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Soil Survey

Uinta County Wyoming

By
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and
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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
In cooperation with the
University of Wyoming Agricultural Experiment Station

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SOIL SURVEY OF UINTA COUNTY, WYOMING

By T. W. GLASSEY, Soil Survey Division,[a] Bureau of Chemistry and Soils, United States Department of Agriculture, in Charge, and T. J. DUNNEWALD and D. M. STEVENS, University of Wyoming

Area inspected by T. D. RICE, Inspector, District 3

United States Department of Agriculture in cooperation with the University of Wyoming Agricultural Experiment Station

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COUNTY SURVEYED

Uinta County is in the extreme southwestern part of Wyoming and is bounded on the south and west by the State of Utah (fig. 1). Evanston, the county seat, is 315 miles west of Cheyenne and 86 miles northeast of Salt Lake City. Uinta is the second smallest county in Wyoming. Its total area is 2,094 square miles, or 1,340,160 acres.

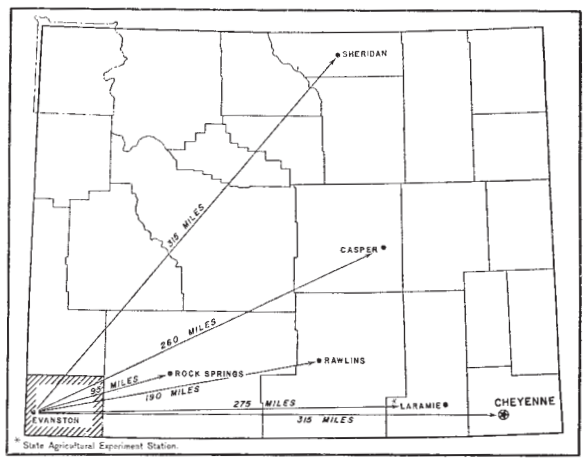

FIGURE 1.—Sketch map showing location of Uinta County, Wyo.

This county lies in the high mountainous country west of the Continental Divide. The crest of the Uinta Mountains rises in Utah just south of and approximately parallel to the Wyoming southern State line, and

[a] The Soil Survey Division was transferred to the Bureau of Plant Industry, July 1, 1939.

the southern part of Uinta County is on their northern slopes, at an elevation of about 9,700 feet above sea level. In front of the mountains, the plain is tilted by the uplift slopes downward toward the north, and, in the northeastern corner the elevation is about 6,300 feet. Numerous streams rise in the mountains and flow across the county in a general northerly direction. The most important stream systems are those of Bear River, Muddy Creek, and Blacks Fork. Between the stream valleys are divides, the slopes of which generally are eroded to form deeply cut valleys and minor ridges. Nowhere do flat areas of the original plain remain undissected.

The largest of the main ridges enters the county across the western half of the southern boundary and extends in a northerly direction. For a distance of about 16 miles it forms the watershed between Bear River and Muddy Creek. Continuing in a direction a little west of north, this ridge is joined by Aspen Ridge, and it becomes more prominent. A high point in this divide is Medicine Butte, about 7 miles northeast of Evanston where it is known as Bear River Divide. From this butte Bear River Divide runs north, separating the valleys of Bear River and Albert Creek. The slopes of the southern part of the divide range from gently to sharply rolling and are covered by a scanty vegetation consisting of sage and grasses. In the northern part the shales and sandstones are excessively eroded, and large areas are bare of soil and vegetation.

Toward the east, the next prominent highlands are Hog Back Ridge and Cedar Ridge, which form the divide between Albert and Muddy Creeks. The red shales of this section are thoroughly dissected. In places the thin soil supports a scanty vegetation, but large areas are bare and desolate.

The valleys of Blacks Fork and Smiths Fork and their tributaries traverse the eastern half of the county. This lowland belt enters the county in the south-central part and extends toward the northeastern corner. As they flow down the mountain slopes the streams are small and swift and are bordered by only narrow belts of alluvial material. From the foot of the mountains, valley fillings and fans of outwash material extend for several miles. As the streams descend past the outwash aprons they are flanked by alluvial terraces that stand one above the other, separated by steep eroded escarpments. These terraces, which are composed largely of coarse mountain debris, gradually diminish in width toward the north. The alluvial lands near Lyman have a width of more than 10 miles, lying between Blacks Fork and Smiths Fork. A few miles north of this town, Smiths Fork empties into Blacks Fork and the valley narrows. Northeastward from the junction of these streams, the alluvial land in few places exceeds a mile in width.

In the southeastern part of the county is an area of lowland bordering Henrys Fork. This valley is partly surrounded by a number of isolated mountains, the most prominent of which are Table, Hickey, Sage Creek, and Cedar Mountains.

Albert and Muddy Creeks are bordered by narrow bands of alluvial deposits.

Bear River and its tributaries drain nearly one-fourth of the western part of the county. Bear River enters with a border of alluvial terraces, which within a few miles widens to more than 5 miles. This

belt narrows above Hilliard Flat, but the river continues, bordered by a belt of alluvial land ranging from 1 to 2 miles in width, to a point where it leaves the county.

The drainage west of the Bear River divide is carried by Bear River, except an area of a few square miles in the southwestern corner, which drains into Chalk Creek and flows westward into the Weber River at Coalville, Utah. The rest of the county is drained by several forks of Green River, which flow into Green River a short distance east of Uinta County.

As already stated, the slope from the southern to the northeastern part of the county is rapid. Evanston is situated 6,743 feet above sea level; Lyman, 6,695 feet; and Le Roy, 6,708 feet. At the point where Bear River leaves the county the elevation is less than 6,400 feet. Henrys Fork enters the southeastern part at an elevation of 8,535 feet and leaves at an elevation of about 7,300 feet.

The native vegetation in the arid sections is dominantly of the sagebrush or northern desert shrub types. The most abundant plant is sagebrush which locally is called black sage. Rabbitbrush is widely distributed, but the growth is not abundant except in a few small areas. Desert grasses of several species make a sparse growth between the clumps of sagebrush over much of the land. The well-watered stream bottoms and marshy areas support a dense growth of shrubs and grasses. Needlegrass grows at intermediate altitudes in association with bluegrass and blue grama grass. The highest parts of the county, most of them above an elevation of 8,300 feet, are covered by dense forests of lodgepole pine, blue spruce, fir, and Engelmann spruce. Thickets of aspen grow on the edges of the conifer forests. Where the forest cover is less dense or absent, there is a grass cover consisting of needlegrass, porcupine grass, alpine timothy, meadow barley (locally called wild barley), junegrass, hairgrass, slender wheatgrass, bluegrass, and many other species. Species of vetch and wild peas grow among the trees on the Bear River divide.

In 1869 Carter County, one of the original counties formed by dividing the State into sections along the line of the Union Pacific Railroad, was divided to form Uinta and Sweetwater Counties. At that time Uinta County extended much farther north and included the greater part of what is now Yellowstone National Park. In 1913, a part of the county was taken to form Lincoln County.[1]

One of the first white men to enter this area was John Colten, who came between 1807 and 1810. Later, fur trappers visited this section, and, in 1842, James Bridger established a fort and trading post on the site of Fort Bridger. The Mormon pioneers, under Brigham Young, crossed the county on their way to Utah in 1847. Fort Bridger later became an important stopping point for the early emigrants to Oregon and California, as well as a station for the pony express. The first permanent home in the county was established by John Robertson. In 1853, Orson Hyde, of the Mormon Church, with 46 people established the first agricultural settlement in Wyoming at Fort Supply, about 9 miles above Fort Bridger. The first permanent settlement on Bear River was made by John Meyers in

[1] BARTLETT, ICHABOD S. HISTORY OF WYOMING. v. 1, illus. Chicago. 1918. See p. 529.

1860. In 1869, the Union Pacific Railroad was built across the county, and Evanston was established as the terminal point.[2]

Uinta County was first settled by people from States east of the Missouri River. The original county had a population of 856 in 1870 and 2,859 in 1880, all classed as rural. The population increased to 7,414 in 1890 and to 12,223 in 1900, still all classed as rural. By 1910, the urban population was 2,583 and the rural 14,399, or a total of 16,982. Following the reduction of the county to its present boundaries, the population was 6,611 in 1920. The next 10 years saw a decrease in the urban population from 3,479 to 3,075 and an increase in the rural population from 3,132 to 3,497, so that the total population decreased from 6,611 in 1920 to 6,572 in 1930. The loss in population evidently was due to decrease in employment on the Union Pacific Railroad, when the shops were moved to Ogden, Utah.

The urban population of 3,075 reported by the 1930 census is that of Evanston, the county seat. It is situated on United States Highway No. 30S—the Lincoln Highway—and the main line of the Union Pacific Railroad. Both the railroad and highway enter the county near the northeastern corner, extend almost diagonally across it, and leave near the center of the western boundary. Carter, the only other town served by the railroad, is in the north-central part. Lyman, Fort Bridger, and Mountainview are in the east-central part of the county a few miles from each other. Lyman and Fort Bridger are on the Lincoln Highway.

The Lincoln Highway is now surfaced with oiled macadam. A modern gravel highway connects it with Mountainview. The State highway down the Bear River Valley to Woodruff, Utah, also is surfaced with oiled macadam as far as the Utah line. Partly improved roads radiate from Evanston to most sections but are graveled for only a few miles. The county is well supplied with grade and high schools. Telephone service is available throughout the greater part. The larger towns have churches. The transcontinental air route crosses the county and has two emergency landing fields, one west of Fort Bridger and the other southeast of Evanston and west of Hilliard Flat. Evanston and Lyman are equipped with electricity for power and light. The principal towns and some farms are supplied with natural gas from the main line from the gas field near Rock Springs, which also supplies Salt Lake City, Utah.

Important industries in Evanston that employ labor are the Union Pacific Railroad reclamation plant, a State hospital, a brewery, and a creamery. Several miles north of the city coal is mined for local use. Several small coal mines and oil wells are near Junction, east of Evanston, and a coal mine is in Hog Back Ridge northwest of Le Roy. From the timber on the upper valleys of Blacks Fork and Smiths Fork, cross ties are made and transported to the railroad by truck. A cheese factory and a State experiment farm are located at Lyman.

CLIMATE

The climate of Uinta County, being of a continental type, is characterized by short summers, cold winters, and long cool periods in spring and fall. The rainfall is variable over the county, averaging less in the plains areas and more in the adjacent mountain areas.

[2] STONE, ELIZABETH ARNOLD. UINTA COUNTY, ITS PLACE IN HISTORY. 276 pp., illus. Evanston, Wyo. 1924.

The mean annual rainfall at Evanston, in the western part of the county, is 13.96 inches. The highest temperature recorded by the United States Weather Bureau at this station is 93° F., and the lowest, −38°.

Frosts may occur any month of the year in the elevated areas, but temperature conditions are favorable for the maturing of small grains, alfalfa, and potatoes in the lower, irrigated valleys. The average date of the last killing frost at Evanston is June 12 and that of the first is September 7, giving an average frost-free season of 87 days. The records show that frost has occurred, however, as late as July 3 and as early as August 11, and snow has been recorded in every month of the year except August. The longest frost-free season is in the extreme northeastern and northwestern parts of the county where the elevations are lower.

Hardy grains, grasses, alfalfa, and a few vegetables are the crops best adapted to climatic conditions. In summer the precipitation comes in the form of showers and in the winter consists entirely of snowfall. The snowfall seldom is more than a foot or two deep on the level at any one time, but it may drift sufficiently to block the roads for a duration of 2 or 3 days. This supply of moisture produces good range grass, and, in some seasons, livestock are kept on the range all winter and require no supplemental feed. During some winters, however, they must be fed throughout the season.

Field work can be performed from April 1 to November 1. As the average annual rainfall is light, supplemental irrigation is necessary for the production of hay and cultivated crops.

The normal monthly, seasonal, and annual temperature and precipitation at Evanston are given in table 1.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Evanston, Uinta County, Wyo.*

[Elevation, 6,860 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1931)	Total amount for the wettest year (1906)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	20.0	57	−26	0.89	0.77	1.04	6.3
January	19.2	55	−28	1.17	.16	1.37	9.7
February	21.1	53	−38	1.26	.13	1.02	10.5
Winter	20.1	57	−38	3.32	1.06	3.43	26.5
March	28.0	65	−30	1.44	.59	2.26	10.6
April	38.4	75	−7	1.34	.72	1.45	5.6
May	46.4	84	12	1.50	.97	4.51	3.7
Spring	37.6	84	−30	4.28	2.28	8.22	19.9
June	54.6	91	20	.95	.15	1.72	.3
July	62.0	93	28	.97	.80	.38	(1)
August	60.6	90	24	1.10	1.00	2.51	.0
Summer	59.1	93	20	3.02	1.95	4.61	.3
September	52.2	86	16	1.08	.58	.97	1.1
October	41.4	79	−3	1.34	.57	1.24	4.2
November	30.9	66	−17	.92	.75	1.19	5.0
Fall	41.5	86	−17	3.34	1.90	3.40	10.3
Year	39.6	93	−38	13.96	7.19	19.66	57.0

(1) Trace.

AGRICULTURAL HISTORY AND STATISTICS

The agriculture of the county from its early settlement has been based primarily on the raising of livestock, with hay as the main crop for feed during the long winters. Owing to the division of the county in 1913 into Lincoln and the present Uinta County, the census figures before 1920 are not applicable to the area surveyed except in a general way. The early settlers are reported to have grown some grain crops as well as native hay. The only crop, other than hay, reported by the United States census of 1880, was oats. Ten years later a small acreage was devoted to potatoes and a larger acreage to wheat, and the acreage in oats had increased. Crops of alfalfa, clover, barley, rye, millet, and strawberries were reported at the turn of the century. The sale of beef cattle, sheep, and wool furnished practically the entire income of the farmer and rancher. A small proportion of the income was derived from the sale of dairy and poultry products. The census of 1910 showed that meat, wool, and other animal products were still by far the most important sources of farm revenue, but the production of grains, potatoes, and vegetables were gaining in importance. Oats were at this period, and still are, the most important grain crop.

At present, the proceeds from the sale of beef cattle, sheep, dairy products, and poultry products amounts to about 75 percent of the total farm income. The value of all field and orchard crops, vegetables, and farm gardens in 1929 was $599,750, and the principal item was hay and forage, with a value of $502,474. Butter, cream, and whole milk were sold for $247,108; wool shorn and poultry products were valued at $204,194 and $95,321, respectively.

The greatest increase in field crops in the 10-year period 1920–29 was in the acreage of tame hay, especially timothy and clover and alfalfa. The production of all crops was reduced sharply in 1934, owing to the excessively dry weather and the resulting lack of irrigation water. Acreages of the important crops for the years 1919, 1929, and 1934 are given in table 2.

TABLE 2.—*Acreages of the principal crops in Uinta County, Wyo., in stated years*

Crop	1919	1929	1934 [1]	Crop	1919	1929	1934 [1]
	Acres	*Acres*	*Acres*	Hay—Continued.	*Acres*	*Acres*	*Acres*
Oats	2,119	1,715	528	Clover alone	795	192	55
Wheat	1,247	775	286	Alfalfa	6,994	10,954	4,849
Barley	317	769	421	Small grains for hay	643	43	337
Hay	35,428	48,828	23,129	Other tame hay	12,537	19,122	17,469
Timothy and timothy and clover, mixed	3,571	8,363	419	Wild hay	10,888	10,154	[2]

[1] Year of severe drought.
[2] Included with other tame hay.

The numbers of all livestock have declined somewhat since 1920. The data of the last census show the effect of the drought in 1934, during which the Federal Government purchased 10,670 cattle and 24,423 ewes, according to the records of the county agent.

Table 3 gives the number and value of livestock on farms for the years 1920, 1930, and 1935.

TABLE 3.—*Number and value of livestock on farms in Uinta County, Wyo., in stated years*

Livestock	1920		1930		1935 [1]
	Number	Value	Number	Value	Number
Cattle	25,134	$1,407,385	24,023	$1,345,784	19,092
Horses	4,166	233,935	3,617	143,578	4,060
Sheep	92,720	1,248,780	89,650	762,537	86,616
Swine	1,768	24,692	628	9,464	200
Poultry	17,849	19,584	[2] 17,800	[2] 13,213	[2] 16,946

[1] The number of livestock was greatly reduced owing to lack of feed following the drought in 1934, and the value was not reported.
[2] Chickens only.

The work animals, most of which are horses, are generally of good grade. Cattlemen and sheepmen use largely purebred or high-quality bulls or rams so that their livestock is of high grade.

The dairy industry centers around Evanston, Lyman, Fort Bridger, Mountainview, and Hilliard Flat. Grade cattle of the various dairy breeds are milked. The local demand for milk is supplied, and the surplus is used in making butter and cheese.

A few chickens are kept on most ranches, which, together with several large-sized flocks, produce enough eggs for local consumption. The raising of turkeys has become more important within the last few years.

There are at least two fox farms which produce furs and breed foxes.

The principal farm expenses are for feed and labor. Only two ranchers reported the purchase of fertilizer in 1929, at a total expenditure of only $40. Some farmers spread barynard manure over the fields.

Cattle are pastured on the stubble of the hay and grain fields during most winters. Sheep usually graze all winter on the range in the northern and northeastern parts of the county where the elevation is lowest and the snowfall least. The ration of hay for each head of cattle and each seven head of sheep is about 1 ton. In exceptionally long severe winters this quantity of hay is not sufficient. Cottonseed cake and corn are fed to sheep at the rate of one-fourth pound a day during the winter. Cottonseed cake is used also to supplement the hay ration for cattle. An expenditure of $225,996 for feed was reported by 285 farms in 1929, or $793 a farm reporting.

Native-white laborers are employed on the farms and ranches. Wages amounting to $197,442 were paid on 243 farms in 1929, or $813 a farm reporting. The supply of labor is plentiful, and the workers are efficient. Wages range from $30 to $40 a month for general farm workers, and from $40 to $60 a month for sheep herders.

The farms and ranches occupy 517,128 acres, or 38.6 percent of the total area of the county, according to the United States census for 1935. Only 49 percent of the land in farms and ranches represents improved land, that is, cropland or plowable pasture. The average size of ranches has increased from 795.3 acres in 1920 to 1,197.1 acres in 1935. A large number of the homesteads taken up during the last 20 years proved too small for grazing farm units

and were bought and added to the established ranches. Of the 432 farms in 1935, 83 included 1,000 or more acres each, with a total area of 402,079 acres. The size of farms ranges from 160 to more than 50,000 acres.

Few of the farms are rented. In 1935, 91.9 percent of the farms were operated by owners, 6.5 percent by tenants, and 1.6 percent by managers. Rental is on both a share and a cash basis.

Most of the farmhouses are built of logs, but some more pretentious houses are built of lumber, brick, or stone. The buildings generally are fairly well constructed, but many are rather old and out of date. Barns, sheds, corrals, and other farm buildings are adequate on most farms for the livestock and equipment. The supply of tools and machinery is sufficient to carry on the farm operations necessary in the growing of hay and grain for livestock.

SOIL-SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil, as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil [3] and its content of lime and salts are determined by simple tests.[4] Drainage, both internal and external, and other external features, such as relief, or lay of the land, are taken into consideration, and the interrelation of soils and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics soils are grouped into mapping units. The three principal ones are (1) series, (2) type, and (3) phase. Areas of land, such as coastal beach or bare rocky mountainsides that have no true soil, are called (4) miscellaneous land types.

The most important group is the series, which includes soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics or the same natural drainage conditions and range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The soil series are given names of places or geographic features near which they were first recognized. Thus, Shavano, Cut Bank, and Avon are names of important soil series in this county.

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[3] The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity, and lower values indicate acidity.

[4] The total content of readily soluble salts is determined by the use of the electrolytic bridge. Phenolphthalein solution is used to detect a strong alkaline reaction.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Ashuelot gravelly sandy loam and Ashuelot fine sandy loam are soil types within the Ashuelot series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a variation within a type, which differs from the type in some minor soil characteristic that may have practical significance. Differences in relief, stoniness, and the degree of accelerated erosion frequently are shown as phases. For example, within the normal range of relief for a soil type, there may be areas that are adapted to the use of machinery and the growth of cultivated crops and others that are not. Even though there may be no important difference in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such an instance, the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS

The soils of the hills and mountain slopes which make up so large a part of Uinta County are not suited to cultivation. The thinness of these soils, the steepness of the slopes, the frequency of frosts due to elevation, and the scant precipitation are unfavorable to the production of cultivated crops. The comparatively small areas that can be used for the production of farm crops are mainly on the lower slopes, terraces, and bottom lands, where irrigation can be practiced or where a high water table supplies moisture to crops. Here, the soils vary widely in texture and in their content of organic matter and salts. Under more favorable moisture conditions, a wide range of crops could be grown, but climatic conditions limit the use of the tillable land to a few small-grain and hay crops.

As has been stated, the agriculture is centered on the raising of livestock. The soils, climate, and market facilities combine to favor this enterprise and to discourage the production of cash crops. The remoteness from the great market centers and the consequent high freight rates make cash grain farming unprofitable. The climate limits the number of crops that can be grown, even in the valleys. The soils throughout a greater part of the county are not especially well suited to the production of small grain, but, under irrigation,

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they produce good yields of alfalfa and hay. The most important factor that determines the type of farming, however, is the fact that a large part of the county either is rough or lies at an elevation that makes irrigation impossible. These areas cannot be used for successful dry farming, but they furnish from poor to good pasture for sheep and cattle. A great number of sheep and cattle are grazed on these lands in the summer, but feed must be provided for long or short periods in the winter, depending on the quality of the grass and on weather conditions. The entire product of the cultivated fields, the hay meadows, and areas from which wild hay can be mowed is required to provide feed for the livestock. That this amount of hay and other feeds grown in the county is not sufficient for local needs is shown by the fact already noted that cottonseed meal and corn must be shipped in to supplement the local production of feedstuffs.

The value of the land is measured, therefore, by its ability to furnish grazing and winter feeds for cattle and sheep. On the basis of such utilization, the soils may be placed in three general groups: (1) Soils suited in part to the production of hay and grain crops, (2) soils suited in part to the production of hay, and (3) soils suited to grazing.

The soils of the first two groups are described as suited in part to the production of grass and hay crops, because a large percentage of the area of these soils is not under cultivation and because irrigation is not practiced usually, either by reason of topographic position or lack of water.

In the descriptions of the various soils which follow, an attempt is made to arrange them in the order of their natural productivity under present conditions. It is difficult to do this with any degree of accuracy, as some areas of a given type are widely scattered, and variations in the water supply from year to year greatly affect yields. The distribution of the soils is shown on the accompanying soil maps, and their acreage and proportion extent are given in table 4.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Uinta County, Wyo.*

Soil type	Acres	Percent	Soil type	Acres	Percent
Logan silty clay loam	47,424	3.5	Avon stony sandy loam, steep phase	13,440	1.0
Ashuelot gravelly sandy loam	32,576	2.4	Avon gravelly loam	13,824	1.0
Evanston very fine sandy loam	5,568	.4	Willow Creek loam	3,392	.3
Almy silty clay loam	6,080	.4	Uinta stony sandy loam	68,032	5.1
Billings very fine sandy loam	17,536	1.3	Leavitt loam	16,256	1.2
Billings silty clay loam	48,704	3.6	Billings sandy loam	2,368	.2
Cut Bank fine sandy loam	91,840	6.8	Ashuelot fine sandy loam	8,896	.7
Ashley stony sandy loam	22,656	1.7	Ashuelot gravelly sandy loam, steep phase	1,856	.1
Bridger loam	6,400	.5	Cut Bank fine sandy loam, shallow phase	165,760	12.4
Hilliard fine sandy loam	2,176	.2	Shavano loam	18,240	1.4
Hilliard stony fine sandy loam	17,856	1.3	Shavano loam, steep phase	291,328	21.7
Mesa fine sandy loam	5,184	.4	Shavano loam, shallow phase	19,392	1.4
Havre clay loam	5,760	.4	Shavano silt loam	7,296	.6
Havre gravelly loam	4,352	.3	Shavano silt loam, shallow phase	38,656	2.9
Havre fine sandy loam	832	.1	Shavano fine sandy loam	12,992	1.0
Havre silt loam	1,664	.1	Rough broken land	217,600	16.2
Gooch silty clay loam	7,232	.5	Dune sand	18,240	1.4
Shavano loam, colluvial phase	8,704	.7			
Avon loam	11,776	.9	Total	1,340,160	
Avon loam, steep phase	192	(1)			
Avon stony clay loam	6,272	.5			
Avon stony sandy loam	71,808	5.4			

[1] Less than 0.1 percent.

SOILS SUITED IN PART TO THE PRODUCTION OF HAY AND GRAIN CROPS

This group includes soils of which a part of their area—in most instances, only a small part—is used for the production of tame-hay and grain crops. Only that part of the soils is under cultivation which is irrigated, drained, and otherwise suited to crop production. The inclusion of a soil in this group does not necessarily mean that it is one of the best soils of the county in texture and composition, as it may be that a favorable topographic position and an ample supply of water make it capable of producing better yields than do other soils of better composition which lack an adequate supply of water. For example, Ashuelot gravelly sandy loam is a rather shallow soil overlying beds of gravel, and, if it had only a limited supply of water, it would not be productive; but, with abundant water for irrigation, the unfavorable features are overcome and good crops are produced.

The Logan soils occupy the low stream bottoms. The Ashuelot, Almy, Ashley, Evanston, Bridger, and Billings soils are developed on terraces or alluvial fans. The soils of the Cut Bank series are developed in part from fine-grained sandstones and sandy shales. A part of these occupies flat areas that can be irrigated.

The soils of this group differ widely in color, texture, structure, content of organic matter, and content of salt. Common characteristics are a fairly smooth surface, a comparatively low position, and a supply of water for irrigation.

Logan silty clay loam.—Logan silty clay loam is the most extensive and important soil of the lower stream bottoms. It is developed over stratified sediments brought down from many kinds of upland material. For this reason there are rather wide differences in texture and in the content of organic matter, lime, and soluble salts. Each stream valley has its distinctive soil, the composition of which depends on the character of the rocks and soils of the surrounding country. A gradual change due to climatic conditions and the character of the vegetation also takes place as the stream valleys descend from higher to lower altitudes. Numerous small areas of soils that differ widely from Logan silty clay loam have been included with it because they were too small to separate on a map of the scale used. Some of these variations are described.

Even typical Logan silty clay loam has definite characteristics that vary within a certain range. The 6- to 12-inch surface soil is dark grayish-brown, dark-gray, or nearly black silty clay loam or silty clay, which is composed of variously textured sediments, dominated by heavy materials. The soil is either granular or lacking in structure and is nearly everywhere mellow and easily tilled. In most places, it ranges from slightly to highly calcareous, but a few areas have been leached of their lime. The dark-colored surface soil gradually changes downward and is underlain by dark grayish-brown silty clay loam. A further change takes place, as depth increases, to gray or light grayish-brown silty clay loam or clay. Water-worn gravel occur here and there near the surface and are abundant at a depth ranging from 5 to 6 feet.

Typical Logan silty clay loam occurs in many areas along streams in nearly all parts of the county. The most extensive developments

are along Yellow Creek, Bear River, Muddy Creek in the vicinity of Piedmont, Beaver Creek in the vicinity of Lonetree, Blacks Fork near Lyman and Fort Bridger, and Smiths Fork in the vicinity of Mountainview.

This soil occupies the stream bottoms and low terraces. The land overflows with every heavy rain, and when the snow is melting on the mountains the water remains on the land so long that crops, such as alfalfa, are injured. The soil is naturally productive, but its value is greatly reduced by frequent flooding. The principal crop—hay—consists of a mixture of redtop, tufted hairgrass, timothy, and alsike clover. A small acreage of the higher land is sown to barley and oats. More than half the area of this soil has never been cultivated and remains in its native state, covered by grasses, willows, and sagebrush.

A variation of this soil occurs along the upper reaches of Bear River and along streams that emerge from the Uinta Mountains and enter Blacks Fork and Smiths Fork. The elevation is greater than that of other areas of Logan silty clay loam, therefore the climate is colder, precipitation is heavier, and the vegetation is correspondingly different from that in the lower and more arid sections. The surface soil consists of dark grayish-brown friable granular silty clay loam. It is underlain by lighter brown or grayish-brown stratified clay loam or sandy loam, and this layer, in turn, is underlain by lighter colored stratified material of variable texture, which continues to a depth of more than 5 feet. Below this depth, beds of loose rounded gravel occur in many places, particularly in the areas along Mill Creek. The vegetation on this variation of Logan silty clay loam consists of several native grasses, willows, birch, and a scattered growth of aspen trees. A part of this soil is cropped to timothy, redtop, and alsike clover for hay, which yields about 1 ton to the acre.

Another variation of this soil begins along Bear River below the crossing of the Evanston-Woodruff Highway and extends northward to the point where Bear River flows back into Utah. The elevation in this part of the valley ranges from 6,300 to 6,500 feet, and the mean annual precipitation is about 10 inches. The 8-inch surface soil throughout most of this included area is dark grayish-brown clay loam. It is underlain by lighter colored clay loam, and below a depth of 24 inches, the lower part of the subsoil shows evidence of poor drainage by the presence of iron stains and iron concretions. Sand or water-worn gravel underlies this soil at a depth ranging from 4 to 6 feet. A distinguishing feature of this included soil is its high content of salts. The soil material contains a high percentage of lime and in addition carries a varying percentage of soluble salts, known as white alkali. In places the salts form a white crust on the surface. In other places, greasewood and alkali spikegrass indicate the presence of large quantities of salts. The soil in this part of the valley varies considerably, and a cross section at any point shows a number of belts of different materials. Near the stream the soils generally are sandier, and, in places on the outer edges of the bottom, the soil is tinged by the red color of the weathered material washed in from the red shales of the higher land.

This part of the valley lies at an elevation ranging from only 6 to 10 feet above the river bed, and it is flooded frequently. A small

acreage of alfalfa is grown, but, because of flooding, the crop is not very successful. The river and incoming drainageways cut the land into small irregular patches that are difficult to irrigate and cultivate.

Ashuelot gravelly sandy loam.—Ashuelot gravelly sandy loam is extensively developed on terraces underlain by gravel. A distinguishing feature of the soils of the Ashuelot series is that the gravel is cemented by lime into a concretelike mass.

The upper 2 or 3 inches of the surface soil is grayish-brown or gray loose gravelly loamy sand which effervesces when tested with hydrochloric acid. Beneath this and continuing to a depth ranging from 6 to 12 inches, the soil is light-brown or light grayish-brown gravelly sandy loam or, in places, gravelly loam. The fine material contains a larger quantity of lime than does the first 2 inches of soil. The gravelstones are water-worn. Most of them range from ½ to 3 inches in diameter and are coated with a white layer of lime. Gravel forms a large proportion of the surface soil and interferes with farm operations. Below this and continuing to a depth ranging from 20 to 28 inches is a compact mass of gravel with a small quantity of interstitial grayish-brown sandy loam. In this layer, the gravelstones range from 1 to 6 inches in diameter, comprise from 50 to 75 percent of the soil mass, and are cemented together with lime. Under this layer the gravelly mass becomes less cemented, the content of lime is less, and the sand is browner. The stony layers are underlain at a depth between 40 and 45 inches by loose grayish-brown or gray gravelly sand which reaches a depth ranging from 4 to more than 6 feet. The size and percentage of the gravel are the same as in the layer above. This soil rests on green and gray shales and sandstone of the Bridger formation that appear to contain the alkali salts occurring in this soil, especially on the lower slopes south and east of Lyman.

Included with areas mapped as Ashuelot gravelly sandy loam are bodies having a somewhat heavier texture and containing a smaller quantity of gravel. These areas are situated near Urie and extend in a southwestern direction for 4 miles along the outer edge of the upper bench.

The principal area of Ashuelot gravelly sandy loam extends both northeast and southwest of Lyman, paralleling the bottoms of Smiths and Blacks Forks. The Ashuelot soils occur on benches that slope gently northeastward from the Uinta Mountains in the southern part of the county and extend north of Lyman for a distance of several miles. They are developed over the gravelly outwash material from the mountains. They lie in a region of comparatively light rainfall but have greater rainfall than does Cut Bank fine sandy loam which lies at a lower altitude and farther from the mountains.

Although Ashuelot gravelly sandy loam is not a naturally productive soil partly because of its low or moderate water supply, parts of it farmed under irrigation with an abundant supply of water hold a relatively high rank among the soils of the county. Timothy and other hay grasses make a good growth. The greater part of the land is not irrigated and presents a desertlike appearance. The dry land has only a low value for grazing.

The main native vegetation on this soil is black sage, together with a sparse growth of grasses. On the salty areas, greasewood (*Sar-*

cobatus sp.), two species of hop-sage or saltbrush (*Grayia* sp.), rabbitbrush (*Chrysothamnus* sp.), a grass locally called alkali spikegrass, two species of dropseed (*Sporobolus* sp.), and foxtail barley, locally called squirreltail grass (*Hordeum jubatum*) were observed.[5]

The soil in one area mapped as Ashuelot gravelly sandy loam, although similar to the typical soil in other respects, differs from it in having a dark grayish-brown color and a surface soil leached of lime. It occurs south of Mountainview on a bench higher than that occupied by the typical soil. The native vegetation is sagebrush and some grass. A large part of this included land is in alfalfa which yields well in places where sufficient water is available.

Evanston very fine sandy loam.—The brown soil of the higher terraces, which is not underlain by gravel, is mapped as Evanston very fine sandy loam. The upper 1 or 2 inches of material is a loose mulchlike layer of grayish-brown sandy loam. Below this is granular friable slightly compact brown very fine sandy loam. This changes abruptly at a depth of 4 or 5 inches to rich-brown loam or clay loam. This part of the subsoil is moderately compact in position and breaks into small angular blocks, but at a depth ranging from 12 to 20 inches, the material becomes more friable than that above and has a lighter grayish yellow color. It ranges in texture from very fine sandy loam to silt loam. Lime is present in most places at a depth of about 24 inches. The parent material, which begins at a depth of about 45 inches, is light grayish-brown silt loam containing a considerable amount of fine sand. The lime content is lower than in the layer above.

This soil is developed on terraces and alluvial fans along Bear River Valley extending northwestward from Meyers Bridge to the northern boundary of the county. The greater part of it lies at an elevation between 25 and 100 feet above Bear River. The areas are long, and they parallel the valley with a gentle slope toward the river. Because of the even slope and the freedom from stone, this soil is well suited for farming under irrigation.

The native vegetation consists of big sagebrush (*Artemisia tridentata*), which in places makes a dense growth, rabbitbrush, and needlegrass (*Stipa* sp.).

Evanston very fine sandy loam is one of the principal soils farmed along Bear River. Most of the cultivated areas are in the vicinity and north of Evanston. Only parts of the areas south of that city are used for crops at present, although a considerable acreage formerly farmed is abandoned and covered with sagebrush and grass.

The greater part of the soil in crops is devoted to hay crops, including alfalfa, redtop, and native grasses. On the land owned by the Wyoming State Hospital, a large variety of crops, including oats, alfalfa, and other hay crops, wheat, barley, potatoes, rutabagas, turnips, carrots, cabbage, red beets, parsnips, cauliflower, peas, lettuce, radishes, rhubarb, green onions, dry onions, spinach, green beans, sweet corn, strawberries, chard, and garlic. are produced. No records of the acreage of individual crops are kept at the State Hospital, therefore it is impossible to give estimates of acre yields.

[5] The plants mentioned throughout this report were identified by Aven Nelson, professor of botany, and C. L. Porter, assistant professor of botany, University of Wyoming. These identifications were verified so far as possible by S. F. Blake, senior botanist, Bureau of Plant Industry, U. S. Department of Agriculture.

Small areas of a heavier textured soil are included on the soil map with Evanston very fine sandy loam. Spots of silt loam occur near Millis, Evanston, and the junction of Christensen Hollow and Bear River. Areas having a loam texture occupy the southern part of Evanston and the site of the State Hospital. These areas are slightly more productive than the typical soil.

Almy silty clay loam.—Almy silty clay loam occurs in comparatively small areas on terraces and gentle slopes. The surface soil is loose friable reddish-brown silty loam underlain to a depth of 10 inches by reddish-brown calcareous heavy silt loam or silty clay loam. Below this and continuing to a depth of 16 inches, is a layer of reddish-brown calcareous material which is somewhat compact in position and breaks out in blocky clods. The next lower layer, which continues to a depth of 3 feet, is lighter colored, owing to an increase in the content of lime. The substratum is light reddish-brown silt loam. No marked change takes place in the material to considerable depth. In places, as along Little Muddy Creek east of Cumberland, the soil material reaches a depth of 20 feet.

The surface soil of this soil as mapped is not uniform. Areas of loam are included because of their small area, and a small area of silty clay near Chalk Creek is included.

A characteristic feature of Almy silty clay loam is the presence of boulders at all depths, which are generally, but not everywhere, more abundant near the surface. These boulders almost invariably are composed of quartzite. In the lower subsoil layers, they are cemented loosely by lime.

Areas of this soil along Muddy Creek and near Ragan contain salts and, in some places, a small quantity of "black alkali." The areas south of Evanston are well drained and free from harmful salts.

The areas of this soil in the vicinity of Evanston are the only ones farmed. Along Yellow Creek the soil is very productive. Oats yield 60 bushels to the acre, and barley yields 50 bushels. Three tons per acre of alfalfa hay can be obtained from two cuttings.

On uncultivated land, the native vegetation is sagebrush and some grasses. In salty areas, greasewood, cactus, and alkali spikegrass replace the sagebrush.

Billings very fine sandy loam.—The 5- to 8-inch surface soil of Billings very fine sandy loam is gray or light-gray very fine sandy loam. Below this and continuing to a depth of several feet are successive layers of sediments of various textures. Fine sand, fine sandy loam, and loam are the most common, with loam making up the greater part of the material. Both the surface soil and the underlying material are loose and friable.

This soil occurs on low terraces along Blacks Fork, Smiths Fork, Muddy Creek, and Little Muddy Creek, and in many unnamed draws in the northeastern part of the county. Over the greater part of it, a high content of salts has retarded the growth of vegetation and the ground is bare. About one-fourth of the surface is covered by salt sage, black sage, and pricklypear. In places where the salts are concentrated, rabbitbrush, saltbush, alkali spikegrass, greasewood, and squirreltail grass make a sparse growth.

Most of this land is used for the grazing of sheep in the winter and spring. The areas southwest of Verne have produced a few crops

of grain by irrigating the land with water from a newly constructed reservoir. Under irrigation the soil is well suited to the production of any of the crops commonly grown. Only a small proportion of this land, however, can be irrigated.

Billings silty clay loam.—Billings silty clay loam is developed on low terraces and alluvial fans built up of materials washed from gray sandstone and shale areas on the upland. The 8-inch surface soil is gray or light-gray highly calcareous silty clay loam. Owing to the scanty vegetation, almost no organic matter has accumulated in this layer. Below this, little change takes place in the color to a depth of 6 feet or more. The entire soil is built up of stratified sediments ranging in texture from sandy loam to silty clay loam, the heavier strata generally being thicker and forming the larger proportion of the soil mass. Both surface soil and subsoil are somewhat compact in position and break out in large blocky clods. The material in the surface soil, however, is pulverized more easily than is the subsoil. Large quantities of lime and other salts are present at all depths. In some areas the content of black alkali is sufficient to injure vegetation.

Billings silty clay loam occurs mainly in the northeastern part of the county, which has the lowest elevation, along Little Muddy Creek, and along Blacks Fork in the vicinity of Fort Bridger. The rainfall is lighter here than elsewhere, and a desertlike condition prevails.

The salt content of the soil prevents the rapid spread of vegetation, and only about one-fourth of the land is covered by plants. Black sage and a species of saltbush, locally called salt sage (*Atriplex* sp.), are the most common, and, over much of the area, the only plants. In places, greasewood and rabbitbrush make some growth. In places where salts are concentrated in the surface soil, greasewood, hop-sage, alkali spikegrass, and foxtail barley make a spotted growth.

The principal use made of this soil at present is the grazing of sheep during the winter and spring. Some small areas are being placed under irrigation ditches, the water for which is to be supplied by reservoirs. Areas in which the salt content is not too high should be productive under irrigation. Their greatest deficiency is a lack of organic matter, which would have to be supplied by manures and certain cover crops. The greater part of this land, however, cannot be irrigated and will probably continue in its present condition.

Cut Bank fine sandy loam.—The surface soil of Cut Bank fine sandy loam consists of a 2- or 3-inch layer of loose gray calcareous fine sandy loam underlain by a 5- to 8-inch layer of light grayish-brown more compact fine sandy loam. The subsoil is light-gray or almost white loam or heavy fine sandy loam to a depth ranging from 26 to more than 40 inches. The gray color of this soil is due largely to the high concentration of lime in the subsoil. The lime gives the subsoil a smooth silty feel and, together with fine particles, makes it much more dense than the surface layers. The substratum consists of gray, olive-drab, or green sandstone or sandy shale, that contains considerable lime.

Scattered over the surface are angular fragments of gravel ranging from ½ to 2 inches in diameter, which are coated with dark material,

frequently called a desert pavement. When the land is plowed, the gravel disappears from the surface and is mixed with the soil material.

Cut Bank fine sandy loam is developed almost entirely in the lower parts of the county, extending southwestward from the northeastern corner. The rainfall in this section ranges from 7 to 10 inches annually. The greater part of this soil is used as grazing land, as it is far from the water supply in the Uinta Mountains, and irrigation water has never been applied to it.

This is the main soil suitable for crop production among those that lie under the Austin reservoir north of Lyman. The gently sloping or slightly rolling relief and large size of the bodies renders this soil very desirable for irrigation. Some of the irrigated land has been cropped to alfalfa and grain. This is considered by the Wyoming Agricultural Experiment Station at Lyman to be a more desirable soil than Ashuelot gravelly sandy loam, and it produces crops of alfalfa, barley, sweetclover, oats, and potatoes very successfully. The experiment station results indicate that two crops of alfalfa or three crops of sweetclover can be produced annually during most seasons. A dense growth of black sagebrush and a scant growth of grasses cover the uncultivated areas.

Included in mapped areas of this soil are bodies, on terraces paralleling Blacks Fork, which have a typical surface soil and subsoil but flatter relief than other areas. Near the Sweetwater County line, 2½ miles south of the Lincoln Highway, are two areas that have a loamy fine sand surface soil. An area of similar soil lies along Lincoln Highway 1 mile north of the first crossing over Blacks Fork south of Church Buttes. In some included areas on the high benches along the Sweetwater County line in the vicinity of Wildcat Buttes, lime is leached from the surface soil which is somewhat darker brown than that of the typical soil.

Ashley stony sandy loam.—Ashley stony sandy loam is a stream-bottom soil of the higher altitudes. The upper 6 inches of soil is dark brown or nearly black owing to a large proportion of organic matter. The finer material consists of sandy loam or loam. Numerous water-worn stones, ranging from 1 to 12 inches in diameter, are embedded in the surface soil and are more or less scattered over the surface. No change in texture takes place below this layer, but the color gradually becomes brown. Between depths of 12 and 36 inches the material is brown or reddish-brown sandy loam or loamy sand. Below a depth of 36 inches the texture of the finer material is loamy sand, and the color is light brown. In general the content of stones increases with depth. The reaction of this soil ranges from slightly acid to slightly alkaline.

Included in mapping is a large area in the vicinity of Meyers School, in which the surface soil and subsoil are mottled with rusty brown and gray, and the lower part of the subsoil contains layers of light-brown stony loam or stony clay loam.

Ashley stony sandy loam is developed along the upper part of Bear River, Smiths Fork, Blacks Fork, and Henrys Fork, and their larger tributaries. It occupies benches above the areas subject to overflow, and some of it lies 50 feet above the river. Owing to the

steep gradient of the river, water is easily applied to the land. The general practice is to leave the water on the land the greater part of the summer. Under this practice, the soil is saturated most of the time, and this is conducive to the invasion of the fields by squirreltail grass. The experience of one rancher indicates that limiting the time of application of the water to the land results in better yields.

The original cover of vegetation was native grasses and a few willow, birch, and aspen trees. At the time of this survey, the greater part of the area, probably 60 percent, was used in the production of hay for the sheep and cattle raised on the nearby ranches. The main hay crop is timothy and alsike clover, the average yield of which is about 1 ton to the acre. A very small area is devoted to alfalfa. Cossack and Grimm are the main varieties. Since this soil is near the base of the mountains, at an elevation of over 7,000 feet, where the growing season is short and frost may be expected any month of the year, it will produce only short-season crops. Alfalfa is not grown extensively on this soil, as both the first and second crops frequently suffer injury from frost.

Bridger loam.—The 1-inch surface layer of Bridger loam is dark-brown loose laminated fine sandy loam. Beneath the loose upper crust is dark-brown granular and friable loam which continues to a depth of 10 or 12 inches. The material in the surface soil has a high organic-matter content and a slightly acid reaction. The subsoil is light-brown somewhat compact clay loam which is slightly acid in reaction. The depth of the subsoil varies greatly, ranging from 30 to 72 inches, according to the relief. This soil occurs at the foot of steep hillsides or on lower slopes, especially on the northern and northeastern slopes, on which the snow drifts during the long winters. Water from the melting snow has leached the soil of lime, and it now is slightly acid throughout the surface soil and subsoil.

Although Bridger loam is very productive, it is not farmed unless it adjoins other tillable soil. Most areas of this soil are very small and are surrounded by higher and rougher land. A little gravel and a few stones are scattered over many of the areas, especially those adjacent to gravelly soils. This soil material is transported and placed on gardens in Evanston. The native vegetation consists of a heavy growth of black sagebrush and silver sagebrush (*Artemisia cana*), together with a dense cover of grasses, including bluegrass, wheatgrass, and oatgrass.

Small patches of this soil on sloping outwash fans between the hills and stream bottom near Evanston are irrigated and used for the production of crops, mainly hay and small grains. Acre yields, under irrigation, of 60 bushels of oats, 50 bushels of barley, from 2 to 3 tons of alfalfa hay in two cuttings are reported. The total yield on these small areas is of little importance.

At the foot of the mountains and on the tops of the high ridges in the lodgepole pine forests are small treeless areas and strips which would be mapped as a gravelly phase of Bridger loam, had their size justified this separation. The topmost 1 or 1½ inches of this included soil is dark loose laminated gravelly fine sandy loam underlain, to a depth ranging from 9 to 12 inches, by a layer of dark-brown gravelly loam that is very friable but not so loose as the

material above. Both these layers contain a large quantity of organic matter and have a slightly acid reaction. The subsoil is light-brown gravelly loam or gravelly clay loam and generally is slightly compact. It, also, is slightly acid. The subsoil continues to a depth ranging from 3 to 6 feet. This soil, in most places, is developed on outwash material from Uinta Mountains. The gravel stones range from 2 to 6 inches in diameter, and most of them are water-worn.

The vegetation on the included soil is the same as on the typical soil. During summer the included soil, together with the other high mountain soils, is used for the grazing of livestock, for which purpose it is highly valued.

SOILS SUITED IN PART TO THE PRODUCTION OF HAY

The soils in this group are used to a considerable extent for the production of hay. A small proportion of a few of them is sown to alfalfa, timothy, alsike, and white clover. The greater part of the hay, however, is obtained by mowing the wild grasses. These soils occupy stream bottoms, terraces, and colluvial slopes, where the land is smooth and haymaking machinery can be used. A large proportion of these soils is used only for pasture.

Hilliard fine sandy loam.—The surface soil of Hilliard fine sandy loam consists of a 1- or 2-inch layer of dark-gray or dark grayish-brown fine sandy loam, over a 5- or 6-inch layer of brown or grayish-brown fine sandy loam containing a few water-worn gravel. The material in the surface layers is free of lime and gives no reaction when tested with acid. The subsoil, to a depth of 23 inches, is light-brown or light grayish-brown noncalcareous gravelly fine sandy loam or gravelly loam, and, below that depth, it is light-gray calcareous gravelly sandy loam or gravelly clay loam. The gravel is water-worn. Most of the pebbles range from ½ to 5 inches in diameter, but a few are larger. The material in the lower part of the subsoil is somewhat firm in place and is less porous than the overlying material, although it does not prevent water from seeping through. It rests, at a depth of 3½ feet, on very loose porous stony sandy loam containing a large proportion of water-worn gravel and stones, ranging from 1 to 12 inches in diameter. Some lime is concentrated in the lower part of the subsoil and the substratum. The looseness of the material throughout the soil profile to a depth of 6 feet allows the water to seep downward readily so that it is possible to supply water to it through subirrigation.

The native vegetation on this soil is a moderately thick cover of black sagebrush, some blue grama, and native bluegrasses. The larger body on Hilliard Flat is cropped to a mixture of timothy, alsike, and white clover, or mammoth red clover. Yields ranging from 1 to 2 tons of hay are cut annually, with an average of approximately 1½ tons an acre. Alfalfa is not grown, owing to the short growing season and danger of damage from frost. One crop of hay a year is harvested. In dry years, a scarcity of water allows irrigation of only a small part of this soil.

Hilliard stony fine sandy loam.—The 1- to 2-inch surface layer of Hilliard stony fine sandy loam is grayish-brown stony loam or stony fine sandy loam. It is underlain by a 6- to 7-inch layer of

grayish-brown or light-brown stony fine sandy loam. The greater part of the gravel and stone in the surface soil ranges from ½ to 5 inches in diameter, and a few are larger. Free lime is not present in either of these two layers. The subsoil, to a depth ranging from 20 to 24 inches, is stony loam or stony clay loam, which is somewhat compact but not tight enough to interfere with the downward movement of water. This part of the subsoil has been leached free of lime, so there is no reaction when the material is tested with acid. Water-worn gravel and stones, ranging from 1 to 15 inches in diameter, form the greater part of the lower subsoil layer; consequently it is more porous than the upper subsoil layer and the surface soil. The fine material in this soil ranges from stony clay loam to heavy-textured stony sandy loam, and the color is light gray due to concentration of lime in the lower part. The soil material extends to a depth ranging from 4 to more than 6 feet.

Included with this soil in mapping are two areas of gravelly loam texture, about 1 mile northwest of Evanston, and a large area of the same kind is 3 miles southwest of Evanston along Yellow Creek. The large area of typical Hilliard stony fine sandy loam on Hilliard Flat contains patches of heavier textured soils too small to separate on the soil map.

The native vegetation is the same and the same hay crops are grown on this soil as on Hilliard fine sandy loam. The two soils are closely associated and produce similar yields. Owing to the large quantity of gravel and stones, the land is sown to the hay crop and kept in grass, with as few plowings as possible.

Mesa fine sandy loam.—The 2- or 3-inch surface layer of Mesa fine sandy loam is gray calcareous loose fine sandy loam. The surface soil continues to a depth of 6 or 8 inches as grayish-brown loose fine sandy loam which is more calcareous than the material in the layer above. The subsoil, to a depth ranging from 12 to 15 inches, is highly calcareous light grayish-brown or gray fine sandy loam or heavy fine sandy loam, containing light-gray streaks of lime. This section of the subsoil is somewhat compact. The lower part of the subsoil is light-gray compact very fine sandy loam or silt loam, in which lime is highly concentrated to a depth of 28 or 30 inches. A little water-worn gravel, consisting of pebbles from 1 to 3 inches in diameter, is present. The subsoil gradually changes and, at a depth ranging from 4 to 6 feet, becomes light-gray or gray gravelly sandy loam. The gravelstones are water-worn, range from ½ to 4 inches in diameter, and form a rather loose and open substratum. In places, the soil material rests on shale at a depth of less than 6 feet, but in most places the gravelly material extends below a depth of 6 feet.

Mesa fine sandy loam is developed along Blacks Fork and Muddy Creek on terraces, now above overflow, laid down by these streams. A thick growth of sagebrush, together with some grass, covers this soil. None of this land was in cultivation during the course of this soil survey. This is an inextensive soil and is similar to Cut Bank fine sandy loam with respect to its fertility and value for crop production.

Havre clay loam.—The 5- to 7-inch surface soil of Havre clay loam consists of loose dark-brown calcareous clay loam which contains some water-worn gravel. The upper subsoil layer extends to

a depth of 18 or 20 inches and is light-brown calcareous fine sandy loam or sandy loam. This material is stratified and consists of river sediments which have undergone but little modification. It gives way abruptly to the lower subsoil layer of light-brown calcareous loose stratified gravelly sand or gravelly sandy loam, which continues to a depth of 6 feet. A few cobblestones occur in the lower part of this layer, and most of them range from 1 to 4 inches in diameter, but in the upper part of Bear River Valley the stones are larger.

Havre clay loam is associated with other Havre soils along Blacks Fork southwest of Fort Bridger, along Henrys Fork, and in numerous areas along Bear River from the southern boundary of the county northward to Evanston and vicinity. The water table is near the surface, as the terraces on which this soil occurs are only a few feet above the river. Because of their small extent, a few bodies of other types of Havre soils, especially the silt loam, are included in mapping. Areas of the silt loam are developed 2½ miles southwest of Fairview School, west of the same school, west of Meyers School, and east of Bear River at Meyers Bridge.

The native vegetation consists of tall grasses, with groves of willow and aspen. The small part of this soil in cultivation is seeded to native grasses. The yield of hay ranges from ½ to 1¼ tons to the acre. Most of the land is used for the grazing of livestock.

Havre gravelly loam.—The 5- to 7-inch surface soil of Havre gravelly loam is dark-brown or brown calcareous gravelly loam. The upper subsoil layer, which reaches a depth of 18 or 20 inches, consists of light-brown calcareous stratified fine sandy loam or sandy loam and contains variable quantities of water-worn gravel. This material passes abruptly into the lower subsoil layer of light-brown calcareous loose stratified gravelly sand and gravelly sandy loam. The soil material continues to a depth of 6 feet. Beds of cobblestones which range from 1 to 4 inches in diameter occur in the lower part of this soil.

The position, native vegetation, and uses of Havre gravelly loam are similar to those features of Havre clay loam with which it is associated. Its total area is small.

Havre fine sandy loam.—The surface soil of Havre fine sandy loam is a dark-brown or brown calcareous fine sandy loam 5 or 6 inches thick. The upper subsoil layer is light grayish-brown calcareous fine sandy loam or loamy fine sand. Below a depth of 20 inches the subsoil is underlain by very loose and porous gravelly and stony sand containing some water-worn cobbles ranging from ½ to 6 inches in diameter.

This soil occurs along Bear River, and most of it lies from 3 to 8 feet above the river bed. One of the largest bodies is east of Evanston along the highway. Other bodies are southeast of Millis, near Meyers Bridge, west of Almy, and near the point where Henrys Fork leaves the county. The area along the upper part of Henrys Fork includes a strip of soil, in which there is no lime near the surface and in which the depth to the gravel layer ranges from 25 to 40 inches.

Havre fine sandy loam is farmed in conjunction with the other Havre soils. The crops grown and yields obtained are similar to those on Havre clay loam. Redtop and tufted hairgrass are said to produce

2 tons of hay to the acre. The greater part of this land, however, is in its native state and is covered with grass, willow, aspen, and some birch trees.

Havre silt loam.—The dark grayish-brown silt loam or silty clay loam surface soil of Havre silt loam is 6 or 8 inches thick. The material, for the most part, is free from lime, granular, and friable. Beneath this, and continuing to a depth of 20 inches, is light-gray highly calcareous clay loam or silty clay loam. The next lower layer contains variable quantities of water-worn gravel. Lime is less concentrated and the proportion of gravel is greater below a depth of 30 inches than it is in the material above. The subsoil continues to a depth ranging from 40 to 72 inches. Here and there, large water-worn gravelstones and cobblestones occur in this soil, and, in places, they are abundant below a depth ranging from 36 to 60 inches.

This soil occurs along Mill Creek and in the upper Bear River Valley, as narrow strips paralleling the drainageways. Included in mapping is an area, 1 mile north of Fairview School, in which the surface soil is silty clay. Havre silt loam adjoins Ashley stony sandy loam but is nearer the drainageways.

This land is used for the production of timothy and alsike clover, which yield about 1 ton of hay to the acre. The native cover was grass, and willow, birch, and aspen trees.

Gooch silty clay loam.—Gooch silty clay loam, to a depth of 6 inches, is gray or light grayish-brown light-textured highly calcareous silty clay loam which is very friable and breaks into thin layers. It is underlain, to a depth of 20 inches, by similar but lighter colored and slightly less friable material. The subsoil is light-gray or almost white friable highly calcareous loam to a depth of 42 inches, where it changes to light-gray, mixed with light-brown, highly calcareous and friable loam or fine sandy loam, which continues to a depth of 72 inches.

Large bodies of Gooch silty clay loam are west of Robertson along Blacks Fork, 1½ miles west of Fairview School parallel to Bear River, and in the vicinity of Lonetree. Small bodies are along Poison Creek south of Lonetree, and at Ragan. Areas in which water-worn gravel and stones occur throughout the surface soil and subsoil are on Hilliard Flat, east and north of Meyers School in Bear River Valley. The gravelly areas generally are darker gray than the typical soil.

Only a very small area of the typical soil is used for the production of crops, as the ranchers find it produces much less than adjoining bottom-land or terrace soils. The darker colored gravelly areas on Hilliard Flat are used for hay crops in conjunction with other soils.

Plants of many varieties, including the following evergreen trees, grow on the uncultivated areas: Utah juniper or cedar (*Juniperus utahensis*), dwarf juniper, locally called shrubby cedar or juniper (*J. communis*), and blue spruce (*Picea pungens*). Russet buffaloberry (*Lepargyrea canadensis*), bearberry (*Arctostaphylos uva-ursi*), bentgrass (*Agrostis* sp.), reedgrass (*Calamagrostis* sp.), redtop (*A. alba*), junegrass (*Koeleria cristata*), two species of dropseed, sedge (*Carex* sp.), slender wheatgrass (*Agropyron tenerum*), thickspike or downy wheatgrass (*A. dasystachyum*), needlegrass, bluegrass, and bush cinquefoil or woody potentilla (*Dasiphora fruticosa*) also grow. The clumps of cedar and spruce trees readily dis-

tinguish this soil in the river valley from the surrounding soils, on which only grass, brush, and deciduous trees grow.

The occurrence of Gooch silty clay loam on slightly sloping flats and in low places on the bottoms or on benches, where the water table is near the surface, and the numerous springs, indicate that the lime deposited in the soil originates from underground water or springs containing calcium carbonate.

This soil is of limited extent. Included in mapping are some small wet swampy areas of dark-brown muck and peat south of Meyers School.

Shavano loam, colluvial phase.—The colluvial phase of Shavano loam is developed on slopes leading down from areas of other Shavano soils. The soil forms a deeper cover over the rocks than do the other Shavano soils, as a result of two conditions: Slightly greater supply of moisture due to its lower position, which promotes deeper weathering of the parent material; and transportation of colluvial materials from the higher land, which are spread over the surface of this soil at a more rapid rate than they are removed by erosion.

The surface layer of this soil, to a depth of 5 or 6 inches, is brown or light grayish-brown loam. It is underlain by brown or grayish-brown loam or very fine sandy loam. Below this the material is variable in texture. The substratum, to a depth of 6 feet, in most places, is built up of stratified material consisting of successive layers of very fine sandy loam, loam, or silt loam. Below a depth of 3 feet the material becomes lighter in color and contains light-gray or nearly white streaks of lime. The surface soil may or may not contain lime, but the subsoil invariably is calcareous.

This soil is formed on colluvial material along the valleys of small streams, on gentle slopes of colluvial fans, and on long narrow strips formed at the foot of slopes from high hills and ridges.

The native vegetation consists mainly of sagebrush, together with occasional patches of rabbitbrush. Grasses, including grama and bluegrass, furnish good grazing on the lower slopes. Small patches of this soil, which are included in irrigation projects, are very productive. Alfalfa is grown wherever possible. The average yield from two cuttings is about 2 tons to the acre.

SOILS SUITED TO GRAZING

In this group are placed those soils which are not suited for cultivation, owing to rough relief, shallowness, stoniness, or high elevations where climatic conditions are unfavorable for farming. Most of this land is not used as hay land, either because the growth of grass is too scanty or because the land is too rough or stony to allow the use of mowing machinery.

Avon loam.—The 6- to 9-inch surface layer of Avon loam consists of dark-brown loam or fine sandy loam, high in organic matter and free from lime. The next 3- to 5-inch layer is light-brown noncalcareous or slightly calcareous loam containing variable quantities of gravel. The subsoil is stony sandy loam or stony loam, to which a large content of lime imparts a light-gray color. The stones and gravel are water-worn, and they range from 1 to 15 inches in diameter. They form a large part of the material in the subsoil. A little gravel is scattered over the surface in places.

Both surface soil and subsoil are more or less loose and porous. A large quantity of water would be required to irrigate this land. Most of the sloping to rolling benches, on which this soil is developed, are well above the present water supply. Owing to their small size and inconvenient location, areas of this soil are not likely to be placed under irrigation.

The native vegetation, consisting mainly of black sagebrush, silver sagebrush, bluegrass, and blue grama, furnishes good grazing. The soil is used only for range pasture.

Avon loam, steep phase.—The steep phase of Avon loam differs from the typical soil only in that it lies on the steep slopes along the edge of the benches, where the degree of slope ranges from 20 to 90 percent. This land is too steep for cultivation.

Avon stony clay loam.—Avon stony clay loam differs in many respects from the other Avon soils. The 10-inch surface layer is dark reddish-brown clay loam. The soil everywhere contains a very large proportion of stony materials consisting of both rounded gravel and angular rock fragments of various sizes. Much of the stony material consists of large fragments ranging from 4 to 24 inches in diameter. The subsoil is light-red heavy clay loam containing stone, which is similar in quantity and character to that in the surface soil. Lime is not present in the surface soil but is abundant in the subsoil.

Avon stony clay loam occurs mainly in one large area between Henrys Fork and Poison Creek in the southeastern part of the county, where it is developed on steeply sloping and eroded fans of outwash material brought down from the Uinta Mountains.

The land is not cultivated, owing to its roughness and isolation. The vegetation is characteristic of arid land and consists of sagebrush, with a sparse growth of grama and other grasses. The land is used for the grazing of livestock, for which purpose it has a fairly good value.

Avon stony sandy loam.—The surface layer of Avon stony sandy loam is very dark brown or almost black stony sandy loam, from 7 to 10 inches thick. It contains a large amount of organic matter but no free lime. Water-worn gravel and stones, in most places ranging from 1 to 12 inches in diameter, constitute a large proportion of the soil mass. In some places near the mountains, the stones are larger. Beneath the surface layer is a subsurface layer of light-brown or light grayish-brown stony sandy loam or stony loam, which contains no free lime. The subsoil is light-gray stony sandy loam or stony loam, in which the lime leached from the surface layers is highly concentrated to a depth ranging from 35 to 45 inches. Below that depth the quantity of lime decreases, but it is distributed throughout the gravelly substratum.

This soil is developed on gently sloping to rolling outwash plains and benches that extend out from Uinta Mountains. The underlying gravelly material washed from the mountains ranges from 4 to more than 6 feet in thickness. This material rests on the Bridger shale formation.

The soil occupies a position between the light-colored soils of the lower lands and the higher timber-covered soils of the mountains. A dense growth of sagebrush and some bluegrass, blue grama, and rabbitbrush covers this soil. The land is used principally for graz-

ing during the spring, summer, and fall, and it is one of the best grazing soils in the county.

An area of soil with a higher content of lime than is typical of Avon stony sandy loam is included with it on the soil map. The surface layer of this included soil is dark-brown highly calcareous loam which is 12 inches thick and contains a large quantity of gravel and stones, ranging from 3 to 20 inches in diameter. The subsoil is light-gray or gray calcareous loam, in which there are gravel and stone similar to those in the layer above. The gravelly and stony material represents debris from quartzitic and limestone formations in the Uinta Mountains. The only area of this included soil is on Bald Range in the extreme southeastern part of the county. The relief ranges from rolling to steep. Sagebrush and considerable grass furnish good grazing.

Avon stony sandy loam, steep phase.—Avon stony sandy loam, steep phase, varies greatly in the thickness of the soil over bedrock. On gentler slopes, where the soil has developed to a maximum thickness, it has a profile similar to that of the typical soil. Here, the 7- to 12-inch surface layer is very dark brown or black stony sandy loam and contains a large proportion of water-worn gravel and stone, ranging from 1 to 12 or more inches in diameter. The dark color is due to the high content of organic matter. This material grades into a subsurface layer of light-brown or light grayish-brown stony sandy loam or stony loam, which continues to a depth ranging from 12 to 20 inches. Both the surface and subsurface layers are free from lime. The subsoil is light-gray stony sandy loam or stony loam, in which lime is concentrated, as in the typical soil, to a depth ranging from 35 to 45 inches. Below this depth the quantity of lime is less, although some is distributed throughout the gravelly substratum.

Throughout most of its area, however, the relief of this soil is steep, the slope ranging from 20 to 100 percent. On such slopes the soil naturally is thin, and, in places, the shale is exposed. The steeper soil occurs, for the most part, in long narrow bodies on the breaks between two benches, occupied by the typical soil, that lie at different levels.

This land is suited only for grazing, for which purpose it is less valuable than the typical soil. The vegetation is similar to that growing on the typical soil, but it forms a thinner more broken cover and affords less forage.

Avon gravelly loam.—Avon gravelly loam is similar to Avon loam except that the proportion of water-worn gravel in its surface layers is larger than in the corresponding layers of that soil. The surface soil is dark-brown loam containing so large a proportion of gravel that cultivation would be very difficult. The gravelstones are of various sizes, but most of them range from 1 to 5 inches in diameter. Lime is present in only small quantities. Below a depth of 10 inches the soil material is light-brown loam with about the same content of gravel as the surface soil. This gives way, at a depth of 18 inches, to light-colored loam containing such a large proportion of gravel of all sizes as to impair the water-holding capacity of the soil. The fine material in this layer has a high lime content.

This soil is developed over gravelly materials washed down from

the Uinta Mountains and spread out in alluvial fans or terraces along the mountain front. Several areas are on the slopes of Hilliard Flat. Few of these exceed an area of 1 square mile. Larger areas are in the southeastern part of the county, near Dry Creek, and in the south-central part, southeast of Robertson.

The vegetation is similar to that on Avon loam, but the cover is more sparse than on that soil. Sagebrush is the most common plant. A thin stand of grasses grows in favorable localities. The land is used only for grazing.

Willow Creek loam.—The upper 2 or 3 inches of the surface soil of Willow Creek loam is dark-gray or dark grayish-brown silt loam free from lime, except for fragments of angular limestone throughout the soil material. This layer is loose and friable and contains a large quantity of plant roots and organic matter from decayed plant roots and leaves. The lower part of the surface soil, to a depth of 6 or 8 inches, is dark-gray or dark grayish-brown silt loam. It is not so loose or so granular as the uppermost part. Limestone fragments are present in this layer also. Below this is light-gray loam or silt loam with a brown cast, which continues to a depth, in most places, not exceeding 20 inches. Limestone fragments are present, and the entire subsoil is highly calcareous. The underlying parent material is light-drab or gray plastic clay which is high in lime and breaks to columnar pieces. This material apparently is weathered from a thin layer of limestone over gray shale.

Willow Creek loam occurs on ridges between Muddy and Lachapelle Creeks, well above the creek bottoms. A dense growth of sagebrush and a sparse growth of native grasses cover the land. This soil is suitable only for grazing land.

Uinta stony sandy loam.—Over the mineral part of Uinta stony sandy loam is an organic layer, generally about 1 inch thick, composed of partly decayed needles and cones from pine, spruce, and fir trees, and leaves from aspen trees. The upper part of the surface soil, to a depth ranging from 2 to 4 inches, is dark grayish-brown friable strongly acid sandy loam. Stones of various sizes are scattered over the surface and throughout the surface layer. Beneath this is light-gray stony sandy loam which is about 8 inches thick. This material, in many places, has a pinkish-gray color. The next lower layer is compact dark reddish-brown clay loam or clay, which becomes more friable below a depth of 18 inches. Below a depth ranging from 25 to 30 inches, the substratum continues as light reddish-brown clay or sandy clay, containing all sizes of gravel and boulders, some as much as 2 feet in diameter. Below a depth ranging from 40 to 45 inches is the parent material of light reddish-brown clay loam, in which stone fragments are numerous. This material ranges from slightly acid to calcareous.

This soil is developed along the southern boundary of the county, in a fairly broad belt which crosses the foothills of Uinta Mountains. The soil occurs in the highest part of the county, above an elevation of 8,500 feet. It is formed from gravelly and stony outwash materials from the mountains, a part of which may have been moved by glacial ice. The ridges occupied by this soil range from rolling to very steep.

The native vegetation consists of lodgepole pine, Engelmann spruce, blue spruce, aspen, and fir. Lodgepole pine is more numerous than

all the others combined. A number of grasses grow in the open spaces. They include bluegrass (*Poa* sp.), needlegrass, procupine grass (*Stipa spartea*), alpine timothy (*Phleum alpinum*), bentgrass, meadow barley or wild barley (*Hordeum nodosum*), junegrass, tufted hairgrass (*Deschampsia caespitosa*), thickspike or downy wheatgrass, slender wheatgrass, sedge, wild oats (*Avena fatua*), possibly wild pea, Utah vetch or Utah pea (*Lathyrus utahensis*), American vetch or buffalo pea (*Vicia americana*), and timber poisonvetch or milkvetch (*Astragalus campestris*). The latter is one of the three poisonous vetches of Wyoming that cause losses of livestock.[6] In general, these grasses make a satisfactory growth only where the stand of timber is thin.

The only agricultural value of this land, except as a source of timber and water, is for the summer grazing of sheep and cattle. Some of the herds belong to local stockmen; others are brought in from Utah. A large part of this soil is included in the Ashley and the Wasatch National Forests.

Leavitt loam.—Leavitt loam is developed under a cover of aspen trees on the outwash fans in front of the Uinta Mountains. The influence of this type of vegetation and the accompanying moisture conditions have produced a marked effect on the character of this soil.

In most places, the surface is covered by a layer, 1 inch or less thick, of partly decayed leaves of the aspen trees. The upper 4 or 5 inches of the surface soil is dark grayish-brown very fine sandy loam or loam. In general, this part of the surface soil is loose and friable, and it contains a moderate quantity of organic matter which imparts the dark color. The lower part of the surface soil, which continues to a depth ranging from 10 to 15 inches, is grayish-brown or gray clay loam or loam. The material in the lower part of the surface soil is granular and friable but not so loose as that in the upper part. The reaction throughout the surface soil is slightly acid. The subsoil, which continues to a depth ranging from 20 to 40 inches, is light-gray compact clay, with a somewhat brown cast. The material in this layer breaks into prismatic or blocky pieces. It has a medium to strongly acid reaction. The subsoil rests on the parent material which consists of light grayish-brown or light-gray sandy clay loam or silt loam. The reaction of the parent material is neutral or slightly alkaline.

The largest areas of Leavitt loam are in the foothills of Uinta Mountains, adjoining and just below the areas of Uinta stony sandy loam. Several areas are developed east of Medicine Butte and north of it to the county line. Small areas, some of which are too small to indicate on the soil map, occur in other hilly parts of the county, especially in the western half.

Instead of the coniferous forest, which covers the higher and adjoining soil, Leavitt loam supports dense groves of aspen (*Populus tremuloides* Michx.). In places where the growth of aspen is not too dense, some grasses, including wild oats, alpine timothy, junegrass, and slender wheatgrass, cover the soil. Clumps of serviceberry

[6] BEATH, O. A., DRAIZE, J. H., and EPPSON, H. F. THREE POISONOUS VETCHES. Wyo. Agr. Expt. Sta. Bull. 189, 23 pp., illus. 1932.

(*Amelanchier* sp.), snowberry, or buckbrush (*Symphoricarpos* sp.), russet buffaloberry, and myrtle boxleaf (*Pachistima myrsinites*) flourish around the edges of the aspen groves.

The areas covered with aspen are developed on the northeast slopes of the hills and ridges, where snow collects during the winter, and many of them are only a few acres in size. The development of this soil seems to depend on the altitude and on the length and steepness of the slope. The soil is formed on the gravelly outwash materials, and, in places where this is thin, the subsoil is developed in part from the shales and sandstones under the gravelly material. As mapped the soil varies in degree of leaching and intensity of the gray color in the surface soil and subsoil. In places where this soil adjoins stony or gravelly soils, water-worn gravel and stones are more or less common throughout the surface soil and subsoil.

Uinta County, together with the rest of the western part of Wyoming, is subjected to winds, generally from the southwest, that are prevalent during winter and spring. The winter season lasts from November to May, and the northeastern slopes are covered by huge snowdrifts that last far into the spring before they are completely melted. The large quantity of water from these drifts causes excessive leaching of the soil, which probably is hastened by the organic acid from the decayed aspen leaves.

Leavitt loam is used only for grazing, in connection with other soils. In places where there are few trees, grass is abundant and of good quality. Where the aspen groves are dense, the land has little value for grazing, but it has some value as it holds the snow late in the spring and provides water for the livestock grazing on adjoining soils.

Billings sandy loam.—Billings sandy loam is formed over highly calcareous water-laid material washed from gray shales and sandstones. The surface soil, to a depth of 6 or 8 inches, is gray or light-gray loose sandy loam. The subsoil also is gray or light gray. It consists of slightly modified highly calcareous stratified stream-laid sediments of very fine sandy loam, fine sandy loam, sandy loam, and loam texture. This material continues to a depth of 6 feet or more.

This soil is developed on gently sloping flats adjoining the drains. It is more porous than the heavier members of the Billings series and hence is not so well suited for farming under irrigation as are those soils. Small quantities of both white and black alkali are present in this soil, as in the other Billings soils, but not in sufficient concentration to prevent the production of crops, except in a few small areas. This soil is associated with other members of the Billings series along the streams and washes in the northeastern part of the county, but, as a rule, it is nearer the stream channels than are the heavier soils.

Billings sandy loam has a native covering of salt sage, a few clumps of sagebrush, greasewood bushes, and pricklypear. Areas in which there is a concentration of salt are readily recognized by the growth of rabbitbrush, saltbush, greasewood, dropseed grass, alkali spikegrass, and foxtail barley, or squirreltail grass.

Ashuelot fine sandy loam.—The surface soil of Ashuelot fine sandy loam consists of a 2- or 3-inch layer of gray or dark-gray

slightly calcareous fine sand or fine sandy loam, underlain to a depth of 5 or 7 inches by light-brown or light grayish-brown fine sandy loam containing a small quantity of lime. A little water-worn gravel is scattered throughout the surface soil. The subsoil consists of light-gray gravelly material, 12 or more inches thick, which is cemented with lime. Beneath this are layers of less calcareous and looser gravelly material.

A dense growth of sagebrush and a few grasses cover the virgin land. Freedom from gravel in the surface soil makes this land easier to cultivate than Ashuelot gravelly sandy loam, but the few areas that have been broken and cropped to alfalfa have been abandoned, owing to drought. The principal area is around the Department of Commerce Landing Field No. 9 on the Piedmont-Bigelow Bench west of Fort Bridger.

Ashuelot gravelly sandy loam, steep phase.—The topmost 2 or 3 inches of Ashuelot gravelly sandy loam, steep phase, is gray or dark-gray loose gravelly loamy sand containing a small quantity of lime. Below this, the lower part of the surface soil, to a depth ranging from 3 to 12 inches, is light-brown or light grayish-brown gravelly sandy loam containing a larger quantity of lime. The gravelstones are from ½ to 3 or more inches in diameter and have a white coating of lime. They form the greater part of the soil mass in the two surface layers. The subsoil, which ranges from 3 to 28 inches in thickness, is light-gray or light grayish-brown compact gravelly sandy loam. The gravel, composed of pebbles ranging from ¼ to 4 inches in diameter, comprises 50 percent or more of the material in the upper part. The fine material and gravel are tightly cemented together with lime. Beneath this layer the material, to a depth ranging from 40 to 45 inches, is less compact, lower in lime, and more intensely brown. It grades into loose grayish-brown or light grayish-brown gravelly sand. Gravel, consisting of pebbles ranging from 1 to 6 inches in diameter, comprises from one-half to three-fourths of the material in the lower part of the subsoil.

Land of the steep phase differs from typical Ashuelot gravelly sandy loam in that it occupies a position on steep slopes, most of which have a 20 to 100 percent grade. The depth of the soil ranges, according to the degree of slope, from that of the typical soil to that of shallow areas, in which the underlying shales and sandstones are exposed in small patches in many places. The type of native vegetation is the same on the two soils, but the growth is not so heavy on the steeper soil as on the typical soil. Black sage is the most common plant. Grasses make a very thin growth. The slope precludes any use of the land except for grazing, and it has a low value even for this purpose.

Cut Bank fine sandy loam, shallow phase.—The 1- to 4-inch surface soil of Cut Bank fine sandy loam, shallow phase, consists of light grayish-brown fairly loose fine sandy loam. Beneath this layer is the light-gray loam subsoil which continues to a depth ranging from 10 to 20 inches. Under this lies gray or olive-drab sandy shale or sandstone. Lime occurs throughout the soil and the substratum and is concentrated in the subsoil. The shallow soil differs from the typical soil in the shallowness of the surface soil which renders the land unfit for any purpose other than grazing. The relief ranges from sloping to very steep.

This soil is extensively developed throughout the county. A large area occupies Hog Back Ridge south of Cumberland. The land is used mainly for the grazing of sheep during winter and spring.

As mapped, Cut Bank fine sandy loam, shallow phase, contains areas of typical soil, shallow soil, and bare rock ledges, all occurring in bodies too small to separate on the soil map. In the vicinity of Hog Back Ridge the soil contains a large proportion of shallow gray soils, with a surface texture ranging from fine sandy loam to clay loam. Desert sage and some greasewood and sagebrush grow in this particular area. Farther east the vegetation is principally low sagebrush and a scanty growth of grasses.

Shavano loam.—The 1- or 2-inch surface layer of Shavano loam is dark-brown loam containing a moderate quantity of organic matter and no free lime. Below this dark layer is brown or light-brown noncalcareous or slightly calcareous granular and friable fine sandy loam or loam, which continues to a depth of 6 or 7 inches. The upper subsoil layer, to a depth of 12 inches, is light-brown noncalcareous or slightly calcareous loam that is more compact than the material above. The lower subsoil layer, which consists of light grayish-brown or light-gray highly calcareous moderately compact loam or sandy clay loam, continues to a depth ranging from 28 to 32 inches. The soil rests on the gray or reddish-brown and gray partly weathered shales of the Wasatch formation. Included are areas of Shavano fine sandy loam and Shavano silt loam, too small to separate on the soil map.

Shavano loam occurs mainly along the higher part of the Bear River Divide and southward from there to the county line. It occupies higher slopes than do Shavano silt loam and Shavano fine sandy loam. The land supports a fairly thick growth of black sagebrush, silver sagebrush, blue grama, and other grasses. This soil is used mainly for grazing, and its value for this purpose equals or slightly exceeds that of the other Shavano soils.

Shavano loam, steep phase.—The topmost ½ to 1½ inches of Shavano loam, steep phase, is dark-brown loose slightly calcareous loam or very fine sandy loam. This changes abruptly to brown or light-brown slightly calcareous or noncalcareous loam which continues to a depth of 4 or 5 inches. The upper part of the subsoil, to a depth ranging from 7 to 9 inches, is light-brown loam similar in reaction to the overlying material. The lower part of the subsoil is light grayish-brown or light-gray compact highly calcareous silt loam, loam, or clay loam. This rests, at a depth ranging from 15 to 20 inches, on gray or reddish-brown and gray partly weathered shales of the Wasatch formation. As mapped, areas of typical Shavano loam and bare exposures of shale, which are too small to differentiate, are included with the shallow phase. Some areas of this included soil are covered by fragments of shale.

The steep phase differs from the shallow phase of Shavano loam in that it has a steeper slope, ranging from 30 to 40 percent or more. The steeper land is more eroded, in most places, except on the northeastern slopes, and is less valuable than is land of the shallow phase. The vegetation is similar to that growing on typical Shavano loam, except that it grows in patches and strips and does not afford so

much forage as on that soil. This land is used only for grazing in connection with the other Shavano soils.

This soil occupies 21.7 percent of the total area of the county. It is developed principally in the western part.

Shavano loam, shallow phase.—The ½- to 1½-inch surface layer of Shavano loam, shallow phase, consists of dark grayish-brown slightly calcareous loam or fine sandy loam. It is underlain, to a depth of 4 or 5 inches, by noncalcareous or slightly calcareous brown or light-brown loam. Below this, the color of the material becomes lighter and, in most places, the texture becomes heavier. The soil rests on reddish-brown or grayish-brown partly weathered shales of the Wasatch formation. Exposures of bare shale are common on the steeper slopes. Areas of Shavano fine sandy loam and Shavano silt loam, too small to separate on the soil map, are included with this phase.

This shallow soil is developed on the higher part of the Bear River divide and in high hilly areas in the southern part of the county. It generally occupies a higher position on the slope than do typical Shavano loam and Shavano silt loam.

The native vegetation is similar to that growing on the deeper typical soils, but it is not so uniform or so dense. The most common plants are black sagebrush, silver sagebrush, blue grama, and other grasses.

This soil is used for summer grazing. Its value for this purpose is somewhat lower than that of the typical soil.

Shavano silt loam.—The upper 1- or 2-inch layer of Shavano silt loam is grayish-brown loose mulchlike fine sandy loam. It contains lime in sufficient quantities to effervesce when tested with acid. It is underlain, to a depth of 5 or 6 inches, by reddish-brown or light-red highly calcareous granular silt loam or silty clay loam. The upper part of the subsoil, to a depth ranging from 16 to 20 inches, is light reddish-brown or light grayish-brown silty clay loam or heavy clay loam. This layer of the subsoil is somewhat compact and breaks to angular fragments. It grades into light-gray or light reddish-brown calcareous silty clay loam or silty clay, which rests, at a depth ranging from 17 to 25 inches, on partly weathered shale of the Wasatch formation.

The greater part of this soil lies west and north of Muddy Creek. A few small areas are scattered over the rest of the county.

This land is used almost exclusively for grazing. Most of the areas are too small and too high above the streams to be irrigated. The natural vegetation is sagebrush, rabbitbrush, and a little grass. Where salts are present, salt sage and greasewood are the principal plants.

Shavano silt loam, shallow phase.—The surface layer of Shavano silt loam, shallow phase, in most places, is grayish-brown fine sandy loam from ½ to 2 inches thick. In many places, however, this layer is absent. In places where it does occur, it is underlain by reddish-brown or light-red silt loam to a depth ranging from 2 to 4½ inches. The surface soil is highly calcareous, granular, and friable. The subsoil is light reddish-brown or light grayish-brown silty clay loam or heavy clay loam. The subsoil is moderately compact, is highly calcareous, and breaks to angular fragments when crushed. It rests,

at a depth ranging from 11 to 15 inches, on light-gray and light reddish-brown calcareous silty clay loam or silty clay, consisting of partly weathered shale of the Wasatch formation.

This soil covers a much larger area than does typical Shavano silt loam. In mapping, it includes many small areas from which the surface soil, and in places both the surface soil and subsoil, have washed away, leaving the subsoil or the shale substratum exposed and bare of vegetation. Some areas of normal Shavano soils, too small to separate, are included on the soil map with the shallow phase of Shavano silt loam.

The shallow phase of Shavano silt loam is associated with the typical soil in areas of undulating to slightly rolling relief.

The same type of vegetation grows here as on the typical soil, but the growth is thinner. Grazing, on areas associated with other types and phases of the Shavano soils, is the only use made of this land.

Shavano fine sandy loam.—The upper 1 inch or 2 inches of the surface soil of Shavano fine sandy loam is the mulch which commonly develops in this section. It consists of loose friable grayish-brown fine sandy loam, and, in most places, lime is abundant near the surface. This mulch is underlain, to a depth of 6 or 7 inches, by light reddish-brown or light-red fine sandy loam. The next lower layer is light reddish-brown or light-red clay loam or clay, in which, in most places, lime is accumulated. This material rests on the light reddish-brown or gray partly weathered shales of the Wasatch, Green River, and Bridger formations. The thicknesses of the soil layers above the partly weathered shale vary widely. On gentle slopes the thickness of the soil ranges from 20 to 30 inches. Over the greater part of the area, however, the slopes are steep, soil formation has been slow, and erosion active; therefore the soil covering is thin—in many places less than 8 inches thick.

In small areas, mainly on the lower valley slopes, the soil is thicker than is typical. This greater thickness is due, not only to deeper soil development in such situations, but also to deposition of material brought down from the higher lands. The texture of the surface layers also varies. Many areas of loam texture are scattered through areas of this soil, but, on account of their small size, they were not indicated separately on the soil map.

Shavano fine sandy loam is not extensive. The principal areas are along Muddy Creek between Piedmont and Carter. Like other soils of the Shavano series, this soil is developed on the high rolling interstream divides.

The vegetation is typical of the arid upland. Sagebrush is the most common, and, in places, the only vegetation. In places, rabbitbrush and other desert plants are scattered among the clumps of sagebrush. Coarse grasses also make a sparse growth in favorable locations. As the position and relief of this land prevent irrigation, no attempt is made to cultivate it. Grazing is its only use.

Rough broken land.—Rough broken land comprises extremely rough eroded areas and stretches of bare flats which have been denuded of their surface soils by erosion. The rougher areas are developed along the streams where bare vertical cliffs and rocky ledges mark the descent from the tableland to the stream valleys. This type of rough broken land occurs in irregular areas or as long nar-

row strips that follow the streams for long distances. Shelves and benches form comparatively smooth tracts within the rough areas, but these are covered by bare rock or, if a shallow soil has formed, it is thickly covered, in many places, by rock fragments. The vegetation on the areas that have some soil covering is sparse in most places. It consists of black sage, greasewood, saltbush, and a thin growth of grasses. On high ridges, such as Hog Back Ridge south of Cumberland, juniper makes a stunted growth.

Another type of rough broken land in the northeastern part of the county includes areas nearly bare of vegetation, which stretch along the base of the rough escarpment just described. The land is flat or moderately sloping. Erosion has removed a part or all of the surface soil over most of these areas, and the salt content of the soil material that remains is sufficient to prevent the growth of useful vegetation. In places a thin soil has formed and supports a growth of black sage, greasewood, saltgrass, and other grasses of low grazing value.

Rough broken land, as a whole, has little agricultural value; both the relief and the character of the soil preclude cultivation. The flats have a low value as pasture for sheep.

Dune sand.—Dune sand covers a number of small tracts, mainly in the northeastern part of the county. The dunes are formed where sand has been piled by the wind into ridges and hummocks, ranging from 2 to 6 feet in height. In places where the entire surface is not covered by dunes, the intervening areas consist of bare exposures of sandy shales or sandstone. The sand composing the dunes is derived locally from the underlying sandy rocks. The surface layer of the dunes consists of gray or grayish-brown sand or loamy sand, and little change takes place in the character of the sand below the surface. The vegetation is mainly sagebrush which, in places, makes a fairly good growth. A sparse growth of grasses has gained a foothold in the more favorable locations. This sand, because of its loose shifting character and billowy relief, is not suitable for farming, and its value, even for grazing, is low.

LAND USES AND AGRICULTURAL METHODS

The hay land in this county was prepared originally by first clearing off the sagebrush, trees, or bushes that might be growing. After that, the land was either plowed and sown to grasses and clover, or the seed was sown on the unplowed land. The stony and gravelly soils, such as those in the upper Bear River Valley, usually are left without plowing as long as a good stand of hay remains on the land. Little, if any, definite rotation is practiced by most ranchers, especially at the higher altitudes, partly because the number of crops that can be grown successfully is limited.

The Uinta County experiment farm at Lyman, which is operated by the State, advises the use of a rotation consisting of (1) oats, wheat, or barley; (2) white sweetclover; and (3) a cultivated crop of sunflowers or potatoes, or summer fallowing for 1 year in place of the cultivated crop. One rancher sowed sweetclover with barley, followed by wheat, oats, and barley, with the result that his yields of

oats and barley, increased to 50 bushels an acre and his yields of wheat increased, but to less extent on his best land.

The experiment farm recommends the following varieties of crops as giving the best results over a period of years: Wheat, Dicklow; barley, Trebi; potatoes, Bliss Triumph or Idaho Russet; sweetclover, white; and sunflower, Mammoth Russian. Over a 3-year period, yields of barley ranging from 28.5 to 51.7 bushels to the acre have been obtained. Wheat produced from 20.6 to 25.3 bushels, and potatoes, 85.7 and 78.9 bushels an acre during 1932 and 1933. Higher yields have been obtained, but these are considered about the average variations in yields. Yields of sweetclover range from 1½ to 3 tons an acre from three cuttings and average about 2 tons. Alfalfa produces from 1½ to 2 tons an acre from two cuttings. Sunflowers for silage produce from 10 to 40 tons of green material a year, with an average of 15 tons. Only small quantities of potatoes or sunflowers are grown at present, but the experiment farm considers them crops that could be grown more extensively with profit. The demand throughout a large part of northern Utah for seed potatoes from the experiment farm has exceeded the supply.

The hay and grain crops produced are used as feed for the beef and dairy cattle, sheep, poultry, and other livestock. It is necessary to ship in considerable cottonseed cake or meal, hay, and grain for the cattle and sheep. The United States census of 1920 indicates that $186,762 was spent for feed in 1919, most of which was shipped in from other counties or States. In 1929, $225,996 was expended for feed. Since then, unusually dry weather has reduced crops so that a larger proportion of the feed has had to be shipped in from other States.

The breeding herds of cattle usually are fed through the winter on the home ranches in the more or less sheltered valleys, where they graze on the meadow until the snow covers it in November or December. A supplementary ration of hay, with or without the addition of grain or cottonseed cake, is given them. During summer the cattle are allowed to graze on the higher ridges in the southern and western parts of the county as well as in the Uinta Mountains in Utah south of the county line. In the fall the animals are shipped either direct to market at Omaha, Nebr.; Ogden, Utah; San Francisco, Calif.; or other points; or to Nebraska, Utah, or California for fattening.

Hereford is the main breed of beef cattle raised. Purebred bulls or a high class of grade bulls generally are used for breeding purposes.

Sheep are kept on the home ranch during the winter and are fed hay or hay and some grain or cottonseed cake, or they are grazed on the lower land around Carter and toward Granger in Sweetwater County. Often some additional hay is given to supplement the grazing. Owners of the larger flocks of sheep usually depend on grazing for wintering of their sheep, except in seasons of extreme drought or heavy snowfall, when corn or cottonseed cake is fed with or without hay. Sheep are grazed on the lower range until after lambing in the spring, after which they are moved to the higher foothills or into the Uinta Mountains during the latter part of May or early June. They usually are kept on the summer range until September

or October when they are returned to the lower areas. The lambs and other sheep for market are taken out and shipped to markets for further feeding or immediate slaughter.

IRRIGATION AND ALKALI AMELIORATION

Irrigation is necessary for the profitable production of cultivated crops, except in the lower bottoms which are poorly drained or naturally subirrigated. There are no large irrigation systems in this county, but local diversions of several streams provide irrigation water in some areas. The largest continuous irrigated areas are on the terraces along Bear River and on the broad terraces between Smiths Fork and Blacks Fork.

The waters of the streams as they emerge from the mountains do not carry harmful amounts of salts, but as they pass through the porous salty soils or receive drainage from irrigated areas, the salts became more concentrated. The salt content in these soils usually consists of a mixture of various soluble salts, commonly called white alkali. In places there is a harmful amount of sodium carbonate, or black alkali. Nearly all of the shales of the arid part of the county contain salts in greater or less quantities. When the rocks disintegrate, the rainfall is not sufficient to remove the salts from the soil. Later, the movement of soil waters, particularly in irrigated areas, tends to concentrate the salt. Before the streams leave the county they deposit in the soils of the lower bottoms accumulated soluble salts in sufficient quantities to affect vegetation noticeably. In places where the concentration is greatest, only the most salt-resistant plants will grow. The most common of these plants are alkali spikegrass, squirreltail grass, dropseed grass, rabbitbrush, saltbrush, and greasewood. In irrigated and cultivated areas, a considerable acreage has been damaged by the accumulation of salts. In places, the accumulation has been produced by seepage; in other places, the large quantity of salts in the surface soil is the result of evaporation.

Nearly all of the soils of the bottom lands in the more arid part of the county contain small or large quantities of salts, and in places these salts are concentrated. On the higher alluvial lands, the soils of the Billings, Mesa, and Ashuelot series carry the largest amounts. Large areas of the Billings soils cannot be farmed on account of their salt content. Near Lyman areas of Ashuelot gravelly sandy loam have been abandoned for this reason. These areas are on the lower benches, and salts have accumulated through seepage from higher lands.

The experiment farm at Lyman has been carrying on experiments for the reclamation of alkali and salty land. The only method that has proved successful is to flood the land with a large quantity of water and wash out the soluble salts. Because of the large amount of water required and the low value of land after it is reclaimed, it will not be profitable to reclaim very much of this land.

MORPHOLOGY AND GENESIS OF SOILS

The soils of Uinta County have developed under a wide range of local environmental conditions. As already pointed out, the county has a range in elevation from about 6,300 feet in the northeastern part

to about 9,700 feet on the mountain slopes in the southern part. The northern, and lowest, part of the county has a mean annual precipitation of about 8 inches. The vegetation is of a desert type consisting mainly of sagebrush, desert sage, cacti, needlegrass, and, in the more alkaline areas, greasewood, saltbrush, and alkali spikegrass. The higher mountain slopes have a mean annual precipitation of about 20 inches. These slopes have a dense cover of conifers including lodgepole pine (*Pinus murrayana*), Engelmann spruce (*Picea engelmanni*), blue spruce, and fir (*Abies* sp.). Aspen makes a dense growth on the borders of the conifer forests. In open forests or in clearings, grasses of several species cover the ground.

Between these extremes of environment are all gradations of altitude and climate with their accompanying types of native vegetation.

The parent materials of the soils were accumulated from two original lithological materials: (1) The rock debris, composed mainly of quartzite, brought down from the Uinta Mountains; and (2) various shales and sandstones of the Wasatch, Bridger, and Green River formations which underlie the greater part of the county.

In the southern part of the county, debris from the breaking down of the rocks of the Uinta Mountains is spread over the lower slopes of the mountains and beyond their front in extensive outwash fans and valley fillings. The material is only slightly assorted and is composed mainly of boulders and water-worn gravel. At lower elevations this material is confined to the stream valleys, where it has been deposited in a series of terraces. The sediments from the areas of sandstone and shale, which have been reworked and reassorted, form the flood plains of the larger streams. Over the northern part of the county, including the rolling and rough upland, weathered shale and sandstone form the parent material.

Geographically, this county is near the border between the Brown soils and the Desert soils, but, due to local conditions of climate and vegetation, all gradations in development are represented from Desert through Chestnut, Chernozem, and Podzol, with intrazonal developments of Solonchak, Solonetz, and Wiesenböden.

The soils of the arid part have accumulated little or no organic matter and are light colored. The soils of the rolling uplands, developed over shales and sandstones, are grouped in this survey as various members of the Shavano series. Over the greater part of their area these soils form a thin covering over the rock formations from which they are derived. The A horizons in most places are light reddish brown, but in some places the color is slightly darker near the surface owing to a small content of organic matter. Other variations in color are due to the influence of red, yellow, or gray parent materials. The B horizons are heavier in texture and generally are darker red, yellow, or brown. The soil rests, at a depth generally ranging from a few inches to 2 feet, on partly weathered sandstone or shale. These soils have developed from rocks rich in lime and other salts, and as the precipitation is not sufficient to leach the soils of these constituents, the Shavano soils are in most places calcareous from the surface down to the parent rock.

The Cut Bank soils in the same general section are developed over gray or greenish-gray shales of the Green River and Bridger formations on flat benchlike areas.

Following is a description of a profile of Cut Bank fine sandy loam as observed 4 miles southwest of Church Buttes:

1. 0 to 3 inches, gray calcareous friable fine sandy loam having a vesicular and platy structure.
2. 3 to 12 inches, light grayish-brown highly calcareous material which is slightly firmer in position than that above.
3. 12 to 37 inches, light-gray or almost white highly calcareous loam having a blocky structure.
4. 37 to 49 inches, light-gray highly calcareous sandy loam which grades into partly weathered sandy shale.

The Mesa soils have reached a stage of development similar to that of the Cut Bank soils, but they are developed over gravelly terrace material.

The soils of the Billings series occupy low terraces in the northeastern part of the county. The soil material originally was brought down from areas of shale. The surface soils are light grayish brown, gray, or in places almost white, and are underlain by light-gray generally heavier material. Over a large part of the area of these soils no development of a profile is evident. The soil material at all depths contains sufficiently large quantities of soluble salts to retard the growth of vegetation and to modify soil development.

Soils with slightly darker surface horizons (Brown soils) are developed mainly in the central part of the county. Evanston very fine sandy loam, which occurs along Bear River, is representative of this group. The surface layer of this soil is a loose silty or fine sandy mulch, 1 or 2 inches thick. This is underlain to a depth of about 6 inches by brown very fine sandy loam. The next lower layer is somewhat variable but in most places is rich-brown or moderately dark brown compact very fine sandy loam or loam. This material breaks to small cubical blocks. Below a depth ranging from 20 to 27 inches this layer gives way to light grayish-brown or yellowish-brown calcareous very fine sandy loam.

Soils of the Hilliard, Ashuelot, and Almy series also belong to this group. Their differences are due mainly to the character of their parent materials.

At a still higher elevation on the mountain slopes, dark-brown (Chestnut) and almost black (Chernozem and Wiesenböden) soils have developed. Lime has been leached more deeply than in the Brown soils of the more arid belt. The Avon, Ashley, and Willow Creek soils, and the Bridger soils, formed on colluvial slopes watered by snow and seepage, belong to this group.

The principal soil of the high forested mountain slopes designated as Uinta stony sandy loam is a true Podzol. The profile has the following features:

A_0. A thin layer of partly decayed pine needles.
A_1. 0 to 2 inches, very dark brown or nearly black sandy loam containing a large amount of rounded gravel and stone. The material is strongly acid.
A_2. 2 to 15 inches, light-gray or light grayish-brown stony sandy loam. The reaction is strongly acid.
B_1. 15 to 27 inches, brown or reddish-brown compact clay or sandy clay containing a variable amount of rounded gravel and stone. This material is medium acid in reaction.
B_2. 27 to 43 inches, light reddish-brown sandy clay loam having a cloddy structure.

C. 43 to 60 inches, light-brown or reddish-brown clay loam containing a considerable quantity of sand. This material is less compact than that above.

The alluvial soils of this area, for the most part, occupy low or poorly drained flood plains. The parent materials are recently deposited and poorly assorted river sediments. With the exception of the Gooch soil, which is light colored, these soils have accumulated organic matter and have dark surface soils.

The results of mechanical analyses of two soils are given in table 5.

TABLE 5.—*Mechanical analyses of samples of 2 soils from Uinta County, Wyo.*

Soil type and sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
Logan silty clay loam:	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
4810109	0–10	0.3	1.6	2.8	9.7	9.9	33.6	42.1
4810110	10–23	.0	.4	1.0	4.6	5.3	34.4	54.3
4810111	23–29	.0	.3	1.9	16.0	14.9	29.7	37.2
4810112	29–55	.1	.7	2.1	16.8	17.8	33.0	29.5
4810113	55–63+	.4	3.8	9.6	28.3	20.1	22.2	15.5
Gooch silty clay loam:								
481081	0– 6	.8	1.7	2.5	8.3	9.8	37.7	39.3
481082	6–19	.5	2.4	3.4	7.9	9.9	31.5	44.3
481083	19–42	1.7	5.0	5.8	12.4	8.6	21.9	44.6
481084	42–72	2.0	8.1	10.2	19.4	10.9	21.6	27.7

SUMMARY

Uinta County is situated in the southwestern corner of Wyoming. It occupies a high intermountain region west of the Continental Divide. The Uinta Mountains rise to the south, and the county extends up their slopes to an altitude of 9,700 feet. The general slope is downward toward the northeastern part of the county, where the elevation is less than 6,300 feet. Numerous streams rise in the mountains and flow across the county in a northerly direction. The largest stream systems are those of Bear River, Muddy Creek, and Blacks Fork. The divides between the stream valleys are dissected into gently to sharply rolling country, in which many areas are bare of vegetation. Aprons of mountain debris are spread in front of the foothills. The materials of which they are formed are coarse—largely water-worn gravel. Farther down the streams, extensive terraces stand at several levels. Strips of alluvial land bordering the streams are subject to overflow.

The climate is characterized by short summers and cold winters. The average frost-free season at Evanston is 87 days. The mean annual rainfall, recorded at the United States Weather Bureau station at Evanston, is slightly less than 14 inches.

The agriculture is based on the raising of sheep and cattle. The crops grown are incidental to this enterprise, and they consist of hay and small grains, which are fed on the farms and ranches. The raising of poultry, particularly turkeys, is becoming important. Vegetables are grown to a small extent for local consumption.

The parent materials of the soils vary widely in different parts of the county. In the northern and central parts, the parent rocks are red and gray shales and sandstones, and, in the southern part, they consist of debris brought down the mountain slopes. The soil-

forming processes, set up by different conditions of moisture, temperature, and vegetation, acting on these parent materials, have produced soils that differ widely in their properties and productivity.

The soils of the hill and mountain slopes, which make up a large part of the county, are, in general, thin, stony, and unsuited to cultivation. The comparatively small areas that are cultivated are on the lower slopes, terraces, and stream bottoms, where moisture is supplied by seepage or irrigation. Some of the soils in such positions are productive, but the short growing season limits the use of the land to a few hay and grain crops.

Nine types of soil are used, in part, for the production of grasses and grains. Less than one-half of the total area of these soils is cultivated. The cultivated area of some of these soils, however, constitutes only a small proportion of their total area. Logan silty clay loam, a black soil of the stream bottoms, is used in the production of hay, and a small acreage of the higher land is devoted to barley and oats. Ashley stony sandy loam is a dark-colored bottom-land soil in the higher altitudes. A large part of this soil is irrigated and is used mainly for hay crops. Evanston very fine sandy loam occurs on terraces along Bear River. About 20 percent of its area is irrigated and utilized in the production of oats, alfalfa, and hay grasses. The other soils of this group are cultivated to a small extent in places where water is available for irrigation.

The soils of the second group, which also includes nine types, are used to greater or less extent for the production of wild hay, but the greater part of the area of all these soils is used only for pasture. These soils occupy stream bottoms, terraces, and colluvial slopes. The Hilliard soils on outwash terraces are the best soils of the group. These are brown soils underlain by gravel. The Havre soils are dark-colored soils of the stream bottoms and are used mainly for hay and pasture. Mesa fine sandy loam is a grayish-brown soil of the terraces in the drier section. None of it is cultivated, but hay is cut from a small part of it. Shavano loam, colluvial phase, a dark-colored soil of the colluvial slopes, is used to some extent for hay and has a high value for grazing. Gooch silty clay loam is a poorly drained soil of the stream valleys.

The rest of the soils are used only for grazing. Over the greater part of this land the relief is too rough or the soils are too stony or thin for cultivation. A few of the soils occur at a high elevation where the seasons are too short for the production of crops. The Avon soils are the best of this group for grazing land. They have dark-colored surface soils and gravelly subsoils. They occupy high outwash fans at the foot of the mountains. Other soils on the better part of the upland and on some of the stream terraces have fair value for grazing. A very large proportion of the county, however, is occupied by soils that furnish grazing of poor quality. The greater part of the Shavano soils of the rolling arid upland and the steep phases of the Cut Bank and Ashuelot soils belong with this class. Dune sand and rough broken land are almost worthless.

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This soil survey is a contribution from

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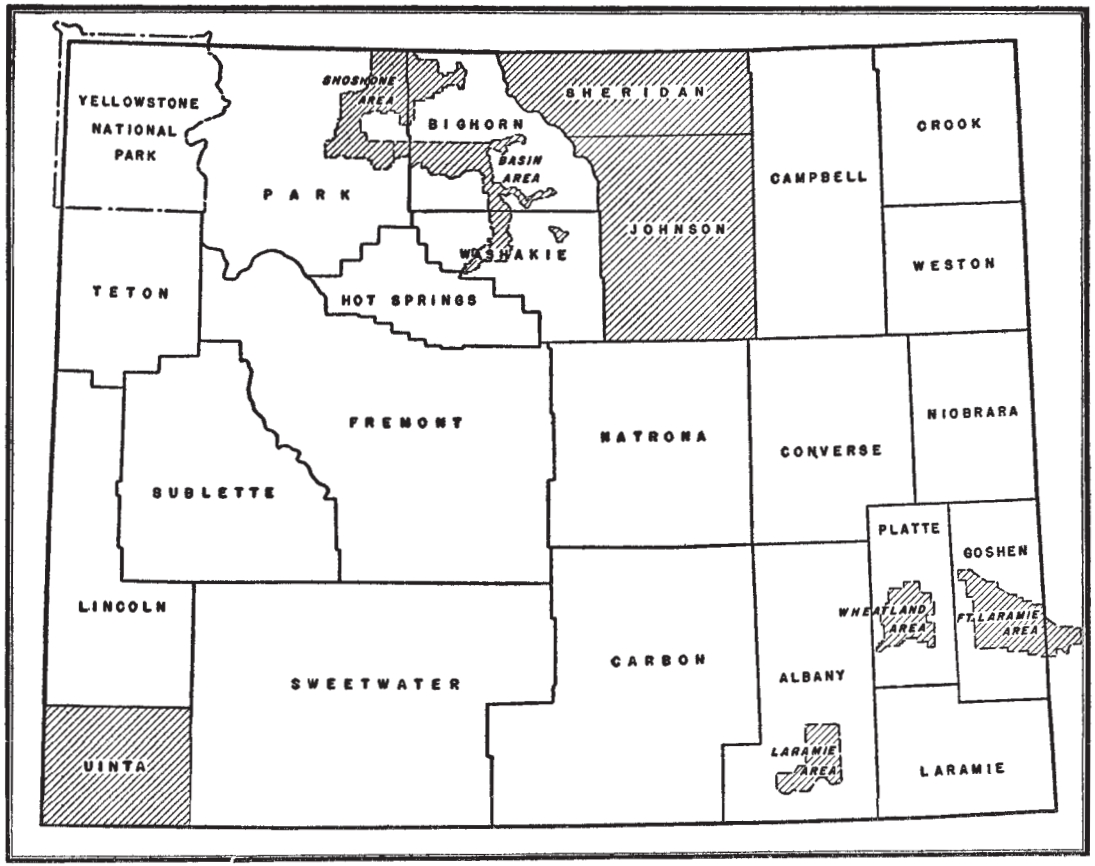

Areas surveyed in Wyoming, shown by shading

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