U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS.
IN COOPERATION WITH THE IOWA AGRICULTURAL EXPERIMENT STATION.

SOIL SURVEY OF GREENE COUNTY, IOWA.

BY

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

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[PUBLIC RESOLUTION—NO. 9.]

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

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

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

Approved, March 14, 1904.

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

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MAP.

Soil map, Greene County sheet, Iowa.

SOIL SURVEY OF GREENE COUNTY, IOWA.

By A. W. GOKE, of the U. S. Department of Agriculture, in Charge, and C. L. ORRBEN, of the Iowa Agricultural Experiment Station.

DESCRIPTION OF THE AREA.

Greene County, Iowa, is situated west of the center of the State and is included in the upper Mississippi plains region. The county has a total area of 574 square miles, or 367,360 acres. It is bordered by Calhoun and Webster Counties on the north, Boone County on the east, Dallas and Guthrie Counties on the south, and Carroll County on the west.

The county lies in the Wisconsin drift area and has the drift-plain topography characteristic of this part of the State. Low, inconspicuous knobs and swells in the moraines are features of an otherwise uniformly level surface. Ponds, sloughs, and poorly drained areas are numerous. There has been very little stream erosion or land dissection, except along the courses of the larger streams, which have cut narrow gorgelike valleys.

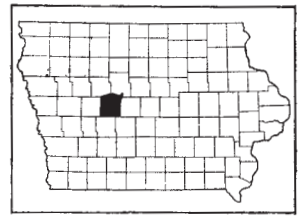

FIG.—12. Sketch map showing location of the Greene County area, Iowa.

The Raccoon River and its affluents constitute the principal drainage system of the county. This river flows diagonally across the county from northwest to southeast. Other minor streams, such as Willow, Greenbrier, and Snake Creeks, flow south out of the county. They are fed by local springs and from swampy or poorly drained are as which have recently been tiled. The most extensive areas lacking natural drainage are in Dawson, Highland, and Paton Townships, in the northern part of the county. Other level areas with like drainage conditions occur in the southern part of the county in Franklin, Greenbrier, and Jackson Townships.

The principal stream bottoms are narrow and are subject to overflow. The smaller streams have wider valleys, but these also are subject to overflow after rains. Their zigzag course indicates a youthful stage in the drainage system.

The terraces along the larger streams extend for long distances and vary in width from one-half to one-eighth mile. Along the smaller streams they occur as remnants or occupy filled-in depressions and are more irregular in their distribution.

Small knobs composed of gravel or containing pockets of gravel stand above the general level throughout the county. The most extensive of these gravel hills are found in sections 19 and 20 northwest of Grand Junction and in sections 24 and 25 in Hardin Township, where are also mapped the most extensive areas of the O'Neill sandy loam.

The water supply is obtained from bored wells or from artesian wells, which range in depth from 50 feet in the lowland to 100 to 150 feet in the upland. The water is fairly wholesome, but in many places, especially near the region of the coal mines south of Rippey, it contains large quantities of iron and other minerals which give it a disagreeable flavor. Many small intermittent streams furnish stock on the farm with water, but these can not always be relied upon during the dry periods of the summer. The greater number of artesian wells occur in Hardin Township, and a few are located on farms in Willow Township.

The average elevation of the county is approximately 1,000 to 1,200 feet above sea level. Elevations of some of the principal towns are: Scranton, 1,175 feet; Dana, 1,130 feet; Rippey, 1,078 feet; Cooper, 1,060 feet; Grand Junction, 1,040 feet.

The first settlement was made about 1849, four years before the county was organized. The greatest influx of settlers, however, came after the Civil War from Ohio, Illinois, and Indiana, and a few from Virginia, Kentucky, and the Carolinas. Most of these settlers obtained their land at a few dollars an acre from speculators who owned large tracts of land through the purchase of Government warrants.

According to the 1920 census, Greene County has a population of 16,467, 79.3 per cent of which is classed as rural. Jefferson, with a population of 3,416, Grand Junction with 1,010, Scranton with 843, Churdan with 763, Paton with 414, Dana with 163, and Rippey with 409 are incorporated towns of local importance.

The census shows that 95 per cent of the inhabitants of the county are native whites, and more than four-fifths of these are of native parentage. The foreign population, mainly English, Irish, German, and Scandinavian, is well distributed over the county.

Farming is the primary industry of the county. Minor industries include the manufacture of cement products, such as tiles and culverts in Jefferson, and mining in two important coal mines south of Rippey. The mines are in operation during the greater part of the year. The daily output of coal from each mine is approximately from 25 to 35 tons, practically all of which is sold within the county. A few small coal mines along the Raccoon River are used by the owners to supply their own fuel.

The county is well provided with transportation facilities. It is traversed by the Chicago & North Western Railway east and west and by the Minneapolis & St. Louis Railroad and the Chicago, Milwaukee & St. Paul Railway north and south. These lines provide connections with Omaha and Chicago. Very few farms are more than 6 miles from a railway station.

Every town or station has market facilities, so that the farm products can be shipped to the larger markets in a comparatively short time. The grain is sold to private elevators or through the farmers' cooperative elevator companies. Livestock is sold to local feeders or to the farmers' livestock shipping association, which collects the stock from the small farmers and ships it in carload lots to Omaha or Chicago. The dairy products are mostly handled by a cream station maintained by some large creamery company or by the farmers' cooperative creamery association. Most of the grain and livestock is shipped to Chicago.

Public roads follow section lines. Where the Raccoon River and other large streams traverse the county the roads follow the valleys or the slopes. The roads are commonly of earth construction and are kept in fair condition by using the drag after rains. A few of the principal highways are graveled and are good roads even during inclement weather. Seven miles of continuous paved road on the Lincoln Highway traverses the county from section 1, Grant Township, to the Raccoon River in section 14, Jackson Township. Most of the bridges are of concrete.

The county is well supplied with schools. In addition to the 81 common rural schools there are 6 consolidated rural schools, situated at Dana, Cooper, Rippey, Scranton, Grand Junction, and Paton, and 2 independent schools, located at Jefferson and Churdan. Boys' and girls' clubs have been organized by the farm bureau through the help of the county agent.

Practically every farm has telephone and rural free delivery service. Very few farmsteads are located more than a mile from a mail route. Some farms have electric-light plants, and a few receive their electric current from the plants of near-by towns.

CLIMATE.

The climate of the county is quite favorable for agriculture. Total crop failure is unknown and a wide variety of crops common to this section can be grown successfully. According to the records of the Weather Bureau station at Jefferson, the average date of the last killing frost in the spring is May 4 and that of the first in the fall October 3, giving an average growing season of 151 days. Sometimes the growing season is shortened as much as 13 days, causing injury to late-maturing crops or to crops planted late in the season. The date of the latest killing frost recorded in spring is May 26 and that of the earliest in the fall September 20.

Precipitation is favorably distributed over the entire year. It is heaviest during the growing season in May, June, and July, and is sufficient during the fall and spring for germination and growth of seed and plant. The average annual precipitation is 30.29 inches. The total precipitation for the wettest year on record (1902) was 49.77 inches and for the driest year (1911) 20.40 inches.

The winters are occasionally severe, but very few cases of crops being damaged by winterkilling have been reported. The prevailing soil conditions enable the crops to endure severe freezing during the winter. Enough moisture is available so that winter winds do not exhaust the supply, and the soil is sufficiently compact to prevent wind erosion, which is so commonly injurious to winter crops such as winter wheat. The average temperatures for January and February, respectively, are 19.2° F. and 22.1° F. The lowest recorded temperature is −37° F.

The summers are generally pleasant, with plenty of sunshine, but include rather prolonged periods of intense heat. The highest recorded temperature for the summer is 111° F. The mean for the summer is 73° F.

The following table gives the climatic data for the county as recorded at the Weather Bureau station at Jefferson.

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

[Elevation, 1,052 feet.]

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1911).	Total amount for the wettest year (1902).
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	25.4	58	−26	1.04	3.43	2.32
January	19.2	57	−37	.72	.50	.95
February	22.1	59	−26	.88	1.82	.37
Winter	22.2	59	−37	2.64	5.75	3.64
March	35.6	80	−9	1.60	.34	1.21
April	50.6	86	17	2.50	2.20	.83
May	62.0	94	29	4.85	3.38	4.68
Spring	49.4	94	−9	8.95	5.92	6.72
June	70.3	102	36	4.13	1.41	9.21
July	75.2	111	41	3.64	.08	10.65
August	73.6	103	35	3.35	1.96	8.27
Summer	73.0	111	35	11.12	3.45	28.13
September	65.6	101	27	3.78	2.07	5.32
October	52.8	87	11	2.42	2.69	3.62
November	35.8	78	−2	1.38	.52	2.34
Fall	51.4	101	−2	7.58	5.28	11.28
Year	49.0	111	−37	30.29	20.46	49.77

AGRICULTURE.

The agriculture of Greene County consists mainly of general farming combined with stock raising. Every farmer raises enough livestock to consume the roughage, such as cornstalks and hay grown on the farm, and many keep enough to consume all or a large part of the grain produced. When the market price of grain was at a prevailingly high mark most of the farmers turned to grain production and entirely neglected the feeding of stock, thus discontinuing temporarily a system of farming whereby the fertility of the land is maintained. The present (1921) low price of grain will, however, cause a reversion to the former practices.

The following table, compiled from the reports of the census, gives the acreage and production of the principal crops in 1899, 1909, and 1919:

Acreage and production of principal crops, 1899, 1909, and 1919.

Crop.	1899		1909		1919	
	Area.	Production.	Area.	Production.	Area.	Production.
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
Corn	125,389	4,866,700	121,786	4,000,334	129,233	5,831,389
Oats	62,955	2,294,710	60,059	1,662,953	76,735	2,972,027
Wheat	9,120	139,860	529	6,627	5,550	79,141
Rye	558	5,740	109	1,051	32	648
Barley	3,392	105,320	2,119	33,645	5,599	15,871
Potatoes	1,610	176,965	2,010	92,368	448	18,080
		Tons.		Tons.		Tons.
Clover	1,710	2,725	376	518	1,420	2,114
Clover and timothy	.....	.....	21,920	32,761	12,943	19,938
Timothy	.....	.....	8,878	12,156	4,768	5,581
Wild grass	22,432	30,753	14,827	19,248	4,331	5,405
Millet	1,546	3,547	362	625	173	372
Coarse forage	368	861	1,797	4,295	8,431	28,495

Corn is the chief grain crop. About half of the crop is consumed by the stock in the county and the remainder is sold for cash, mainly at local markets. On most farms it occupies about 50 per cent of the total acreage in cultivation. The principal varieties grown are Iowa Silvermine, Reid Yellow Dent, and Bloody Butcher. The average yield of corn over a period of 10 years is about 45 bushels per acre.

Corn is fed to stock in three different ways: (1) As grain rations supplemented with other feeds, (2) in the form of silage, and (3) in the form of fodder. Owing to the scarcity and high cost of labor, however, farmers are resorting to the method of feeding corn known as "hogging down." This method greatly reduces the expense and makes feeding more profitable. The fields are fenced off into small lots and the hogs are permitted to feed upon this and other crops, such as soy beans and rape, which are sown between the rows of corn.

Oats are usually raised on land that has been in corn the year before. The seed bed is prepared by disking the field, which thoroughly pulverizes the soil and at the same time cuts the cornstalks. The seed is either sown broadcast or drilled in. The latter method gives a more uniform yield. The average yield of oats is about 45 bushels per acre.

Oats require a little cooler weather than corn during the growing season, and the occurrence of a very hot period during the later stages of growth reduces the yield considerably. In 1921 a late frost and hot weather later in the summer resulted in a low yield of oats. The practice of selecting early maturing varieties and seeding early usually results in higher yields, because it insures rapid growth during the early part of the season, and leaves ample time for the crop to mature before the hot weather sets in. Albion (Iowa No. 103), Richland (Iowa No. 105), and Green Russian are the varieties most generally grown.

The wheat acreage in this county is small, because rust and plant diseases, with resultant low yields, make the crop unprofitable. The area in wheat had been gradually decreasing, but was increased in the last few years by war-time demands and consequent high prices. Turkey is the principal variety grown.

Wheat does not fit in well with the other crops, as it requires harvesting at a time when the tame-hay crop must be gathered and and the corn cultivated. This conflict of labor results in loss of time and added expense in farming operations.

The total production of rye, barley, and flax is small. Rye and barley are raised chiefly as supplementary feed for hogs. Flax is raised principally upon alkali and peat soils which have been recently tiled, the crop doing better under the untoward conditions than the other crops of the region.

Millet is grown in a small way on peat and muck soils, chiefly as a supplementary crop. Its use for forage is declining, as it is said to have a bad effect upon cattle and horses and does not compare in feeding value with other tame grasses and legumes. Attention is being directed to the raising of hay crops which have greater feeding value and which at the same time may be beneficial to the soil.

Of the hay crops, clover and timothy rank first in acreage and production. Timothy is usually sown with clover because better feeding quality can be obtained from the combination. The timothy permits more rapid and free circulation of air within the hay and shortens the curing period; it holds together the clover hay and prevents the loss of leaves, which are the most nutritious part of the clover hay, and it usually gives a larger yield with clover, as the latter improves the fertility of the soil.

Timothy and clover are usually sown with oats or after the oats have been sown and disked. The rate of seeding is from 6 to 15 pounds of clover and 6 to 10 pounds of timothy per acre. If the crops are grown separately, which is very rare, the rate of seeding is slightly heavier. If grown for seed, they are handled in the same manner as oats.

Alfalfa as a rule has not been very successful. It does best on land that is well drained and is supplied with lime, at least in the subsoil. In most cases the land has been improved so as to produce a good crop of alfalfa by treating with lime and inoculating.

Sweet clover produces a luxuriant growth along roads and railway embankments. It has been regarded more or less as a weed, but experiments have shown that it is a forage plant of high feeding value. Sheep and hogs make good growth while foraging on this plant, if corn is used as a supplement. Sweet clover is not cut for hay, but is used mostly as pasture for cattle and hogs.

The acreage and production of wild hay is gradually decreasing with the progress made in tiling the low, poorly drained areas. The average yield of wild hay is from 1 to 2 tons per acre. It must be cut twice during the growing season in order to obtain good hay, as it usually grows rank, and if permitted to grow during the entire summer before cutting, the hay is very coarse and unpalatable.

Bluegrass is the natural cover for pastures, except where the land has been seeded to other tame grasses. It does well on bottom lands and provides excellent pasture for stock during the early spring and late fall. During the droughty period of the summer the grass becomes parched, but revives quickly after a rain.

Sudan grass occupies a very small acreage. Most of it has been grown in an experimental way. Yields of 4 to 7 tons of hay per acre have been reported.

Soy beans are gradually increasing in popularity. A few farmers have seeded the beans with corn to be hogged down. The combination provides a balanced ration and produces a good type of hog for the market. The beans are planted in the rows when the corn is planted at the rate of three or four beans to every three-stalk hill of corn. In most cases a more satisfactory stand is obtained when a special bean-planter attachment is used.

Very little rape is grown in the county, but it has been grown successfully on a few farms. It is seeded with small grain in the spring and between rows of corn at the last cultivation. Rape is most useful for hogs and sheep, and provides a well-balanced ration with corn. Most of it is grown with corn for hogging down.[1]

Fruit growing is not carried on extensively, as the climate is not favorable. Apples, grapes, strawberries, plums, and cherries are grown in a small way, principally for home use. Many of the

[1] See Iowa Experiment Station Circular No. 53, Grow More Rape.

orchards would produce better if more attention were given to pruning and spraying.

The principal livestock industries, named in order of their importance, are hog raising, cattle feeding, sheep feeding, and dairying. These industries are carried on more extensively along the Raccoon River and in the southwestern part of the county than elsewhere. On land that can be utilized only for pasture, such as the rough broken land and morainic hills in the southwestern part of the county, cattle raising is a more profitable industry.

The livestock raised on the farms consists of good grades, and considerable interest is being shown in the improvement of stock. According to the records of the county farm bureau, there are in the county 150 members of livestock breeders' associations.

Hogs are the principal livestock. In January, 1920, there were 52,105 head in the county. Hogs are usually sold when 10 to 12 months old at the weight of 225 to 275 pounds. They are pastured in small lots in cornfields during the harvesting period and later fattened in small pens or feed lots before shipping to market. A number of self-feeders are in use. On many farms meat meal or alfalfa is used to balance the ration. A very good grade of hogs is raised. Duroc-Jersey and the Poland-China are the principal breeds. Other breeds of less importance in the county are the Chester White and Hampshire.

The raising of beef cattle is not important. Most of the cattle are purchased from Omaha and Chicago markets as feeders and after a 60 or 90 day feeding period are shipped to market. Corn is fed during the husking period, and later an added ration of hay and silage is fed with a little concentrate.

The breeding herds are usually purebred stock. The principal breeds, named in order of their importance in the county, are Shorthorn, Aberdeen Angus, Hereford, and Polled Hereford.

The local demand is not sufficient for the practice of dairying exclusively, except on a small scale on a few farms near towns. On most farms a small surplus of dairy products is sold, mainly in the form of cream to local cream stations. The Holstein is the leading dairy breed in the county, with the Jersey second.

Poultry raising is carried on as a side line, but as the current prices obtained for poultry and eggs are more remunerative than for other farm products this industry is receiving increased attention. The products are sold at local markets and to local buyers who make a specialty of buying for shipment to the larger markets.

The 1920 census reports 14,531 horses and 904 mules in the county. The Percheron is the favorite breed of horse. Most of the horses used for farm work are of the draft type. A few farmers make a specialty of raising draft horses. These are usually sold at the age of 4 to 10 years to buyers for shipment.

The sheep industry is developed mainly on farms having a considerable acreage of rough land. A few farms keep a small flock of sheep as a side line, but where sheep feeding is carried on extensively the feeders are bought on the Omaha and Sioux City markets, weighing on an average from 60 to 80 pounds. They are pastured in the cornfields where rape or soy beans have been sown and later put on a fattening ration for a period of 40 to 60 days. The wool is usually marketed through the county woolgrowers' association, which pools

and grades all the wool and later sells it. The census places the wool clip of 1919 at 29,739 pounds.

According to the census, the proportion of farms operated by tenants increased from 23.4 per cent in 1880 to 54 per cent in 1920. Most of the land is rented on the share-cash or cash basis. Cash rent for cultivated land ranges from $7 to $12 an acre, averaging about $9, while for pasture land the rent averages about $7 an acre. The terms of share leases vary with the individual farm. Where the renter furnishes everything he ordinarily gives one-third to one-half of the crop, and where the owner furnishes everything he receives four-fifths of the crop. Between these extremes there are numerous arrangements.

The following table, compiled from the reports of the census, shows the number of farms, proportion of land in farms, average size of farms, and the acreage and percentage of improved land per farm in the census years from 1880 to 1920, inclusive:

Farms and farm lands.

Census year.	Number of farms.	Proportion of total area in farms.	Average size of farms.	Improved land per farm.	Proportion of improved farm land.
		Per cent.	*Acres.*	*Acres.*	*Per cent.*
1880	1,694	57.7	125.0	95.1	75.9
1890	2,114	89.0	155.0	126.0	81.9
1900	2,314	99.7	158.2	142.4	90.0
1910	2,151	97.5	166.4	145.7	87.5
1920	2,059	92.3	164.7	148.5	90.2

The average acreage per farm at present (1921) is 164.7 acres. A few farms contain 400 to 500 acres. Where most of the land is tillable the farms are gradually decreasing in size. The larger farms occur along the Raccoon River and in the southwestern part of the county, where large areas are suitable only for grazing.

According to the census records the value of all farm property per farm increased from $3,232 in 1880 to $53,720 in 1920. Most of this increase can be attributed to the increase in land values; the assessed land value per acre is given by the census for 1900 as $35.56, while that for 1920 is given as $271.46.

Owing to the productiveness of the soils of the county, little attention has been paid to soil improvement, but the high price of land and interest in the general development of the county is directing attention to reclaiming land for cultivation and to improving land already in cultivation. Drainage districts have been laid out and tile drains are being laid to drain the low wet cultivated lands and swamp areas. A drainage project in Goose Lake, the largest peat bed in the county, has recently been completed.

Attempts to practice a definite system of crop rotation have been made by only a very few farmers. The majority follow no particular system. The probable reason for this is that most of the farmers are tenants and practice a system of farming that will bring the largest immediate returns. Where a system of rotation is followed it consists of corn one year, oats one year, and timothy and clover one to two years, then returning to corn. Ordinarily the grain crop is

fed to stock, but during the World War, when grain commanded a high price, it was sold.

Barnyard and stable manure are applied to land as available. No need of commercial fertilizer has been felt.

Fall plowing is practiced to some extent. The average depth of plowing is from 4 to 5 inches. The plowed surface remains untouched until the following spring, when the seed bed is prepared. Fall plowing aids in accumulating moisture and starting the bacterial activities in the soil, and, coming at a time when farm work is not so pressing, prevents a rush of work in the spring.

SOILS.[2]

The soils of Greene County may be differentiated into dark-colored and light-colored soils. As the climatic factors have been uniform over all parts of the area, the soil owes its color to local conditions, mainly those that have been favorable or unfavorable to the accumulation of black organic matter. On the older soils of the uplands, the character of the vegetation has determined the color of the soil, a heavy growth of grasses being favorable and a forest growth unfavorable to the accumulation of organic matter.

The area of dark-colored soils is coextensive with the area of prairie on the upland and includes also areas of dark-colored alluvial soils. These soils, which include all the series except the Conover and the Sarpy, may be subdivided into groups whose differentiation is based on drainage conditions of soil or subsoil, or both, during their development.

One of these groups includes the soils developed under conditions of good soil and subsoil drainage. The typical profile has a dark-brown surface soil, underlain by a lighter brown granular upper subsoil, which in turn is underlain by a heavy brown or yellowish-brown lower subsoil. Lime has been removed from the entire 3-foot section to such a degree that it will no longer effervesce with acid. This group includes the Carrington soils on the uplands and the Waukesha on the terraces. With the group may also be placed the soils of the O'Neill series, which have gravelly subsoils.

Another group, which includes the Clarion and the Pierce series, has a soil profile that indicates only a partial leaching and oxidation of the material. The soils and upper subsoils are not unlike those of the Carrington group, but the lower subsoils consist of the unleached and little altered parent soil material and are highly calcareous.

Another group of soils has been developed under conditions of poor drainage unfavorable to leaching and oxidation. These have a characteristic profile consisting of a deep, black surface soil with a heavy gray or mottled, highly calcareous subsoil. Soils of this group are represented by the Webster series on the flat upland areas, the Fargo series on flat terraces and in depressions, and the Lamoure series in the first bottoms.

Soils that have a profile similar to that last described, but which have been more thoroughly leached of their carbonates within the

[2] Greene County adjoins Webster County on the north. In certain cases the soil maps do not appear to agree along the boundaries. This is due to changes in correlation. Since the soil survey of Webster County was made, a part of the Fargo soils, as mapped in Webster County, have been correlated with the Webster series.

3-foot section, are represented by the Bremer soils on the terraces and the Wabash soils in the first bottoms.

The areas of light-colored soils on the upland are coextensive with the areas on which forests have long been established. The Conover, the only light-colored upland series, consists of gray soils, underlain by a yellowish-gray upper subsoil and a brown, compact, heavy lower subsoil. Both soil and subsoil are low in lime. With the light-colored soils belong also the recently deposited Sarpy soils of the first bottoms. These soils are light brown or grayish brown and are underlain by sand and gravel.

Greene County lies within the area overrun by the Wisconsin ice sheet, the last that invaded this region. The ice gathered up, ground, and transported vast quantities of rock débris, and upon its retreat left a mantle of this glacial drift composed of clay, sand, gravel, and bowlders. The great soil-forming processes, such as leaching, aeration, oxidation, and the accumulation of organic matter, have changed the surface of this material to its present state. The comparatively short time during which the material has been subjected to weathering is indicated by the shallow depth to which leaching and oxidation have taken place, as well as by the constructional topography of a large part of the area. All the upland soils have been derived directly by weathering from the glacial till, and the alluvial soils consist largely of wash from the drift reworked and redeposited by the streams.

The soils of the county have been differentiated into series on the basis of color, structure, and minor details of the soil profile, and on the basis of the source, character, and processes of accumulation of the material from which the soils have been developed. The series are divided in types upon the basis of texture. Nineteen soil types, representing 12 series, have been mapped in this area, in addition to Muck and Peat.

The surface soils of types of the Carrington series are dark brown to black, and the subsoil is yellowish brown to light brown. The soils are derived through the weathering of glacial drift. They usually have good drainage. Neither the soil nor subsoil is calcareous. The Carrington series is the most extensive in the county, and is represented by the loam and fine sandy loam types.

The types of the Clarion series have very dark brown to black surface soils, which usually grade through a dark-brown upper subsoil to a light-yellow lower subsoil having a high content of lime. The types usually occupy gentle slopes leading to types of the Webster series. The loam is the only type of this series mapped.

The surface soils of the Webster series are usually dark brown to black and the subsoil is mottled black, gray, and sometimes yellowish brown to rusty brown, with some drab. Gravel and bowlders occur locally on the surface and in the lower subsoil. The subsoil is calcareous and effervesces with acid. The series has been formed by the weathering in position of glacial till under conditions of poor drainage. Erosion has not extended into these soil areas and drainage is very much restricted. The series is represented in the county by the loam, clay loam, and silty clay loam types.

The surface soils of the types included in the Pierce series are dark brown in color and rest upon a shallow gravelly subsoil. The gravel

consists of various kinds of rock and is more or less rounded and waterworn. These soils occur on kames and outwash plains formed at the immediate front of the glacier. The topography is hilly and the land is droughty. The Pierce sandy loam is mapped.

The Conover series includes types characterized by brownish-gray surface soils, a subsurface layer of slightly lighter shade and somewhat mottled with gray, and a dull yellowish brown, tough subsoil, which usually gives way to yellow, gravelly, highly calcareous till within the 3-foot depth. The Conover silt loam is mapped in this survey.

The O'Neill series includes types with dark-brown surface soils and a brown to yellowish-brown subsoil which contains a large proportion of sand. The types occupy terraces along the larger valleys. Neither soil nor subsoil is highly calcareous. One type, the O'Neill sandy loam, occurs in this county.

The types of the Waukesha series are characterized by dark-brown to black surface soils underlain by a brown to yellow subsoil. The soils are mainly noncalcareous. They occur on terraces above overflow and are well drained. The sandy loam and the silt loam types of the series are mapped.

The surface soils of the types in the Bremer series are black. The subsoil is dark gray or drab, mottled with yellowish brown and iron stains, and is heavier than the surface soil. This series occupies outwash plains, terraces, and smooth areas of water deposition. The drainage varies from fair to poor. The Bremer silt loam and silty clay loam are mapped.

Black surface soils and a dark-drab or mottled heavy subsoil are characteristic of the types of the Fargo series. They occur on lake or river terraces, where they have been formed by the reworking of glacial till and subsequent weathering under conditions of poor drainage. The soils contain a large percentage of organic matter and lime and are poorly drained. Only the Fargo silty clay loam is mapped.

The types of the Wabash series occur in the bottom land and are subject to overflow. The soils are dark brown to black, with a high content of organic matter. Both soil and subsoil are low in lime. The natural drainage is good. Three types are mapped—the loam, very fine sandy loam, and silty clay loam.

The Lamoure series occupies the same relative position as the Wabash series, but the natural drainage is not as good. The subsoil is also much lighter in color and in places more compact than in the Wabash series. Local accumulations of alkali and a high lime content in the subsoil are distinguishing features of the Lamoure and Wabash series. The Lamoure silty clay loam occurs in this county.

The Sarpy series includes types with light-gray to brown surface soils underlain by a lighter textured subsoil locally passing into loose sand and gravel within the 3-foot section. These soils occupy first bottoms and are often subject to overflow. The Sarpy fine sandy loam is mapped.

In the following pages of this report the various soils of Greene County are described in detail. The table following gives the name and the actual and relative extent of each type mapped.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Carrington loam	189,120	53.5	Peat	2,048	0.5
Steep phase	7,296		Waukesha sandy loam	1,920	.5
Webster silty clay loam	96,320	26.2	Wabash very fine sandy loam	1,728	.5
Clarion loam	26,240	7.1	Carrington fine sandy loam	1,344	.3
Wabash silty clay loam	8,832	2.4	Webster clay loam	1,344	.3
O'Neill sandy loam	7,936	2.2	Pierce sandy loam	1,024	.3
Fargo silty clay loam	5,632	1.5	Lamoure silty clay loam	960	.3
Webster loam	4,288	1.2	Muck	832	.2
Conover silt loam	2,496	.7	Bremer silty clay loam	704	.2
Sarpy fine sandy loam	2,432	.7	Bremer silt loam	640	.2
Waukesha silt loam	2,112	.6			
Wabash loam	2,112	.6	Total	367,360	

CARRINGTON FINE SANDY LOAM.

The surface soil of the Carrington fine sandy loam is a dark-brown fine sandy loam 12 inches deep. The subsoil is a brown or yellowish-brown sandy loam, in places grading into a loose sand below 36 inches. This type has a lower content of organic matter than the heavier soils. Neither the soil nor subsoil is calcareous.

Only a few small areas of the type are mapped. They occur principally in section 18 of Jackson Township and section 29 of Willow Township.

The type usually occurs on hills and on sloping land bordering the streams. It has a gently rolling topography, is well drained, and is subject to erosion to a slight degree.

Practically all of the type in the county is utilized for grazing. It supports a thin stand of grass, and about 5 to 7 acres per head are required for pasturing in the summer months. The principal grasses on this soil, in order of their importance, are sand reed grass, little bluestem, sedges, and spear grass.

CARRINGTON LOAM.

The surface soil of the Carrington loam is a dark-brown to black mellow loam, about 12 inches deep. The subsoil is a slightly more compact light-brown loam, which grades at 24 inches into a yellowish-brown gritty clay loam. Both soil and subsoil contain scarcely enough lime to effervesce with acid, though there is usually sufficient for crop needs. In places large bowlders are found on the surface or through the soil section, and the occurrence of small glacial pebbles is not uncommon. The surface soil is mellow and friable and is well supplied with organic matter, which makes it retentive of moisture.

In the more rolling parts of the county, especially in the southwestern part, the surface soil is a yellowish-brown mellow loam and the subsoil is a heavy sandy clay. In these areas surface erosion is more active and the soil is being steadily depleted of organic matter at the surface. Wherever subdrainage is partially restricted, as on small slopes of undulating areas or at the foot of slopes, the subsoil is mottled with bluish gray and brown.

This type occurs on gently undulating well-drained prairie land and extends down the smooth slopes bordering the small stream valleys. It is the most extensive soil type in the county and includes more than 53 per cent of the total area.

About 95 per cent of the type is in farms. It is utilized almost exclusively for raising corn, oats, and clover. Corn occupies the largest acreage, with an average yield of 40 bushels per acre. Oats are second in importance and average 35 bushels per acre. The yield of timothy and clover hay is about 1½ tons per acre.

Practically all of the grain and hay is fed to work stock, hogs, and cattle on the farms. The surplus crops are sold to local markets or elevators and shipped out of the county. Wheat serves as a cash crop on most farms. Small orchards are found on nearly every farm, but many of them are succumbing to the attacks of diseases and insects.

The principal livestock industry consists of the feeding of hogs, beef cattle, and some sheep. The hogs are raised on the farms and usually are fitted for market in conjunction with the feeding of beef cattle. The cattle are purchased from western ranges as feeders and are fed principally corn, in the form of grain, fodder, or silage, and in addition hay and other supplementary feeds.

No commercial fertilizers are used. Stable and barnyard manure is applied to a greater extent than to any other soil type, and its application usually results in larger yields. Lime has been used with favorable results on soils to be used for growing clover and alfalfa; better yields have been obtained, and satisfactory stands have been obtained on fields where failure of growth had always occurred.

The mellow, friable structure and good drainage of this type permits cultivation at an earlier period during the spring and after rains, as its tilth is not so easily impaired. Any disturbance of its physical condition is quickly remedied, through the active process of weathering encouraged by the large organic content. Some farmers practice fall plowing so as to prevent rush of work during the following spring. This practice allows thorough aeration of the soil and improves its physical condition.

The average price of improved farm land is $175 to $250 an acre, depending upon location with respect to markets and position of the land.

This type is closely associated with the Webster silty clay loam, and is the predominating soil in nearly all sections.

Carrington loam, steep phase.—The steep phase of the Carrington loam occupies the eroded slopes and bluffs along the Raccoon River and its tributaries and some parts of the Cedar and Buttrick Creek banks. Its total area is small.

The soil is a black to brown friable loam, 6 to 8 inches deep, underlain by a yellowish-brown, compact, gritty clay loam or clay. In many places along the steeper slopes active erosion has removed the layer of organic matter and exposed the subsoil, producing small areas of light-colored soil. Textural variations of the surface soil toward a sandy loam occur along the steepest slopes, but these areas are too small to be shown on the map.

Practically all of this phase is too steep for profitable cultivation. In some places, as along Cedar Creek and the Raccoon River, the bluffs are precipitous and the land has no agricultural value. The most profitable use of this soil is for growing timber and for pastures

on the cleared areas. The phase is mainly in forest, consisting principally of bur oak (*Quercus macrocarpa*), red oak (*Quercus rubra*), basswood (*Tilia americana*), black walnut (*Juglans nigra*), and some hickory and hard maple.

CLARION LOAM.

The surface soil of the Clarion loam is a very dark brown to black friable loam, 15 inches deep. The subsoil is a dark-brown silt loam to about 24 inches, where it passes into a yellow-brown to yellow silty clay loam. The lower subsoil effervesces freely with acid and locally it contains a few small pebbles. The subsoil does not have the compact structure characteristic of the Carrington series.

This type occurs mainly in small areas on low sloping land bordering the Webster soils. The largest areas are in Dawson Township, where the topography is level or undulating, and smaller areas are scattered over nearly all parts of the county.

Practically all of the type is utilized in the production of staple crops, corn, oats, clover, and alfalfa. The yield of corn averages about 45 to 50 bushels per acre, although in exceptional years as much as 70 bushels are obtained. Oats yield 45 to 50 bushels per acre.

Clover and timothy do exceptionally well on this type, the average yield of hay being 1½ tons per acre. Generally a better stand is secured and a larger yield of hay obtained than on the other soil types.

No commercial fertilizer is used. Barnyard manure is applied to some extent.

Improved land of this type is held at $175 to $250 an acre, depending upon improvements and location.

WEBSTER LOAM.

The Webster loam consists of about 4 to 8 inches of black mellow loam, underlain by a more compact layer of silty clay loam to an average depth of 24 inches. At 15 to 36 inches the soil passes into a dark-drab and pale-yellowish silty clay loam. The surface soil contains a high percentage of silt and organic matter and usually works into a good tilth. The subsoil is calcareous and contains more lime and pebbles than the silty clay loam.

The Webster loam is not an extensive type. It occurs in very small areas scattered over the northeastern and central parts of the county, closely associated with the Carrington loam and the Webster silty clay loam.

The type occupies flats and depressions and the surface is for the most part level. The drainage now provided is efficient in ordinary seasons.

Practically all of this type is under cultivation. Corn yields average about 45 bushels, oats 40 bushels, and clover and timothy hay about 1½ tons per acre.

WEBSTER CLAY LOAM.

The surface soil of the Webster clay loam is a very dark brown or nearly black clay loam with an average depth of 15 inches. The upper subsoil is a dark-brown or grayish-brown compact clay loam. The lower subsoil, usually beginning at a depth of 24 inches, is a gray or mottled gray and brown tough clay. The surface soil contains a

high percentage of organic matter and in places is almost a muck. The soil and upper subsoil rarely contain sufficient lime to effervesce, but the lower subsoil is everywhere highly calcareous. Occasional bowlders are found on the surface and through the soil section. In places the surface soil may be partly or wholly composed of sediments washed from the higher land, but the subsoil invariably consists of drift.

The type occurs in a few small areas, mainly in the northeastern part of the county. It occupies very flat areas or slight depressions on the upland and in shallow stream valleys. These areas were formerly covered by water much of the time and most of them are still inadequately drained.

The type is very productive and nearly all of it is cultivated. Corn is the most successful and the most profitable crop and yields from 50 to 60 bushels per acre in years of moderate rainfall.

This soil is rather difficult to till and must be plowed at exactly the right stage of moisture to pulverize well. Fall plowing is preferable, as it allows the clods to break up during the winter and provides a good tilth for the seed bed in the spring.

WEBSTER SILTY CLAY LOAM.

The surface soil of the Webster silty clay loam is a very dark brown to black silty clay loam 12 inches deep. The subsoil consists of a rather compact layer of silty clay loam of yellowish or rusty-brown and gray mottled color, which at a depth of 25 inches grades into a brownish-yellow to brownish-gray or brown and gray mottled silty clay loam. The subsoil usually has a grayish cast and contains small quantities of coarse drift material, which give it a porous structure. Glacial bowlders and pebbles are found on the surface, but they are not numerous.

This is the second largest soil type in the county, with a total area of approximately 96,000 acres, or 26 per cent of the county. The most extensive areas are in the northeastern part of the county, in Dawson and Highland Townships. In the western and southern parts of the county the areas are smaller and closely associated with the Carrington soils. Here the surface is much more eroded and influenced by the principal drainage system.

Webster silty clay loam is developed in all parts of the county in small and more or less isolated areas. The type occurs along intermittent drainage ways and in flat to depressed areas. The natural drainage is rather poor and tiles are used to advantage. Most of the areas are being tiled. The favorable effects of tiling were evidenced in the wet season of 1921, when more of this type of land was cultivable than in previous wet seasons.

Practically all of the type is under cultivation, the principal crops being corn, oats, clover, and timothy. Corn averages 40 bushels per acre, but in favorable seasons as much as 60 bushels is obtained. Oats average 35 to 40 bushels per acre; in favorable seasons a very rank growth prevails and a good part of the crop lodges before ripening. Fine crops of clover and timothy hay are produced on this type, with yields averaging 1½ to 2 tons per acre. Clover is better adapted to this soil than the other legumes. Alfalfa does not do so well, because of the wet conditions during parts of the growing sea-

son. This soil is high in organic matter and does not require the application of manure to supply humus, although a light application will produce a larger yield, probably on account of its other elements of fertility.

PIERCE SANDY LOAM.

The surface soil of the Pierce sandy loam consists of 4 inches of dark-brown sandy loam. The subsoil consists of a shallow layer of gravelly loam, underlain by beds of stratified gravel. In some areas a shallow bed of yellowish-brown fine sandy loam occurs beneath the surface soil. The subsoil is slightly calcareous.

The type has a very small total acreage. The most extensive areas occupy a number of terminal morainic hills in Willow Township. The largest single area is in sections 31 of Scranton and 6 of Willow Townships. Smaller areas occur throughout the county on gravelly knolls. A few of the areas were too small to be mapped. The topography is hilly.

Owing to the droughty character of the soil, cultivation would not be warranted, except on small areas farmed in conjunction with other soils, in order to avoid waste and labor in field operations. The larger areas of this soil are used for pasture.

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

Mechanical analyses of Pierce sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
334723	Soil, 0 to 4 inches	8.3	15.4	9.0	28.2	11.4	18.7	9.1
334724	Subsurface, 4 to 20 inches	16.7	37.4	14.6	19.5	4.8	5.3	1.6
334725	Subsoil, 20 to 36 inches	23.9	40.4	14.6	15.2	2.3	2.3	1.5

CONOVER SILT LOAM.

The surface soil of the Conover silt loam is a grayish-brown to brownish-gray silt loam, 12 inches deep. The lower part of the 12-inch section contains a distinct layer of gray silt loam. The subsoil is a yellowish-gray silt loam underlain below 20 inches by a very heavy, tough, dark-brown silty clay or clay loam. Both soil and subsoil are noncalcareous and low in organic matter. The texture varies from fine sandy loam to silt loam, the lighter soil occurring on the sides of very steep slopes and in pockets on the hillsides.

The type occupies the higher bluffs along the Raccoon River. The areas are not continuous along this stream but are interspersed with areas of the steep phase of the Carrington loam. The total area is comparatively small. One of the larger areas lies along the Raccoon River in sections 29 and 32 of Washington Township.

Practically none of this land is in cultivation. Most of it is covered with virgin forest of bur oak, red oak, basswood, black walnut, pig hickory, elm, and hard maple, together with an undergrowth of sumac and hazel brush. The land is lightly pastured by cattle, sheep, and goats. The stand of native grasses is very sparse, the

shade of the trees and the low fertility of the soil making unsuitable conditions for their growth.

Below are given the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Conover silt loam:

Mechanical analyses of Conover silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
334710	Soil, 0 to 12 inches	2.0	4.3	2.9	10.7	13.7	53.4	13.0
334711	Subsurface, 12 to 20 inches	1.3	4.3	3.4	13.7	17.4	51.1	8.9
334712	Subsoil, 20 to 36 inches	2.2	7.2	5.6	23.1	18.1	33.6	10.2

O'NEILL SANDY LOAM.

The surface soil of the O'Neill sandy loam is a dark-brown to dark grayish brown sandy loam 7 or 8 inches deep. This is underlain by a light-brown to brown loamy fine sand which at a depth of 24 inches grades into a dark-brown coarse sand and gravel. The subsoil is not sufficiently calcareous to effervesce with acid.

The O'Neill sandy loam is the most extensive of the terrace soils, occupying approximately 12 square miles. The largest areas lie along the Raccoon River and Buttrick Creek. The type has a level to gently rolling topography and drainage is good.

Practically all of the O'Neill sandy loam is under cultivation. Corn yields 25 to 35 bushels per acre, oats 20 to 30 bushels, and timothy and clover three-fourths to 1 ton per acre.

The type is doughty in dry seasons, because the porous subsoil permits rapid percolation of moisture into the lower depths. In a few areas, however, the soil is more loamy and retains more moisture, and rapid evaporation is prevented by the surrounding bluffs along the river, which stop the hot summer winds from carrying away the moisture of the air.

The deposits from which this soil is derived appear to be of glaciofluvial origin. Cross-bedding, stratification lines, and other evidences of water deposition may be seen in every exposure. The sand and gravel beds are unconsolidated and rather porous, permitting rapid underground drainage.

The results of mechanical analyses of samples of the soil, subsurface, and subsoil of the O'Neill sandy loam are given below:

Mechanical analyses of O'Neill sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
334751	Soil, 0 to 7 inches	3.5	14.7	7.7	13.7	7.2	36.9	16.2
334752	Subsurface, 7 to 20 inches	2.8	15.5	9.0	17.7	9.2	34.1	12.0
334753	Subsoil, 20 to 36 inches	5.8	27.9	16.4	27.4	7.5	9.9	4.9

WAUKESHA SANDY LOAM.

The surface soil of the Waukesha sandy loam consists of 8 inches of dark-brown to black sandy loam. The subsoil is a light-brown material heavier in texture and slightly compact, passing at a depth of 24 inches into a friable silty clay loam. It does not contain sufficient lime to effervesce with acid. The soil profile is similar to that of the Carrington soils on the upland.

The Waukesha sandy loam has a total area of 3 square miles. The most extensive areas are on high terraces above overflow along the Raccoon River. The topography is level, and drainage is good.

Practically all of the type is under cultivation and produces good yields of grain. This soil warms up early in the spring, and grain crops mature three days to one week earlier than on most of the other oils. In favorable seasons the yield of corn and oats is about the same as on the soils of the Carrington series.

WAUKESHA SILT LOAM.

The surface soil of the Waukesha silt loam is a dark-brown to black heavy silt loam about 15 inches deep. The subsoil is a yellowish-brown silty clay loam underlain at 28 inches by a brown silty clay loam. The soil profile is similar to that of the Carrington silt loam. The subsoil is not calcareous.

This type occupies terraces entirely above overflow. The largest area lies in section 5 of Jackson Township. Although the topography is flat, drainage is good.

All of the Waukesha silt loam is in cultivation to corn, oats, clover, and timothy. Corn yields 45 to 50 bushels per acre, oats 40 to 45 bushels, and clover and timothy 1½ tons per acre.

The soil retains moisture well, and crops do not suffer from the effects of a dry season as quickly as on other terrace soils.

BREMER SILT LOAM.

The surface soil of the Bremer silt loam is a dark-brown to black silt loam 7 inches deep. The subsoil is a silty clay loam to a depth of 20 inches, below which it is a dark-drab and yellow mottled silty clay to clay loam.

The type has a total area in the county of 1 square mile. It occupies flat to gently rolling areas on low terraces above overflow. The more important areas lie along the Raccoon River, in the southeastern part of the county. Drainage is good. All of the type is under cultivation, chiefly to oats and corn.

BREMER SILTY CLAY LOAM.

The surface soil of the Bremer silty clay loam is a black silty clay loam 12 inches deep. The subsoil to a depth of 28 inches is a heavier silty clay loam of similar color. The lower subsoil is a dark-drab and yellow mottled clay loam. Neither soil nor subsoil contains lime carbonate, according to field tests.

The type is confined to terrace outwash plains and other areas of water deposition which were formerly poorly drained but now occupy positions above overflow. Except in position, it differs little from the Wabash silty clay loam of the lower bottoms. The type occurs

principally in small areas on terraces of the Raccoon River. The total area in this county is small, comprising only about 700 acres.

All of the Bremer silty clay loam is under cultivation, and produces good yields of the staple crops. Corn averages 40 to 50 bushels per acre, oats 40 to 45 bushels, and clover 1½ tons per acre.

The type is sufficiently well drained to produce good crops even in years of unusually heavy rainfall. In extremely dry years it withstands drought fairly well, notwithstanding its heavy texture. The texture is not so favorable to the retention of moisture, but the flat surface of the areas prevents run-off and permits the absorption of more water by the soil.

FARGO SILTY CLAY LOAM.

The surface soil of the Fargo silty clay loam is a black heavy silty clay loam, 18 inches deep. The subsoil has the same texture but becomes lighter in color with increasing depth, and below 26 inches is a yellowish and gray mottled heavy silty clay loam. Both soil and subsoil are high in organic matter and lime.

The type occupies old lake or river terraces, where the soil has been formed by the reworking of glacial till and subsequent weathering under conditions of poor drainage. The type is free from bowlders or glacial till. Its surface is very level and relatively lower than that of the surrounding soil, thus forming low depressions or basins in which the run-off of the upland empties. Drainage is usually poor. Practically all of the type occurs in the southwestern part of the county in Willow Township, the largest areas being in sections 11, 14, and 17.

About 50 per cent of the area of the type is under cultivation; the remainder is used for pasture and hay. About 80 per cent of the area is drained by tile or open ditches. The soil is very productive. Corn, the principal crop, yields an average of 50 to 60 bushels per acre. Small grains usually produce a rank growth and begin to lodge before maturing the grain, resulting in low yields. The hay meadows, when well drained, yield an average of 1½ to 2 tons of hay per acre and afford excellent pasturage during the late fall before the cornfields are suitable for pasturing in the winter. The grass grows quickly and yields plenty of pasturage before frost.

WABASH VERY FINE SANDY LOAM.

The Wabash very fine sandy loam is a dark-brown to almost black, friable very fine sandy loam. In general there is little change in color or texture within the 3-foot section, but in places the lower subsoil is lighter colored and slightly more compact. The favorable texture and the high content of organic matter within the 3-foot section aid in the retention of moisture.

The greater part of the type occurs in several small areas along the Raccoon River. The area in section 12 of Franklin Township appears to be an area of recent formation, which, by a sudden shift of the river channel, was left in a position where it could be drained.

About 75 per cent of this type is cultivated. Corn, the principal crop, yields on an average about 40 bushels per acre, and oats yield about 35 bushels.

WABASH LOAM.

The surface soil of the Wabash loam consists of a dark-brown to nearly black mellow loam which gradually passes into a silt loam. The subsoil from depths of 18 to 36 inches is a silty clay loam containing a considerable proportion of fine sand. As a rule there is no great change in color within the 3-foot section, but in places it may change to dark gray or mottled gray and brown. Neither soil nor subsoil contains sufficient lime to effervesce with acid.

The type occurs along a number of small streams. The largest area is on Buttrick Creek, a few miles west of Dana. Many areas too small to map are included in areas of the heavier soils of the Wabash series.

The Wabash loam has better surface drainage than the heavy Wabash types, as the surface is not so hard and the lighter texture of the soil permits better internal drainage.

Only a small part of the type is cultivated, the greater part being used for pasture. It supports a heavy growth of grass and provides excellent grazing. Bluegrass does especially well.

WABASH SILTY CLAY LOAM.

The surface soil of the Wabash silty clay loam is a very dark brown to almost black silty clay loam. The subsoil, which begins at an average depth of 18 inches, is a dark-gray or mottled gray and brown silty clay loam. The texture gradually becomes heavier with increasing depth until it is a heavy clay. Iron stains and iron concretions are abundant in many places in the lower subsoil.

The Wabash silty clay loam is a soil of the lower first bottoms. It occurs along many small streams in all parts of the area. The largest development is along Hardin Creek and Buttrick Creek. There are no areas of any size along Raccoon River.

The surface of the type is flat and so low as to be subject to overflow at every stage of high water. Drainage is slow because of the nearly level topography and the heavy compact subsoil.

On account of the poor drainage, a large part of this type is not under cultivation but is used for pasture. It supports a luxurious growth of pasture grasses, including bluegrass. The soil is very fertile, and where drainage is good and there is reasonable safety from floods, good yields of staple crops are obtained.

LAMOURE SILTY CLAY LOAM.

The surface soil of the Lamoure silty clay loam is a dark-brown to black silty clay loam 12 inches deep. The subsoil becomes heavier in texture and slightly lighter in color with increasing depth. The upper half of the subsoil contains a higher proportion of marl than any other part of the soil section. In a few places, however, practically no change occurs throughout the entire 3-foot section. The subsoil effervesces freely with acid.

The type occupies the first bottoms of sluggish streams and drainage is very poor. Many areas have the appearance of swamps with a rank growth of slough grasses and cat-tails in the standing water. Wherever drainage occurs within the area, an accumulation of alkali is present. The most extensive area of this type lies along Willow Creek in Willow Township.

The type is used only for pasture. The grasses make a rank growth, and are unpalatable later in the season. With better drainage, the land would yield grasses of higher feeding value.

SARPY FINE SANDY LOAM.

The surface soil of the Sarpy fine sandy loam consists of 7 inches of grayish-brown fine sandy loam. The subsoil is a light-gray fine sand, which grades at a depth of 20 inches into loose sand and gravel. Both soil and subsoil are very low in organic matter and lime.

This type is developed chiefly as narrow strips of bottom land along the entire course of the Raccoon River. The widest area lies along this river in the southern part of the county. The type is subject to frequent overflows.

Practically all of this soil is used for pasture. A few areas along the Raccoon River are forested with elm, hard maple, poplar, and willow, with a thin undergrowth of bluegrass and herbs. Willow and cottonwood trees border the edge of the stream channel, where the surface soil is more sandy.

MUCK.

The surface soil of Muck is a black, light, fluffy soil extending to a depth of about 8 to 10 inches. It is composed of 15 to 30 per cent of well-decomposed organic matter, a very small percentage of very fine sand, and the remainder of silt and clay, the silt predominating. At a depth of about 12 inches the soil gradually changes to a dark-brown to black silty clay loam, which grades heavier with depth and becomes a silty clay at about 30 inches. Below this depth, yellowish-brown and gray mottling become very prominent. Snail shells and some mussel shells occur on the surface in many places. Lime concretions are found in the subsoil and both the surface soil and the subsoil are calcareous.

Muck is closely associated with the Webster silty clay loam and the lines of separation between the two are arbitrary. Some of the Muck areas were too small for mapping and were included with the Webster soils.

The total area of Muck is small. All of it is well drained with tiles and is productive. Corn is the only crop grown on Muck.

PEAT.

Peat differs from Muck mainly in that it contains a greater proportion of organic matter and is in a slightly less advanced stage of decomposition. The surface soil of Peat 10 to 14 inches deep is composed of over 35 per cent black organic matter, much of which is undecomposed, so that the original plants may be distinguished; the remainder is a mixture of very fine sand, silt, and clay, the silt predominating, and the proportion of very fine sand being small. The surface soil merges into a silty clay, which becomes heavier and more plastic with depth. Yellowish-brown and gray mottlings occur below 24 inches and gray predominates below 30 inches. Snail shells and some mussel shells are found on the surface and lime concretions are generally present in the subsoil. Both surface soil and subsoil are calcareous.

The total acreage of Peat in the county is small. The largest area occupies the bed of Goose Lake, north of Jefferson. About 80 per cent of the type is tile-drained.

Corn is the principal crop. It is grown with some degree of success. It makes a rapid early growth, but is often subject to severe wilting during dry spells, especially on well-drained areas. One disadvantage is that it matures very late, and is more often caught by frost than on other soil types. Oats produce a rank growth and often lodge before ripening. Peat is fairly well adapted to the growing of potatoes.

SUMMARY.

Greene County is situated west of the center of the State. It has a total area of 574 square miles, or 367,360 acres.

The Raccoon River traverses the county from northwest to the southeast and provides adequate drainage for about half the county. The rest of the county has very little natural drainage, and ponds and poorly drained tracts are numerous.

The first settlement began in 1849, and the county was organized four years later. Most of the early settlers came from the States of Ohio, Illinois, Indiana, with a few from Virginia, Kentucky, and the Carolinas.

Greene County has a population of 16,467, of which 79.3 per cent is classed as rural. Jefferson, the county seat and the largest town in the county, has a population of 3,416.

The county is traversed by three railroads. The Chicago & North Western Railway passes through Scranton, Jefferson, and Grand Junction; the Minneapolis & St. Louis Railroad through Rippey, Grand Junction, Dana, and Paton; the Chicago, Milwaukee & St. Paul Railway through Cooper, Jefferson, and Churdan. No farm is more than 6 miles from a railroad station.

The dirt roads are kept in fairly good condition by the use of a road drag after each rain. The Lincoln Highway has been paved for some distance east and west from Jefferson.

Nearly every farm has telephone and mail service. A few farms have electric-light plants and others receive the current from plants at near-by towns.

The climate is favorable for agriculture. The growing season is long enough for maturing crops, and precipitation is uniformly distributed during this period. The greatest amount of rainfall occurs during the months of May and June. Periods of severe weather in winter are of short duration and not injurious to crops.

The agriculture of the county consists of general farming combined with raising of livestock, principally cattle, hogs, sheep, horses, and chickens. The most important crops are corn, oats, wheat, and clover and timothy.

According to the 1920 census, 44.6 per cent of the farms are operated by owners and 54 per cent by tenants. Most of the land is rented on the share-cash basis.

Only about 10 per cent of the land in the county is untillable. The average size of farms is 164.7 acres. The largest farms occur mainly along the Raccoon River and in the southwestern part of the county. The larger farms on the level upland areas are gradually being divided into smaller units.

No definite system of crop rotation is practiced, and practically no fertilizers are used. Barnyard and stable manure are applied to the soil when available.

The soils of Greene County differ in their agricultural value mainly according to their position, whether they are on the upland, the steep land along the drainage ways, or on the stream bottoms. Each group has soil characteristics which determine the crop adaptations and agricultural values as compared with the others.

The upland soils are fine textured, high in organic matter, and productive. They are prevailingly dark in color. About 50 per cent of this upland area has been improved by artificial drainage. The only droughty upland soil is the Pierce sandy loam in the southwestern part of the county.

The steep lands occur along the streams and are usually forested with oak, hard maple, hickory and black walnut. The soils are brown to gray in color and low in organic matter. The subsoils are noncalcareous. Drainage is excessive.

The bottom-land types are predominantly of sandy loam texture. The soils are dark brown to black in color and usually contain less organic matter than those of the upland. A few of the types mapped have a gravelly or porous subsoil and are somewhat droughty during the dry period of the growing season. An accumulation of alkali occurs in the soils having poor drainage, such as the Lamoure soils.

Nineteen soil types and two miscellaneous soils, Peat and Muck, have been mapped in this survey. The soil types represent 12 soil series. The series of the uplands are Carrington, Webster, Clarion, Conover, and Pierce. The terrace series are the O'Neill, Waukesha, Bremer, and Fargo. The first-bottom soils are of the Wabash, Lamoure, and Sarpy series.

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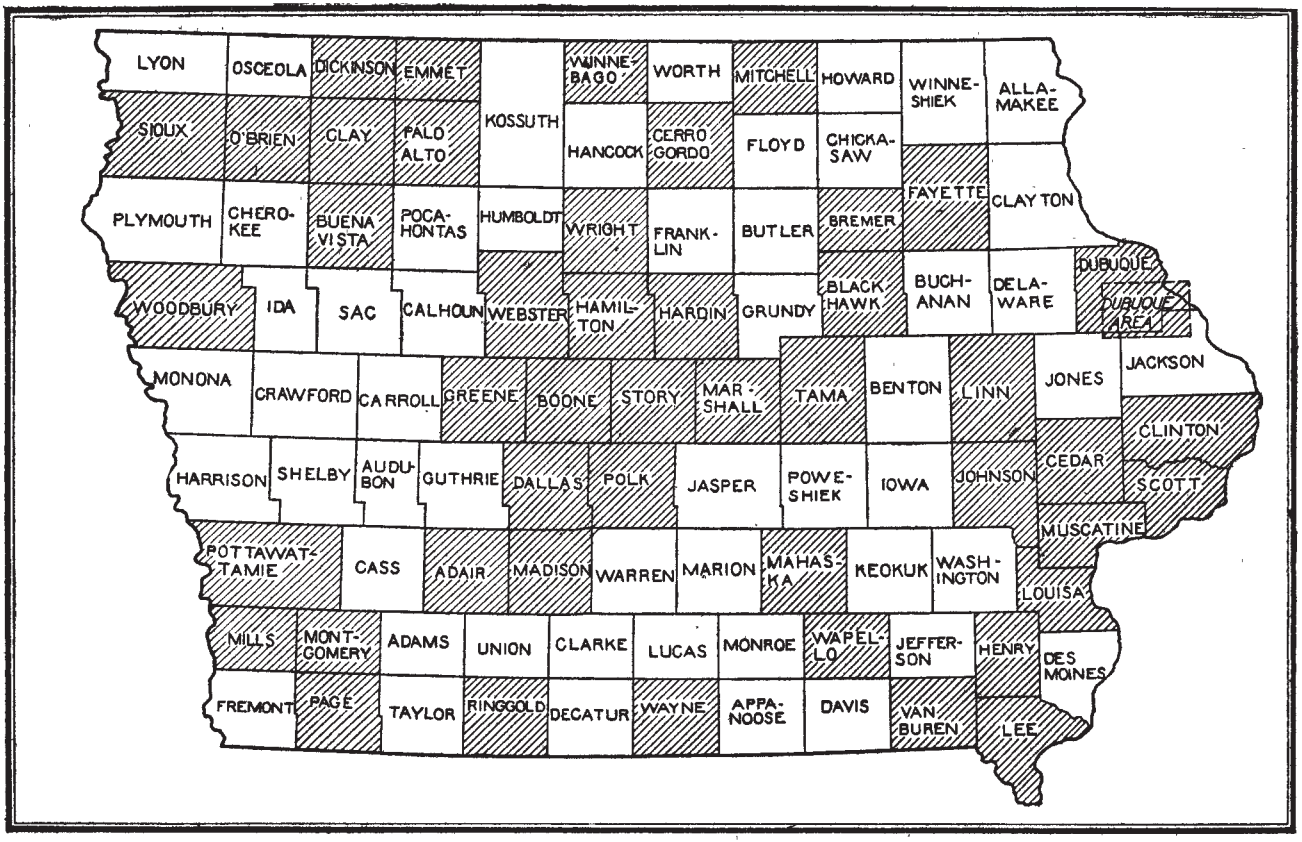

Areas surveyed in Iowa, shown by shading.

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