either the main channel or the South Fork of the Snake River. The flow of water in this stream at different seasons is not known, but the volume is enormous throughout the year, the maximum occurring in the spring. The lowest stage is reached in the latter part of July, when practically all the snow has disappeared from the mountains. Even at this season there is more than enough water to meet all requirements for irrigation, though occasionally there is some difficulty in securing enough water in the neighborhood of Blackfoot, the river at that point flowing mostly through the underlying gravel and reappearing farther south. This peculiarity is noticeable only in seasons of very low water.

The quality of the water is excellent, as is shown by the following analysis, made in the chemical laboratory of the Bureau. Two samples were taken in the latter part of June—one from the Snake River and the other from the Idaho Improvement Company's canal. The samples were necessarily very similar, so a composite solution was made of the two. The first column of the table gives the constituent minerals and acids as actually determined; the second column, the salts as they are supposed to exist in solution.

Analysis of water from the Snake River.

Constituent.	Parts per 100,000.	Constituent.	Parts per 100,000.
Ions:		Conventional combinations:	
Lime (Ca)	4.0	Calcium sulphate ($CaSO_4$)	4.7
Magnesium (Mg)	0.9	Calcium bicarb. ($Ca(HCO_3)_2$)	7.2
Sodium (Na)	3.8	Magnesium bicarb. ($Mg(HCO_3)_2$)	3.5
Potassium (K)	2.0	Potassium chloride (KCl)	3.8
Sulphuric acid (SO_4)	3.3	Sodium chloride ($NaHCO_3$)	8.4
Chloride (Cl)	4.2	Sodium chloride (NaCl)	3.9
Bicarbonic acid (HCO_3)	13.3	Total solids	31.5
Total solids	31.5		

The total amount of salts carried is only 31.5 parts in 100,000 parts of water, or about 0.03 per cent. No doubt this amount is somewhat exceeded when the river is at its lowest stage.

The area is provided with an extensive system of canals, the number of which will forbid a separate discussion. The greater number were built under cooperative systems, making the farmers the owners of their water supply. The only expense under this system is for general operation and repairs. This method furnishes a satisfactory and very cheap water supply. The other canals have been built by syndicates, and the water is sold to the farmers at different prices, generally about $1 per acre irrigated, though higher prices are not uncommon.

The cost of keeping the canals in repair is not very great. The canals have rather steep gradients and gravelly beds, and the water is allowed to flow very rapidly. Silting up is impossible under such conditions, and very little erosion takes place, because of the nature of the soil. The slope of the valley makes it possible to get water on the higher lands without the construction of very long canals.

UNDERGROUND AND SEEPAGE WATERS.

The depth to standing water varies from 10 feet or less on the lower terraces immediately along the river to over 100 feet back near the foothills. The underground waters circulate freely and seem not to be greatly affected by irrigation. Seepage from the canals is slight. Though most of the canal beds are cut through the gravelly subsoil of the area, by a slight puddling of the finer material between the gravel, very little water is allowed to seep away. Many laterals have been built up—some as much as 4 feet above the surrounding lands. The outside banks of these ditches remain entirely dry, or at most are only slightly moist, even after water has been running through them for weeks.

Throughout the area the well waters are hard from the amount of lime carried in solution. With the exception of this salt ($Ca(HCO_3)_2$), the well water is not very different from that carried by the Snake River.

ALKALI IN SOILS.

The area is practically free from injurious accumulations of soluble salts in the soil. However, a thorough investigation of the few instances of present accumulation and of the probable areas of future damage was made.

Six-foot borings were made in all parts of the area, and here and there borings to a depth of 9 feet were sunk to determine if there might be deeper deposits which could, under conditions favoring accumulation, be brought to the surface or within the root zone of the crops. With only two exceptions no alkali was encountered in the area. These two areas, amounting to about three-fourths of a square mile, are classified with the lowest grade of alkali land, viz, that containing from 0.20 to 0.40 per cent of alkali—an amount not in itself sufficient to injure any of the cultivated crops. In these areas the water table has risen near to the surface and this is the cause of the accumulations which occur at or near the surface. Nearly all alkali is accumulated in this way, and unless the cause is removed, either by more careful irrigation or by some system of artificial drainage, the two areas referred to will gradually become more alkaline and may become worthless for agricultural purposes. The larger of the areas is about 1½ miles southwest of Bryan. The other area is about 5 miles northeast of Idaho Falls. On account of the limited amount of alkali found, no alkali map was made to accompany this report.

In making the alkali survey several areas were found which are likely to become alkaline if for any reason the water table be raised to within 6 feet or less of the surface and kept there for any length of time. These areas generally have a little heavier soil, a deeper soil, and are slightly lower than the surrounding country—three conditions conducive to an alkali accumulation when other conditions are made favorable. Around Ammon is an area of this character covering about 3 square miles. Another area of about 1½ square miles is found about 3 miles southwest of Ammon. Along Paine ditch, north of the sugar factory, is another area covering 1½ square miles, and still another is found just north of the junction of Little and Big Sand creeks. The only other area of any size is 5 miles south of Idaho Falls, along the railroad. Precautions should be taken against over-irrigation, and if necessary artificial drainage should be resorted to.

Occasionally along canal banks one finds slight incrustations that without examination might be taken for some of the more soluble salts. As a matter of fact these incrustations are principally calcium carbonate ($CaCO_3$). The soils of the area carry a superabundance of this salt, which as such is very slightly soluble, but which readily passes into solution as the bicarbonate ($Ca(HCO_3)_2$). On evaporation of the water from the surface the bicarbonate reverts into the insoluble form and is precipitated as a white powder. These are very local and should not be mistaken for the harmful alkali salts.

In a general way the cause of damage to land from alkali has been pointed out. It is always best to take the necessary precautions to prevent the accumulation of the salts rather than to rely upon reclamation after the soil becomes too alkaline for the profitable growth of crops. The natural drainage of the Blackfoot area is good, and unless irrigation is excessive it is hardly probable that there will be any trouble with alkali, except possibly in the areas to which reference has already been made.

AGRICULTURAL METHODS.

In bringing new land under cultivation the first step is to get rid of the sage brush—almost the exclusive growth on the drier lands. There are several devices for accomplishing this, all of which are more or less effective. If the growth of brush is small and the covering scant, it is generally removed in the plowing. The first year the land is given a good, deep, plowing, and allowed to fallow until the following spring, when alfalfa, wheat, or some other crop is sowed.

The methods of sowing and caring for alfalfa are about the same as those used in other sections. Two waterings by the flooding method are considered sufficient for each cutting. The first irrigation in the spring is generally given as soon as the plants have begun to grow. By some farmers it is considered unsafe to irrigate until the possibility of frosts has passed. As a result the spring growth is retarded and stunted, and a light harvest follows. Water, instead of being injurious in times of frost, is very beneficial, unless the frost be very severe, which is not likely after crops have begun to grow. The first watering for the second crop should be applied before the first crop is mowed. If this method is followed the second growth will begin much more promptly and continue more rapidly than if the watering were postponed until the hay is removed from the field.

There is some difference of opinion as to the best time to cut alfalfa. The greater part of the crop is cut while in or near full bloom; the remainder not until the bur stage is nearly reached. That the yields are slightly heavier in the latter case is very evident, but always at the expense of the feeding quality of the hay, which is more woody, less palatable, and less digestible. When cut in full bloom the food constituents are more evenly distributed throughout the plant, making the stems about as good food as the more leafy parts. Another point in favor of early cutting lies in the fact that a plant rapidly loses its vitality on nearing the seeding stage, after which most plants take a period of rest. The effect of this on each succeeding crop is apparent in the weakened growth.

Wheat, the next crop in importance, is sown in early spring, as soon as the ground is thoroughly thawed. The moisture accumulated during the winter months, or the spring rainfall, is depended on to bring it up. The first irrigation is given as soon as the wheat has begun to grow. In all, three waterings are required to produce the best yields, which, when the crop is properly cared for, are about as high as anywhere in the United States. There were, however, hundreds of acres to be seen during the time of the survey, where the crop was an almost complete failure, because the fields had not been irrigated at the proper time. Many fields were burned almost to a crisp before water was applied. Such grain does not tiller well, the growth is very much dwarfed, and the heads are generally less than half the normal size. What is said of wheat holds equally well for the other grain crops.

There seems to be no well-founded reason why a good soaking irrigation of the grain lands in early spring should not prove beneficial. By the time the soil has thawed it should be sufficiently dry to be plowed, without inconvenience or damage to the land. There would be enough moisture in the soil to bring the grain up promptly and give it a good early growth. It is claimed that the soil would remain cold too late in spring because of this extra amount of moisture, but the difference can not be very great, and even if the planting was delayed a week or ten days, the early growth would be so much more rapid that the difference would be made up in a very short time.

The matter of economizing in the use of water and labor is also worthy of consideration. At this season of the year there is very little to do, and water is abundant, with no other use to which it can be put. There is, or will be in the near future, a demand for all the water that can be had during the summer months. This early irrigation would practically do away with one of the waterings later in the season. Irrigated grain crops are expensive at the best, and to make them pay every effort should be exerted to secure maximum yields. As the conditions are now the yields as a whole are considerably below what might be obtained from the soils of the character of the Yakima loam if more carefully cultivated.

Potatoes are grown quite extensively, but generally in small patches, or fields only a few acres in extent. The yields vary largely, depending chiefly upon the preparation of the soil for the crop and the subsequent cultivation. Some of the farmers give the land thorough and careful preparation, while others merely break the land with a turning plow, planting the potatoes in about every third furrow, to be covered by the next succeeding furrow. The crop is usually given three irrigations by the furrow method.

During this year (1903) has been made the first attempt to grow sugar beets on a commercial scale. Experiments previously tried have given assurance of the success of the undertaking. In round numbers, 5,000 acres were planted to this crop, and a sugar factory is in process of erection. It is planned to have a capacity to handle the product of twice the present acreage. The beets are being grown by the farmers, under the supervision of a general manager of the company, and by the company itself on lands which it owns or rents.

Rotation is practiced by only a few of the more progressive farmers. Alfalfa and the grains are rotated about every third or fourth year. In this way the land can be kept under continuous cultivation, with good yields every year, while by fallowing the grain lands, as is now extensively practiced, the farmer is deprived of the use of his land half the time, which can ill be afforded by the average farmer even though the yields are somewhat increased thereby. It is believed that a system of rotation could well be substituted for the present method of fallowing.

Two systems of irrigation are practiced in the area, the one used depending upon the crop to be irrigated. Potatoes and beets are irrigated by the furrow method, the other crops generally by flooding. Either method is sufficiently well understood to need no explanation.

Foxtail or squirrel grass is rapidly gaining a hold in the valley. It is now to be seen in and around nearly every alfalfa field. This is one of the greatest pests with which the alfalfa grower has to contend. In some sections of the country the first crop of hay is burned as a means of getting rid of it. With its present distribution in the valley it would still be possible to exterminate it by prompt and concerted action on the part of the farmers, but if allowed to become thoroughly established throughout the valley there will be no practical way of getting rid of it and the alfalfa industry will suffer great injury.

AGRICULTURAL CONDITIONS.

The greater part of the lands of the Blackfoot area was originally taken up by homesteaders with little or no capital. The average home of such settlers consists of a small log house of one or two rooms, with such outhouses as can be improvised from the roughest kind of material. The stable is usually of rough-edge boards or a combination of boards and wheat straw. Settlers of more means built fairly comfortable homes, with correspondingly good outbuildings. Many of the farmers, settling under very adverse circumstances, have not only been able to keep out of debt, but have accumulated sufficient wealth to replace their first rude log dwellings with large and more comfortable houses of wood, brick, or stone. The farmers as a whole are in a prosperous condition. They generally have good farm stock and machinery, the latter usually of the latest improved type.

Most of the farms are operated by the owners. Some lands are rented, either for cash or on shares. The cash rent ranges generally from $1 to $2 an acre, but as much as $7 is being paid in some places for lands on which sugar beets are grown. A third of the crop is given as rent where the tenant furnishes the seed, plows the land, and harvests the crop. Sometimes the landowner furnishes the seed and gives the land the first plowing, in which case half the crop is taken as rent.

The size of farms depends to a great extent upon the manner in which the land was acquired. One hundred and sixty-acre farms are the most common. There are quite a number of 320 and 640 acres. Farms of 40 and 80 acres are generally tenanted, and represent subdivisions of larger holdings.

The agriculture of the area has not reached such a development as to make the labor problem of serious consequence. With the labor-saving machinery now extensively used the farmer, with his family, can do nearly all the work. In harvest time there is some need of additional help, which is generally drawn from the families of the neighboring farmers. The beet-sugar industry, which is now being developed in the area, will no doubt upset the labor conditions to some extent, as it requires a relatively large number of laborers to handle this crop, although some of the operations can be performed by children.

All the agricultural products of the area are of good quality. Alfalfa is the principal crop and is likely to continue so for some years to come. On account of the short season only two crops are harvested, with an average yield of from 3 to 7 tons, depending on the care and attention received at the hands of the farmers. Wheat yields from 15 to 50 bushels an acre, averaging about 30 bushels. In quality this wheat is equal to that grown in other western areas. There is reason to believe that the sugar-beet yields will be heavy, and preliminary tests show that beets grown in the valley contain a high percentage of sugar. The potatoes grown are put on the market branded as "Idaho potatoes" and command the highest prices.

Apple culture may, within the next few years, prove to be a paying industry. A number of orchards have been set out, and some of the trees are in full bearing. The trees grow unusually well and seem at present entirely free from injury, either by insects or fungous diseases. There should be a ready market for all the apples raised in this part of the country. Raspberries and currants are raised to a limited extent for home use. They also do well.

Sheep raising, while not strictly an industry of the area, receives considerable attention in the valley. The extent of the industry could not be learned. There are several stock companies which have the industry in hand. The sheep are kept in the mountains during the summer months and brought to the valley to be fed during winter. Sheep from other parts of the country are also shipped in for winter feeding. The farmers are thus given a good market for their alfalfa hay, which is sold in the stack. About 100 carloads of wool were marketed at Idaho Falls during 1903 and a few additional carloads were shipped from Blackfoot.

On account of the general uniformity of the soils throughout the area, there has been but little attention to special crop adaptations. It is generally known that the gravelly phase of the Yakima loam is not adapted to wheat or the other grains, as it is too droughty for shallow-rooted crops. Such areas, however, are recognized as good locations for fruits.

The railroad facilities of the area are very good. The Oregon Short Line Railroad passes through the middle of the area, with branch lines from Blackfoot and Idaho Falls. There are stations at convenient distances all along these roads.

In the developed sections of the area there are wagon roads on nearly every section line. These roads are always passable, but are rarely in the best of condition. After they are thrown open to the public they receive very little or no attention, aside from the building of a few bridges across the larger canals. Irrigation waters are turned into the roads at will, and as a result many of the roads are frequently little more than rivers of water and mud.

Idaho Falls and Blackfoot are the principal markets of the area. Only a relatively small part of the agricultural products goes to outside markets. Most of the potato crop, a part of the wheat crop, and a small quantity of alfalfa hay are shipped. The remainder of the wheat crop is handled by flour mills at Idaho Falls, Blackfoot, and Rigby. Most of the alfalfa hay is sold in the stack to stockmen, who winter large herds of sheep in the area. This method of disposing of the crop seems to be very satisfactory. The price paid is usually $3.50 a ton. As high as $7 a ton is paid for the baled hay in the summer, and sometimes it can not be had even at that price. Oats and barley are not grown very extensively, and are consumed locally. The sugar-beet crop will be handled entirely by the factory in the area. Prices fixed for the first crop are as follows: $4.50 a ton for beets with a sugar content of 15 per cent, and $4.25 a ton for beets containing 12 per cent sugar, on board cars at any of the receiving stations or at the factory.

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